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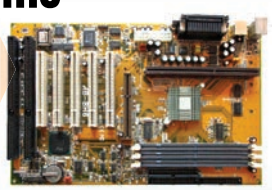

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DECEMBER

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Dear Windows,

We've had some good times, you and I. Sure, we've been through some rough spells, but like any relationship, we've each worked hard to stay close throughout the years. It's all about appreciating each other, right? I remember when I first saw you back in 1990. You were so rough around the edges. And you hated playing my games so much! But there was something about you I couldn't resist. OK, I'll confess. Ours was an arranged relationship. I was working at *PC Week* at the time, so I had no choice. I love that I can be honest with you.

I sometimes think about how shallow my life was before I gained access to your blocky 16-bit curves. We were both so young and innocent then! I was a clueless college kid with a Mac Plus, a hacked CompuServe account, and a subscription to *Mac User* magazine. You were a fledgling OS that would go on to dominate the world. Somehow, we made it work. I didn't even know what I was missing until I first turned on that 16MHz 286 Dell. It was like seeing the world in color for the first time. Literally!

Our couple's counselor always said that learning to forgive each other was the most important thing, and now I know why. Remember that time in 1993 when I used your built-in compression-utility DriveSpace in an attempt to double my drive capacity and promptly watched all my data go up in smoke? Or that time when I tried to copy a bunch of my family photos from one drive to another and you crashed in the middle of the process, destroying a bunch of them? Heh heh, yeah, I was pretty pissed after that and said some pretty awful things. But we got past that, right? We've even survived my dalliance with Linux when you went through your "Vista" phase.

And now you're 25 years old. Twenty-five! I guess this means I'm getting old, too. I sometimes wonder what will happen 10 years down the road. I'll be 50 and set in my ways, and you'll be a spritely 35, with the whole world in front of you. You'll be sophisticated and worldly and mobile, with an entire network of friends and other devices.

As you mature into the OS I've always hoped you would become, I hope you apply the lessons we both learned during our formative years together. Be punctual. Be consistent. Be stable. And, most importantly, be exciting. The old days weren't always fun, but they sure were interesting.

George

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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

Sandy Bridge Crossed

Intel unveils its new standard bearer of mainstream computing goodness —GORDON MAH UNG

If Intel's Clarkdale and Arrandale processors were criticized by AMD fans as inelegant multichip hacks, the company's new Sandy Bridge architecture addresses that—and beats AMD to the Fusion punch.

The new chip, due early next year, ditches the multichip design in favor of a closely integrated and modular CPU that fuses compute and graphics. The integration is so complete between the graphics and traditional compute cores that they share the last level of cache in the chip.

When Intel moved the graphics from the chipset into the CPU with Clarkdale, it picked up about a 1.5x gain performance. With Sandy Bridge, given the newer graphics engine, shared cache, and other enhancements, the company predicts performance will be 20 to 25 times the typical chipset-based integrated graphics of just a few years ago.

In a demonstration of Starcraft II running on Sandy Bridge and a second system running an Nvidia 310M graphics card, Sandy Bridge ran close enough that few gamers would be able to tell the difference.

Sandy Bridge isn't just about graphics, though. This is Intel's big leap forward, and enhancements to the compute cores also up performance. Some of those enhancements will come later on, through the chip's new AVX instructions. AVX isn't a reality today, as it's only enabled in Windows 7 with SP1 installed—which is not out yet. Other enhancements include an incredible amount of internal bandwidth between the cores and graphics and a greatly enhanced Turbo Boost.

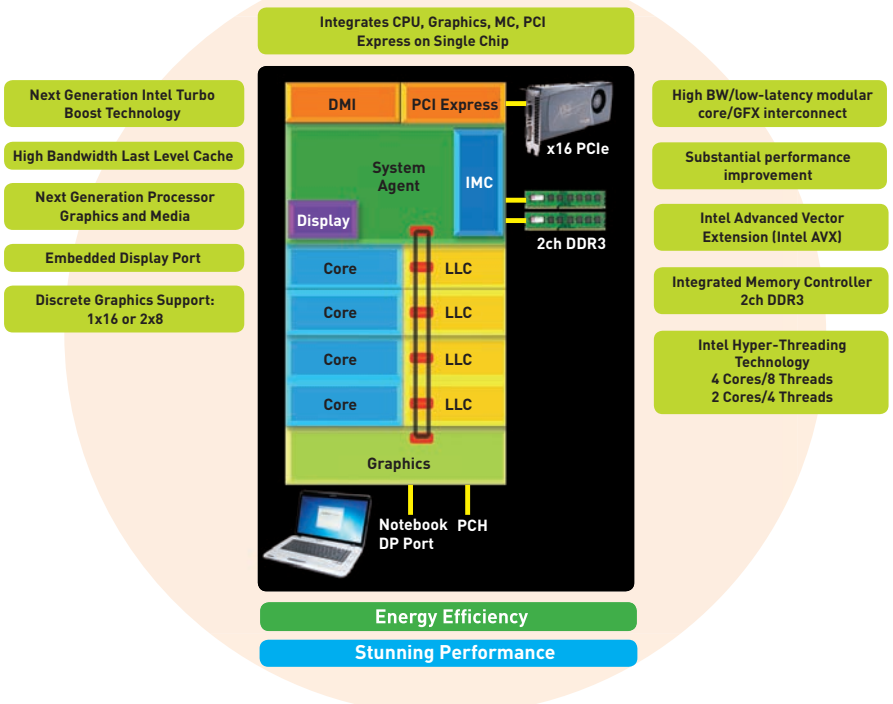
Intel now calls the feature Turbo Boost 2, and says it has learned from Nehalem and Westmere how to push the cores even further. In previous generations of chips, Turbo would all but vanish when all cores were loaded up. Turbo Boost 2, however, will allow the compute cores to effectively run overclocked even when all are in use. It's only when the cores approach overheating that the chip's power control unit, or PCU, will throttle back the Turbo Boost.

TURBO BOOST 2 WILL ALLOW THE COMPUTE CORES TO EFFECTIVELY RUN OVERCLOCKED EVEN WHEN ALL ARE IN USE

Hard details on the P67 and H67 chipset for Sandy Bridge are sparse, but we know that SATA 6Gb/s support will finally be included, and that native USB 3.0 integration won't. Like Lynnfield and Clarkdale, Sandy Bridge chips will include but a single x16 PCI-E 2.0 lane to run a discrete graphics card. Intel is addressing shortcomings of its P55 chipsets though, by upping the bandwidth of the PCI-E 2.0 ports in the chipset to full speed. The P55/H55's PCI-E 2.0 ports ran at PCI-E 1.0 speeds, which greatly limited expansion options.

The first Sandy Bridge chips are expected to appear early next year and require a new LGA1155-based motherboard. Interestingly, Sandy Bridge leaves Intel's enthusiast LGA1366 platform untouched. Intel officials say enthusiasts who want to have as many cores as possible and run multiple GPUs should stick to LGA1366 for now.

Officials didn't say when LGA1366 would be replaced, but many folks believe that will happen when Intel releases its Waimea Bay chip in LGA2011 trim.



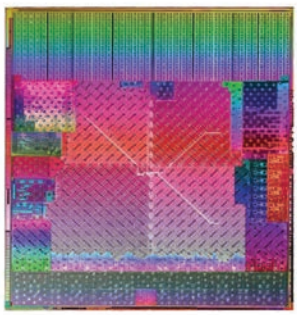
The new Sandy Bridge chip combines the GPU and CPU into one single chip and will feature an enhanced Turbo Boost mode. Intel is predicting 20x to 25x performance jumps vs. previous integrated CPUs.

AMD Demos Zacate

New Fusion APU struts its stuff at IDF

AMD's next-generation APU will kick the ass of Core i5, the company said, and demonstrated, on the opening day of Intel's Developer Forum (IDF) conference.

AMD publicly lifted the veil on the Zacate accelerated processing unit, a Bobcat core that fuses the guts of a traditional CPU with the guts of a GPU. The result of that hard work, AMD said, is a chip that consumes from 9–18 watts and outperforms existing Core i5 chips in gaming. The company showed Zacate running City of Heroes: Going Rogue as smooth as butter on a mobile development platform.



AMD said a $500 Zacate-based laptop will outperform an $800 Intel Core i5–based computer. The company also demonstrated the same 2.4GHz Core i5 M240 choking on Microsoft's Internet Explorer 9 performance demo while the Zacate could smoothly run several of the demos at three to four times the frame rate of the Intel part with integrated graphics.

AMD said notebooks using Zacate are expected to ship to OEMs at end of the year, with the first products for sale early next year. It should be noted that the demo mostly demonstrates the graphics prowess of Zacate against the recognized anemic graphics performance of Intel's Arrandale core.

Intel itself was busy detailing its next-generation Sandy Bridge chip, which is expected to overclock the compute cores higher than existing chips, as well as overclock the graphics cores. **—GU**

Dell to Launch Convertible Tablet

At this year's IDF, Dell showed off a 10-inch tablet with a unique design—it comes with a physical keyboard hidden underneath the screen. Essentially it's a convertible/hybrid netbook. Open the clamshell device, swivel the screen around, and use the keyboard. The design addresses concerns that it's difficult to actually be productive using only a virtual keyboard, as with the iPad. Dell didn't reveal any other specs or features, but did say the device would ship by the end of this year. —PL

AMD's Bulldozer Foreshadows the Future

AMD's new Bulldozer core is the company's biggest innovation in seven years. Meanwhile, Intel has regained the ground it lost when AMD introduced the first 64-bit x86 processors and shamed Intel's Pentiums with a superior balance of performance and power consumption.

With the first Bulldozer-based chips due in 2011, is AMD poised for a comeback? Not quite. Intel is rolling out its own new core microarchitecture, code-named Sandy Bridge. Like Bulldozer, it's designed for chips that integrate multiple CPUs with a GPU on the same die.

If AMD had shipped its CPU/GPU Fusion chips on schedule two years ago, Intel would have been shamed again. Instead, the first Fusion systems won't appear until early 2011—and they will have AMD's low-power Bobcat core, not the higher-performance Bulldozer.

At best, Bulldozer is a match for Sandy Bridge. (We'll know more when production silicon is benchmarked.) However, I think Bulldozer is a harbinger of things to come, because it's the first processor core that's really two cores working as a unified processing unit.

There will be no single-core Bulldozer chips—the basic building block is a cluster of two cores, which can be replicated. AMD calls them "conjoined" cores. Like some Siamese twins, they are joined at birth and inseparable, because they share vital organs.

Those shared components are the L1 instruction cache, L2 cache, instruction fetchers, instruction decoders, twin FPUs, and FPU instruction scheduler. Each core can execute four instructions per clock cycle and reorder them for higher efficiency.

Other components aren't shared. Each core has its own ALU scheduler, two ALUs, two load/store units, and data cache.

Bulldozer isn't multithreaded—each core operates on a single thread of instructions at a time. In principle, however, the twinned single-threaded cores are similar to Intel's dual-threaded cores. To the software, including the operating system, each configuration looks like two processor cores.

Bulldozer is a milestone. As processors integrate more CPU cores, the basic building block will keep growing. Bulldozer's block is a dual-core unit. Next will come quad-core clusters. Eventually, we'll have mainstream processors with dozens or hundreds of cores.

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

Rosewill RGD-CT5005 Battery Charger

Ever wish you could recharge those piles of dead alkalines? You can with Rosewill's RGD-CT5005 battery charger ($30, www.newegg.com) and feel all green while sticking it to "the man." We used the unit to charge three different brands of dead-ish AA batteries, going from 20 percent to 80 percent of charge. This doesn't come without caveats, though: You should stick with tier-one batteries and also recharge them before totally drained for optimal results. There's a risk of leakage, but we didn't see any in our test cells. The RGD-CT5005 also doubles as a NiMH charger (but not NiCad). –GU

Boxee Box Pulls CPU Switcheroo

Media streamer dumps Nvidia for Intel

D-Link has announced that its Boxee Box media streamer will use Intel's Atom CE4100 system-on-chip when it ships in November, the same processor that powers Google TV devices. D-Link stated previously it would use Nvidia's Tegra 2 ARM-based SoC.

Despite the new hardware, D-Link still plans to sell the Boxee Box for $200—a move that could put Logitech in a bind. Rumor has it that Logitech plans to sell its Revue Google TV box for $300. While we haven't laid hands on either device, we suspect the Revue will offer more features. But will they be compelling enough to convince couch potatoes to part with the extra Benjamin? **–MB**

D-Link is now accepting preorders for its $200 Boxee Box and expects to ship the device in November.

HDCP Cracked

HDCP, the High-bandwidth Digital Content Protection protocol, which ensures that Blu-ray and other high-def content can only be played on approved devices, has been cracked. A block of numbers purported to be the HDCP master encryption key was anonymously posted on the Internet in mid-September, and later confirmed as authentic by Intel, the developer of HDCP.

To play HDCP-protected content, every device involved in playback has to be HDCP-compliant, which means, among other things, that the manufacturer has to license the tech from Intel and pay an annual fee. To play a Blu-ray movie on your computer, for example, your Blu-ray player, graphics card, and monitor all have to be HDCP-compliant. This prevents unauthorized copying via the "analog hole," though Blu-ray ripping has been possible (and easy) for years.

The crack paves the way for devices that can make full-quality rips of streaming HD content. But Intel's Tom Wardrop told CNet.com that Intel expects HDCP to remain effective for most users, and pointed out that anyone who manufactures such a device can expect legal action from Intel under the DMCA. –NE

GAME THEORY

Come, Mr. Taliban

I've made no secret of my love for the DICE team and their work on the Battlefield series, so I was pleased to see them taking over the reigns of the revived Medal of Honor series. Although I suspected they would try to top the worst excesses of Modern Warfare 2, the merest hint of certain gameplay elements is already causing outrage.

First, the Secretary of Defense for Great Britain called for retailers to ban the game. Then, the Army & Air Force Exchange Service's Commander (the man in charge of retail and PX operations on all military bases) banned the game from being sold on-base.

The cause for concern is a feature that allows people to play as the Taliban, fighting against Western forces. Gamers who have spent the last 15 years playing Nazis, Commies, Viet-cong, monsters, alien, thugs, and Lemmy from Motorhead found this one puzzling. As EA quite reasonably said: "Someone has to be the bad guy." Why is the Taliban suddenly verboten?

The reason is fairly obvious: None of those were current enemies who were in the process of fighting and killing members of our military. It's not an unreasonable complaint from those unfamiliar with gaming. We understand that it amounts to little more than a different skinning for one side, and one that's frankly less offensive than the Nazi regalia seen in historical games. But to those who have lost loved ones to the Taliban, it's simply grotesque.

In fact, military shooters are hugely popular among active duty military, and COs are known to organize game nights and competitions for Modern Warfare or Battlefield.

My concern is less with the "play as the Taliban" mode than with any potential single-player missions. A "No Russian"-style level with gamers playing as a terrorist would simply be wrong, and it would do a great deal of harm to the image of gaming. I'm hoping that DICE can keep things both intense and tasteful given the theater of war they are modeling. I have my doubts that this is even possible.

Thomas L. McDonald has been covering games for 20 years. He is an editor at large for *Games* magazine and blogs at sopgaming.blogspot.com.

ATI Brand Retired

By the end of 2010, the ATI brand—for years a mainstay in the world of discrete graphics—will cease to be used on new graphics products. After chipmaker AMD bought ATI in 2006, it continued to label its graphics products with the ATI brand, which had widespread recognition among gamers and video enthusiasts. But according to AMD, a recent survey conducted across the United States, United Kingdom, and China found that the AMD brand was stronger than ATI against graphics competitors. **–KS**

Apple, Adobe Make Nice

Restriction on third-party development tools lifted

Tensions between Apple and Adobe reached an all-time high last April, when Apple suddenly decided to prohibit iOS developers from using third-party cross-platform compilers to develop apps for Apple devices. Adobe, as well as many industry analysts, saw the change to Apple's SDK license as a direct attack against Flash-based software, which required a cross-platform compiler to run on iOS.

Applications developed with Flash can now be ported to iOS for use on the iPhone and iPad.

Now, Apple has reversed that decision. And in addition to that, the company has decided to make its App Store Review Guidelines public. Previously, only Apple knew its rules for application approval. Both changes received praise from app developers and Adobe alike. More importantly, Apple's about-face appears to address the growing popularity of Android, which gives developers complete freedom to use any development tools they choose.

The new license agreement, however, has no bearing on users' inability to view Flash content in the browser of an Apple device. That issue isn't expected to be resolved anytime soon. **–KS**

INTEL BUYS INFINEON

Expect smartphones to follow

Just weeks after buying security software maker McAfee, Intel made another notable acquisition by purchasing the wireless unit of Infineon for $1.4 billion. The latest buy gives Intel the one element it was missing to break into the exploding smartphone market.

European-based Infineon makes baseband processors, essentially 3G chips, for the likes of Apple's iPhone and Samsung's Galaxy S. A baseband processor combined with an Intel x86-based system-on-chip will create a complete mobile platform. And the potential for integrating the two into a single chip at some point in the future means Intel could gain a big advantage in cost and power consumption—and make the company a serious competitor with ARM.

This acquisition, as well as Intel's purchase of McAfee, demonstrates the company's interest in expanding its markets beyond personal computers. Still, the security and wireless IP could also find its way into traditional PCs. –KS

BYTE RIGHTS

QUINN NORTON

Courts Giveth, and Taketh Away

Copyright's a funny thing. You can buy a copyrighted work, and own a copy, but not own the work. And while trying to figure out that last sentence can really mess with your head, we generally have the right to treat the physical thing we buy like it's ours. Or at least, we did until recently.

It started in 1908. The Bobbs-Merrill publishing company decided to see just how far it could push its copyright. It released a book called *The Castaway*, with this notice in the front: "The price of this book at retail is $1 net. No dealer is licensed to sell it at a less price, and a sale at a less price will be treated as an infringement of the copyright."

Macy's put it to the test, selling the book for $.89. The resulting lawsuit went to the Supreme Court. They established the ambiguously named "first-sale doctrine," which said if you bought a lawful copy of a copyrighted work you had the right to sell your copy on your own terms. Macy's won, and consequently, so did the idea of a used market in media.

Nearly a hundred years later in 2007, Timothy Vernor bought a few used copies of AutoCAD and sold them on eBay. The maker, Autodesk, didn't take too kindly to this and sent DMCA notices to eBay. It erupted into lawsuits, then appeals. Eventually, the 9th Circuit Court of Appeals decided that not only did Autodesk's EULA give the company the right to prohibit resale, but that Vernor was bound by it even though he himself had never agreed to it. First-sale rights, they held, could be contracted away with a click, which the first purchasers had done. In contrast to 1908, the rights of software makers are absolute; by changing licenses they can take away all the rights of owning a legitimate copy.

With licenses becoming so common, our money doesn't buy our digital media anymore. It just gets us into a cryptic rental agreement with no specific return date.

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
Dead Networking Technologies

5 APPLE TALK

AppleTalk was slow (a data-transfer rate of just 230.4Kb/s), but it was a helluva lot faster than the sneak-ernet most PC users relied on at the time.

4 HomeRF

Developed in 1998 by a consortium that included Intel, Motorola, and Philips, HomeRF used a 2.4GHz radio to deliver 1.6Mb/s data-transfer speeds (second-gen products delivered 10Mb/s). The consortium disbanded in 2003, as 802.11b routers proliferated.

3 HomePNA

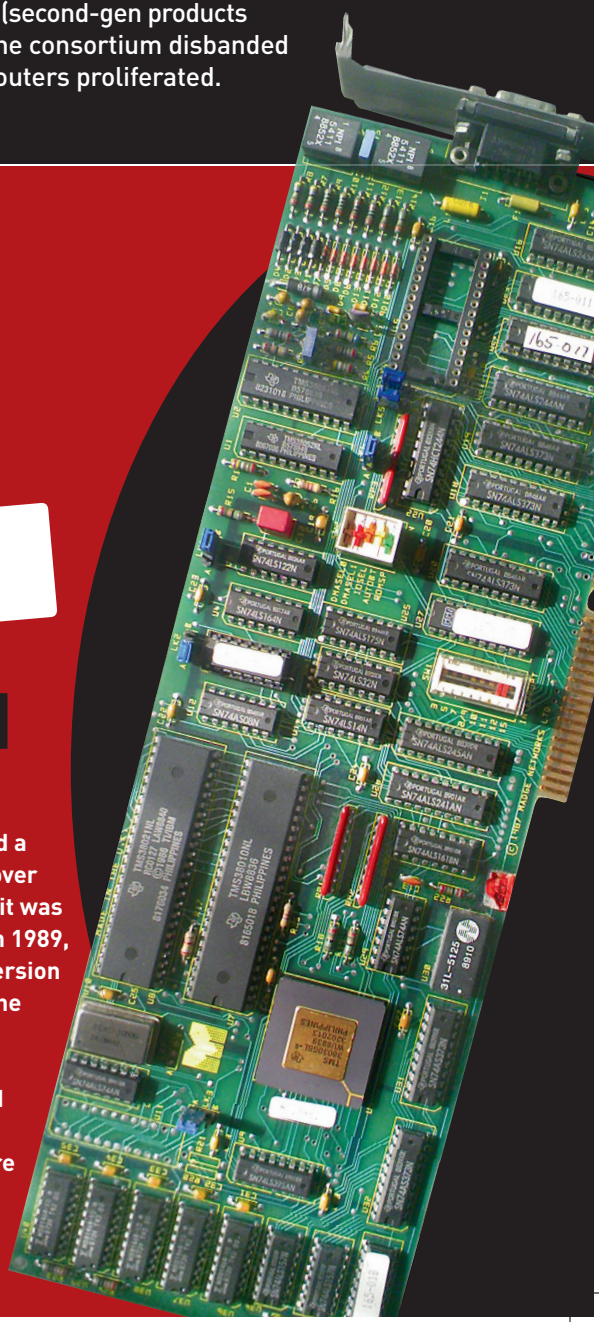
Another early no-new-wires initiative. HomePNA carries network traffic over your home's existing telephone lines. The spec isn't entirely dead, but it hasn't been updated since the HomePNA Alliance added coax support in 2006.

2 IEEE 802.11a

Some multiband routers still support 802.11a, introduced in 1999, but it has terrible range and is no faster than 802.11g.

1 TOKEN RING

Token Ring supported a maximum data rate over cable of 4Mb/s when it was introduced in 1985. In 1989, IBM shipped a new version capable of 16Mb/s. The technology reached 100Mb/s in 1999; but Fast Ethernet offered the same speed with simpler infrastructure requirements.

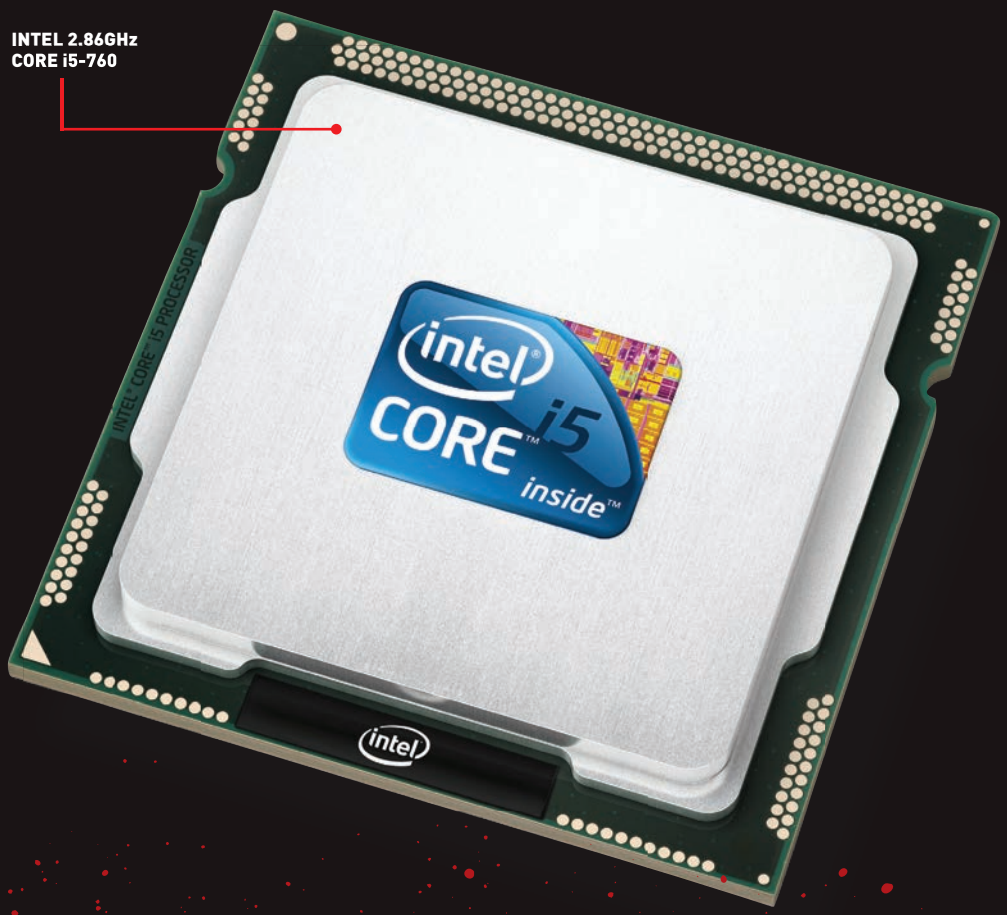


DEATHMATCH

Intel 2.86GHz Core i5-760 vs. AMD 3GHz Phenom II X6 1075T

Yeah, you walked into the dealer with every intention of buying a Corvette, but instead you walked out with the keys to a Chevette. This happens all the time in the CPU world, where PC builders like to read about Intel's top-flight Core i7-980X, but rarely shell out the cash for that super-fast and super-pricey processor.

The real battle among budget-minded enthusiasts is waged in the $250 range. That's where AMD is hoping that its new midrange hexa-core will continue to sway enthusiasts who like the sound of six cores but don't want to pay Intel's premium pricing for it. But does the new Phenom II X6 1075T have what it takes to compete with its Intel contemporaries? To find out, we clocked it against Intel's fairly new Core i5-760. Fight! —GORDON MAH UNG



ROUND 1

INFRASTRUCTURE

If you haven't kept up with current events, both Intel's LGA1156 and AMD's AM3 sockets are on the way out. Next year will pave the way for LGA1155 and AM3+. So, fantasies of using your existing mobo to socket in a Sandy Bridge or Bulldozer next year are just that.

With that out of the way, we can still weigh the pluses and minuses of LGA1156 and AM3. Frankly, as much as we love Intel's LGA1156 CPUs, we have to admit that its infrastructure is weaker. It has far more limited PCI-E support due to the single x16 2.0 PCI-E lane. This can lead to bandwidth issues with SATA 6Gb/s and USB 3.0 with multi-GPU setups.

However, one thing LGA1156 has going for it is SLI and CrossFire support. The stalemate between Nvidia and AMD (each side blames the other) mean SLI is nonexistent on AMD-chipset boards. Sure, there are still Nvidia-chipset boards out there for AMD, but they're mostly budget plays.

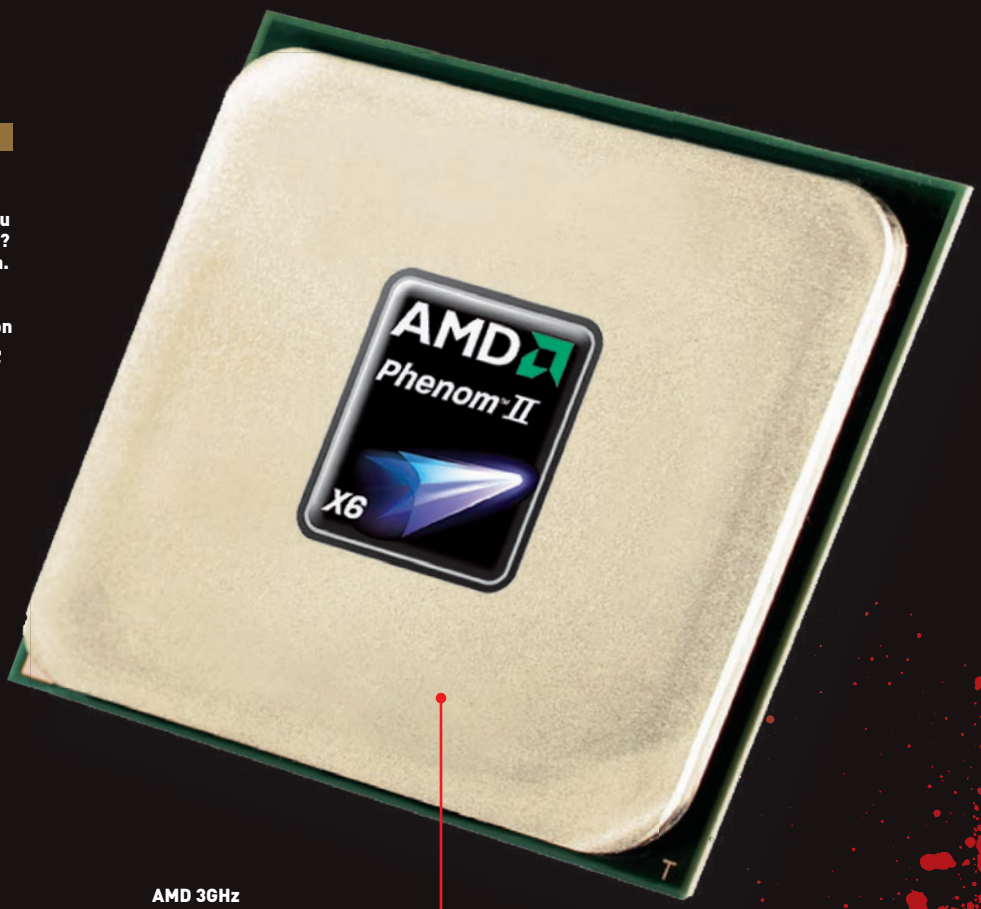
This said, we greatly appreciate that AM3 utilizes a single socket for all chip designs. You can build a dual-, tri-, quad-, or hexa-core rig using the same board. With Intel, hexa-core is limited to only LGA1366. With its superior PCI-E support and CPU configurations, AMD earns this win.

