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Ed Word

The Good and Bad of In-Game Ads

*Please send feedback and anything but fruitcake to **will@maximumpc.com.***

I was floored by the deluge of feedback I received about my *Battlefield 2142 review* (December 2006). It turns out that you guys really don't like in-game ads in any form—at least you don't think you do. You guys are even talking about boycotting every game that uses in-game ads. But not all in-game ads are bad.

The problem with the game industry is that development costs are skyrocketing. A triple-A, single-player title shipping this holiday probably cost $20 million to create. Games that include copious content—like MMOs—can cost twice that. And developments costs are only going up in the future.

To break even on a $20 million game, the developer needs to sell more than 400,000 copies at $50 a pop. (To keep the math simple, I'm going to skip the retailer's cut of the profit, marketing costs, packaging and distribution, and the rest of the incidentals). Now 400,000 doesn't sound like a lot of copies, but it is—especially for a single-platform title, and especially if that platform is the PC. To put the number in perspective, *Half-Life 2* is one of the best-selling PC shooters ever, and it's only moved 4 million copies since 2004.

While the cost of game development has skyrocketed over the last 10 years, the price of games has remained relatively steady. We're just now making the jump from $50 to $60, and only for PS3 and Xbox 360 games, so far. Although games are selling more copies, developers and publishers still have to recoup massive development costs—not to mention the losses on failed games.

To cover the gap, some companies have embraced subscription models, where you pay a monthly fee to play. Other publishers have boosted revenue by selling small add-ons that enhance the base game. But in-game advertising isn't anything new. Companies have been placing ads in their games for several years. These ads aren't all banners or billboards; there are pop soundtracks and in-game product placements too.

As the trend continues, there will inevitably be some offensive in-game ads, but most are inoffensive, and won't hurt us (or our hobby). Here's my rule: *In-game ads shouldn't distract me from the game I'm playing.* They should fit in with the setting. They shouldn't be animated or use a distracting color palette. And they shouldn't collect any more information about me than a similar web ad would.

If in-game ads let developers make more innovative games, without passing the added cost to me, then I say, "Bring 'em on"—as long as they follow my rule.

Will Smith

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AMD's Quad FX

Can a machine that houses two distinct dual-core processors compete with Intel's quad-core rigs? That's what AMD is aiming for with its high-end Quad FX platform, which lays the foundation for octo cores next year

A pair of the new dual-socket-capable dual-core Athlon 64 FX-74s gets four cores into your AMD machine.

When your competitor has you on the ground with a quad-core boot at your throat, do you tap out or bust an unexpected move?

With its own quad-core chips more than half a year away, AMD's surprise maneuver is the Quad FX platform, which accommodates any of the company's newly minted dual-core processors—Athlon 64 FX-70, FX-72, or FX-74—*in tandem*. In other words, dual dual-cores.

The Quad FX platform essentially repurposes a dual-Opteron configuration with a few key differences. The first is RAM. Dual-processor Opteron machines generally require registered system memory, which uses a small chip to ensure signal integrity with large amounts of RAM. These registers are valuable when running 16GB of RAM with mission-critical applications, as you would in a server, but they actually impede performance on desktop machines. The Quad FX does away with the need for registered RAM.

The Quad FX platform will also not be compatible with Socket AM2 CPUs; the Athlon 64 FX-7X procs use a new Socket 1207 interface. And even though the interface is pin-compatible with Opteron CPUs, it's not electrically compatible. AMD says it has disabled Opteron support in the Quad FX for marketing purposes. AMD officials acknowledge that this is even more of a kludge quad-CPU design than Intel's Kentsfield, but they point to the future. Next year, when AMD's quad-core chips are out, a Quad FX will be able to run a total of eight execution cores by utilizing two quad-core CPUs.

There's a price, of course. The top-end 3GHz FX-74 will run about $1,000 for