WINNER: PHENOM II X6

ROUND 2

FEATURES

Old-timers will remember the MMX wars, a time when you had to have the latest and greatest instruction set or you were nobody. What? You don't have SSE? Or SSE2 or x86-64? Yadda, yadda, yadda. Frankly, today the feature war is all but over. Both chips here have x86-64, aka AMD64, support. Both have virtualization acceleration, both have a "turbo" mode, and neither has support for encryption/decryption acceleration. We're calling this category a draw. **FEATURES: TIE**



AMD 3GHz
PHENOM II X6 1075T

ROUND 3

POWER CONSUMPTION

To measure power consumption, we isolated each setup at the motherboard, pairing each with a GeForce GTX 280 GPU, a WD Raptor, and 4GB of RAM. Each had a single fan running the stock heatsink, and that's it. We used the same Corsair AX850 PSU on both configurations and measured the idle power using a Watts Up! watt meter. To create a load, we ran the CPU test in Cinebench 11.5. Power-sipping tools on each respective motherboard were not enabled.

In the end, the Core i5-860 won hands down. At full load, it averages 155 watts, and at idle, it uses about 85 watts. The Phenom II X6 averaged about 209 watts under load and 98 watts idle. Of course, the Cinebench 11.5 score for the Phenom II X6 rocks the Core i5-860 because, well, it has six cores. **WINNER: CORE I5**

ROUND 4

PRICE

Let's face it, both chips are immense bargains. The Phenom II X6 gets you a 3GHz hexa-core chip for $245. The cheapest hexa-core from Intel is its Core i7-970, which costs a wallet-busting $900. That's probably the single reason why AMD's hexa-cores have been immensely popular. The Core i5 is also a mega-deal. For $205, you get a quad-core mini-Nehalem that, despite its lack of Hyper-Threading, is still plenty fast for most folks. To decide on a winner, though, you have to factor in performance. That makes this one too close to call. **WINNER: TIE**

ROUND 5

PERFORMANCE

For many people, this is the only category that really matters because it tells you how long your butt is going to idle while you wait for your machine to perform a given chore. So, which CPU is fastest? That very much depends on how you ask the question. If you want a chip that's faster for 3D modeling and apps that are heavily multithreaded, the Phenom II X6 is the one.

However, if you're looking for an all-around chip that performs faster in apps and games that aren't optimized for multiple threads, the Core i5 takes the cake. (Turn the page for the results of our benchmark tests.) This is an unfortunate and surprising outcome, but we have no choice but to declare a tie. **WINNER: TIE**

Benchmark Analysis

For our showdown, we used an MSI 890FXA-GD70 equipped with the new Phenom II X6 1075T, 4GB of DDR3/1333, a WD Raptor, a GeForce GTX 280, and Windows 7 Professional. For the Core i5-760, we used the same parts, OS, and drivers as the AMD setup.

We drew on our usual stable of benchmarks that run the gamut from 3D modeling to video editing and transcoding to gaming. The results were interesting, to say the least. After our 26-benchmark run, we've come to the conclusion that Phenom II X6 is clearly the better CPU for 3D modeling. In fact, it absolutely crushes the Core i5-760 in this category. The Phenom II X6 also out-muscles Intel in video encoders and transcoders that can exploit the extra cores in the chip. Surprisingly, however, the Core i5 surpasses the six-core, higher-clocked AMD chip in both Premiere Pro and Sony Vegas. In Vegas, Intel's margin of victory is fairly small—we attribute this victory to the higher efficiency of the Intel core. In Premiere Pro, the Core i5 wallops the Phenom II X6. We suspect that this is due to the encoder in Premiere Pro, which can't exploit all six cores in the Phenom CPU.

Our digital photography tests produced mixed results. The Core i5 is faster in Photoshop and ProShow Producer. Once again, this boils down to the apps' ability to leverage multiple cores. Photoshop CS3 is pretty light in multicore support and ProShow Producer has never run that fast on AMD, despite being hand-tuned for both architectures. In Bibble, though, we see AMD's extra cores pay major dividends. We were also surprised to see the Phenom II X6 win our Lightroom 2.6 test by such a large margin.

When we shifted our focus to gaming, things became fairly negative for the Phenom II, however. With the resolution and graphics features turned down to offset the power of the GPU, the Core i5 wallops the Phenom across almost every category.

BENCHMARKS

	3.33GHz Core i7-980X	3.33GHz Core i7-975 Extreme Edition	2.93GHz Core i7-870	2.8GHz Core i7-860	2.66GHz Core i5-750	2.8GHz Core i5-760	2.93GHz Core i3-530	2.8GHz Athlon II 630	3.4GHz Phenom II X4 965 Black Edition	3.2GHz Phenom II X6 1090T	3GHz Phenom II X6 1075T
Premiere Pro CS3 (sec)	453	504	539	581	615	**599**	967	855	780	749	765
Sony Vegas Pro 9.0c (sec)	2,675	3,244	3,531	3,863	4,899	**4,680**	7,310	7,083	5,990	5,010	5,460
Cinebench 11.5 64-bit	8.92	5.99	5.54	5.15	3.83	4.01	2.46	3.17	4	5.67	**5.35**
POV Ray 3.7	6,556.5	4,235.9	4,496.7	3,882.6	2,809.8	2,958	1,902.1	2,719.6	3,313.1	4,656.5	**4345**
HandBrake 0.9.4 DVD to iPhone (sec)	941	1,170	1,247	1,360	1,702	2,282	2,804	2,144	2,348	1,580	**1,679**
MainConcept 1.6 (sec)	1,827	2,308	2,486	2,735	3,092	2,971	4,663	3,952	3,286	2,816	**2,766**
Photoshop CS3 (sec)	89	91	100	123	118	**120**	142	157	133	130	130
Adobe Lightroom 2.6 (sec)	419	418	422	469	603	460	535	512	548	426	**422**
ProShow Producer 4 (sec)	1,092	1,208	1,290	1,382	1,425	**1,348**	2,112	2,309	1,912	1,669	1,744
Bibble 5.02 (sec)	97	120	122	142	186	186	261	284	202	145	**152**
Everest Ultimate 5.30.1900 MEM Copy (MB/s)	13,086	17,712	14,693	15,372	15,445	**15,879**	8,187	9,741	10,083	11,043	10,909
Fritz Chess Benchmark (KiloNodes/s)	12,733	12,738	11,995	10,997	8,407	8,712	5,344	6,682	8,196	11,219	**10,555**
3DMark Vantage CPU	62,893	51,321	48,816	46,064	44,594	**45,458**	35,005	36,077	41,796	44,587	43,655
World in Conflict low-res (fps)	358	317	253	253	256	**242**	180	124	179	162	165
Dirt 2 low-res (fps)	155.7	157	153.3	94	155	**156.4**	147.3	151.6	174.8	121	111
Far Cry 2 low-res (fps)	158.6	158.2	153.3	150.2	146.53	**147.6**	94.6	79.5	101.2	99	98.47
Price	$999	$999	$294	$284	$196	$205	$113	$99	$165	$295	$245

Best scores between the Core 15-760 and the Phenom II X6 1075T are bolded.

And the Winner Is...

Once you take in the benchmark results, you can see why we're declaring this a draw. Both chips have enough wins and losses to neutralize any clear victory by either party. We can already hear Intel fanboys exclaiming that a tie by a chip that's $40 cheaper must make it a victory for the cheaper chip, right? They'll also likely say that spending just another $50 gets you the Hyper-Threaded Core i7-870, which all but erases every win for the Phenom II X6 1075T in our Lab tests. AMD fanboys will likely respond that at least they can run their hexa-core chip in the same motherboard, mistuh, and that if Intel partisans want hexa-core, they have to spend $900 and buy a new motherboard.

If we were forced to choose a winner at gunpoint, we'd give the nod to the **Core i5-760**, but only by the thinnest of margins. It does cost less and it does outperform the Phenom II X6 1075T in games. Ultimately, you're going to want to pick one CPU or the other based on your personal needs. Truth be told, we think you'll be happy either way.

This month the Doctor tackles...

Installing Windows on a 3TB RAID
Blu-ray Playback
Replacing Antiquated Industrial Equipment

3TB Boot Drive Doesn't Work

During my Windows 7 Ultimate 64-bit install, I got an error message saying that Windows could not reboot the computer to prepare for the next phase of the installation. This is a new install on a three 1TB RAID 5 config. During installation, Windows setup splits the array into three partitions: one 100MB partition, one 2TB partition, and the rest unassigned. It is not connected to the Internet and it fails after the upload part of the install. And yes, I did install the RAID drivers.

—David Campbell

First, Windows 7 will automatically create a 100MB system-reserved partition during the install process. That's normal. As for the rest of your space, there's a limitation in the PC that prevents Windows 7 from booting from a drive larger than 2TB (unless you have a 64-bit version of Windows, a GPT partition, and a UEFI bootloader). The maximum size of a Windows boot partition is roughly 2TB. You may want to try manually creating a smaller partition—like a 1.5TB one—and also double-check to see if the array is bootable from the RAID configuration panel as well as from the PC's BIOS.

CPU Underclocking

I have a Dell Inspiron 518 with a 2.4GHz Core 2 Quad Q6600, running 32-bit Windows Vista. I recently ran CPU-Z on my machine and found that my 2.4GHz CPU is actually running at 1.6GHz. I went through the BIOS and can't find any way of changing this. Dell's BIOS doesn't let you do much. I assume it must have been that way when I bought the machine since there is no way of changing it. Of course, my warranty has run out and there doesn't seem to be any way to contact Dell without paying for it. How can I get my CPU up to its rated speed?

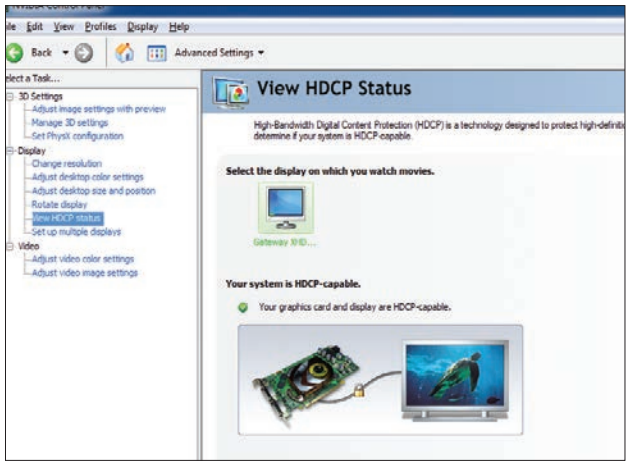
—Joe Hyland

Your Core 2 Quad Q6600 is using Intel's SpeedStep technology, which underclocks the CPU when it's idling. Since you don't need the full 2.4GHz when your CPU isn't doing anything, SpeedStep underclocks to save energy. Don't worry, as soon as you put any load on your chip, it'll go back up to 2.4GHz. You can confirm this by firing up CPU-Z while your CPU is under load; you'll see the clock speed go back up. If you'd like your CPU to run at 2.4GHz all the time, you can disable Intel SpeedStep in the BIOS.

What Do I Need for Blu-ray?

I have a Gigabyte EP45-DS3R motherboard and a 2.5GHz Intel Core 2 Quad Q9300 CPU. My videocard is an Nvidia GeForce 8400 GS. I added a generic Blu-ray drive, and when I attempt to play a Blu-ray disc, I get an error message indicating that I don't have an application that will play the file. I wonder if you have a favorite application for this, and also, since this is Blu-ray, is there some hardware requirement to play the files (do I need a videocard with an HDMI connector, for instance)?

—Dave Morton



If you use an Nvidia GPU, you can use the Nvidia Control Panel to check your HDCP status.

Dave, either CyberLink PowerDVD or InterVideo WinDVD will play Blu-ray movies just fine; those are the ones we use. To play Blu-ray videos in 1080p, you'll need to make sure that your videocard, its drivers, and your display are all compliant with HDCP, the high-def copy-protection scheme that the studios require for Blu-ray playback. Fortunately, your GeForce 8400 GS is HDCP-compliant, and the HDCP signal can travel over DVI. So if your monitor supports HDCP and has a DVI input, or you have a DVI-to-HDMI cable, you should be good to go. A quick way to figure out if your setup is Blu-ray-capable is to right-click your desktop and go to Nvidia Control Panel. Go to the Display menu and select View HDCP status.

CyberLink also has a Blu-ray compliance checker available for free on its website (www.cyberlink.com). It's called BD & 3D Advisor. It will check your drivers, GPU, and monitor for HDCP compliance. Finally, if your monitor is so old that it does not support HDCP, you can sidestep the copy-protection by buying and running SlySoft's AnyDVD HD (www.slysoft.com).

Can I Use OEM Windows Discs?

I currently have a PC that I built almost a year ago with Windows Vista Ultimate 64-bit. I was looking on Newegg.com and came across the OEM version of Windows 7. I noticed that the price was lower and I could get it because I had a custom-built PC. I was doing research on the OEM version and found out that you have to first install the OPK package. Since this installation is for one computer, do I have to get the OPK first, or can I simply boot from the DVD and do a regular install?

—Brett Walton

Most people who build their own PCs select the OEM version of Windows 7 because it's far cheaper. You do not need the OEM Preinstallation Kit (OPK) for a one-machine install. You should just be aware that with the OEM version you get no phone support from Microsoft, and technically, an OEM version is tied to the first board it's installed in. If you decided in two years to build a new rig and use that same product key, Microsoft can technically deny reactivation because the product key is tied to the previous motherboard. Even if the board dies, it's possible a reactivation could be denied. However, we have known Microsoft to be quite lenient in allowing reactivations, especially in the case of dead motherboards.

Why does Microsoft tie OEM installs to specific motherboards? The policy prevents you from, say, trying to reuse a Dell or HP product key (which is sold at a very, very deep discount) on a new machine using a different motherboard.

ISO: ISA Board

We have an old optical inspection machine at work that has an ISA card that must be used to communicate between the PC and the machine. Purchasing an updated PC with PCI communication from the OEM is more costly than the inspection machine is worth.

The PC is from the late 1990s and is running Windows 2000, and we are concerned about its health. The inspection machine itself still functions well. Is there a current motherboard that has an ISA slot, or is there an adapter that could convert the ISA to PCI? Any other options you can think of would be appreciated, as well.

—Brad Taflinger

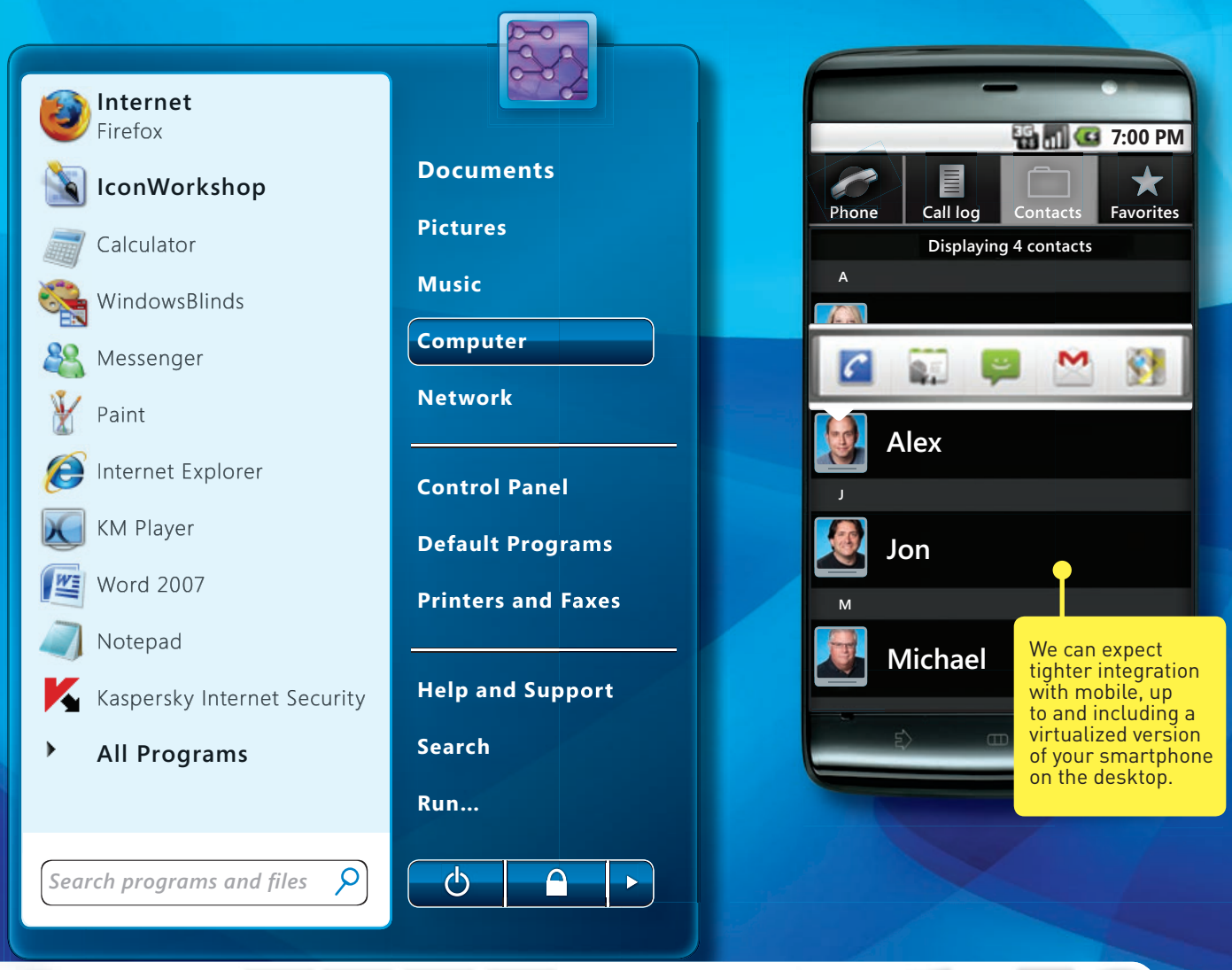
Surprisingly, you can still get somewhat current motherboards with ISA support. These boards are specifically built for industrial use. Adek Industrial Computers (www.adek.com) sells boards with Core 2 Duo and Core 2 Quad support as well as boards with P4, PIII, and Celeron support. Numerous other vendors also carry boards with ISA slots. Just search for industrial motherboards with ISA support and you can pick and choose at will. One thing you may want to think about is the application and the consequences of moving it from, say, a 400MHz Pentium II to a 2.93GHz Core 2 Duo. Some applications may not behave well when suddenly given a huge boost in CPU speed. You might, instead, take the NASA approach. Crack open the case and find out what make the board is, as well as the CPU and hard drive. Then visit eBay and buy those components. Build the machine up and have it standing by for the day the other box goes kaput.

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.

The Future of Windows

On the 25th anniversary of Windows, we examine the future of Microsoft's flagship operating system

BY GEORGE JONES, GORD GOBLE, AND MICHAEL BROWN



For what it's worth, the first 25 years of *our* lives weren't that smooth, either. So forgive us for favoring words like "commemorate" or "contemplate" instead of "celebrate," which feels like too rosy a word for an operating system that has given us so much frustration, confusion, and heartache. Hey, maybe now that it's 25, Windows will behave like a grown-up.

For better or for worse, the fact remains that on November 20, 1985, Microsoft released the very first version of Windows. If we asked you to use just a single word to define the 25-year history of Microsoft's OS, we're betting that "erratic" would pop up 70 times out of 100. There are a lot less-accurate descriptions.

Instead of recounting the very well-known past of the venerable OS—we're sure that we'll all see countless retrospectives, timelines, and detailed histories online—we decided it would be more interesting to peer into the future. These are wild and woolly times for Microsoft, Apple, and even Google as each company tries to give users the digital equivalent of the moon in exchange for a lifetime of loyalty. Based on the leak published earlier this summer, it's clear that Microsoft has already given ample consideration and thought to Windows 8, or whatever the next version will be named.

To shed some light on the matter, we decided to ask a handful of the world's leading independent PC manufacturers what they've heard and what features and functionality they'd like to see in the next big Windows release. A few people were OK going on the record, but most preferred to keep their comments anonymous or on a "background only "basis.

We also checked in with our Lab (of course), and with you, our readers, via our Facebook Fan page. To cap off our story, Reviews Editor Michael Brown reports on his hands-on experience with the beta of Microsoft's upcoming Windows Home Server V2, which we expect will release later this year.

Imparted wisdom, thoughts, facts, and some outright guesses are inside.

Where Do We Go from Here?

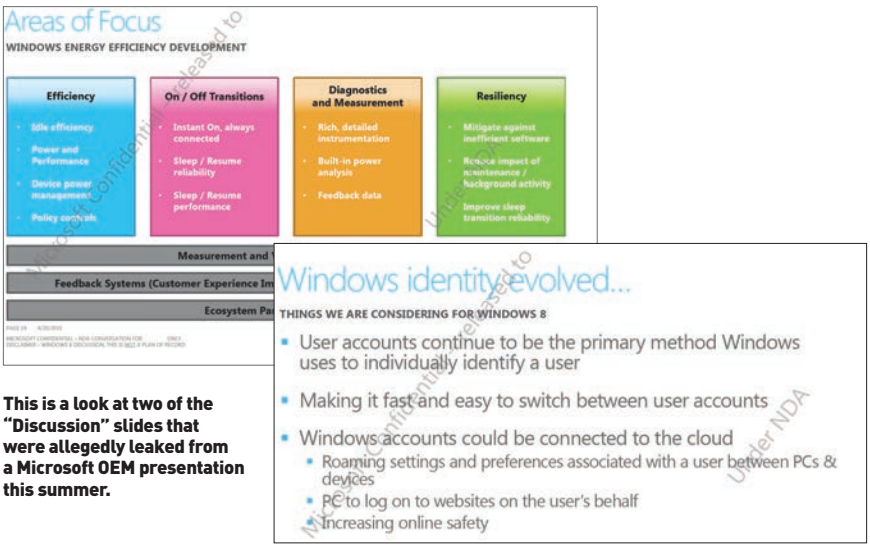
In Windows 8, users will trump systems and the cloud will rule us all

What will Windows 8 look like? And when will it happen?

This summer, the world got its first chance to see what might be in the cards for Windows 8 when Italian tech site Windowsette.com posted several allegedly leaked internal Microsoft PowerPoint slides. Most of the leaked slides end with a disclaimer saying they were a "Windows 8 discussion" rather than a "plan of record," but they still shed insight into the future.

Arguably the most intriguing and surprising slide is one that not only admits to the successes of a rather well-known competitor, but in effect champions it. Entitled "How Apple does it: A virtuous cycle," the slide addresses the perceived positive user experience of Apple customers and gives a huge nod to Apple product satisfaction and in turn the brand loyalty and revenue generated by that satisfaction.

Another key slide, labeled "Focus: hardware capabilities," flaunts an image of a prototypical all-in-one PC in order to make the point that the formfactor for Windows-based systems is evolving. Accompanying this image are a number of bullet points discussing everything from biometric recognition logins (the presentation later forecasts that "camera integration will likely be ubiquitous by 2012"), to voice control, to a touch display with "five or more contact points for improved sampling." Furthermore, a "Sensors" section alludes to support for features such as infrared proximity sensors, proximity-based sleep/wakes, and light sensors that automatically adjust screen brightness to suit ambient room and environment conditions.



This is a look at two of the "Discussion" slides that were allegedly leaked from a Microsoft OEM presentation this summer.

It also seems clear that Windows 8 will have its head in the cloud, so to speak. According to the leaked "discussion," Windows will evolve from a machine-based system to a user-based one. In theory, Windows customer accounts will be connected to the cloud. Remote PCs will log onto websites on behalf of users, and cloud-ensconced settings and preferences will follow users from one device to another.

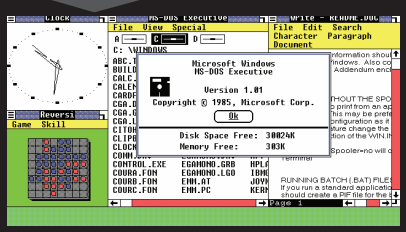
What's more, the leaked slides put forth the concept of a cloud-based "Windows Store," ostensibly Microsoft's take on Apple's App Store. In the ideal scenario envisioned by

OBLIGATORY ANNIVERSARY MONTAGE

The 10 Most Important Moments in Microsoft's OS

Windows 1.0

Released on November 20, 1985, the original Windows was better known by its more formal name: MS-DOS Executive. The OS environment/GUI included a calendar, clipboard, calculator, and more. Unfortunately, the windows in this 1.0 release couldn't overlap. The patent for that feature was owned by Apple at the time.

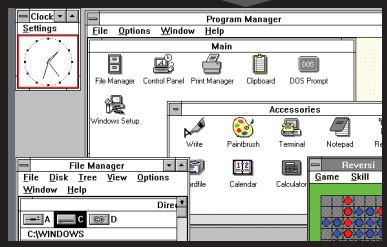


Windows 2.0

Released two years later in October 1987, this version featured overlapping windows like the Apple OS, albeit in a chunkier, more DOS-y looking way. The end result was an Apple lawsuit that lasted for almost 10 years. It's worth noting that both Windows 1.0 and 2.0 were more GUI than OS—DOS still handled all file-system services and data requests. In defense of the GUI, it was paired with a fairly flexible virtual memory system, which allowed for multitasking functionality that was ahead of its time.

Windows 3.0

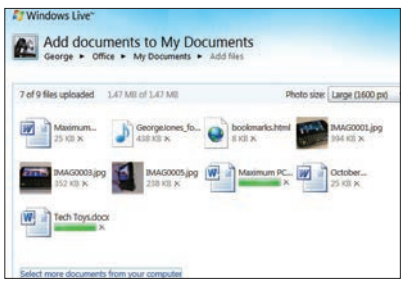
Microsoft capitalized on the explosion of desktop sales in homes and offices, selling millions of copies of Windows 3.0 in its first year. This version made major UI changes and took even more advantage of virtual memory and virtual device drivers. It wasn't the most stable OS, however, and Microsoft quickly scrambled to release a 3.1 version in 1992 that enhanced stability. This iteration of Windows also introduced Protected Mode, which granted applications access to additional megabytes of memory.



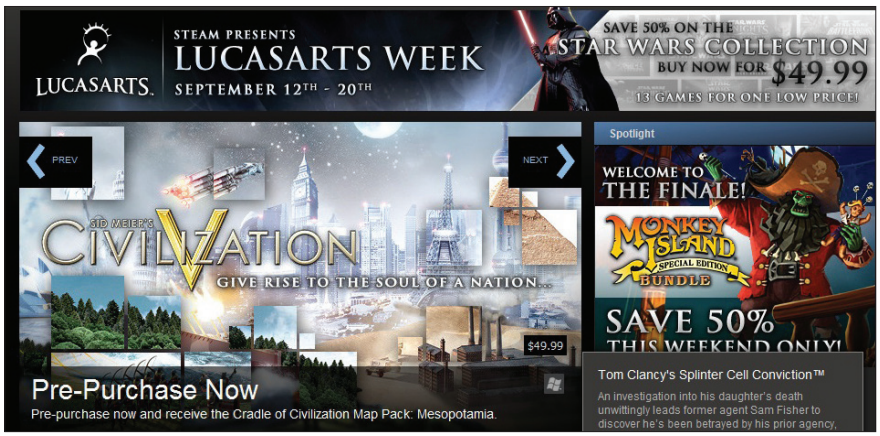
the PowerPoint deck's discussion, consumers will be able to purchase applications online that "they can use on any Windows device," and where developers can get a big helping hand to "reach millions of users."

Other notable innovations on the table for discussion include instant (or near-instant) on, improved diagnostics and hardware/software monitoring, and support for a one-touch "reset" button that not only reinstalls Windows but retains the entire user environment, including settings, personal files, and applications. If the leaked material can be believed, an emphasis will be placed on being able to "connect end users to the right help when they need it," which is no small challenge given the preponderance of software and hardware developers.

Interestingly, when the presentation discusses target formfactors, it does so without referencing the stalwart desktop PC. Instead, the three "centers of gravity" include all-in-ones, laptops, and slates.



With SkyDrive, Microsoft already has its Dropbox killer. We can expect to see SkyDrive fully integrated into the File Manager in the next version of Windows.



Valve's Steam gaming client has caught on like wildfire in recent years. It's an ideal app/gaming marketplace client, and we should see something similar in Windows 8.

WHAT WON'T WE SEE?

Not surprisingly, when we asked our panel of independent hardware vendors what they wanted in Windows 8, we received a wide range of responses. Most of them took the time to laud Windows 7 for being stable and fast. One of our panel members, Kelt Reeves, owner of Falcon Northwest, told us his company is still riding high on Windows 7 sales, so much so that his only hope for Windows 8, "Is that they don't mess up all the progress they've made with Win7!"

Given what seems to be a two-year development cycle as opposed to the traditional five-year cycle—more on this below—it's likely that Microsoft won't introduce any major new underlying technology in Windows 8. Given the stability and reliability of the NT kernel that has served as the foundation for all recent versions of Windows, it's unlikely we'll see any significant changes there. And, given the satisfaction that hardware manufacturers and users alike have expressed regarding Aero as implemented in Windows 7, it's unlikely we'll see any significant changes in the interface schema itself, aside from touchscreen enhancements.

WHAT WILL WE SEE?

Instead, what we—and everyone we spoke to—expects to see in Windows 8 is a shift in focus from system-based computing to user-based computing. This is no small task—the implications of this shift are massive, with thousands of ripple-effect ramifications. We also expect to see performance boosts and feature implementation designed to ward off not just Apple, but Google's Android and Chrome

OS/2 It's hard to believe that there was a time when even Microsoft believed that Windows wouldn't last more than five years. The company's open collaboration with IBM on OS/2 (Operating System 2) was important for two reasons. First, it helped Microsoft realize the true potential of a protected-mode, multitasking environment. Second, the failed partnership with IBM—which wanted to use OS/2 exclusively to drive sales of its own hardware—reinforced Microsoft's decision to keep Windows an open-architecture operating system with support for lots of different hardware configurations.

Windows NT The first release of Windows NT 3.1 was in 1993, and was a ground-breaking moment because it marked the debut of the NT kernel that has been the foundation of every version of Windows from Windows XP on.

Windows 95 A new interface, support for 32-bit applications, and native support for PC games compliments of Direct X were the high points of Windows 95, which debuted 15 years ago in August 1995. It was unanimously hailed as a significant step forward in terms of performance and gaming.

Pocket PC 2000 This marked the debut of the Windows Mobile OS. It looked and functioned like Windows 95, and featured built-in support for Word, Excel, and Outlook.

Windows XP It was fairly stable and it lasted long enough that it became ubiquitous. 'Nuff said.

Windows Home Server Released in July 2007, WHS represented Microsoft's important initial foray into providing a network framework for homes as opposed to enterprise environments. It remains fairly underground, but power users have found Home Server stable, easy to use, and extremely configurable.

Windows 7 Talk about rebounds. After listening to all the chatter about how badly it had screwed up Windows Vista—which was mired in production delays and bugs—Microsoft saved the day with a stable and easy-to-get-into OS that shattered all previous sales records.

EDITORS' CHOICE

Windows 8: What We Want

Nathan Edwards

I really want greater cloud integration. There's no reason Windows 8 shouldn't be able to integrate something like Dropbox to keep documents synced. Hell, just allowing us to map Windows Live SkyDrive as a network drive would do it. This should extend to mobile devices like Windows 7 phones or (if you wanna be really cool) Android phones, too. Faster boot times would be great, and coming back from sleep faster would be nice. This is one thing Apple does really well—closing the lid of a MacBook puts the computer to sleep, and opening the lid wakes it up quickly. Why can't we have that?

Katherine Stevenson

A couple of things come to mind, having just dealt with a virus attack. I want Microsoft to offer third-party patch management, so I can update *all* of my apps through Microsoft Update. I'm also intrigued by rumors that Windows 8 might include a restore button that lets you reinstall the OS without losing any data or having to reinstall applications—too often, System Restore is itself a target for malware.

Alan Fackler

I think a 3D desktop interface like you can find in Linux would be really cool, and also practical. That way, you could customize each part of this virtual cube's OS desktop, selecting a different desktop depending on the task at hand.

Gordon Mah Ung

When you look at the properties of a file, show the damned time it was accessed/modified/created down to the seconds! This went away with Windows Vista and it's a pain now to get that information. Can we please also have a pause button added to the file-copy dialog?

Amber Bouman

Um, I honestly really (really) like Windows 7 so far, and I have no reason to be greedy. So, I'll dream big: I want Windows 8 to make me coffee in the morning.

operating systems, as well. Windows 7's relative stability should greatly aid Microsoft in this pursuit because the company can focus on adding features as opposed to fixing bugs. "Windows is under fire from all sides—with iOS and Android/Chrome threatening them," one of our off-the-record OEMs told us. "It still has incredible momentum and is not going away, but the OS of the future needs to be more nimble and responsive."

As always, faster boot times will be a goal, and the onset of SSDs—which we're betting will be ubiquitous by the end of next year in mid- to high-end systems—will help. "We are asking Microsoft for boot times of under 30 seconds," one manufacturer told us. With the constantly evolving power of the PC platform, we won't be surprised to see the next version of Windows booting in less than 20 seconds.

> 'WE ARE ASKING MICROSOFT FOR BOOT TIMES OF UNDER 30 SECONDS'

Almost every one of our experts was adamant in insisting that Windows implement an instant-on mode. In an ideal world, and a stable OS, boot times will take a back seat because instant-on is essentially the same thing as waking up from standby. Either way, the feature is a no-brainer with all the media streaming and remote access sure to come in future iterations of all operating systems. To date, display-driver instability and incompatibility continue to thwart fast system wake-ups. Microsoft will have to address the third-party driver situation at the code and distribution levels. No big surprise here: We'll see a more effective means of certifying and automatically distributing these drivers.

Let's get the other no-brainer enhancements out of the way now, also. Universal requests include deeper calendar/contact integration and social network integration—preferably at the desktop level as opposed to the browser or application level. Given the popularity of Android's highly dynamic desktop, we also expect to see more useful and functional application-style widgets, multiple desktop views that we can change based on the context and situation, and improved taskbar and desktop notifications. There's obvious room for improvement around troubleshooting, diagnostics, and self-healing.

Enough of the small stuff—let's take a look at the bigger features and functionalities we can expect to see in Windows 8.

APPS & GAMING

Every year Microsoft, Apple, and Google keep expanding their spheres of influence by acquiring, mimicking, or duplicating third-party software makers' applications and services. We're betting that for Windows 8, Microsoft applies the lessons Valve and Apple have learned with Steam and the App Store.

The next iteration of Windows will have tighter built-in integration with games and other applications via a built-in games/applications manager. Origin PC founder Kevin Wasielewski agrees. "Although Mobile Phone 7 will include Marketplace," he told us, "it will be nice to see this carry over to Windows 8. Programs installed should function more like apps, with updates, in-game purchases, and more." Valve's Steam client is the perfect model here. In Windows 8, app management, updates, and even purchases will all be seamlessly and automatically managed, with no need for install discs or serial keys. We're drooling for cloud-based saves that will allow us to play games across multiple systems.

The truth is, Microsoft already has a marketplace. It's called Xbox Live. The company also already has a framework for independent game development with its XNA software developer's kit, which is capable of running on Windows, Xbox 360, Windows Mobile, and Zune. The real secret sauce could be Microsoft's ability to encourage and allow users to migrate their apps, games, and gaming content between devices, or permit access to games via remote connection. Wasielewski adds, "OnLive is cool, but I am limited to their content and possibly their bandwidth during heavy use. I'd like the ability to remotely connect to my slick gaming PC or server at home and remotely play my games from another location and/or my mobile device."

CLOUD-BASED OS

We're starting to get sick of hearing about Cloud Computing—it feels like an obvious evolution, and one that's actually been around for quite some time—but it will be extremely relevant as Microsoft shifts to a cloud-based user-first architecture in Windows 8. But what does this mean in terms of actual features? First, companies like Dropbox, Carbonite, and other cloud-based storage and backup services should be concerned, because Windows 8 will include built-in support at the File Manager level for Windows SkyDrive, which will allow us to save and access files from anywhere and

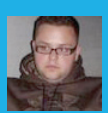
READERS RESPOND

What's Essential to You?

Jeff Miller What I would love to see is a focus lock—a way to keep focus locked on a program—like when I am going through my email on Outlook and clicking links that I want to load and look at later when I am done clearing out my email. I would like in this instance for Outlook to keep the focus until I say, "I'm done" and I unlock focus. This would also be great in many other things that tend to pop up into your focus and distract you when you don't want them to.

Steven Crider A low-level kernel OS to power basic functions, running any/multiple Windows OS in a virtual/protected environment, communicating seamlessly between all without performance degradation. Windows should store various settings/functions in the cloud or on a LAN without having to set up complicated domain server architecture. It should also facilitate info-sharing between designated WinPads, desktops, laptops, and phones. Finally, you should be able to drag or fling a file or open window to another device vis-à-vis Windows Surface.

Troy Leonard I want to see fully integrated virtual desktops like the PowerToy for XP. I was hoping 7 would have it. The cube effect in Linux would be nice for organizing my workflow. I would also like to see MS buy RocketDock and fully integrate it into Windows 8. If they combined the two, with the ability to have different docks on each desktop, as well as different wallpapers, visually it would blow Mac out of the water.



Brendon Vaillant I would like better multi-monitor support. I would also like to run dual monitors with separate instances of a desktop (similar to the Mac function), allowing essentially two separate computers to be run off of one processor, with seamless transitions between the two.

Gavin Farrington For all the features they keep adding to Windows, it still sucks at basic things like networking. Is it really necessary to hang the whole damn OS while it searches for something on the network that is no longer there? Oh, and WinFS would be cool.

on any device.

Along similar lines, we'll finally see robust implementation of Microsoft's entire Office suite via Office Live. The big difference is that it will be built into the OS itself. We envision Microsoft implementing a pricing scheme similar to Xbox Live here—various recurring monthly or annual subscriptions will grant users access to Office Live applications, cloud services, video/movies, and the Windows app marketplace.

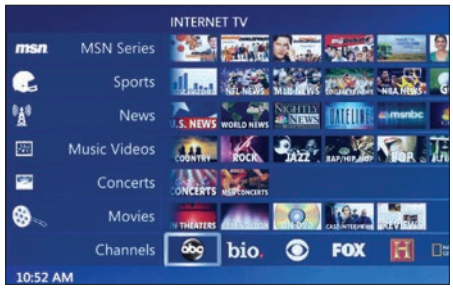
VIRTUALIZATION

To date, virtualization feels under-utilized, and we expect this to begin to change with Windows 8. It's difficult to predict how this will play out though, aside from virtual application threads and quarantined safe zones for browsers and applications. One of the experts we consulted with for this story gave us an interesting idea by suggesting that Microsoft implement a "high-performance mode for gaming that turns off unnecessary BS services and tasks with a simple click." Agreed. We took this sentiment a step further and began to contemplate the possibilities of combining hardware-accelerated virtualization with cloud-based gaming services. Imagine a service like OnLive that uses virtualization, but also provides unfettered, no-latency access to your PC's hardware layer.

Virtualization could also be utilized to enhance remote connectivity and interoperability between mobile devices and Windows. It's not too big a reach imagining Microsoft coming up with an application that leverages the company's VirtualPC technology to allow users to fully and automatically connect to and use their mobile device within the Windows OS. Virtualization could be used to duplicate and host such an environment, which we'll dub the "Windows Teleporter." This would be easy to accomplish with the Windows Mobile OS, but would obviously require more complicated (and conflict-laden) solutions with BlackBerry, Android, and iOS.

STORAGE

Windows 7 included support for the Trim function, which allows the operating system to communicate with a solid-state drive about which sectors are OK for garbage collecting, and made consumer use of solid-state drives practical. However, SSD space is limited, and is best used for applications, not documents. Windows 7's Library feature made it easy to set default libraries to link to external drives, but to truly offload *all* documents meant fiddling with symbolic linking to fool programs that save to the C:\ drive no matter where they're stored. As such, we expect Windows 8 to include greater separation between apps and data (like Linux),



We expect to see Windows Media Center stripped down for installation on appliances such as HDTVs and low-end all-in-one PCs.

and allow for total dissociation between the OS partition and document and data storage—or at least include a wizard for moving the Documents folder.

On the other end of the spectrum, expect support for bootable partitions greater than 2TB. This is supported in 64-bit versions of Windows since Vista, but they need UEFI bootloaders and GPT partitions. Windows 8 and the hunger for bigger storage will drive UEFI adoption.

THE LIVING ROOM AND BEYOND

One final thought: We're betting that Windows 8 spells the end of the Windows Media Center layer as well as the Windows Media Player itself. The direction Microsoft has pursued with Xbox Live makes us think Zune will become the foundation for all Windows-oriented media in the same manner that iTunes is for Apple.

TV and Home Theater is one category where Microsoft has strong offerings, but attaching an entire OS to an HDTV or even to a low-end all-in-one PC doesn't make sense. One request we heard repeatedly from our experts was for a version of Windows that is "smaller and has lower specs for low-cost appliances such as HDTV, but with the full Windows shell and GUI," as one boutique systems manufacturer put it.

So, when will Windows 8 make its debut? One of the slides in the leaked discussion presentation indicates a beta release in the summer of 2012, with a full release at the end of the year. This would be a greatly accelerated release schedule for Microsoft, which has previously released new versions of Windows every five years or so.

This said, we're betting that the release of Windows 7 marks a development-cycle shift for Microsoft from five-year cycles to two-year cycles. Why? Apple does it, and Android does, too. In today's rapidly changing environment, five years is too long to wait for even a minor iteration of a major operating system. We're calling late 2012 on this one.

Windows Home Server V2

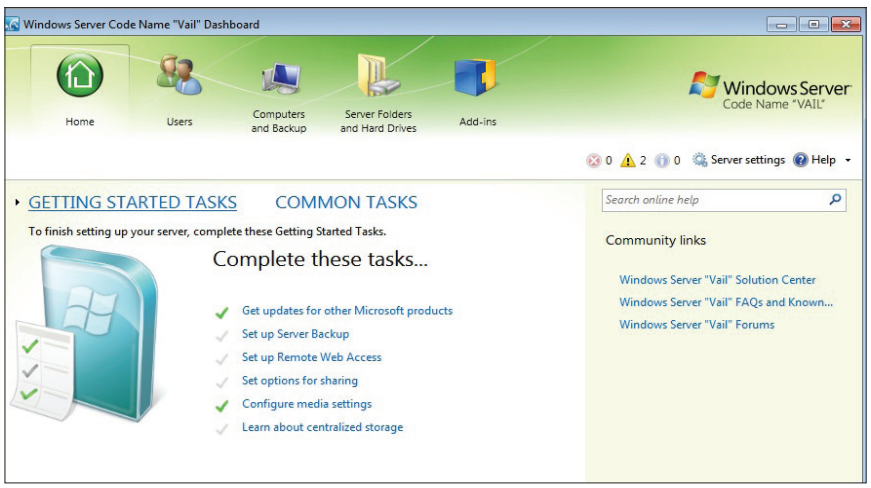
Extended hands-on time with Microsoft's new home server OS reveals some interesting and powerful new features

We dig Windows Home Server, Microsoft's home-oriented server operating system. It's provided us with an easy-to-use and relatively bullet-proof means of backing up our multiple PCs, made it easy to access important files over the web, protected our shared libraries through automatic file duplication, and so much more.

But Windows Home Sever Version 1 has never been pretty to look at—we've long since replaced its weak media server with a third-party application, and its 32-bit code base (based on Microsoft's Windows Server 2003) makes client restoration more awkward than it should be. While we've had to speculate as to the features that might be included in Windows 8, Microsoft's follow-up to Windows Home Server has been in beta since last April.

Here's a high-level look at the new operating system, based on an interview with Microsoft Senior Product Manager Michael Leworthy and some quality time we've spent using the beta. Microsoft has not announced a target ship date, but we're guessing WHS Version 2 (which is based on Windows Server 2008 R2) will ship in the second or perhaps third quarter of 2011.

The new Windows Home Server Launchpad runs on client machines and can start third-party apps as well as the server's Dashboard.



Vail's Dashboard performs the same functions as the current Windows Home Server Console, but with a Windows 7 look. This version will continue to support up to 10 users, including Macs.

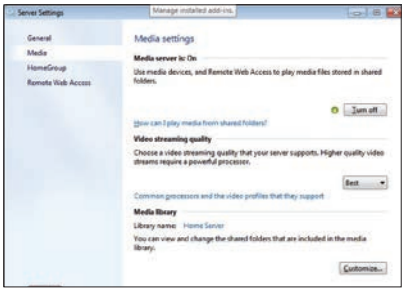
HARDWARE REQUIREMENTS

As with Windows Home Server Version 1, Microsoft expects most consumers will buy Version 2 (the beta version's full name is Windows Home Server Code Name "Vail") pre-installed on a headless computer. We expect most of our readers, however, will buy the system-builder version of the OS and install it on a cast-off machine. Either way, the minimum hardware requirements are a 1.4GHz x64 processor, 2GB of RAM, and at least one 160GB, NTFS-formatted hard drive. The server must be hardwired to your router, and a UPnP-certified router—while not required—will deliver the best experience.

Where WHS Version 1 supported a maximum of five hard drives, Vail will support up to 10 (internal SATA, eSATA, USB, or FireWire). The system disk (the one on which the OS is installed) can reside outside Vail's Drive Extender storage pool. If you're not familiar with Microsoft's Drive Extender technology, it's a file-replication system that provides multi-disk redundancy to protect you from data loss in the event of a catastrophic disk failure. The system duplicates shared folders to different drives, so there's always a backup copy. Unlike a RAID configuration, however, a Drive Extender storage pool can consist of different-size drives. And unlike a JBOD array, there are no drive letters; the capacity of all the drives is aggregated into a single pool.

CLIENT SUPPORT

As does the current version, Vail will support a maximum of 10 users or 10 computer clients (running any combination of Windows XP SP3, Vista SP2, or Windows 7. The 64-bit version of Windows XP is not supported). The release version of Vail will support Macintosh clients out of the box, too. Client machines



Vail uses Microsoft's Silverlight and Windows Media Foundation technologies to stream media.

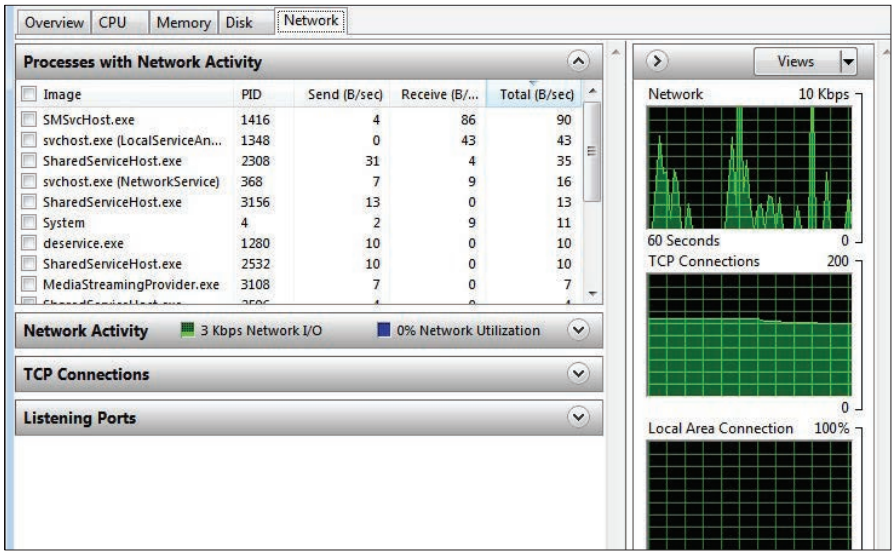
will run a taskbar app called Launchpad, which provides an easy way to log onto the server, access shared folders on the server, initiate manual backups, access the server's remote website, or start the server's Dashboard app. Launchpad will also be able to start third-party server-oriented applications.

Dashboard is a replacement for the Windows Home Server console used in WHS Version 1. It's the primary user interface for configuring your server's settings as well as the backup settings for each of its client machines. It's not much different from the Windows Home Server console from a functional standpoint, but it's a whole lot prettier.

The OS will automatically perform block-based backups of its clients (Version 1 performed file-based backups); and for the first time, you'll be able to back up the server, shared folders, and your client backups to an external hard drive for offsite storage. The OS has hooks for backing up to the cloud, too, but Microsoft's Leworthy tells us the company has not decided whether or how it might expose that capability.

WHS Version 1 is capable of restoring individual files and folders, but since it's a 32-bit OS, it's rather clumsy when it comes to performing a bare-metal restore of a 64-bit system—since it can't automatically restore a system's 64-bit device drivers, you must locate them manually and copy them to a USB memory device. Vail features 64-bit code and will be able to perform a full restore using a bootable USB drive (Version 1 requires a bootable system-restore disc for each client).

A Vail server will be able to join a Windows 7 HomeGroup, so everyone who belongs to the same home group will have access to the same shared folders. The system administrator, however, will be empowered to assign permissions to each user. Mom and Dad might have read/write access to shared photos and videos folders, for example, while the rugrats are limited to read-only access. The system administrator will also be able to monitor the health of client machines and will have the power to push Windows updates and new antivirus definitions out to them.



Resource Monitor enables you to keep an eye on your server's workload and overall performance.

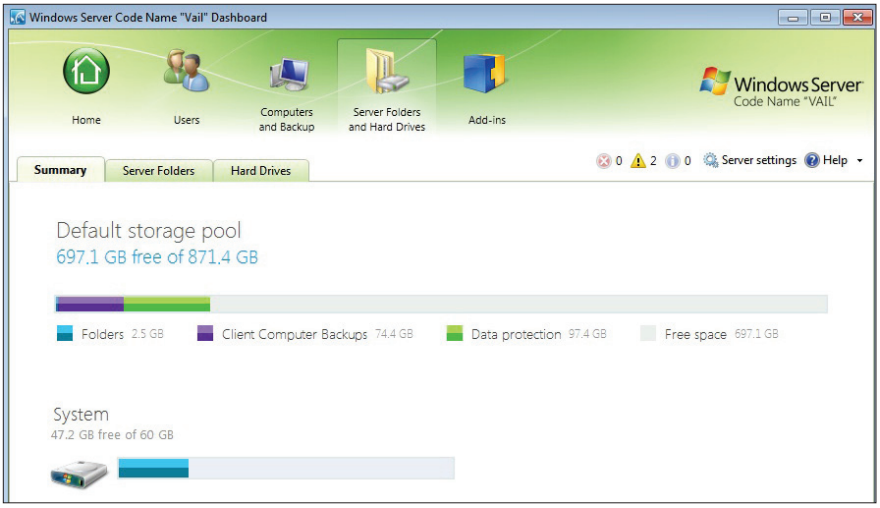
MEDIA STREAMING FEATURES

The original Windows Home Server is a relatively weak media server right out of the box, needing a third-party add-on such as Twonky's TwonkyServer or PlayOn's PlayOn Digital Media Server to reach its full potential. Leworthy promises Vail will be different: It will not only be DLNA 1.5–compliant, it will use Microsoft's Silverlight software to stream DRM-free media to clients on your local network *and* to clients on the Internet—including mobile devices.

Silverlight will also improve Windows Home Server's remote-access feature, enabling friends and family to whom you grant access to view shared content on your server in a friendly, browser-like environment. Real-time video transcoding is fully supported, which is essential for streaming HD video to handheld devices, but not so for streaming to more powerful clients. You'll need a relatively strong CPU in your server to pull off that trick, though—an Atom isn't going to cut it.

Vail promises to deliver a much stronger, easier to use, more feature-packed home-server OS than ever, but there's one feature that we're disappointed to report *won't* make it: any implementation of Windows Media Center. Imagine installing Ceton's InfiniTV CableCARD tuner into a Windows Home Server box and connecting it to your cable TV service: You'd have the ultimate DVR with the ability to stream recorded TV programs—including video from premium channels such as HBO and Showtime—to wherever you happen to be. Sadly, we don't expect that will happen anytime in the near future, simply because the Windows Server 2008 code base lacks any of the DRM hooks that are present in Windows 7.

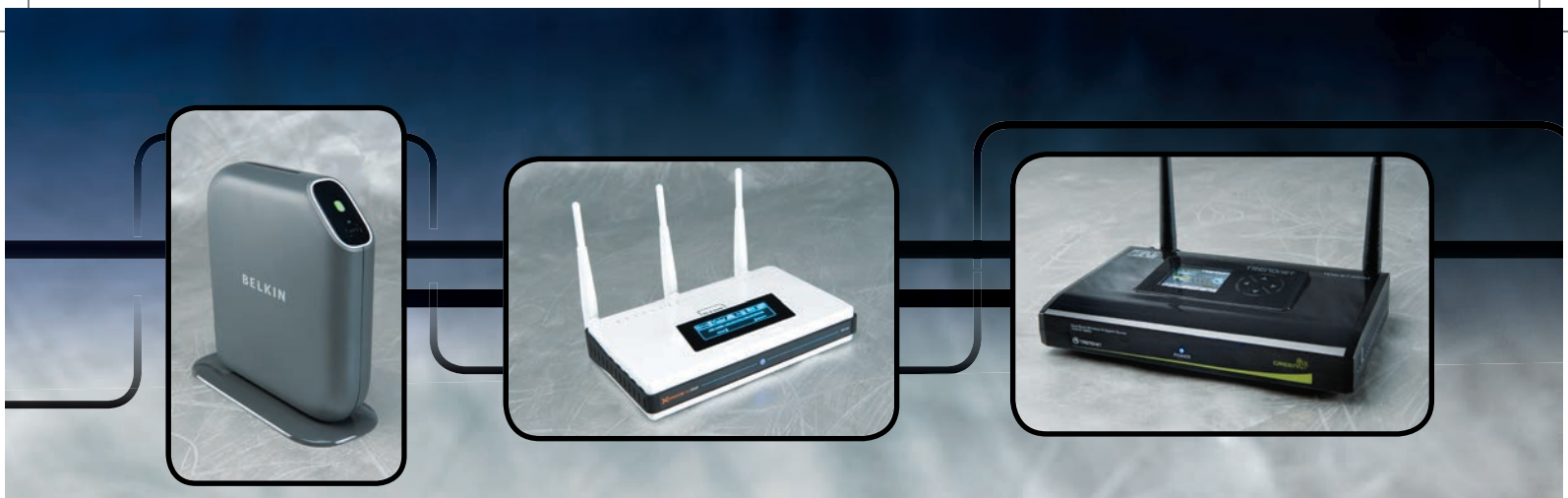
But when all is said and done, we can't wait to build a new Vail-based server—and we're even more excited to see what OEM builders and add-on developers will do with the new OS.



Whether your server has one hard drive or 10, Vail will aggregate them into a contiguous pool of storage.

Routers that go the Distance

If aesthetics matter in your router, you're sure to find a design that suits your style, although its performance might not be up to snuff. Hey, that's why we're here.



Today's premium Wi-Fi routers push the boundaries of design, features, and range

BY MICHAEL BROWN

You've been getting by with the cheapie router you bought two years ago, so why should you upgrade now? In a word: Performance. And features. Oh, sorry. That's two words. We looked at a host of budget offerings in our last router roundup (February 2010) and didn't find much to get excited about. This time, we asked seven manufacturers to send us the best consumer routers in their stables regardless of price tags.

In most cases, that meant a simultaneous dual-band router capable of running 802.11n wireless networks using the typical 2.4GHz frequency band and the less-crowded 5GHz band, plus a guest network that isolates its clients from your primary LAN. In all cases, it meant a router with an integrated four-port gigabit switch and at least one USB port for sharing a printer or a storage device over the network (some have two USB ports to support both functions). In an interesting twist, however, no one submitted a product using a three-stream wireless chipset promising raw throughput of 450Mb/s.

We're absolutely fine with that, because our first experience with this bleeding-edge standard, courtesy of Trendnet's single-band TEW-691GR, left a bitter taste on our tongues. The TEW-691GR was very fast, but only at very close range. As we observed in our review, which you can read at http://bit.ly/9qQTRA, you can't buy a USB Wi-Fi adapter with three antennas today, so much of that extra bandwidth is effectively wasted.

Astute observers will notice that we've previously written stand-alone reviews of three of the routers here—namely, the Netgear WNDR3700 V1 (our current Best of the Best pick), the Linksys E3000 (previously known as the WRT610N), and the Belkin Play N600 HD (previously known as the Play Max). Since wireless performance varies with Wi-Fi client device drivers, router firmware updates, and even atmospheric conditions, we didn't think it would be fair to compare one product with the latest updates to a competitor we reviewed several months ago.

So, will Netgear's WNDR3700 V1 retain its title, or will a scrappy challenger exceed our lofty expectations? Turn the page to find out.

Asus RT-N16

A solid, if unexciting, bargain

The Asus RT-N16 is a solid performer with dual USB ports, strong firmware, and support from the DD-WRT community.

The Asus RT-N16 is a single-band router with three removable (and therefore upgradeable) antennas, but the third antenna didn't help the router rise above third place overall in terms of TCP throughput. It did, however, do a solid job of penetrating our media room.

The RT-N16 is equipped with two USB ports, so it can support both a portable USB hard drive and a printer. USB storage devices are shared using SMB/CIFS, so the shares appear when you use Windows to browse your network. This is a far superior alternative to forcing you to install a client to access the shares, as some of the other routers do.

Asus has developed a very user-friendly GUI for the RT-N16's firmware, and the EZQoS utility makes it easy to assign bandwidth priority to various applications (with settings for VoIP, games, video streaming, and the built-in FTP server). There's an integrated BitTorrent client, too. If the stock firmware doesn't float your boat, you can replace it with a version of the popular open-source alternative DD-WRT.

The RT-N16's stock firmware includes a UPnP media server, but it's not DLNA-compliant. This means the router is not a great choice if you're looking to stream media from an attached drive to an Xbox 360 or a PS3 gaming console.

You'll find our complete Asus RT-N16 network and NAS benchmark results at http://bit.ly/bMvh6S.

SPECIFICATIONS

RADIO FREQUENCIES	Single-band: 2.4GHz only
GUEST NETWORK	No
DLNA-COMPLIANT MEDIA SERVER	No
USB PORTS	Two (for printer and/or storage)
NTFS DRIVE SUPPORT	Yes
WDS BRIDGE/REPEATER SUPPORT	No

VERDICT 8

ASUS RT-N16
$92, www.asus.com

Belkin Play N600 HD

Homey don't play dat

Belkin's Play N600 HD router has a single status LED that glows green when the router is connected to the Internet and amber when it can't make that connection.

The Belkin Play Max's claim to fame was a fat set of hardware features and a generous collection of apps that ran not on the router but on client PCs connected to the router. In relaunching the Play Max as the Play N600 HD, Belkin has kept all the hardware features but axed three of the apps (the music library tool Daily DJ, the backup utility Memory Safe, and the MP3 tagger Music Labeler).

No big loss, as far as we're concerned; we're far more interested in the hardware. Like its predecessor, the Play N600 HD features two wireless radios, so you can operate distinct networks on the 2.4- and 5GHz bands, plus a second guest network (on the 2.4GHz band only) that provides Internet access while isolating visitors from your LAN. You'll also find two USB ports, so you can share both a mass storage device and a printer across your network (but not with clients on the guest network).

The Play N600 HD's wireless routing performance using the 2.4GHz band was distinctly middle of the road, placing third in two of our test locations and tying for third in another. On the other hand, it managed a relatively strong second-place performance in our challenging media-room test. Performance on the 5GHz band was roughly the same, except that it couldn't penetrate our double-walled media room at all.

Belkin includes a BitTorrent client that's useful for finishing Torrent downloads without tying up a host PC; but as you can see from our benchmark charts, the router's NAS performance is abysmal.

You'll find our complete Belkin Play N600 HD network and NAS benchmark results at http://bit.ly/cIPITz.

SPECIFICATIONS

RADIO FREQUENCIES	Dual band: 2.4GHz and 5GHz
GUEST NETWORK	On the 2.4GHz band only
DLNA-COMPLIANT MEDIA SERVER	Running on a host PC only
USB PORTS	Two (for printer and/or storage)
NTFS DRIVE SUPPORT	Yes
WDS BRIDGE/REPEATER SUPPORT	No

VERDICT 7

BELKIN PLAY N600 HD
$100, www.belkin.com

Buffalo AirStation Nfiniti

This bison no longer roams

We weren't impressed with the AirStation Nfiniti WZR-HP-G300NH's TCP throughput, but its price tag is a saving grace.

Of the three routers we're taking second looks at, none has changed more than Buffalo's WZR-HP-G300NH. That's because Buffalo has thrown the firmware we tested earlier out the window and adopted the open-source DD-WRT.

Comparing our earlier benchmark numbers to the performance we recorded this time out, however, we much prefer the Kick Ass award–earning router we tested in January to the one in front of us now. That router turned in the best throughput we've ever seen with our client in our well-insulated media room and in our furthest outdoor location; this one took fifth-place finishes in both tests (in a field of seven). We have little doubt the reason for this performance discrepancy is due to the fact that no matter how we configured the router, we couldn't coax Buffalo's WLI-UC-G300HP01B USB client adapter to connect to it at a stated data rate faster than 130Mb/s.

This is a single-band router that enables you to run virtual wireless networks with distinct SSIDs, but these aren't true guest networks that provide Internet access while isolating guest clients from your primary LAN. The router is equipped with a single USB port that's limited to NAS functions—you can't use it to share a printer attached to your network. It does, however, feature a DLNA-compliant media server, and it can be converted to a wireless bridge/repeater when you upgrade to a newer router down the road.

You'll find our complete Buffalo AirStation Nfiniti WZR-HP-G300NH network results at http://bit.ly/9DyAqq. We didn't test NAS performance because this router doesn't support NTFS-formatted drives.

SPECIFICATIONS

RADIO FREQUENCIES	Single-band: 2.4GHz only
GUEST NETWORK	Sort of
DLNA-COMPLIANT MEDIA SERVER	Yes
USB PORTS	One (for storage only)
NTFS DRIVE SUPPORT	No
WDS BRIDGE/REPEATER SUPPORT	Yes

VERDICT

BUFFALO NFINITI WZR-HP-G300NH

$80, www.buffalotech.com

7

D-Link DIR-855 Xtreme N

Does 'Xtreme' refer to the price tag?

You can attach either a printer or a USB storage device to the DIR-855's single USB port, but you'll need to run D-Link's SharePort utility on any client that needs to access it.

In terms of features, D-Link's DIR-855 came the closest to matching Netgear's routerlicious WNDR3700. It's a simultaneous dual-band model that allows you to run guest networks on either the 2.4- or 5GHz frequencies, it provides a USB port for sharing either a printer or a storage device, it's equipped with three removable/upgradeable antennas, it sports an OLED display, and its firmware is a tweaker's paradise.

But the benchmark performance we experienced with the DIR-855's 2.4GHz radio in no way justifies its astronomically high street price of $240. Netgear's WNDR3700 V1 spanked the DIR-855 on both frequency bands, has almost as many features, and costs $90 *less* than D-Link's router.

The DIR-855's 2.4GHz radio scored fourth or fifth everywhere except at our outdoor location, where it placed first. Its 5GHz radio performed better, coming in second (behind the WNDR3700) in our two close-range tests, and third and fourth in two other tests.

On the bright side, D-Link's firmware boasts more customizable settings than any other router in this field. You can configure both radios to operate on a schedule, so you can shut off your entire wireless network when you're away from home (with independent schedules for your guest networks), you can grant or deny guests access to your LAN, and more. But in the final analysis, we'd be a lot more impressed if the DIR-855 was a whole lot faster and much cheaper.

You'll find our complete D-Link DIR-855 Xtreme N Duo Media Router network and NAS benchmarks at http://bit.ly/byU8i6.

SPECIFICATIONS

RADIO FREQUENCIES	Dual-band: 2.4- and 5GHz
GUEST NETWORK	Yes, on both radios
DLNA-COMPLIANT MEDIA SERVER	No
USB PORTS	One (for printer or storage)
NTFS DRIVE SUPPORT	Yes
WDS BRIDGE/REPEATER SUPPORT	No

VERDICT

D-LINK DIR-855 XTREME N DUO

$240, www.dlink.com

6

Linksys E3000

Same as it ever was?

The Linksys E3000 scored dead last in most of our benchmarks—and left us wondering which of its two radios we were testing.

As we mentioned earlier, the Linksys E3000 is actually a rebadged WRT610N. We're taking a second look at it now because it remains Cisco's best consumer router; as such, we owe it to our readers to compare it to the best of what the rest of the industry has to offer.

We updated the router with the latest firmware for this review and downloaded fresh drivers for the Linksys AE1000 dual-band USB client adapter, so we were quite surprised to see the router perform more poorly than it did when we tested it several months ago. Cisco Connect remains the easiest tool we've ever used to establish a connection to a router, but Cisco's "fix" for a problem we described in our initial review has rendered the router a whole lot less appealing.

In that earlier review, we discovered that using the router's web interface to change the router's SSID broke Cisco Connect. The new firmware not only forces you to use Cisco Connect to change the SSID, it uses the very same SSID for both the 2.4- and 5GHz networks. So when your client Wi-Fi adapter surveys the airspace, it sees only one network plus the guest network. That's just dumb.

You'll find our complete Linksys E3000 network benchmark results at http://bit.ly/aR1X5Q. We didn't test NAS performance because this router doesn't support NTFS-formatted drives.

SPECIFICATIONS

RADIO FREQUENCIES	Dual-band: 2.4- and 5GHz
GUEST NETWORK	Yes, on the 2.4GHz band only
DLNA-COMPLIANT MEDIA SERVER	No
USB PORTS	One (for storage only)
NTFS DRIVE SUPPORT	No
WDS BRIDGE/REPEATER SUPPORT	No

VERDICT

LINKSYS E3000
$150, www.linksys.com

5

Trendnet TEW-673GRU

My eyes! The goggles do nothing!

We like the Trendnet TEW-673GRU's removable/upgradeable antennas, but the flakey display gives us pause.

We thought the 1.5x1.25-inch LCD on Trendnet's TEW-673GRU was pretty cool at first. It informs you of the router's status, provides real-time performance numbers, displays the time and date, and more. But our enthusiasm wilted when the display became corrupted to the point of being illegible. That's unfortunate, because there's a lot else to like about this router.

The TEW-673GRU is a dual-band model with two USB ports to support both a printer and a portable hard drive. It finished second in terms of TCP throughput on the 2.4GHz band (taking third place on the 5GHz band), and it turned in the fastest transfer speeds as a NAS device.

But it's not all hot fudge and cherries with this sundae. You need to install a utility on each client PC in order to grant access to the attached storage device, for instance, and only one client can utilize those ports at a time. And while the TEW-673GR delivered high throughput to our outdoor patio using both radios, neither was able to penetrate our media room or reach our second outdoor location. The router isn't capable of operating a guest network, either, and its integrated media server is not DLNA-compliant.

You'll find our complete Trendnet TEW-673GRU network and NAS benchmark results at http://bit.ly/dk4RFy.

SPECIFICATIONS

RADIO FREQUENCIES	Dual-band: 2.4- and 5GHz
GUEST NETWORK	No
DLNA-COMPLIANT MEDIA SERVER	No
USB PORTS	Two (for printer and/or storage)
NTFS DRIVE SUPPORT	Yes
WDS BRIDGE/REPEATER SUPPORT	No

VERDICT

TRENDNET TEW-673GRU
$120, www.trendnet.com

7

Netgear RangeMax V1

The winner, and still champeen!

Supremely fast, feature-rich, and relatively inexpensive: There's little we don't like about Netgear's WNDR3700.

It wasn't much of a contest: Netgear's WNDR3700 V1 retained its crown as our Best of the Best router with spectacular TCP throughput, a strong feature set, and an even stronger price/performance ratio. It's the second-most expensive router we tested, but it's worth every penny.

The WNDR3700's 2.4GHz radio delivered the best performance at every client location except one (where it placed second), and its 5GHz radio finished first in six of our seven locations. D-Link's DIR-855 firmware is more customizable, but Netgear's router offers several important features D-Link can't match, including a DLNA-compliant media server, the ability to configure either radio as a wireless bridge/repeater, and NAS functionality that doesn't require a client-side utility.

If your ISP subjects you to download limits and penalizes you for overages, you'll appreciate the WNDR3700's traffic meter. This tool measures both online time and download volume and can be configured to prevent you from exceeding either quota. Unfortunately, the meter measures in aggregate, so you can't establish limits on a per-client basis. We also find it odd that Netgear doesn't support printer sharing on the WNDR3700's single USB port.

We suspect the primary reason the WNDR3700's press-time street price was so low is because Netgear was clearing inventory to make way for the WNDR3700 V2. Netgear is promising to double the router's memory, deliver a 50 percent performance boost on the 5GHz band, and provide full support for IPv6. We can't wait.

You'll find our complete Netgear WNDR3700 V1 network and NAS benchmarks at http://bit.ly/dziOp1.

SPECIFICATIONS

RADIO FREQUENCIES	Dual-band: 2.4- and 5GHz
GUEST NETWORK	Yes, on both radios
DLNA-COMPLIANT MEDIA SERVER	Yes
USB PORTS	One (for storage only)
NTFS DRIVE SUPPORT	Yes
WDS BRIDGE/REPEATER SUPPORT	Yes, on both radios

KICK ASS!

VERDICT

NETGEAR RANGEMAX WNDR3700

$150, www.netgeat.com

9

The Performance Picture

A router worth its salt will perform favorably in a variety of real-world scenarios

Read more about our testing methodology on page 92.

2.4GHZ BENCHMARKS

	Asus RT-N16	Belkin Play N600 HD	Buffalo WZR-HP-G300NH	D-Link DIR-855	Linksys E3000	Netgear WNDR3700	Trendnet TEW-691GR
Bedroom, 10 feet (Mb/s)	74.3	53.2	56.9	59.6	56.1	**98.7**	75.9
Kitchen, 20 feet (Mb/s)	54.1	60.9	42.8	55.0	55.9	**96.6**	86.8
Enclosed Patio, 38 feet (Mb/s)	35.5	32.9	3.7	5.7	4.8	**53.8**	44.9
Bedroom 2, 60 feet (Mb/s)	25.5	25.5	**41.5**	4.3	3.8	27.1	2.0
Media Room, 35 feet (Mb/s)	6.3	18.5	3.7	4.9	2.3	**22.8**	1.1
Outdoors, 85 feet (Mb/s)	1.9	3.1	0.5	3.2	N/C	**4.0**	N/C

Best scores at 2.4GHz are bolded. TCP throughput measured using IPerf. N/C indicates no connection at that location.

NAS BENCHMARKS

	Asus RT-N16	Belkin Play N600 HD	D-Link DIR-855	Netgear WNDR3700	Trendnet TEW-691GR
Large File Write (min:sec)	8:24	22:23	9:06	11:41	**5:52**
Small Files Write (min:sec)	2:48	9:42	2:13	4:15	**1:32**
Large File Read (min:sec)	7:53	23:36	11:58	**3:59**	6:45
Small Files Read (min:sec)	1:59	5:36	2:36	**1:04**	1:11

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

New Developments in Home Wireless

A host of new technologies promise to meet our evolving needs

Believe it or not, 300Mb/s IEEE 802.11n routers have already been on the market for several years. What's more, the first 802.11n routers that support three 150Mb/s data streams—that's raw throughput of 450Mb/s—have reached store shelves, too.

As we've already mentioned, we didn't find the first such model to be very impressive in terms of range, and we haven't been able to find any USB client adapters equipped with the three antennas needed to take full advantage of the technology. Let's take a quick look at what other wireless technologies are headed our way in the near future.

WIRELESS USB

We once dismissed Wireless USB because it offered terrible range, but the technology has improved considerably and several manufacturers are now using it to build inexpensive video-streaming solutions. Instead of streaming video from the Internet or a media server over your network to a set-top box connected to your TV, these devices will stream video to your TV from a laptop in the same room.

You can read our review of Warpia's PC-to-TV Display Adapter at http://bit.ly/bFymoC. The recently announced Veebeam HD promises an even better experience: Warpia's device uses a VGA output and supports a computer-oriented maximum resolution of 1440x1050. The Veebeam HD uses HDMI and promises resolution of 1080p.

INTEL'S WIDI

Intel announced its Wireless Display (WiDi) technology at CES last January, and notebook manufacturers including Dell, Sony, Toshiba, and Asus have been slowly rolling out machines that support it. Since WiDi is incorporated into Intel's wireless chipset, it doesn't require a USB dongle to transmit. As with Wireless USB, however, it still requires a set-top receiver that plugs into your TV, and that means buying Netgear's $100 Push2TV.

WIGIG

Future tri-band routers will operate three wireless networks on the unlicensed 2.4-, 5-, and 60GHz frequency bands simultaneously. Initial WiGig solutions will likely cover short distances, but there's talk of deploying reflectors and repeaters to enable the 60GHz signals—which can deliver data-transfer rates up to 7Gb/s—to cover wider areas within the home.

The WirelessHD specification seeks to deliver similar data-transfer rates, but we're putting our money on the WiGig Alliance thanks to its strategic partnership with the Wi-Fi Alliance, which has already done such a great job of ensuring the interoperability of IEEE 802.11 devices. It could be a year or two before we see the first WiGig products hit store shelves

The Veebeam HD uses Wireless USB to stream HD video from your notebook PC to a television in the same room.

WI-FI DIRECT

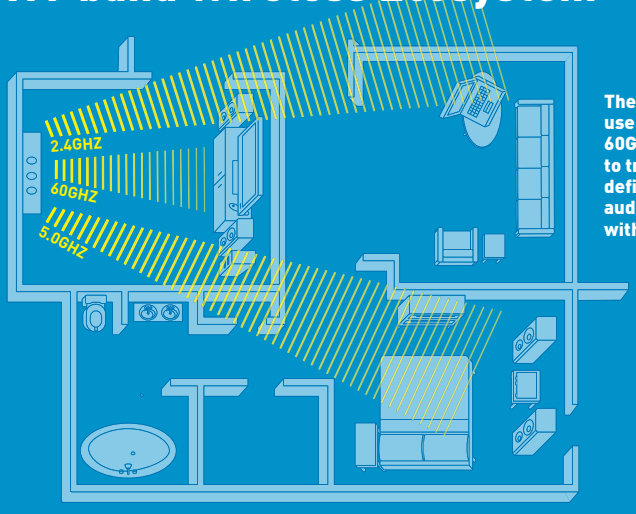
Wi-Fi Direct is another initiative promoted by the Wi-Fi Alliance. Today, the typical wireless network involves clients connected to a wireless access point (typically a router), which is connected to a wired gateway, which is in turn connected to the Internet. Most of these networks operate in infrastructure mode, with the access point acting as a central hub.

That mode works well enough when you're dealing with a few computers sharing a common broadband connection and a printer. Throw in smartphones, media-streaming devices, digital picture frames, and empowering guests to share your network's resources—without giving them carte blanche access to your data—and things quickly become unwieldy. Wi-Fi Direct envisions products that have embedded software access points that would enable the casual formation of an ad hoc network. This would enable your guest to establish a wireless connection between their smartphone or laptop and your printer directly, without involving your router or granting access to the rest of your network. By the same token, a digital media player could stream music and video directly to your TV or A/V receiver.

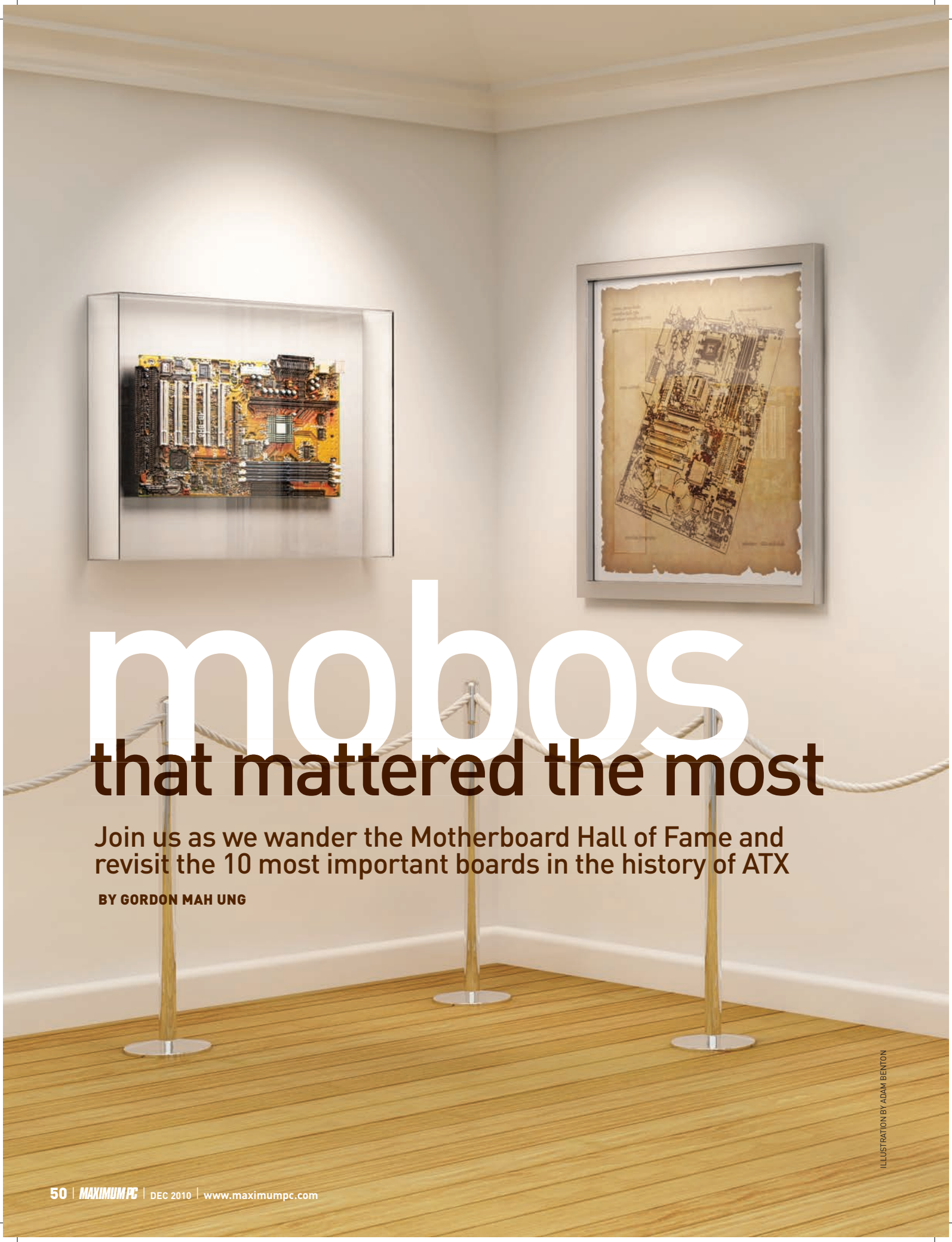
A security protocol similar to Wi-Fi Protected Setup would prevent unauthorized connections, while a protocol similar to Microsoft's UPnP or Apple's Bonjour would enable each device to exchange information about its capabilities. The Wi-Fi Alliance says it expects to begin certifying Wi-Fi Direct products in late 2010.

HOW IT WORKS

Tri-band Wireless Ecosystem



The WiGig spec will use the unlicensed 60GHz spectrum to transmit high-definition video and audio short distances without cables.



mobos that mattered the most

Join us as we wander the Motherboard Hall of Fame and revisit the 10 most important boards in the history of ATX

BY GORDON MAH UNG

ILLUSTRATION BY ADAM BENTON

If you think old motherboards go off to die long, slow deaths in an e-waste dump or silver reclamation plant, think again. Motherboards that have made a significant contribution are elevated to star status where they live forever.

Not all boards are worthy of the Motherboard Hall, of course. In fact, our list notably starts with ATX and moves forward. Why no AT or Baby AT boards? When was the last time someone thought wistfully of a 1992 VL-Bus motherboard? Those boards of old, while certainly heroic, hark back to a day when the component received little attention or enthusiasm—a time before it had realized its true potential.

You'll also notice that our list doesn't include any boards made in the last three years. We've intentionally excluded modern boards because it remains to be seen how much of an impact they'll make over time. Even today's most stellar boards, such as EVGA's Classified SR-2—the board we used in this year's Dream Machine, and an obvious contender for the Hall—are still too young to get inducted.

The reverence owed to the 10 boards you'll see here, however, is unquestionable, as you'll learn when we recount their respective roles in modern motherboard history. But if there are others you feel we've overlooked, please let us know at comments@maximumpc.com.

CIRCA 1996

Intel Advanced ATX/Baseboard

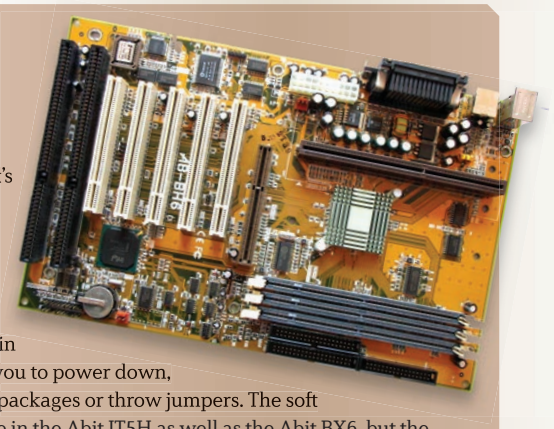
Intel's first ATX board and Triton chipset schooled the competition

It didn't have a splashy name (hell, we're not sure if it even had a name), but Intel's Socket 7 "Advanced ATX/Baseboard" was a tectonic shift in the mobo scene. First, it used Intel's 430FX Triton, which arguably marked Intel's emergence as the core-logic chipset leader. Before that, third-party chipset manufacturers such as Opti, ALi, SiS, and VIA vied for control. The Triton series turned those other chipset makers into overnight has-beens. The Advanced ATX/Baseboard was also the first ATX board that we know of. A new formfactor designed to take us beyond AT and Baby AT, ATX has withstood the test of time and continues to dominate 15 years later. Even Intel's own attempt to kill ATX with BTX came to naught.

CIRCA 1998

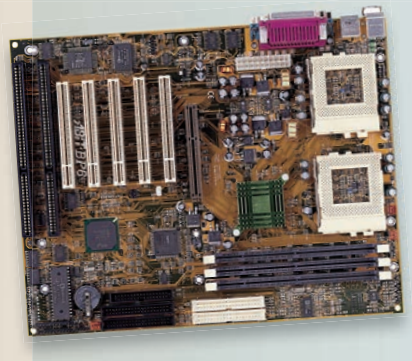
Abit BH6

Overclocking was never the same again



Defunct motherboard maker Abit's main claim to fame was its "SoftMenu." Before the appearance of the soft jumpers, no one had made a mass-market motherboard that let you overclock the front-side bus and other features in the BIOS. Other boards required you to power down, crack open the case, and flip DIP packages or throw jumpers. The soft jumpers first made an appearance in the Abit IT5H as well as the Abit BX6, but the SoftMenu seemed to really hit its stride with the Abit BH6, which some reviewers called the "perfect" 440BX motherboard. How big of an impact did the BH6 have? Today, you can't find an enthusiast motherboard that doesn't use a BIOS-based overclocking feature.

CIRCA 1999



Abit BP6

Perhaps the most famous motherboard of all time

Prior to Abit's BP6, consumers didn't run dual processors. But in a bold move that gained the attention and respect of PC enthusiasts, Abit built its BP6 specifically for the purpose of running two Celeron CPUs in symmetric multiprocessing (SMP) mode, despite the fact that Intel had disabled dual-proc support in those chips. Practically overnight, the BP6 became the poor-man's workstation board, allowing consumers to build affordable dual-processor machines for the first time. Built on Intel's 440BX chipset, the BP6 didn't just let you run two Socket 370 chips, it also let you overclock them. A common configuration was two 300MHz Celeron's overclocked to 450MHz. The BP6 was such an oddity that it didn't even work with the standard OS of the time, Windows 98. Consumers had to run Windows NT, BeOS, or Linux to get that second processor to show up to the dance.

CIRCA 1999

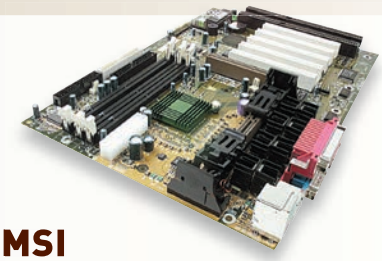
FIC SD11

He pulls a Pentium III, you pull an Athlon.... That's the AMD way

There's a line from *The Untouchables* that explains the SD11. In the movie, Elliot Ness is told, "Everybody knows where the booze is. The problem isn't finding it, the problem is who wants to cross Capone." In late 1999, it wasn't difficult to make an Athlon mobo (although they were pricier than typical boards of the day), but crossing Intel was another matter. Real or imagined, boards vendors were scared crapless of angering the chip giant.

Of those vendors, FIC was the first to cowboy up by not only making the SD11, but also daring to sell it. Sure, the board had electrical and compatibility issues, but when other vendors saw that Intel really didn't seem to care about Athlon, they, too, broke out designs they were previously too afraid to air publicly. We still believe that if not for the SD11, it's possible the Athlon and its descendants wouldn't be here.

CIRCA 2000



MSI MS-6167K7T266

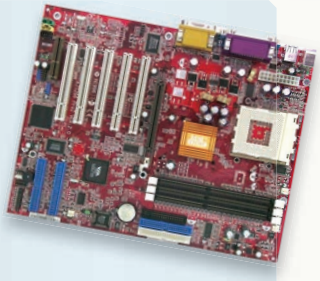
The first good Athlon board

MSI certainly didn't earn a chapter in *Profiles in Motherboard Courage* when it came "out" with the MS-6167. You couldn't find the Athlon-compatible mobo on the company's website, and inquiries to the company about the board were met with silent stares. Despite such caginess, the MS-6167 deserves recognition for being the first solid Athlon motherboard on the market. It was fast and reliable enough to blow the doors off any Pentium III–equipped contemporaries. Unlike the finicky SD11 board, the MS-6167 used AMD's "Irongate" chipset for both the north and south bridges, which proved to be a wise decision in the long term. While the AMD south bridge had its own problems, we'll always have a soft spot for MSI's MS-6167 and the blazing-fast Athlon chip that paired with it.

CIRCA 2001

MSI K7T266 Pro 2

DDR gains the upper hand over RDRAM

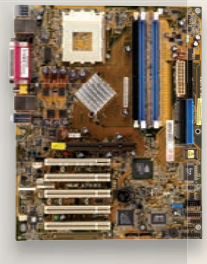


DDR is taken for granted today, but at the turn of the millennium, there was a Tolkien-esque struggle between DDR and RDRAM for the future of the PC, with Intel and Rambus in one camp and a coalition of AMD, DDR manufacturers, and chipset makers in the other. The K7T266 Pro 2 may have been Pippin, but its role was nonetheless important. With AMD's and Ali's DDR chipsets faltering, it was up to VIA to prop up the fallen standard. VIA's first attempt, the KT266, didn't cut it, leading many to question DDR's fate. But VIA's second attempt, the KT266A, was the white knight DDR needed. Boards based on the chipset, such as MSI's K7T266 Pro 2, combined with DDR and an Athlon CPU, helped secure DDR as the standard for PC main memory, and even helped beat back the vaunted Pentium 4 in many subsequent CPU battles. We fondly remember the K7T266 Pro 2 for being a loyal foot soldier in the great memory wars.

CIRCA 2003

Asus A7N8X Deluxe

The sun sets on VIA but rises for Nvidia



The A7N8X Deluxe was trend-setting in many ways. The chipset in it, the nForce 2 SPP, was the first runaway hit for Nvidia's newly minted chipset division, and the A7N8X Deluxe was the pinnacle of nForce 2 boards. Among its noteworthy features was the ability to encode audio streams in real time to Dolby Digital Live and pump them out via optical or coax. This made the board ideal for a system that would be paired with a home theater receiver. The other story behind the A7N8X was its performance. Normally, motherboard performance comparisons can be pretty boring, as the CPU does all the heavy lifting. But the nForce 2's superior memory performance enabled the A7N8X Deluxe to thrash two other VIA-based boards in a showdown we ran back in 2003. In many ways, the nForce2 and the A7N8X marked the end of VIA's dominance in AMD chipsets—a position VIA had held since the introduction of its popular and fast KT266A chipset.

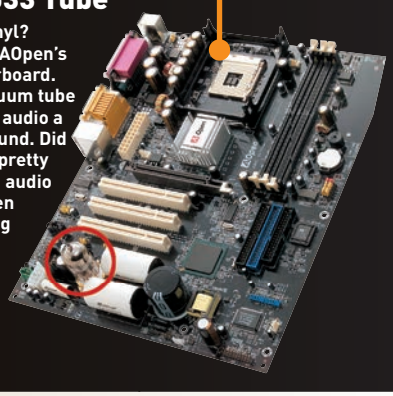
SAY WHAT?

The Most Unusual Motherboards in Recent Memory

CIRCA 2002

AOpen AX4B-533 Tube

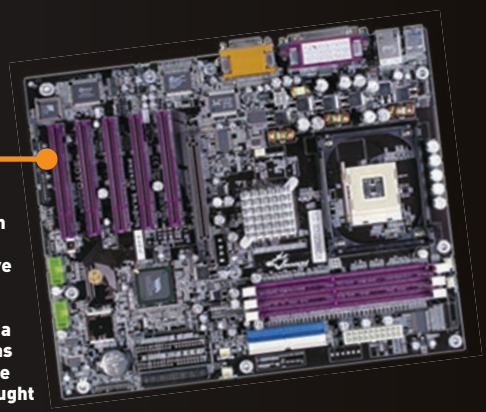
Still rolling pressed vinyl? Then you'll appreciate AOpen's AX4B-533 Tube Motherboard. Yes, a board with a vacuum tube to give that cold digital audio a nice warm "analog" sound. Did it work well? Well, it's pretty tough to make onboard audio sound better, even when piped through an analog circuit that the mobo maker has put a lot of time and engineering into.



CIRCA 2002

Soyo P4X400

It's hard to determine which board was the first with the garish colors, but we believe Soyo's P4X400 may have been ground zero. With its purple expansion slots and a silver-painted (the paint was practically still wet when we got it) PCB, the P4X400 brought the original bling.



CIRCA 2003

Chaintech 9JCS Zenith

The kitchen-sink approach

Remember when even a high-end board came with just cables, an I/O shield, and a flimsy manual? That changed with Chaintech's 9JCS Zenith. While certainly a good motherboard with premium chips and pack-leading performance, what made the 9JCS Zenith so memorable was the incredible amount of add-ons that Chaintech included with it. Besides the cables, you also got a riser board for audio, a screwdriver, a bay drive with memory card readers and IR receiver, and a remote control, too. The only thing the board didn't come with was a box of Cracker Jacks.

It didn't take long for competing companies to follow in the steps of Chaintech's kitchen-sink approach with their own bundles of over-the-top accessories. So, when you crack open your next packed-to-the-gills enthusiast motherboard, say a little "thank you" to the 9JCS Zenith.

CIRCA 2006

Intel D975XBX

The first Intel board that gave you serious overclocking features

There was a period when we didn't bother to review Intel motherboards. Not because they weren't interesting or unique, but because enthusiasts didn't give a damn about Intel CPUs in the heyday of the Athlon 64. With badly ignored Pentium 4s came badly ignored motherboards. Intel's Core 2 flipped the world on end overnight, leaving fanboys and even the jaded tech press awestruck that the tables could be turned so rapidly. Intel stepped out of that void with its D975XBX "Bad Axe" mobo. Designed to address complaints that its boards didn't appeal to enthusiasts, the Bad Axe actually supported—gasp—overclocking. The D975XBX even sported a little 'tude, with heatsinks shaped like flames. Boards from Asus, MSI, Gigabyte, and others would eventually overtake the D975XBX in features, bling, and overclocking capabilities, but when we think of the stunning debut of Core 2, we'll always think of the D975XBX, too.

CIRCA 2007

EVGA nForce 680i SLI

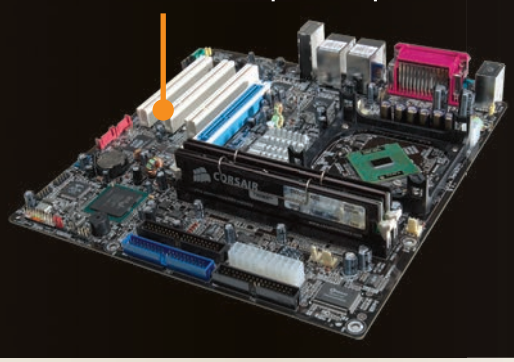
Nvidia aces Intel at its own game: performance chipsets for Intel CPUs

Nothing proved that Nvidia was a force to be reckoned with more than EVGA's nForce 680i SLI board. Essentially a clone of the Nvidia reference boards, the EVGA nForce 680i SLI demonstrated the benefits of a chipset designed to work closely with graphics cards. Besides offering the obvious SLI benefits with the GeForce 8800 GTX, the nForce 680i SLI would overclock the PCI Express slots and also introduced the concept of embedding memory profiles to overclock the RAM. The board and chipset weren't perfect—said PCI-E overclocking feature was eventually pulled—and many users reported problems with Sound Blaster soundcards. Despite those issues, the nForce 680i SLI was a sweet setup for many years.

CIRCA 2005

AOpen i855 GMEm-LFS

You can't say that AOpen isn't different. The company's i855 GMEm-LFS took the unusual step of letting you mount a mobile Pentium M chip in a desktop motherboard. Why? Pentium Ms ran cooler (something no Prescott P4 ever claimed) and also performed quite well.



CIRCA 2002

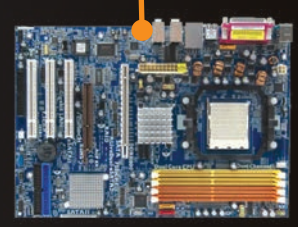
ECS PF88 Extreme Hybrid

ECS's PF88 was a truly insane idea. The board started off with an LGA775 socket for Pentium 4 support. Not satisfied with P4? No problem, drop in a large SIMA daughter board and start running an Athlon 64 in Socket 939 trim. Other SIMA cards planned for the board included Socket 478 and Pentium M support. The SIMA card actually contained a new chipset and RAM slots, and pretty much disabled the chipset on the motherboard.

CIRCA 2010!

Asrock AliveDual-eSATA2

You aren't giving up your AGP card until they rip it out of your cold, dead hands? Well, then peep Asrock's AliveDual-eSATA2 board. This unusual motherboard, which Asrock introduced this year, supports PCI-E GPU *or* AGP! Yes, AGP! Asrock pulls off this trick by using two different chipsets on the board: an Nvidia M1695, and for the AGP, an nForce3 250.



WHITE PAPER

4G Wireless

How the next generation of mobile technology boosts performance –ZACK STERN

The statement "4G mobile technology has evolved beyond 3G" might score high on the "Duh" meter; but when we asked how this evolution manifested itself, we got different answers from different folks.

Mobile companies maintain that they're rolling out 4G networks and handsets today, but the ITU-R (International Telecommunications Union Radiocommunication Sector) disagrees. That standards body maintains that the gear currently being advertised as 4G falls well short of its ideal, and that *true* 4G networks and devices lie a few years into the future. We'll explain where 4G is today, how the networks have improved since 3G, and where the ITU-R wants the industry to go.

4G TODAY

Devices and services being marketed as 4G today are actually 3GPP LTE (Third-Generation Partnership Project Long-Term Evolution) and Mobile WiMAX (IEEE 802.16e). Both technologies represent major overhauls to prior networks, so they're more advanced than 3G, but they're not quite 4G. Sprint has chosen WiMAX, and Verizon and AT&T are moving ahead with LTE.

While each company evangelizes its own decision, the differences are nuanced. "In many ways, WiMAX and LTE are pretty comparable," says Verizon's Executive Director, Ecosystem Development Brian Higgins. "Both are OFDMA-based technologies, so they're quite similar."

OFDMA (Orthogonal Frequency-Division Multiple Access) changes the way the wireless spectrum is divvied up. CDMA (Code Division Multiple Access), which Verizon uses today, assigns each transmitter a code in order to multiplex the signals from many users over the same physical channel. OFDMA uses two-dimensional resource scheduling (in time and frequency) to dedicate an overlapping but non-interfering frequency range to each user so that multiple users can be supported in the same time slot. Verizon's LTE service will divide the 700MHz frequency spectrum it purchased during the 2008 FCC auction into 10MHz channels.

"Within milliseconds," says Higgins, "we're making decisions on what chunk of frequency and what chunk of time we are going to allocate, and how many of those chunks, down to each individual user." This allows the network to shift more bandwidth to more demanding requests in real time.

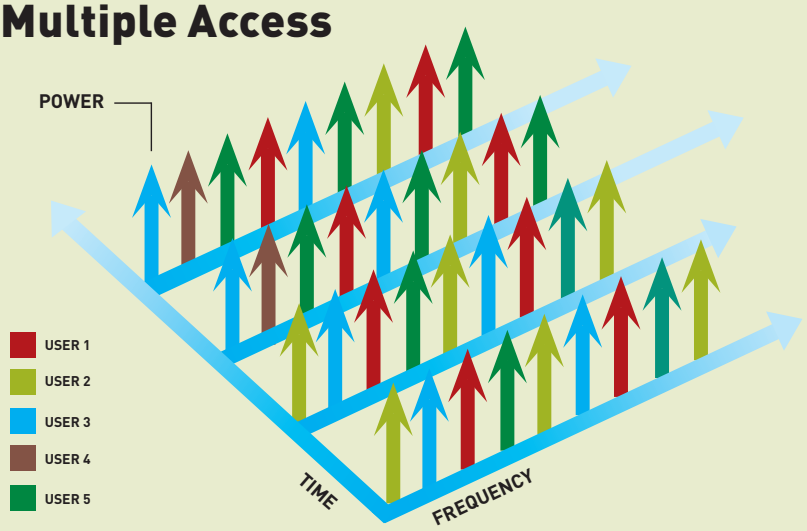
Verizon augments OFDMA with MIMO (Multiple-Input, Multiple-Output) antenna technology at the downlink end. MIMO takes wireless communications' greatest weakness—multipath signal propagation—and turns it into an advantage. Radio signals propagate as they bounce off buildings, mountains, and other physical obstacles. Instead of rejecting the multiple signals, MIMO antennas accept all of them and combine them into a single coherent data stream.

Higgins uses sound waves to illustrate how MIMO works. Imagine listening to someone speak at the opposite end of a furnished room. That person represents a single radio transmitter. As the sound waves emanate from his mouth, some bounce off the walls, windows, and furniture, while upholstery, curtains, and other materials absorb others. Your ears represent a radio receiver. "If you are someone who has just one ear," says Higgins, "you're going to have an ability to hear a conversation to a certain level. But if you have two ears—which is what you're thinking about with MIMO—you have the ability to pick up different paths of sound coming across."

Packet-switched networks mark another major improvement in LTE and WiMAX. In earlier networks, such as CDMA, the phone

HOW IT WORKS

Orthogonal Frequency-Division Multiple Access



Both next-gen mobile technologies—3GPP LTE and Mobile WiMAX—rely on Orthogonal Frequency-Division Multiple Access (OFDMA) to make the most efficient use of the available wireless spectrum. OFDMA allocates time and frequency range to each user on a schedule, so that multiple users can be supported in the same slice of time.

transmits to a base station, and that traffic is then sent through a T1 circuit to a mobile switching station. The data can then be converted to IP (Internet Protocol) packets, if needed. LTE and WiMAX networks can process *all* traffic using IPv6 and avoid the conversion step. Verizon, however, will continue using CDMA for voice traffic for now, reserving LTE for data traffic.

All of these changes combine to reduce latency in LTE and WiMAX networks: OFDMA allocates bandwidth more efficiently, MIMO improves signal quality, and packet-switched networks reduce conversion overhead. Verizon claims its LTE latency is in the 30-50ms range, compared to nearly 500ms on some 3G networks. This should render Verizon's network sufficiently responsive for online gaming, VoIP, and other demanding applications.

WILL THE REAL 4G PLEASE STAND UP?

LTE can reach speeds of 100Mb/s downlink and 50Mb/s uplink, while WiMAX delivers up to 128Mb/s down and 56Mb/s up. These speeds hurtle past 3G standards, but they're still far off the 4G purists' target, which has led some to dub LTE and WiMAX "3.9G" technologies.

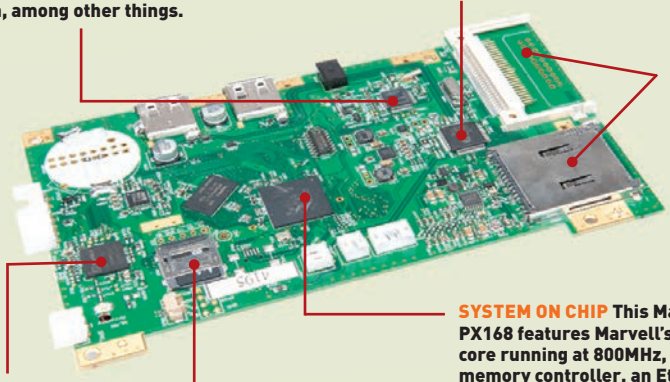
The ITU-R guideline for true 4G is known as IMT (International Mobile Telecommunications) Advanced. According to that standards body, wireless technologies must run at 1Gb/s for stationary users and 100Mb/s for moving connections. The IMT Advanced guideline also calls for significantly reduced latency: 10ms.

The ITU-R hasn't identified a specification that meets its goals for IMT Advanced; instead, the next generations of LTE and WiMAX—LTE Advanced and IEEE 802.16e—are being designed to achieve those speeds.

While the ITU-R definition of 4G will push the industry toward even faster performance, carriers defend their "4G" designators. "We're talking about doing basically an order of magnitude change in the capabilities of our wireless technology," says Verizon's Higgins. "To us, that's a meaningful difference and is worthy of creating the right kind of brand around that, which is '4G.' "

Insignia Infocast

This Internet appliance is a Chumby through and through. It can run all the Chumby apps, make a wireless connection to your 802.11b/g network, display photo slide shows on its eight-inch touch screen, surf the web, and a whole lot more. We thoroughly enjoyed taking this one apart to see what makes it tick. (You can read our hands-on review at http://bit.ly/c3wFha.)



32-BIT MICROCONTROLLER This ST Microelectronics STM32F101 manages the touch screen, among other things.

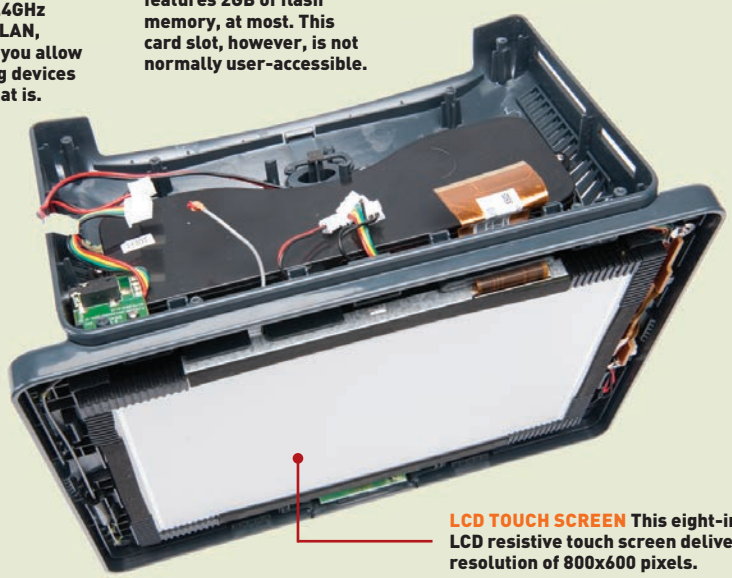
MEMORY CARD CONTROLLER This Alcore AU6350 controls the two memory-card readers and serves as a USB hub.

MEMORY CARD READERS The Infocast is equipped with two memory-card readers to handle CompactFlash, SD, MMC, xD, and Memory Stick media.

SYSTEM ON CHIP This Marvell Armada PX168 features Marvell's Sheeva CPU core running at 800MHz, a DDR2 memory controller, an Ethernet MAC, a USB controller, a graphics accelerator, a general-purpose input/output controller, and more. It handles the bulk of the Infocast's processing needs.

WLAN MODULE This low-power AzureWave AW-GH321 enables the Infocast to connect to your 2.4GHz wireless LAN, provided you allow 802.11b/g devices to join, that is.

MICROSD MEMORY SLOT In addition to the 128MB of DDR2 RAM soldered to the motherboard, the Infocast features 2GB of flash memory, at most. This card slot, however, is not normally user-accessible.



LCD TOUCH SCREEN This eight-inch LCD resistive touch screen delivers resolution of 800x600 pixels.

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

HOW TO Step-by-Step Guides to Improving Your PC

THIS MONTH

SOLDER THE RIGHT WAY

ALEX CASTLE
ONLINE MANAGING EDITOR

A lot of our more ambitious how-to articles involve soldering—it's the best way to make a secure, totally conductive connection between two wires or components. If you've done much soldering yourself, you know that it's actually a surprisingly simple process, but it can be daunting for someone who's never tried it before. Here are three tips to help you get started with solder.

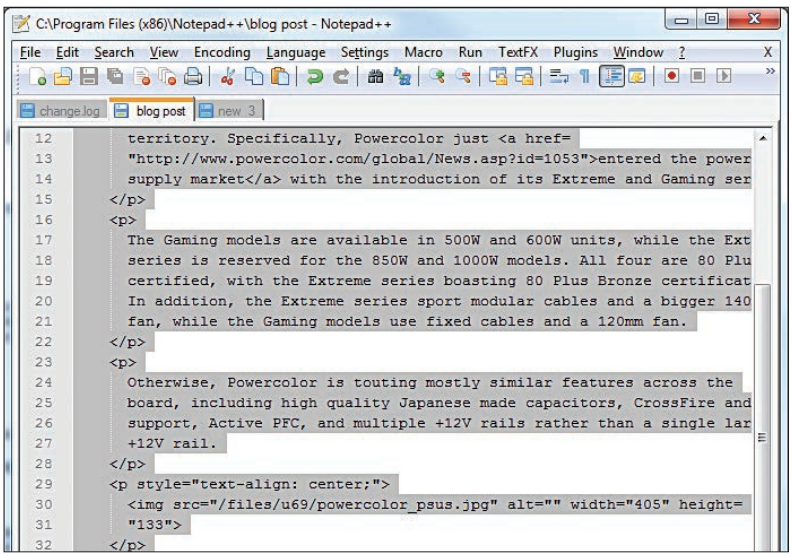
1) When soldering a connection, don't heat the solder directly, instead, heat the wire while holding the solder against it. If done right, the soldered joint will look smooth and shiny, not "crinkly."

2) Keep your tip clean. When the tip of your soldering iron gets oxidized, it doesn't conduct heat well, which makes it hard to solder cleanly. Wipe excess solder off between joints, but leave enough to keep the tip lightly tinned (a thin coat of solder on the tip that helps prevent oxidation). If your tip *does* get oxidized, use a tip-cleaning compound to return it to life.

3) Don't use too much solder. Try to coat a connection with the minimum amount of solder needed to securely join it. A big blob of solder doesn't help anything, and if you're soldering to a circuit board it can cause short-circuits.

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

WINDOWS TIP OF THE MONTH



Upgrade Your Notepad

Word processors are great for documents, but no computer is complete without a good, old-fashioned plaintext editor. You can use Windows' default Notepad software, but there's a much more potent alternative in Notepad++ (www.notepad-plus-plus.org). In addition to a bevy of features for programmers, Notepad++ features some common-sense upgrades, like tabbed editing of text files.

Build Your Own IR Head Tracker

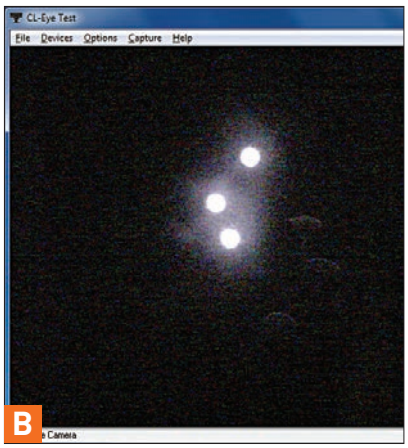
With all the recent hubbub about Microsoft's Kinect and Sony's PlayStation Move, you'd be excused for thinking that motion control is some new phenomenon. In reality, it's a technology that's been around on the PC for years. Head tracking allows you to control your PC with your head. Mostly used in sim games, head tracking lets you move and tilt your head to control where your character looks. There are, of course, some excellent commercial head-tracking systems available, but it's possible (thanks to free software called FreeTrack) to build your own head tracker with just a webcam and a few dollars worth of electrical supplies. We'll show you how. –ALEX CASTLE

HOW IT WORKS

From a hardware standpoint, a head tracker is remarkably simple. It's composed of two parts: a webcam and an array of lights, worn on the head. The camera filters out everything it sees except for the array of lights, and the FreeTrack software interprets the positions of these points of light so that it can tell where your head is facing. It sounds a little complicated, but makes perfect sense when you see it in motion. Here's an example:


A

Here, a V-shaped, three-light array is worn on the side of the head (image A). When facing forward, it forms a straight vertical line of lights. As seen by the webcam (image B), the same array is turned to the right, moving the lights out of alignment.



B

Not so complicated, right? Here's what you need:

THE WEBCAM

First, you need a webcam. Most modern webcams will work, but what you really want is one that has a high frame rate, low CPU usage, and an auto-exposure function that can be turned off. Note that we didn't mention high resolution—you don't actually need anything more than 320x240. So if your camera lets you turn down the resolution and get a higher frame rate, that's a plus.


C

You can find a list of webcams that have been successfully used with FreeTrack at http://bit.ly/fA1CL. For our build, we went with the PlayStation 3 Eye (image C). There are some great reasons to use it (it's a high-quality, super–high frame rate camera that doesn't cost a lot. But we had an even better reason—we already have one, modified to see only infrared light. If you remember when we built the multitouch surface computer (http://bit.ly/aEpDiZ), you'll recall that we had great luck using the PlayStation 3 Eye, so we're going to use it again.

What's that, you say? You don't already have a modified webcam? Well, don't worry, there are plenty of resources that will help you modify your camera. The link for the FreeTrack Forum above has info about how to modify a webcam, and if you decide to go with the PlayStation 3 Eye, you can check out our very own illustrated guide to turning it into an IR camera online, at http://bit.ly/9JwvlH.

THE POINT MODEL

Once your camera is ready to go, it's time to get started on the point model. The point model is the gear that will, one way or another, let your computer see (via the webcam) which direction your head is pointed. There are a lot of ways to make a point model.

The simplest is a single point of light—an LED or a reflector attached to your head. This is enough to allow the computer to calculate your head's location along two axes. When you look up, the point of light moves up, when you look right it moves right, and so forth.

However, if we're going to all the trouble of strapping some lights to our head, we might as well get a full three degrees of precision out of it. By upgrading from a single point to a three-point model, FreeTrack gains the ability to determine your head's position and rotation about the Z axis—in addition to being able to tell when you're looking right or left, and up or down, it can also tell when you move and cock your head.

For a three-point model, you can either use a "clip" model, in which the three points are arranged in a lopsided V shape, and attached vertically to a headset (image A), or a hat model, where one point is placed on top of a baseball cap or visor, and two are placed along the rim. Whichever one you want to go with is really up to you. We chose to go with the clip model because we usually wear a headset while gaming.

D

THE LIGHT SOURCE

Now that you've decided on a configuration for your point model, you need to pick a light source. Your two choices here are infrared LEDs (image D) and reflectors. The advantage to LEDs is that because they emit a ton of infrared light, your webcam will have no trouble isolating the three points. The downside is that they have to be powered, meaning you'll have a battery pack attached to your body somewhere. Reflectors are popular, because they don't require a battery pack. However, they require significant illumination to function, so you'll need to shine a bright array of eight or more IR LEDs on them, preferably from a source near your webcam.

For their consistency, and because we don't mind keeping track of a battery pack with a single triple-A battery, we chose to use IR LEDs. Of all the infrared LEDs available, the SFH485P model is the most recommended, for its wavelength and viewing angle. We happened to have some on hand (again, from the Surface Computer) but you can find them for well under a dollar apiece at online electronics dealers like Digi-Key (www.digikey.com).

Some people swear up and down that you need a resistor any time you're building an LED into a circuit. It so happens that the forward voltage drop of the SFH485P is 1.5V, same as a standard battery, so it's possible that you can get away without one. If you want to play it safe, you can find a very handy resistor calculator at http://bit.ly/9OcBes.

BUILDING THE POINT MODEL

How you actually put your lights together into a point model is up to you. The optimal shapes for both clip- and hat-type point models are described at http://bit.ly/dbf9OH but the actual materials you use to construct them can include almost anything. For maximum thriftiness, we built ours out of the tubes of three basic Bic pens and a paperclip (image E). We simply cut the pen tubes to the right length (according to the diagram linked above), drilled holes for the wires, and glued the whole thing together. Then, we glued


E

the clip on the back to hold the lights to a headset (image F). Is it beautiful? Hell, no. But it gets the job done, costs next to nothing, and makes us feel like MacGyver every time we wear it.

For lots more examples of how a completed point model looks, check out this page: http://bit.ly/cA2ijm.

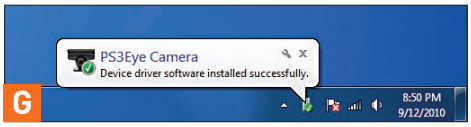
THE SOFTWARE

For this section of the how-to, we're going to assume that, like us, you are using a PlayStation 3 Eye camera. If so, you'll need to install a custom driver for the camera before anything else, as Sony hasn't released official Windows drivers for it. You can download the custom driver at http://codelaboratories.com.

Installation is as easy as running the executable (making sure that your camera isn't plugged in beforehand), and telling Windows it's all right to install this unsigned driver. Afterward, plug in the camera, and you should see Windows recognize it as a PlayStation 3 Eye (image G). To make sure that everything's working fine, you can run the program called CL-Eye Test that came with the driver. You can also use this program to see what your point model looks like through the camera and make sure everything's working.

After installing the driver software for the camera, you can install FreeTrack itself. The latest version is available at www.free-track.net.

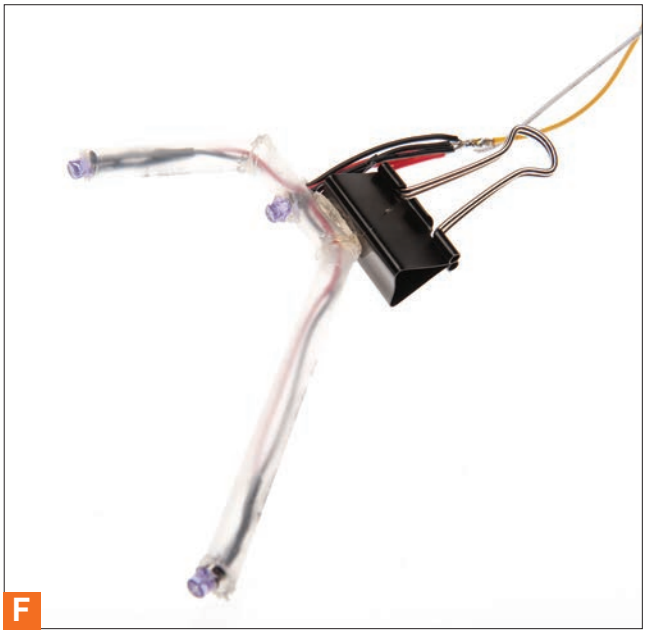
If you're using the PS3 Eye, don't run FreeTrack after installing it. First, you have to download the hack file from http://bit.ly/akDe79 and extract it to your FreeTrack folder. If you already ran FreeTrack, just uninstall it and reinstall, then apply the fix.

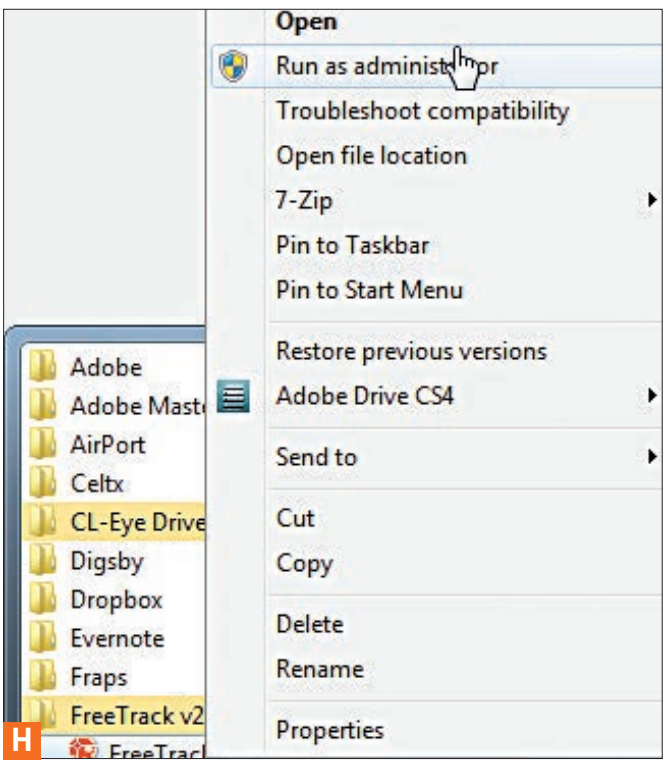


G

Finally, you're ready to launch FreeTrack. If you're running Windows 7, you'll have to run the program as an administrator, or else it can't access your webcam. To run it as an administrator, just right-click the FreeTrack executable, and choose Run as Administrator (image H).

When you launch FreeTrack, you'll need to make some major settings tweaks. First, click the Model button in the upper right corner and choose the type of point model you built. Next, go back to the Cam window and click the Source drop-down and select your webcam. Now, click the Start button and you'll begin to see a live preview of FreeTrack's point detection, which will help you perform the rest of your calibration. Clicking the Camera button will show you some camera-specific options including gain and exposure, which you can adjust to increase how bright your point model will appear (at the expense of


F



H

adding noise).

Back at the main window, look at the Threshold slider. This sets the brightness cutoff for the point detection. What you want to see are three steady circles, and nothing else. If you see extra speckles or noise on the screen, adjust the slider to the right. If any of the three circles are flickering, adjust it to the left. If you can't get three steady circles, consider going back and adjusting the exposure and gain again, or reducing sources of environmental IR light by turning off overhead lights.

Move on to the next tab, labeled Framerate. By default, this is set to 30fps. The best feature of the PS3 Eye is its amazing frame rate, so if you've got it, bump the fps up to 120. The multiplier should automatically reduce to 1. This will make the head tracking noticeably more responsive.

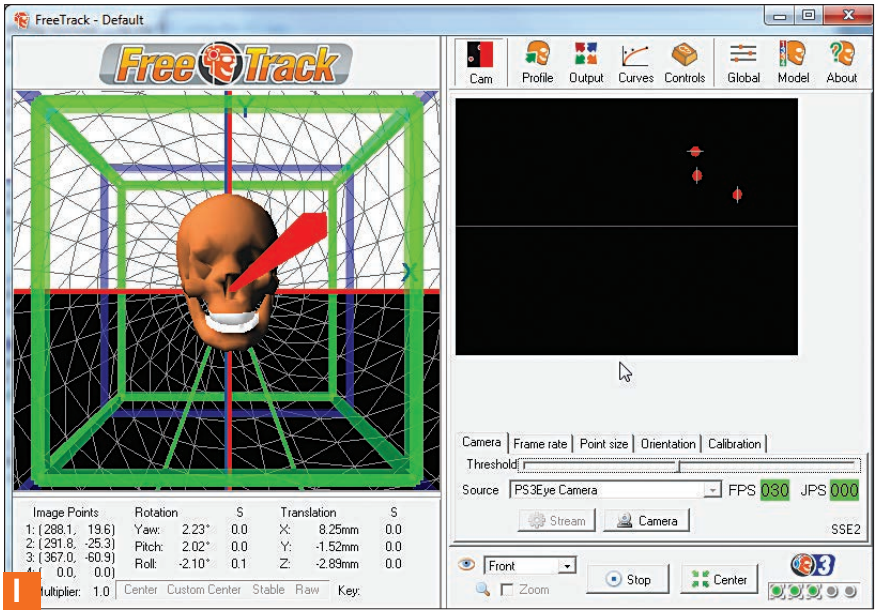
The next tab, Point Size, lets you set constraints on what the program will consider when it's looking for points. For instance, if you can tell by looking at the preview window that your points tend to be in the 10–20 pixels wide range, then you should set the minimum point size up higher than the default of 2 pixels. Setting the minimum pixel size higher will reduce lag, so set it as high as you can without causing the program to lose track of the real points.

In the Global Settings menu, you can change the sensitivity of FreeTrack's movement axes. Leave these alone for now, but you'll probably find yourself wanting to come back and adjust these once you've played a few games.

FreeTrack should now be working as advertised—the 3D skull in the FreeTrack window should smoothly mirror the movements of your head in real time (image I). We can finally get into the games.

THE GAMES

There are three ways that a game can support FreeTrack. First, the game can support FreeTrack natively. There's actually only one game that does this, but it's a doozy: Arma 2. The high-water mark for soldiering sims, Arma 2 takes excellent advantage of FreeTrack head tracking, allowing you to look around, lean, and zoom in or out by moving and turning your head.



I

Even if a game doesn't support FreeTrack directly, you can still make it work. Many sim and racing games support TrackIR, a commercial head-tracking package from NaturalPoint. FreeTrack can emulate TrackIR, so it works with most TrackIR-compatible games (for a list, see http://bit.ly/a91zci). Recently, NaturalPoint has started encrypting the TrackIR software, specifically to break compatibility with FreeTrack. There are, of course, hacks that allow you to use FreeTrack with those games that are restricted to the newer, encrypted version of TrackIR, available at http://bit.ly/bqQKxX.

How you set up FreeTrack with a game is different for every game, of course, but generally you'll find the option somewhere in the control-settings menu (image J).

Even if a game doesn't support FreeTrack or TrackIR natively, it's still possible to incorporate head tracking. In the Controls menu, under the Main tab, you can see the different control options available using FreeTrack. Below the FreeTrack and TrackIR options, you can see an unchecked box labeled Mouse. Enabling this option allows you to control your mouse with FreeTrack. Obviously, you're not going to want to play shooters with this kind of head tracking, but it can work for some other types of games.

J

In the controls menu there's also a tab marked Keyboard, which allows you to bind head movements to keystrokes, giving you yet another option for controlling games with head tracking.

It can take a little finagling to find the combination of control setup and sensitivity options that works for you, but once you do, you won't want to go back.

LENGTH OF TIME
2 HOURS

LEVEL OF DIFFICULTY
INTERMEDIATE

BUILD IT

A Wee Ass-Kicking Machine

You don't need a full-size motherboard and plus-size chassis to build a great gaming rig. Here's how to build a tiny computer with a huge punch

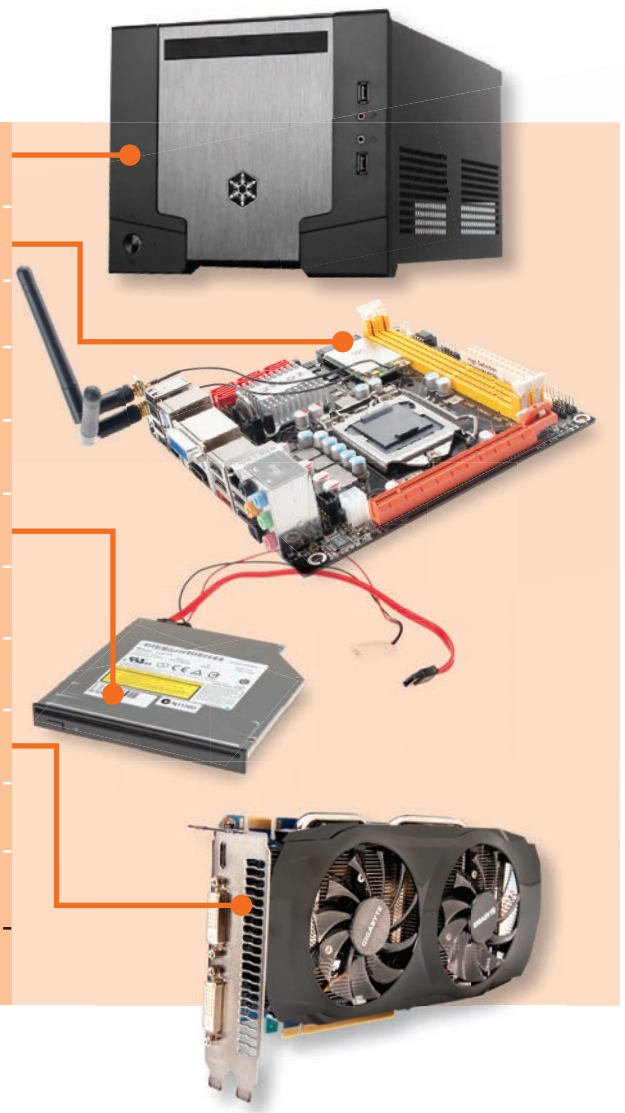
NATHAN EDWARDS
SENIOR ASSOCIATE EDITOR

Forget big. For this challenge, I'm going small. My goal: to create a kick-ass gaming rig on a Mini-ITX motherboard. That means I need a discrete graphics card, a mobo with a full PCI-E x16 slot, a desktop processor, and plenty of storage. I also need a case that can hold it all elegantly, a PSU to power it, and enough airflow to make sure the rig doesn't melt. Finally, it has to look good.

Why a Mini-ITX gaming rig vs. a traditional desktop? For starters, I wanted to see what kind of performance is possible from a small formfactor PC. More importantly, why *wouldn't* I (or anyone else) want a rig that's easy to move from room to room, or take on the road for a LAN party?

INGREDIENTS

✔ **Case/PSU** Silverstone SG07 w/ 600W PSU www.silverstonetek.com	$210
✔ **Mobo** Zotac H55ITX-A-E LGA1156 www.zotac.com	$165
✔ **CPU** Intel Core i7-870 www.intel.com	$290
✔ **Cooler** Stock Intel cooler www.intel.com	$0
✔ **RAM** Corsair TW3X4G1333C9A 4GB Kit DDR3/1333 www.corsair.com	$90
✔ **Optical Drive** Silverstone SOD01 Slimline DVD Combo Drive www.silverstonetek.com	$85
✔ **Hard Drive** 1TB Western Digital Caviar Black 7,200rpm www.wdc.com	$180
✔ **Solid State Drive** 120GB Corsair Force F120 www.corsair.com	$300
✔ **GPU** 1GB Gigabyte GTX N460OC-1G1 www.gigabyte.us	$230
✔ **OS** Windows 7 Home Premium 64-bit (OEM) www.microsoft.com	$99
✔ **Misc** 90-degree SATA data cable Zip ties	$2 $2
Total	**$1,653**



Picking the Essential Elements

In many ways, building a small formfactor PC is a distillation process. You can't afford to include anything nonessential, but you can't strip away anything you're going to need.

Choosing the right kind of chassis for an SFF build is paramount. I chose Silverstone's SG07 case because it offers plenty of cooling, an integrated 600W PSU, and room for two 2.5-inch drives, one 3.5-inch drive, a slimline optical drive, a Mini-ITX motherboard, and a full-size GPU, all in a package that measures just 7.5x8.65x13.75 inches. Plus it looks great.

I paired this enclosure with a Socket 1156 Zotac H55 motherboard with a PCI-E x16 slot, integrated Wi-Fi, and plenty of USB and SATA ports. This gives me room for a quad-core Core i7 CPU with Hyper-Threading, up to 8GB of RAM, one kick-ass GPU, an SSD or two, and a big ol' storage drive. That's all you need for a kick-ass gaming machine.

Because of the SG07's cramped quarters, it's trickier to build in than a more conventional chassis. Certain steps are out of order compared to a traditional build; others are skipped entirely. For this build you'll need the parts listed above, plus a Philips-head screwdriver, some zip ties (optional), and a 2.5mm hex-head wrench (recommended for the last step).

Silverstone's SG07, fully disassembled and ready for our build.

1 PREP THE CASE

The SG07 requires significant disassembly before you can start your build (image A). Start with the rear of the case facing you. Remove the three screws holding the top cover on, and then pull toward your body and up to remove the cover.

Remove the large case fan by unscrewing the three screws that keep it in position. Lift away. (Note that it will still be attached to the rear fan switch via a cable—you can remove the switch mechanism by unscrewing its two mounting screws). Remove the optical drive bracket by unscrewing the four screws holding it in place. The optical bezel is held on by a screw on the left side; remove it also. Take out the two screws holding the hard drive bracket, and then remove the bracket by lifting up and clockwise. We're going to pull out the integrated PSU's power cables so they're ready to use when we need them.

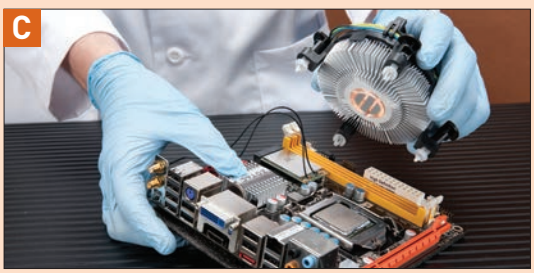
Last step: the motherboard I/O shield. Remove all the little metal port protectors from the outside of the shield. Once all the ports are freed, insert the motherboard I/O shield into the case. Remember, it goes on the inside of the case, facing out. Press it firmly outward until it is seated evenly. Now, you're ready to start building.

2 INSTALL THE CPU

Since the inside of the SG07 is so cramped, you'll want to install the CPU, heatsink, and RAM onto the motherboard before you put it in the case. Place the motherboard on a flat surface, then unclip the CPU retention bar and flip it back. This will lift up the load plate. Carefully remove the plastic socket cover, being careful not to touch any of the pins in the socket.

Hold the CPU parallel to the socket and carefully lower it into place. The notches on the CPU should line up with the corresponding ones on the socket. When the CPU is in place, lower the load plate over it, then secure the arm in its clip (image B).

If the load plate doesn't close smoothly, don't force it. Make sure the CPU is oriented correctly.



3 INSTALL THE COOLER

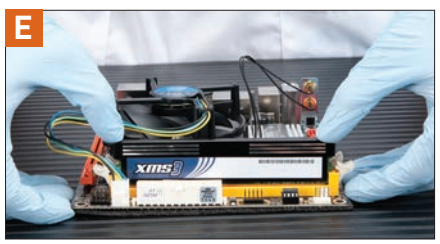
For this build, we're using the stock Intel cooler that comes with the CPU. Although it's not as overclocker-friendly as an aftermarket cooler, it doesn't have any compatibility issues with our mobo/case combo. The stock cooler should have thermal pads preinstalled; you can use those or replace them with your own favored thermal paste. (We prefer Arctic Silver 5.) For this demonstration, we're using the stock pads (image C).

Make sure all four of the heatsink's pushpins are prepared by turning them away from the direction indicated by the arrows. Align the pushpins with the four mounting holes on the motherboard and guide the pins into their respective mounting holes. Once the heatsink is sitting loosely on the CPU with pins in place, press down firmly on two pushpins on opposite corners of the heatsink until each clicks and the cooler is secure. Repeat for the other two pins (image D). The heatsink should be firmly attached without wiggling. Connect the cooler's power connector to the motherboard's CPU_FAN header.

4 INSTALL THE RAM

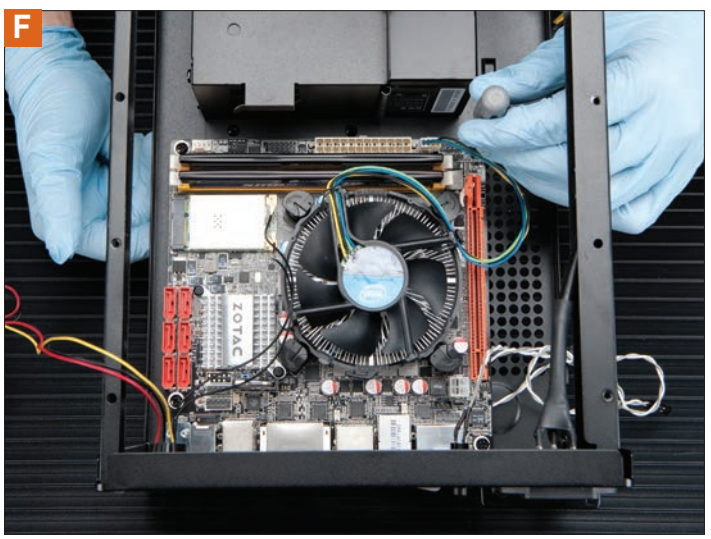
The H55-based Zotac board supports dual-channel DDR3/1066 or DDR3/1333 in its two DIMM slots. For this build, we're using two 2GB DDR3/1333 DIMMS, for 4GB total. Since you're populating both slots, you don't have to worry about setting things up incorrectly.

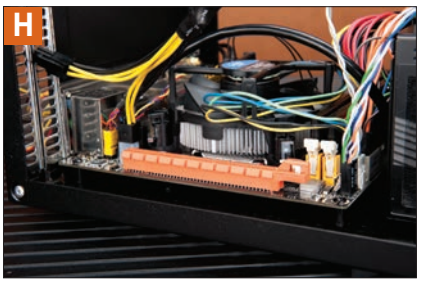
Just open the two brackets on each slot, and make sure the RAM is oriented correctly—match the notch in the DIMM with the notch in the slot. Press down on the corners of the DIMM until it seats and the retention brackets lock into place (image E).



5 INSTALL THE MOBO

By now, you should have your motherboard prepped with a CPU, heatsink, and RAM. Align the I/O ports with the I/O shield and the four mounting holes on the motherboard with the standoffs preinstalled in the case. Secure with screws in each of the standoffs (image F).





Now is a good time to connect your 24-pin and 4-pin ATX power connectors (image G) as well as your front-panel connectors (image H). Since space is so limited, keep careful track of your cables. Wrap excess front-panel connectors in twist ties or zip ties and secure them to the bottom of the case (image I). We'll tidy up the power cables later, but we can take care of the front-panel connectors now.

6 MOUNT THE HDD/SSD

The SG07 can accommodate two 2.5-inch drives and one 3.5-inch drive. With the hard drive cage's retention bar on the left, slide in the 1TB hard drive so that its power and SATA ports are on the lower left facing you (image J) and secure it with the four hard drive screws. Use two SSD screws to attach the SSD to the underside of the drive cage. Before you reinstall the cage, be sure to pull the SATA power cable between where the cage will be and the front wall of the case, then reinstall the cage and connect the SATA power and data cables (image K). Because the case is so cramped, you'll need to use right-angle SATA cables for the SSD and any other 2.5-inch drive you install. The HDD can use a standard cable, like the ones that come with the motherboard.

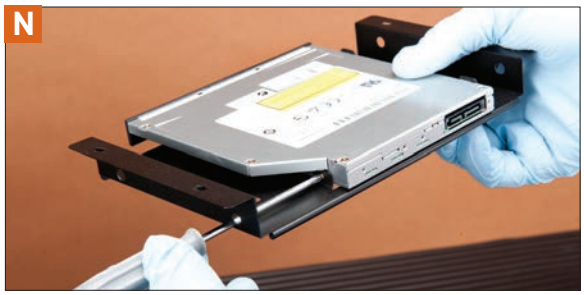
7 INSTALL THE GPU

Unscrew the retention bar holding the PCI slot covers and remove the covers (image L). Hold the GPU vertically in line with the slot and press down firmly, aligning the rear of the card with the expansion slots. Replace the retention bar. Take the two PCI-E power cables from the tangle and connect them. Fold the remaining wiring and place it to the right of the GPU, out of the way (image M).

8 INSTALL THE OPTICAL DRIVE

We're almost done! This is one of the trickiest steps, due to the stupid-tiny screws involved. Place the slimline optical drive in the optical drive bay as shown (image N). Secure with tiny screws. Connect the SATA adapter cable and attach the 4-pin power connector to the PSU's 4-pin Molex power connector (image O).

N



O

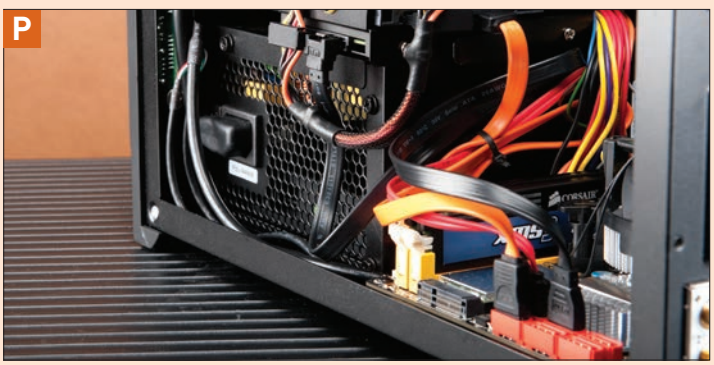
9 WIRING AND REASSEMBLY

Now is a good time to tidy up your wiring. Every cable from the PSU should be attached to something: The 24-pin and 4-pin ATX power cables should be attached to the motherboard, the two PCI-E power cables should be plugged into the GPU, the SATA power cable should be connected to the SSD and HDD, and the 4-pin Molex cable should be attached to the optical drive's power cable. Use twist ties or zip ties to secure cabling (image P).

Remount the optical drive tray using the four screws you removed in the first step. Connect the 18cm fan's cable to the motherboard (image Q) and reinstall the top fan enclosure, reversing the process from the first step.

One last thing: Because of the intake-fan placement on our GPU, we're going to want to rotate the SG07's side-panel window and vent. Use a 2.5mm hex-head screwdriver to reverse the orientation of the side panel (image R). Reinstall the case cover. Connect your keyboard, mouse, monitor, and speakers. All set!

P

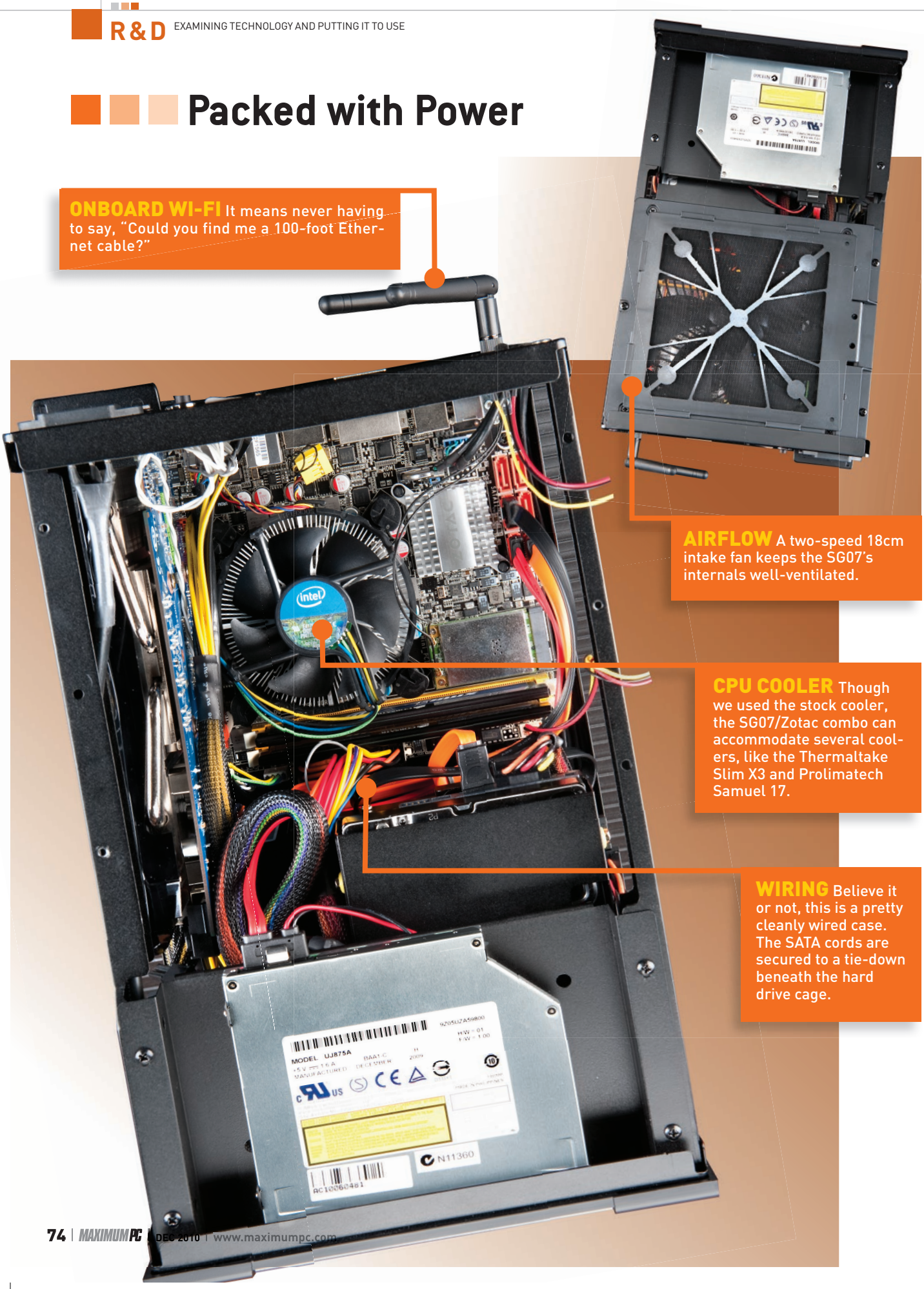


Q

R

Here we're removing and re-orienting the SG07 side-panel window to accommodate the fan on our GPU.

Packed with Power



ONBOARD WI-FI It means never having to say, "Could you find me a 100-foot Ethernet cable?"

AIRFLOW A two-speed 18cm intake fan keeps the SG07's internals well-ventilated.

CPU COOLER Though we used the stock cooler, the SG07/Zotac combo can accommodate several coolers, like the Thermaltake Slim X3 and Prolimatech Samuel 17.

WIRING Believe it or not, this is a pretty cleanly wired case. The SATA cords are secured to a tie-down beneath the hard drive cage.

Torture Testing the Wee PC

So, how does our new Mini-ITX rig stand up to the Maximum PC Lab's zero-point configuration? Not well, at first blush. The wee PC ran 44 percent lower frame rates in the gaming benchmarks, and 17–24 percent slower everywhere else.

Hardly stellar, but a quick glance at last month's $1,400 gaming machine build ("Builder's Creed") buoyed my spirits, at least where gaming is concerned. As we pointed out then, our zero-point machine is designed to go toe-to-toe with $7,500 multi-GPU gaming rigs, not budget builds. Plus, that box has the advantage of using a standard ATX motherboard, with plenty of room for expansion—something we eschewed in favor of smallitude.

This mini-rig is indeed svelte: It's just 7.5 inches tall, 8.65 inches wide, and 13.75 inches deep. You could stack three of 'em on top of each other and still take up less room than most of the systems we test in the Lab. And considering that the motherboard only has one PCI-E slot and two DDR3 channels, we think it holds up damn well. Just look at last month's Acer Predator—that multi-GPU machine is less than 10 percent faster than my mini-rig, and it's 20 percent more expensive, twice the size, and three times as ugly (in my opinion).

Our small formfactor PC is svelte and powerful.

ALTERNATE CONFIGURATIONS

Is my configuration the only possible one? Of course not. You could cut $300 by skipping the SSD, or go the other direction and add an aftermarket cooler and experiment with overclocking, opt for a different GPU or more RAM, or even add Blu-ray playback. And although I used the area between the GPU and the front of the case for cable storage, there's plenty of room for longer GPUs, as long as they don't consume too much power—our 600W power supply can't handle a 5970, for example.

Finally, it's worth noting that there are a few other Mini-ITX gaming boards out there. I happen to like the Zotac board used in this build because of its onboard Wi-Fi and plethora of USB and SATA ports, but Gigabyte's GA-H55N, which adds USB 3.0—albeit at the expense of Wi-Fi and some of the other ports—is another option. Both boards feature full PCI-E x16 slots and the Gigabyte's layout allows for a few more aftermarket cooler options.

The goal of this build was to prove to myself that a hand-built Mini-ITX gaming rig (as opposed to a more-expensive boutique SFF rig) was a probable—even reasonable—option. I believe I've done that, by building a $1,650 machine that performs well for the price, and is compact, quiet, and good-looking to boot.

BENCHMARKS

WEE PC VS. ZERO-POINT

	ZERO-POINT	
Vegas Pro 9 (sec)	3,049	4,028 (-24%)
Lightroom 2.6 (sec)	356	428 (-17%)
Proshow 4 (sec)	1,112	1,418 (-22%)
Reference 1.6 (sec)	2,113	2,703 (-22%)
STALKER: CoP (fps)	42	23.5 (-44%)
Far Cry 2 (fps)	114.4	64.4 (-44%)

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

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

WEE PC VS. BUILDER'S CREED

	BUILDER'S CREED	
Vegas Pro 9 (sec)	3,660	4,028 (-9%)
Lightroom 2.6 (sec)	253	428 (-41%)
Proshow 4 (sec)	1,071	1,418 (-24%)
Reference 1.6 (sec)	2,250	2,703 (-17%)
STALKER: CoP (fps)	27.9	23.5 (-16%)
Far Cry 2 (fps)	72.6	64.4 (-11%)

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

Our Builder's Creed rig consists of a quad-core 2.8GHz Core i5-760 overclocked to 4GHz, 4GB of Corsair DDR3/1333, on an Asus P7P55D-E Pro motherboard. We are running an Asus ENGTX 470 GPU, a 60GB Corsair Force F60 SSD, and 64-bit Windows 7 Home Premium.

REVIEWS

Tested. Reviewed. Verdictized.

INSIDE

ONLINE

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- BEST OF THE BEST
- BREAKING TECH NEWS
- NO BS PODCAST

Velocity Micro's Edge Z55

RAIDed SSDs and SLI for just over $4K

Velocity Micro packs a lot of hardware into a mid-tower case.

If you've always wondered just where Velocity Micro likes to slot itself in a world of $8,000 wonder rigs and $2,000 budget gaming machines, the Edge Z55 seems to nail it.

At $4,300, the Edge Z55 epitomizes Velocity Micro's strategy. There's Ferrari, Lamborghini, and others at the very top and Chevy and Ford at the other end. In that car analogy, Velocity Micro believes it can live in the BMW layer, bringing you great performance, some customization, and still at a pretty good price.

In PC terms, the Edge Z55 occupies the space between the $2,000 quad-core Acer Predator we reviewed last month—a visually stimulating machine that was more show than go—and Digital Storm's HailStorm—a multi-GPU, hexa-core beast that cost almost $8,000.

In this middle ground, the Edge Z55 is no slouch. To save some cash, Velocity Micro tapped Intel's new 3.2GHz Core i7-970 chip. It's essentially a locked and slightly lower-clocked version of the 3.33GHz Core i7-980X. It's only about $120 less, but that's still a savings, and it seems to overclock just as well.

SPECIFICATIONS

Processor	Intel 3.2GHz Core i7-970X (overclocked to 4.3GHz)
Mobo	EVGA X58FTW3
RAM	6GB Patriot DDR3/1600
Videocard	Two GeForce GTX 460 in SLI
Soundcard	Onboard
Storage	Two 128GB A-Data S599 SSD, 2TB Hitachi HDS 7,200rpm drive
Optical	LG WH10L530, Lite-On iHAS 224
Case/PSU	Velocity Micro Gx2-W / Velocity Micro 850-Watt PSU

In fact, the Edge Z55 came with its 3.2GHz proc punched all the way up to 4.3GHz. We were initially skeptical that the new Intel chip could handle that overclock, but it ran our stress test for 36 hours without a crash. Oh, if only Intel had introduced the Core i7-970 at $562 instead of $885!

The full specs of the rig are below, but the highlights include an EVGA X58 FTW3 motherboard, 6GB of Patriot DDR3/1333, a pair of 128GB A-Data SSDs, and interestingly, a pair of overclocked GeForce GTX 460 cards in SLI. That modest graphics-configuration choice sets the Edge Z55 apart from the CrossFireX and tri-SLI machines we've seen before, but we suppose that we understand. After all, you have to shave some build options off somewhere to get to $4,300.

How does the Edge Z55 perform? Against last month's budget gaming build ("Builder's Creed") and the Acer Predator, the Edge Z55 dominates by double and almost triple digits. Against our beefier zero-point, the Edge Z55 also comes out on top by significant margins.

In Vegas Pro, the Edge Z55, umm, edged ahead by 34 percent. In all of our content-creation tests, the Edge Z55 was also the victor, by healthy margins.

The only area where the Edge Z55 didn't completely destroy our zero-point is gaming. Make no mistake, the Edge Z55's pair of overclocked GTX 460 cards is still faster. In Far Cry, it's 18 percent faster. That's not bad, especially when you consider that our zero-point packs the single-fastest card out right now: AMD's Radeon HD 5970. But when we get into more advanced DirectX 11 titles, the margin of victory for the faster—and pricier—Edge Z55 shrinks to about 8 percent. That's still fast, but probably not the margin some would hope for.

That shouldn't diminish the Edge Z55 in your eyes, though. With nearly 240GB in SSD storage, SLI, and high-res gaming capability without having to crack the $7,000 mark, this isn't a bad choice for someone who wants just a little more than the typical PC.

—GORDON MAH UNG

BENCHMARKS

	ZERO POINT	
Vegas Pro 9 (sec)	3,049	2,280
Lightroom 2.6 (sec)	356	278
Proshow 4 (sec)	1,112	911
Reference 1.6 (sec)	2,113	1,523
STALKER:CoP (fps)	42.0	45.4
Far Cry 2 (fps)	114.4	134.9

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

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

VERDICT 8

VELOCITY MICRO EDGE Z55

+ FULL METAL JACKET	− STRAIGHT JACKET
Intel's hexa-core 970 and SLI for a reasonable price.	Gamers may want more than what SLI GTX 460s can give them.

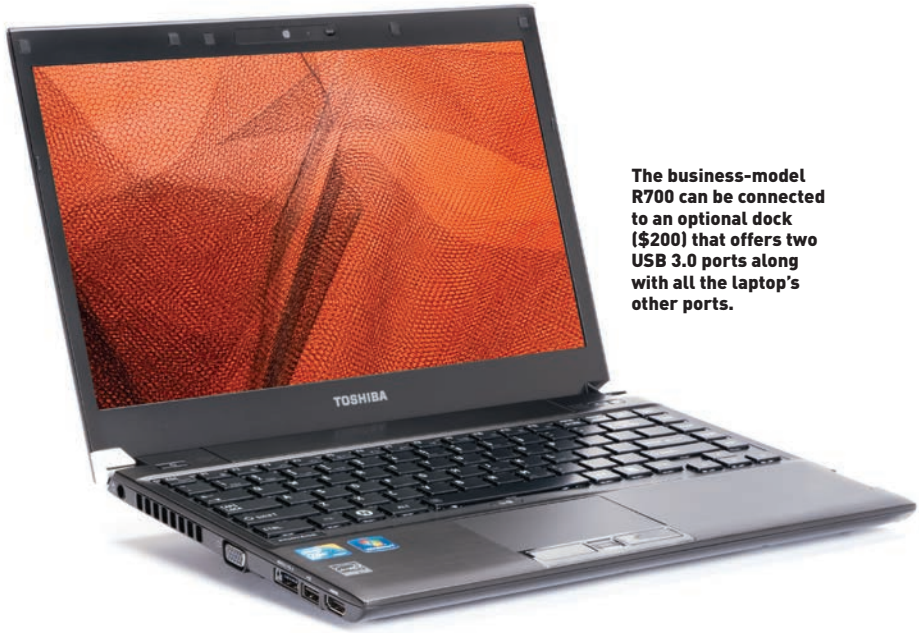
$4,300, www.velocitymicro.com

Toshiba Portégé R700

Not as thin and light as the R600, but far more powerful

In honor of the 25 years Toshiba has been making laptops—starting with the T1100 in 1985—Toshiba is dubbing its new R700 an "anniversary" system. The laptop is the newest addition to Toshiba's venerable Portégé line of business ultraportables. It follows on the heels of last year's R600, which received a 9/Kick Ass in our August 2009 issue, and the R500 before that.

But the R700 differs from those two models in some pretty significant ways—Toshiba says this represents a new direction that will be mimicked in all of its laptops going forward. For one thing, the R700 isn't as wafer-thin as the R500/600, although it still sports a very slim profile at just a tad over one inch thick, and weighs a mere three pounds. The chassis is reinforced with an internal honeycomb design and features a magnesium-alloy top with an attractive anodized black finish. Even when held by one corner, the laptop feels sturdy and rigid.



The business-model R700 can be connected to an optional dock ($200) that offers two USB 3.0 ports along with all the laptop's other ports.

The extra room created by this new design, along with improved thermals, allows Toshiba to outfit the R700 with a full-power processor—versus the ultra-low-power CPU we found in the R600, or even the low-power proc in HP's new 2540p (reviewed in October), which is our new zero-point ultraportable. Our R700's Core i7-620M is clocked at 2.66GHz, with a Turbo Frequency of 3.33GHz, compared with the HP's 2.13/2.93GHz i7-640LM, and that roughly 500MHz advantage is evident in almost all our content-creation benchmarks. Surprisingly, the two laptops were nearly dead even in the Premiere Pro test. Perhaps this has something to do with the R700's 32-bit Win7 OS, vs. HP's 64-bit OS. Toshiba offers 64-bit as an option, which we'd have preferred, if only for the fact that it would make all 4GB of RAM usable; here, only 3GB is available to the OS.

As for the R700's huge performance lead in Photoshop, we gotta figure that's the work of the laptop's solid state drive. Perhaps even more important than an SSD's faster access times compared to an HDD is the lack of moving parts. So while the R700's 128GB might seem paltry compared with the capacity of a mechanical hard drive, the SSD's speed and reliability count for a lot in a portable system.

If you like to upgrade, both the drive bay and the memory slots are easily accessed through panels on the bottom of the laptop. An ExpressCard slot makes mobile broadband possible, and one of the USB ports doubles as eSATA and provides Sleep-and-Charge functionality so you can use the port for powering or charging devices even when the laptop is powered off. A couple things we miss from the R600 are the transflective screen for outdoor use—something Toshiba ditched to cut costs—and the physical volume dial.

Nevertheless, the R700 continues the series' tradition of excellence by combining a superb combination of ultraportability and business performance. —KATHERINE STEVENSON

BENCHMARKS

	ZERO POINT	
Premiere Pro CS3 (sec)	1,260	1,248
Photoshop CS3 (sec)	183.6	118.3
Proshow Producer (sec)	1,533	1,350
MainConcept (sec)	2,530	2,245
Quake III (fps)	191.7	192.5
Quake 4 (fps)	17.0	20.8
Battery Life (min)	240	248

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

Our zero-point ultraportable is an HP EliteBook 2540p with a 2.13GHz Intel Core i7-640LM, 4GB of DDR3/1333 RAM, integrated graphics, a 250GB 5,400rpm hard drive, and Windows 7 Professional 64-bit.

SPECIFICATIONS

CPU	2.66GHz Intel Core i7-620M
RAM	4GB DDR3/1333
Chipset	Intel QM57
Storage	Toshiba 128GB SSD
Optical	Matshita DVD burner (UJ8-44S)
Connectivity	VGA, HDMI, Ethernet, three USB 2.0, one USB/eSATA, headphone, mic, 5-in-1 memory card reader, ExpressCard/54, Wi-Fi, Bluetooth
Lap/Carry	2 lbs, 15.7 oz / 3 lbs, 11.02 oz

MAXIMUM PC KICK ASS!

TOSHIBA PORTÉGÉ R700

VERDICT 9

+ CORNER OFFICE

Slick styling; sturdy build; full-power processor; SSD provides data security.

– CUBE FARM

Trade-off for SSD is limited storage; we miss the R600's volume dial.

$1,600, www.toshiba.com

CoolIT Vantage A.L.C.

An all-in-one liquid-cooler with a built-in display

As one of the few players in the all-in-one liquid-cooling market—which marks the midpoint between air-coolers and custom water-cooling loops—CoolIT's coolers have to compete with Corsair's Asetek collaborations as well as both other categories of coolers. CoolIT's Eco A.L.C. cooler (reviewed June 2010) performed to within a few degrees Celsius of our champion air- and liquid-coolers, but its single fan was noisy and it didn't significantly outpace our category leaders. The CoolIT Vantage A.L.C. has all the features of the Eco but adds an LED screen and a wireless receiver that will tie in with CoolIT's upcoming Maestro control software. Can it match the performance of our category leader, the Corsair H70 (reviewed October 2010)?

The Vantage A.L.C. uses the same mounting system as the Eco—a three-position Intel Socket 775/1156/1366 bracket with backplates for each, plus an AMD bracket. The radiator is the same, though CoolIT uses a spacer to add a fan's-width of space between the radiator and rear of the case, allowing for less turbulent airflow. The spacer is easily replaced with another 12cm fan if you want a two-fan configuration.

The pump is integrated into the water block, and the 12cm radiator fan's 4-pin PWM header runs directly from the pump unit, which also houses the Vantage's controller, as well as an LED-lit LCD that displays temperature, fan speed, system mode, and more. The display is the Vantage's biggest selling point, since it allows you to monitor coolant temperatures from outside your case (assuming your chassis has a side window). The LED backlight can be set to one of six colors, and the screen rotates by 90-degree increments, so you can install it in whichever orientation you choose. Although the temp display is useful, it only denotes coolant temperature, which is usually much cooler than the CPU temperature. The Vantage's pump unit also integrates a wireless receiver that will integrate with CoolIT's upcoming Maestro platform, which allows cooling and lighting control via software.

The Vantage's controller has three fan-speed settings: Quiet, Performance, and Extreme, but regardless of setting, the fan will spin at its maximum speed when coolant temps climb above 55 C—something we never saw, even after upping the intensity of our CPU burn-in test to the point where our stock Intel cooler couldn't keep up. And even at the Extreme setting, with two fans running, the Vantage was much quieter than Corsair's H70.

Unfortunately, a cool display and quieter fans don't make for a better cooler. Though the Vantage outperformed the Cooler Master Hyper 212+ by nearly 5 C at full burn, it couldn't match the Corsair H70's cooling prowess, even with two fans, due no doubt in part to the H70's bigger radiator. Nor could it match the performance of our top-tier air cooler, Prolimatech's Armageddon, with two fans.

The Vantage does have several things going for it. First, it's much quieter than the H70, even with the H70's optional fan-speed limiters in place. Its future Maestro integration increases its appeal to those who plan on dropping $90 on CoolIT's software and hardware-management package, and the LCD display is useful if you have a side window on your case.

The Vantage A.L.C. isn't for everybody. There are more effective and cheaper options in both the all-in-one and air-cooling markets—Corsair's H70 in the former case; Prolimatech's Armageddon in the latter. Unless the LCD display or Maestro integration are must-haves, the CoolIT Vantage A.L.C. is not. —NATHAN EDWARDS

BENCHMARKS

	Vantage (Extreme mode, 1 fan)	Vantage (Extreme mode, 2 fans)	Corsair H70 (2 fans)	Cooler Master Hyper 212+	Prolima Armageddon (2 fans)
Idle (C)	39.5	38.75	**33**	35	34
100% Burn (C)	64.25	62	**57**	69	60.5

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 via HWMonitor.

VERDICT 7

COOLIT VANTAGE A.L.C.

ADVANTAGE	DISADVANTAGE
LCD display; Maestro integration; easy install; two-fan support; usually quiet.	Expensive; not the best cooler for the cash.

$115 (with one fan), www.coolitsystems.com

The Vantage's LCD display shows coolant temperature, not CPU temperature.

Palit GTS 450 Sonic Platinum

New GeForce Fermi finally shatters the sound barrier

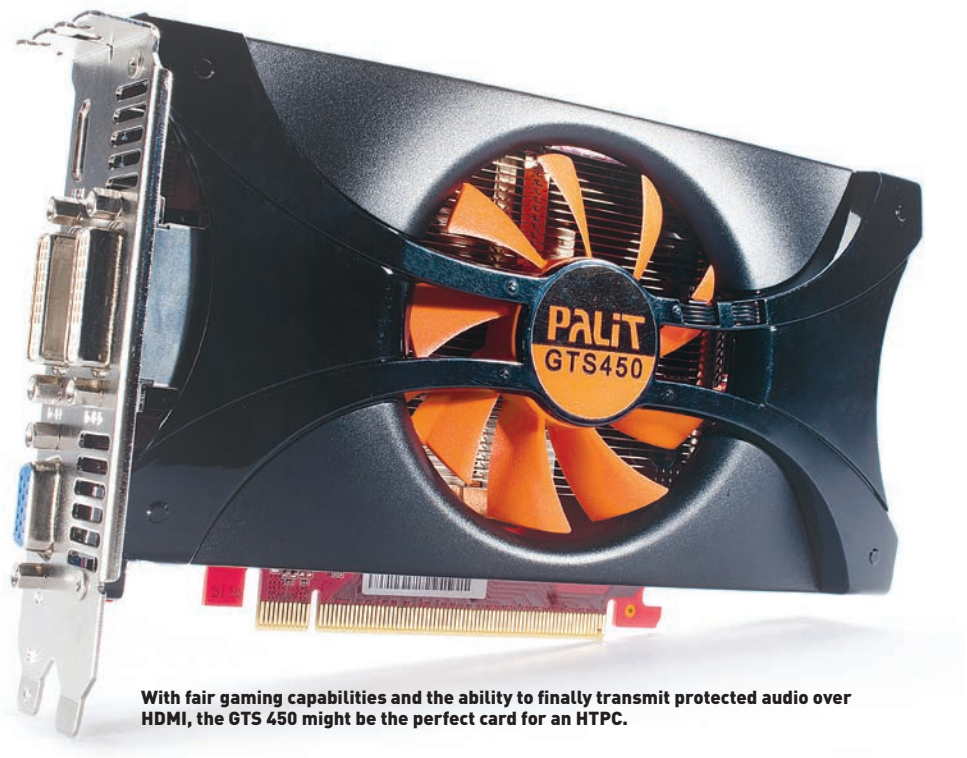
Nvidia's relentless effort to push the Fermi architecture into more affordable territory continues with the introduction of the GeForce GTS 450. This is not just an older chip with disabled units, but rather another actual new chip.

The GTS 450 chip runs at a higher clock than its siblings, but its memory width, texture units, and ROPs are lower. The Palit's core runs at 930MHz—a healthy overclock over a stock 783MHz card. The shader clock runs at 1,860MHz and the memory clock is 1,000MHz.

Bear in mind that our experience with overclocked graphics cards is that you only see slight gains, even with aggressive overclocks. Still, it's good to see the GTS 450 offering that much headroom. Palit equips its Sonic Platinum card with a custom cooler to keep everything running cool and quiet.

With these thoughts in mind, we set our sights on gaming performance. We stuck with our Core i7-975X Extreme Edition test system to minimize any impact from the CPU, but it's likely that a GTS 450 would go into a system with a cheaper and cooler CPU. We also departed from our usual test script, dialing resolution down to 1920x1080 and leaving antialiasing off. Given that 1080p monitors now cost less than $180, 1920x1080 is the new low.

We compared performance to the PowerColor Radeon HD 5750 Green, a passively cooled HD 5750 with no power connector, suitable for home theater PCs. We also included an HIS Radeon HD 5770, a card that can be found for as low as $140. Note that at nearly $170, the PowerColor card is pricier than the other two cards but it's a specialized card running at default clock speeds. Other units can be found at prices as low as $120, with standard cooling fans.



With fair gaming capabilities and the ability to finally transmit protected audio over HDMI, the GTS 450 might be the perfect card for an HTPC.

Aggressive overclocking has its downsides: power and cost. The Palit cost $20 more than a stock card and consumed the most power in this test. We were generally impressed with the frame rates and relative lack of noise of the Palit GTS 450 Platinum. It even managed to outpace the Radeon HD 5770 in six of 10 of our benchmarks. Of course, a GeForce GTX 460 would significantly outperform the GTS 450, but that card would cost $40–$70 more.

So, what's the Palit card best suited for? As a graphics card for a home theater PC, the Palit delivers, since the GTS 450 and the new 260 release drivers solve a problem that's been plaguing past Nvidia cards: audio over HDMI. We verified that the GTS 450 handles audio through HDMI in games, standard Windows audio playback, and protected content, like DVDs and Blu-ray discs. However, if you're looking at a GTS 450 purely for home theater use, the lower-cost, lower-clocked versions may be a better choice.

With the release of the GTS 450, Nvidia is ratcheting up pressure on AMD, but rumors abound regarding AMD's next set of midrange and low-end GPUs, code-named Southern Island. The GTS 450, however, is here now, and delivers decent, if modest, DirectX 11 performance at a relatively affordable price, without requiring a power supply of Hoover Dam proportions. **—LOYD CASE**

BENCHMARKS

	Palit GeForce GTS 450 Platinum	PowerCooler Radeon HD 5750 Green	HIS Radeon HD 5770
Unigine Heaven 2.0 (fps)	**19**	12	15
Battle Forge (fps)	29	32	**35**
Dirt 2 (fps)	**58**	45	52
Far Cry 2 / Long (fps)	**76**	53	63
Far Cry 2 / Action (fps)	**55**	41	48
Tom Clancy's HAWX (fps)	**68**	48	59
Crysis (fps)	20	18	**22**
Just Cause 2	29	25	**30**
Aliens vs. Predator DX11	28	24	**30**
STALKER: Call of Pripyat (fps)	**53**	38	47
System Power Usage (Idle)	**120**	129	128
System Power Usage (Load)	230	**195**	197
Price	$160	$170	$140

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 were run at 1920x1080 with AA disabled.

VERDICT 8

PALIT GTS 450 SONIC PLATINUM

+ PLANTS	− ZOMBIES
Factory overclocked; low power usage; HDMI audio works properly.	A little pricey compared to the competition; slightly higher power draw than reference cards.

$160, www.palit.biz

Corsair HS1 USB Gaming Headset

Company's first headset makes good first impression

Now, the first thing you're going to notice about the HS1 USB gaming headset is that it isn't the best looking set out there. It's bulky, the color choice is uninspired, and the odd decision to pad the bottom *and top* of the headband gives the whole thing a sort of bloated aesthetic. There—now that that's out of the way, we can talk about the reasons that Corsair's first headset kicks ass.

For one, it sounds great. That supersize chassis means more room for big, beefy 50mm drivers. These give the HS1 clear highs and bass that's great for a pair of headphones. The dynamic range is also stellar, letting everything from gunshots to quiet, ambient background noises come through with excellent clarity.

The Dolby Headphone technology does a good job of simulating a 5.1 or 7.1 surround sound environment, and provides you with several virtual listening spaces to choose from. The configuration software also lets you apply environmental effects, mess with the equalization, and apply "karaoke" effects to your own voice with the built-in microphone.

The HS1 is also one of the most comfortable pairs of headphones we've ever worn. The huge, circumaural cans (complete with thick, memory-foam pads) completely envelope your ears, creating sound isolation and transferring all of the pressure away from the sensitive parts of your head. Despite its heavy appearance, the HS1 never felt uncomfortable, even after several hours of gaming. The microphone swings up and out of your way when you aren't using it. The inline remote (which has only the standard volume and microphone controls) is big and brightly lit—you aren't going to lose track of it.

There's one final thing you need to know about the HS1: its price. Coming in at $100, the HS1 is an amazing deal. Though it's not the absolute best headset we've ever used, the HS1 handily takes first prize in the bang-for-your-buck category, and we'd happily recommend it to anyone. –ALEX CASTLE

MAXIMUM PC KICK ASS!

VERDICT 9

CORSAIR HS1 USB GAMING HEADSET

+ PRIVATEERS	– PRIVATE TEARS
A great-sounding, amazingly comfortable headset at a very competitive price point.	Bulky; a shining example of industrial design this ain't.

$100, www.corsair.com

The Corsair HS1 isn't beautiful, but she's got it where it counts.

Asus Eee 1215N

This baby's got it all

The Eee 1215N is the first netbook we've seen with Intel's new mobile dual-core Atom chip—it ships with the 1.8GHz Atom D525, along with 2GB of DDR3/800 RAM. Perhaps more importantly, it also features Nvidia's next-generation Ion graphics chipset and Optimus technology, which enables the dedicated graphics chip when required and switches to Intel's integrated UMA graphics when Ion isn't necessary.

The 1215N adopts the same Seashell body as previous Eee PC netbooks. At 11.6x8x1.4 inches, and weighing three pounds, four ounces, it's thinner than previous Ion netbooks but shares the rest of their dimensions. Like the last Ion Eee PC we reviewed (June 2010's 1201N), the 1215N uses a full-size chiclet-style keyboard, as well as a multitouch trackpad that sits flush with the wrist rest and has a single (right- and left-clickable) trackpad button. Unlike the 1201N, however, this year's model swaps the glossy-black fingerprint-magnet wrist rest for a slightly less grease-showing matte, and the grid-of-dimples trackpad for one delineated by metal insets. Unfortunately, the screen bezel and keyboard area (other than the keys themselves) remain glossy and smudge-prone.

The webcam now has a sliding "privacy cover" for folks who are paranoid about someone hacking their cam to take nude shots of them playing Torchlight.

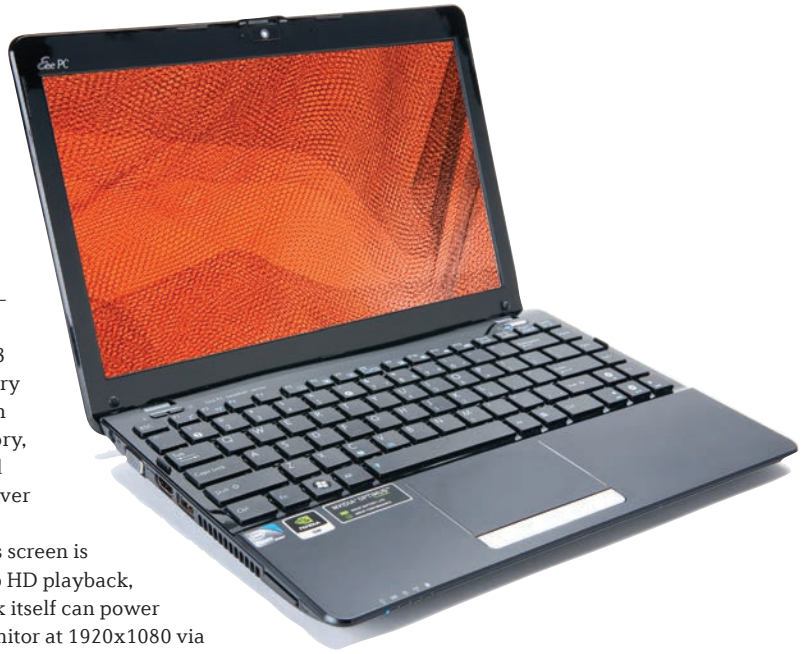
Speaking of Torchlight, the hit action-RPG from Runic: The 1215N plays it. In the game's netbook mode, at 1366x768, we averaged 36fps—definitely playable, though the frame rate can drop to the high teens periodically if there are lots of enemies on the screen or you unleash a particle-heavy attack.

The 1215N also plays Starcraft 2 and Portal—both of which scale down well for less powerful systems, but are still modern games. While next-generation Ion isn't that much faster than the first-gen chip, it no longer swipes RAM from the rest of your machine—this platform's 512MB of DDR3 graphics memory is separate from the main memory, a much-needed improvement over first-gen Ion.

The 1215N's screen is capable of 720p HD playback, and the netbook itself can power an external monitor at 1920x1080 via HDMI. We were able to play 1080p Flash videos from YouTube at 1920x1080, thanks to Flash 10.1's hardware-acceleration support. Local 1080p video will also play, depending on the encoding and your player's codec support—Blu-ray movies played flawlessly to the external monitor from an Asus USB 2.0 Blu-ray external drive, while 1080p QuickTime .mov files had some stuttering, but 720p QuickTime files played fine.

The 1215N set records in nearly every benchmark we have: 17 percent faster than the next-fastest Photoshop score, 25 percent faster than the next-fastest MainConcept encode; 8 percent faster than the last-gen Ion netbooks in Quake 4. The only outliers are battery life—though at five-plus hours, it's not bad—and Quake III. Averaging 104 frames per second is still triple what we get from non-Ion netbooks, but previous Ion netbooks have scored between 130fps and 150fps on that test.

The 1215N is sleek and doesn't feel cheap, and at $500, it's not breaking the bank—or, at just over three pounds, your back. The Eee 1215N takes the best parts of previous Ion netbooks and adds Blu-ray-capable performance (with an external drive), HDMI-out, and a battery boost. We defy you to get similar performance from a $500 ultraportable. —NATHAN EDWARDS



The Eee 1215N is sleek on the outside and powerful on the inside, thanks to its next-gen Ion and dual-core Atom.

BENCHMARKS

	ZERO POINT	
Premiere Pro CS3 (sec)	708	470
Main Concept (min)	251	120 (+109.2%)
3DMARK03	710	3,898 (+449.0%)
Quake 3 (fps)	60.9	104.4
Quake 4 (fps)	3.6	36.5 (+109.2%)
Battery Life (min)	255	307

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

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

SPECIFICATIONS

Processor	1.8GHz Atom D525 dual-core
Chipset	Intel NM10
Graphics	Intel UMA; Nvidia Ion next-generation w/Optimus
Display	12.1-inch LED-backlit 1366x768
RAM	2GB DDR3/800
Storage	250GB 5,400rpm drive
Ports	Three USB 2.0, audio in/out, SD reader, VGA, HDMI out, Gigabit Ethernet
Wireless	802.11b/g/n
Lap/Carry	3lb, 5.4oz / 3lbs, 14oz

MAXIMUM PC KICK ASS!

ASUS EEE 1215N

VERDICT 9

+ GUNPOWDER

1080p playback; HDMI out; great build quality; decent gaming performance.

– CREEPERS

No Bluetooth; USB 3.0 coming later; battery could be better.

$500, www.asus.com

BD-ROM Drive Deliverance

The cost of reading Blu-ray discs drops

This month, we take a look at two different solutions for watching and reading Blu-ray discs from your PC. One is internal, the other external. One offers standard DVD writing capabilities, the other doesn't write to any media whatsoever. Both cost $99. Read on for more details.

—KATHERINE STEVENSON

SAMSUNG SH-B123

Samsung's SH-B123 gives you the dual benefit of DVD writing and Blu-ray reading in a single internal drive. As is the case with just about every internal BD-combo drive we've reviewed in the last couple years, the SH-B123 is rated at 16x for DVD+R writes. Dedicated DVD burners might be capable of reaching higher speeds, but 16x isn't shabby. In our tests, the SH-B123 filled a single-layer DVD+R disc with 4.38GB of data in 5:33 (min:sec). That's virtually tied with the Plextor's PX-B320SA, the last internal BD combo drive we reviewed, back in December 2009.

Both drives have an 8x rating for double-layer DVD writes, but Plextor's drive held an 11 percent lead over the Samsung's in that task (16:58 vs. 18:56). Plextor's drive was also a few minutes faster at ripping a double-layer DVD movie to our hard drive.

On the other hand, in terms of BD-ROM capabilities, Samsung's SH-B123 has the edge. It's got a 12x BD-R read speed vs. Plextor's 8x. The performance difference was clear in both our NeroDisc Speed benchmark and our BD-R ripping test. But probably the most compelling feature in the Samsung combo drive's favor is that it costs just $99. That's nearly half what Plextor's combo drive costs, at $180. Both offer LightScribe for labeling your discs. And for what it's worth, Samsung's drive looks more attractive, with a mirrored tray bezel and far less branding littering the front, and it measures about an inch smaller in length than Plextor's drive.

SAMSUNG BENCHMARKS

	Samsung SH-B123	Plextor PX-B320SA
DVD+R Write Speed Average	11.87x	**11.99x**
DVD+R Read Speed Average	**12.23x**	12.07x
Access Times (random/full)	108/215ms	111/210ms
DVD+DL Write Speed Average	6.19x	**6.86x**
DVD Ripping (min:sec)	14:33	**10:47**
BD-R Read Speed Average	**6.29x**	4.59x
BD-R Ripping (min:sec)	**32:00**	50:00

Best scores are bolded. All tests were conducted using Nero DiscSpeed. Our test bed is a Windows XP SP3 machine using a 2.66GHz Intel Core 2 Quad Q6700, 2GB of Corsair DDR2/800 RAM on an EVGA 680 SLI motherboard, an EVGA GeForce 8800 GTS card, a Western Digital 500GB Caviar hard drive, and a PC Power and Cooling Turbo Cool PSU.

It's a small thing, but we like how Samsung's SH-B123 is free of logos for LightScribe and the various supported media formats, despite offering those features.

VERDICT **9**

SAMSUNG SH-B123
$99, www.samsung.com

PLEXTOR PX-B120U

If all you want is the ability to read Blu-ray discs—and you need that feature in a portable formfactor, to pair with, say, your notebook or netbook, or to share among various computers—then Plextor's PX-B120U has you covered.

Besides its very limited functionality, the PX-B120U is noteworthy for its formfactor—the unit is hinged, so by pressing the front button, the top pops open for you to insert or remove a disc. It's a fun and novel design, and the exterior sports a catchy spiral motif atop a glossy finish. But the drive isn't particularly small or slim, both of which are welcome qualities in a portable device. In fact, the PX-B120U is an inch longer, wider, and deeper than the Asus SBC-04D1S-U external Blu-ray ROM drive that we reviewed in February. And that drive can write to CD and DVD discs. Of course, it's $50 more, as well.

The Asus is also rated at a slightly higher BD-R read speed of 4.8x, vs. the 4x rating of Plextor's PX-B120U. And thus its times in our BD-reading benchmarks were (not surprisingly) faster by a comparable margin. Plextor's drive, however, was twice as fast at ripping a double-layer DVD movie disc to the hard drive.

If you really, truly only want a portable solution for playing Blu-ray discs, then the Plextor PX-B120U does that. But given an alternative option such as Asus's SBC-04D1S-U, which is not only more portable but also capable of CD/DVD writing, we'd be inclined to spend the extra cash for the more well-rounded product.

VERDICT **7**

PLEXTOR PX-B120U
$99, www.plextor.com

PLEXTOR BENCHMARKS

	Plextor PX-B120U	Asus SBC-04DIS-U
BD Read Speed Average	3.03x	**3.67x**
DVD Ripping (min:sec)	**14:45**	30:42
BD Ripping (min:sec)	51:18	**45:00**

Best scores are bolded. All tests were conducted using Nero DiscSpeed. Our test bed is a Windows XP SP3 machine using a 2.66GHz Intel Core 2 Quad Q6700, 2GB of Corsair DDR2/800 RAM on an EVGA 680 SLI motherboard, an EVGA GeForce 8800 GTS card, a Western Digital 500GB Caviar hard drive, and a PC Power and Cooling Turbo Cool PSU.

Plextor's PX-B120U connects to your PC with a single-head USB 2.0 cable and requires no external AC adapter.

Logitech Speaker System Z623

Too much sizzle, not enough steak

Logitech astounds us on a regular basis with its ability to produce dirt-cheap yet solid-sounding speakers. We can only imagine how thin its profit margins must be; heck, that's probably why there are so few other players in this market. The quality of Logitech's latest offering, the Speaker System Z623, however, just barely passes muster. It also leaves us wondering what value THX certification really holds for the consumer.

The Z623 is a 2.1-channel system equipped with a 200-watt amplifier that delivers 35 watts to each of the satellite speakers and 130 watts to the sub. The satellites have a single driver each, a 2.5-inch dome with aluminum phase plug, while the subwoofer utilizes a seven-inch pressure driver with a bass port in its cabinet. As is typical in this category, the satellites have hardwired cables that plug into the sub, where the amp is located.

Logitech offers plenty of analog inputs: The subwoofer cabinet has both stereo RCA inputs and a stereo 1/8-inch jack, and there's a second stereo 1/8-inch jack on the right-hand speaker cabinet. The power switch, knobs for volume and bass level control, and a 1/8-inch stereo headphone jack are also on this cabinet. Unlike Logitech's top-of-the-line speaker system, the $400 Z-5500, there are no digital audio inputs and no surround-sound decoder—not that we'd expect those features at this price.

What we do expect—at any price point—is good fidelity. THX certification notwithstanding, the Z623 speaker system falls short of that mark. We have no complaint with the system's performance with movies or games; it delivered dialog and sound effects with gusto. But when we dove into our library of high-definition FLAC files (downloaded from B&W's Society of Sound), we discovered that the satellites overdrive midrange frequencies, rendering broad swaths of both vocals and instruments unpleasantly harsh at higher volumes.

Listening to "Arawen," from the Toumast album *Amachal*, it felt as though band leader Moussa Ag Keyna was thrashing our ears with his hard-driving guitar work. We had similar experiences with other songs and other instruments from very different musical genres, including the languid piano work on "Slowly," from Juliana Raye's retro-sounding *Dominoes* album, and the vocals on "Nuwaruguma," from the Aurelio Martinez album *Garifuna Afro-Combo*. Each of these tracks was encoded in either 16- or 24-bit FLAC with sampling resolutions of either 44.1- or 48kHz, and yet we couldn't listen to the speakers in a near-field environment for more than 20 minutes before our ears felt fatigued.

The problem is related more to the drivers than the amp, because we enjoyed a much better listening experience with B&W's P5 headphones plugged into the satellite.

The Z623's low price tag, combined with its good performance with movies and games, saves its bacon. If you're looking for inexpensive speakers for listening to music, however, we think Logitech's Z250 speakers are a far better value. They're not THX certified, they don't come with a subwoofer, and they're only $20 cheaper than the Z623, but your ears will be a lot happier. **—MICHAEL BROWN**

SPECIFICATIONS

Satellite Power	2x35 watts RMS (6 ohms)
Subwoofer Power	130 watts RMS (8 ohms)
Satellite Drivers	2.5-inch dome driver with aluminum phase plug
Subwoofer Driver	7-inch pressure driver
Inputs	Stereo RCA and 1/8-inch on sub; 1/8-inch on satellite
Outputs	1/8-inch headphone on satellite
Controls	Volume, bass level on satellite

VERDICT 7

LOGITECH SPEAKER SYSTEM Z623

+ SHARP CHEDDAR	− DULL SHREDDER
Inexpensive, good performance with games and movies; lots of inputs; discrete bass control.	Poor musical performance, with an overdriven midrange.

$150, www.logitech.com

Logitech produces some great cheap speakers, but the $150 Z623's garner only a highly qualified recommendation.

Antec Dark Fleet DF-85

Packed with fans and features

We dinged September's Antec Sonata Proto for being feature-poor. Can't say the same of the flagship of Antec's Dark Fleet line, the DF-85. This full-tower chassis looks great, is packed with fans, and includes luxury extras that wouldn't be out of place in a case twice the price.

The DF-85 stands 23.5 inches high by 20 inches deep by 8.4 inches wide, and is constructed of matte-black painted steel. The entire front is taken up by hinged door compartments: three removable optical-drive doors and three mesh-covered front doors with 12cm three-speed LED fans—removable, washable dust filters included. The DF-85 also has two 14cm top exhaust fans and two 12cm rear LED exhaust fans. All four exhaust fans are two-speed and controlled by switches at the case's rear. The case's front-panel connectors include a hot-swap 2.5-inch drive bay (similar to the CM 690 II Advanced), three USB 2.0 ports, and one USB 3.0 port, fed by a pass-through to the rear panel, à la last month's HAF X.

Below the three ODD bays are nine 3.5-inch bays—technically toolless, though retaining screws are recommended. The case will accommodate 12.5-inch GPUs if the corresponding hard drive bays are empty. The DF-85 includes two hot-swap SATA backplanes that support two drives each, as well as a mount at the bottom for a permanent 2.5-inch drive.

The mobo tray has plenty of cable-management tie-downs, half a dozen cable ties, and cutouts and a CPU backplane cutout—though none are grommeted.

The DF-85 ain't perfect. Its lack of EATX support is surprising given how roomy it is inside, and the paint on the top and right panels is textured in a way that looks shoddy and doesn't match the smooth finish of the interior or rear panels. And like other Antec cases, the DF-85 is a little narrow, so CPU coolers taller than six and a half inches might not fit.

Aside from those quibbles, it's nice to see Antec go all-out and create a stylish, feature-packed case that doesn't break the bank. The Dark Fleet DF-85 shows that Antec is on its game; it's a suitable flagship for the line. —NATHAN EDWARDS

ANTEC DARK FLEET DF-85

VERDICT 9

+ DARK FORCES	– DANK FEET
Packed with two- and three-speed fans; front SATA and USB 3.0; roomy; cable management.	No EATX support; no room for a triple radiator; narrow; top paint looks cheap.

$160, www.antec.com

Roomy enough for nearly anything—except a triple radiator or an EATX mobo.

The DF-85 offers style and plenty of cooling, and those optical-drive doors are removable.

Mafia II

It's Mafio-so-so

Look at this screen. Press W. Congratulations, you have now played about half of Mafia II.

Mafia II's got a script that's probably as thick as four phonebooks, but the phrase we uttered most while playing the game was, "So close." Over and over, it's all we could think as we watched the game grasp at greatness, only to latch onto big old handfuls of disappointment. Unfortunately, close only counts in horseshoes and hand grenades, and last we checked, our copy of Mafia II was neither neighing nor exploding in our faces. (We're kind of thankful about that last one.)

Mafia II sees you take on the role of Vito Scaletta, a young Italian immigrant who's fresh off the front lines of World War II. Or rather, he's on permanent leave, thanks to a buddy of questionable moral fiber who pulled a few strings. Long story short, Vito dives right into the deep end of organized crime—mostly because he wants money and hates dirtying his hands with menial labor. Seriously. See, here's the thing: Vito's kind of an a-hole.

Oh sure, there's a subplot involving his drowning-in-debt family, but even when it reaches its predictably tragic crescendo, Vito's "grief" gets the hell out of dodge so quickly that you'd think even *it* knows how badly it's written. So, which is it, Mafia II? Are you a story of inhumanity and filthy excess, or are you the tale of one man's climb to the top of the "bad guy" totem pole, even as he descends into his own moral hell? Well, if your thin, mostly stereotypical cast can't clue us in, maybe a conclusive ending can.

Oh, wait! You don't actually give us one. Instead, without giving too much away, the game's ending is basically a big neon sign that screams, "To be continued in the upcoming DLC! Buy it!" Which is a shame, because—for all its flaws—the plot still manages to be fairly entertaining, even if it's barely a shadow of the shadow of the first Mafia's beautiful arc.

Speaking of beautiful, Mafia II's city is a sight to behold. From its loftiest heights to its scummiest slums, the attention to detail is absolutely stunning. We actually feel kind of bad for Doc from *Back to the Future*, because if he'd just driven down Mafia II's streets with old-timey music blaring, he wouldn't have needed to build that damn time machine.

Sometimes, however, the game's heaping helping of authenticity leaves very little room for fun, and that's a problem. The game's missions—while something of a mixed bag—tend to hit more often than they miss, but honestly, they only made up a bite-size portion of our playtime. The rest? Driving. Empire City is fantastic—don't get us wrong—but even if we were driving through the Louvre, eventually, we'd get tired of it. And here too, Mafia II's lackluster cast comes back to bite it. Whereas being a glorified chauffeur in, say, GTA or Mafia was excusable because your destination—an entertaining character—was worth the tedium, Mafia II has no such light at the end of the tunnel.

Mafia II's got its issues, but we'll give credit where credit is due: The city is simply gorgeous.

Combat also suffers from "so close" syndrome, with tense, well-paced shootouts that, sadly, occur all too infrequently. Instead, much of the game's combat consists of "I say, good sir, let me set aside my monocle and we shall engage in fisticuffs" style brawls that look about as wonky as they control.

On the whole, Mafia II's a decent experience, and while that will probably keep it from sleeping with the fish-tank simulators at the bottom of the bargain bin, it's not enough to elevate it to cult-classic status like its predecessor. That said, if you're itching to join a family and would rather not become a wanted felon, you could do a whole lot worse. —NATHAN GRAYSON

VERDICT 7

MAFIA II

+ THE MOB	− ANGRY MOB
Stunningly authentic city; excellent attention to detail; brutal firefights.	Absolutely glacial pace; driving, driving, and more driving; storyline lacks compelling characters and a resolution.

$49, www.mafia2game.com, ESRB: M

LAB NOTES

Benchmarking Routers

Keepin' it real-world

MICHAEL BROWN
REVIEWS EDITOR

When it comes to benchmarking routers, *Maximum PC* enjoys an advantage most publishers can't match: My home, which is located on a 10-acre parcel in rural northern California, well isolated from the pollution of neighboring Wi-Fi networks.

I measure TCP throughput by running the free JPerf 2.0.2 network measurement tool (Jperf is the Java GUI for Iperf) as a server on a desktop PC and as a client on a notebook PC. Each router is paired with the same vendor's USB Wi-Fi client adapter. I record benchmark performance with the notebook at four locations inside the home, as well as in an enclosed outdoor patio, and at a location completely outside the home.

For dual-band routers, I perform the same battery of tests on both radios. And for routers that support attached storage devices, I use the same benchmark criteria we use with NAS boxes and home servers. You'll find even more details at http://bit.ly/16w27O.

NATHAN EDWARDS
SENIOR ASSOCIATE EDITOR

Building a mini-ITX rig with some muscle was a fun challenge this month. While I don't think my configuration was absolutely perfect, I'm proud of my work. And like any power user, I'll be updating and tweaking my configuration in the months ahead, as well as brainstorming even more build-it ideas. If you have any ideas for build-it challenges, email 'em to comments@maximumpc.com.

GORDON MAH UNG
SENIOR EDITOR

I'm a half-step away from uninstalling Flash and Acrobat forever. Adobe's two most popular apps are also two of the top methods for infecting machines. Currently, Acrobat is unpatched, which makes me pucker up just browsing the web, and Flash had an active exploit that was unpatched for two weeks. Hello, Silverlight!

KATHERINE STEVENSON
DEPUTY EDITOR

Although we've long been preaching the virtues of Secunia PSI (http://bit.ly/DW9u), I just finally installed the free app on both my desktop and laptop. I was compelled to act after getting hit with a virus by way of a banner ad. Fortunately, I was able to eradicate the malware without too much trauma. Now, PSI will warn me when any apps, such as Flash, need patching.

ALEX CASTLE
ONLINE MANAGING EDITOR

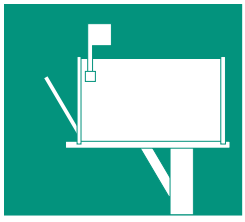
It didn't quite make it in time to be reviewed in this issue, but Firaxis and 2K Games just released Civilization V. If past Civilization games are any indication, you guys might not be hearing from me for the next couple of months. Hopefully, I'll be able to put my world conquest on hold long enough to write a full review for the next issue!

GEORGE JONES
EDITOR-IN-CHIEF

I just purchased Panasonic's Viera 50-inch TC-P50G25 Plasma HDTV and Onkyo's HT-S7300 7.1 receiver/speaker package. I set everything up, turned on the power and… nothing. The TV had no image. I spent an entire weekend troubleshooting and isolated the problem to the HDMI cables I was using. They weren't defective, but they weren't fitting snugly enough into the TV's HDMI port.

We tackle tough reader questions on...

Intel's Light Peak
Gordon's Sneakers
Quad Tuner DVR for FIOS



Light Peak as SATA Replacement?

I read the White Paper in the October edition of *Maximum PC* about Light Peak and have a question/idea. It might not be useful for a mechanical HDD, but what if we implemented a similar strategy of using fiber optics to connect SSD drives? I'm not talking about encapsulating the data, but replacing SATA all together. If, for example, an SSD drive had this fiber optic system built into it, and the mobo/chipset also supported it, couldn't PC technology make one giant leap into the future?

—Braden Pitts

Senior Editor Gordon Mah Ung Responds: You're definitely on the right track, Braden. Light Peak has been called the "one cable to rule them all" by some industry experts. It could potentially replace the insane number of external cables we use such as USB, FireWire, HDMI, DisplayPort, Ethernet, and possibly even PCI-E and SATA. Of course, Light Peak won't show up until late next year, and I suspect the cost will be far too high to replace anything initially. In five years though, it has the potential to subsume many of the cables in use today.

Trim Off!

In the October Comments section, you said, "We're guessing that Apple has implemented some sort of garbage-collection routine in the background of OS X that works well enough that users don't notice the difference...." Oh, really? You're guessing? Come on. OS X does no garbage collection, no Trim, no background defragmentation, and no background file-indexing. The SSD is responsible for all such collection activity, and the reason this works so well on a Mac is because OS X does not require defragmentation, and does not require background file-indexing to operate at peak performance. Trim support, or garbage collection, is best performed in the SSD controller built into the SSD drive, not by the OS. The MacPro line uses decent 512MB SSD drives, and those of us who are in the audio/video/film industry can assure you that OS X and an SSD work as fast as, or faster than, the same drive in a Windows 7 PC. I know because I've done it; I use both platforms daily.

—Rob Ainscough

Senior Editor Nathan Edwards Responds: It's not just Windows that has implemented Trim, Rob—it's in the Linux kernel, as well. Drive manufacturers have implemented various garbage-collection algorithms, but they're not standardized and vary wildly in effectiveness. Trim improves garbage collection in devices with poor implementation and keeps drives running at their best. Regardless, our gripe with OS X was the lack of proper documentation regarding Trim and garbage collection. If your only data is circumstantial evidence that slow, terrible SSDs don't get much worse, and that drives with controller-level garbage collection don't seem to either, that's not enough to be definitive. You say you've run the numbers; we'd love to see them.

Fashion Editor Gordon Mah Ung?

Gordon Mah Ung has been a longtime personal hero for me, so when I was looking for new shoes this past Friday, it was only natural to look to him for some sage advice. I noticed he was sporting a pair of New Balance hiking shoes in the October issue (page 46). When I went to the store, the shoes that most closely matched Gordon's were by far the most comfortable and stylish, all at a great

Gordon loves the extra-wide, comfy fit of his New Balance 645 shoes.

price! The savings will help me afford the MSI Big Bang XPower. Thanks for the years of great computer (and fashion) tips, Gordon.

—Ryan Walters

Unlocked vs. Locked Overclocking

I've been planning my $2,500-or-less computer for about three months. I originally wanted to get an LGA1156 motherboard and an Intel Core i7-875K CPU because the Core i7-875K is unlocked. Until recently, I thought you couldn't overclock chips that are locked, but it's come to my understanding that you can overclock any chip by increasing its FSB speed. The only apparent difference between unlocked and locked chips is that unlocked chips also come with an unlocked FSB multiplier. What's the difference between just cranking up the FSB speed in a more affordable locked CPU versus increasing the FSB multiplier in a more expensive, unlocked chip?

—David Zhang

Senior Editor Gordon Mah Ung Responds: First, you should realize that early next year, Intel will be introducing a new LGA1155 socket with its Sandy Bridge chips that will be faster than today's LGA1156 chips. But to answer your question, if you were to, say, overclock an unlocked 875K to 4GHz using a straight multiplier overclock, your RAM and other components tied to the b-clock would not be overclocked. Overclocking a locked Core i7-860 or Core i7-870 to 4GHz would cause some parts of the CPU and RAM to potentially be overclocked beyond spec, but you can offset this in the BIOS. The upshot is that Intel is smarter than us. If you notice, the 860, 870, and 875K are all so similarly priced ($284, $294, and $342, respectively) that you really won't be saving much. If you move down to a 2.66GHz Core i5-750, you can save $100—but that chip does not have Hyper-Threading, which can greatly impact any multithreaded apps you'll be running.

Stupefy-Hackers Tip

In regards to your "Stupefy Hackers with Strong Passwords" tip in the October issue ("Mastering the Essentials"): As you pointed out, numerical replacement really is the "very least" you should do, as most brute-force hackers already account for geek (g33k) speak. Most people refuse to use secure passwords because they can't remember them. Here is my favorite tip for a bulletproof but memorable password: Make a sentence, preferably with numbers, and use the first letter from each word. "My two kids drive me freakin' nuts" is *m2kdmfn*. "I'm lucky if I have 5 dollars to my name" is *iliih5$tmn*. Or how about, "I laugh at people who can't make 2 strong passwords" (*il@pwcm2sp*).

—Sam Bravata

Quad Tuner and Verizon FIOS?

I recently switched from AT&T U-verse to Verizon FiOS. Although I love the fast speed (which is unfortunately hampered by Verizon's router), the dual-tuner DVR is a point of contention. My wife and I loved the ability to record up to four shows with U-verse. Is it possible to build a quad-tuner DVR that will work *with* the Verizon DVR?

—Perry Curry

Editor-in-Chief George Jones Responds: It is possible to get Ceton Corp's InfiniTV 4 quad-tuner card to work with FiOS, but you can't get it to work with the FiOS DVR—that's a set-top box that has a tuner of its own. Install the InfiniTV 4 in a PC, install a FiOS CableCARD into the tuner, and then connect it to the FiOS network, and you're good, although you'll need to download a special FiOS update from Ceton's website to make it all work.

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.

BUDGET CPU

2.8GHz Core i5-760

We may have pronounced a virtual tie between this CPU and AMD's Jan Brady of hexa-cores, the Phenom II X6 1075T, in this month's Deathmatch, but we are impressed enough by Intel's 2.8GHz Core i5-760 to bump AMD's budget Phenom II X6 1055T for it. Make no mistake, in many tasks that are optimized to take advantage of six cores, the 1055T is a champ, but for the vast majority of games and applications, the multithreading isn't there. The fact that an Intel quad-core without Hyper-Threading can best a six-core AMD chip is a testament to the strength of Intel's Nehalem line of processors.
www.intel.com

THE REST OF THE BEST

High-End Processor
Intel 3.33GHz Core i7-980X
www.intel.com

Midrange Processor
Intel 2.93GHz Core i7-870
www.intel.com

LGA1366 Motherboard
Asus Rampage III Extreme
www.asus.com

LGA1156 Motherboard
Asus Maximus III Formula
www.asus.com

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

High-End Videocard
ATI Radeon HD 5970
www.ati.com

Midrange Videocard
Gigabyte GeForce GTX 470 GV-N470D5-131-B
www.gigabyte.com

Budget Videocard
Asus 460 ENGTX TOP 768MB
www.asus.com

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

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

Air-Cooling
Cooler Master Hyper 212+
www.coolermaster.com

High-End Cooler
Prolimatech Armageddon
www.prolimatech.com

DVD Burner
Samsung SH-S223
www.samsung.com

Blu-ray Drive
Plextor B940SA
www.plextor.com

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

30-Inch Display
HP ZR30w
www.hp.com

Speakers
Bowers & Wilkins MM-1
www.bowers-wilkins.com

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

Games we are playing

StarCraft II: Wings of Liberty
www.starcraft2.com

Minecraft
www.minecraft.net

Civilization V
www.civilization5.com

Left 4 Dead 2
www.l4d.com

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

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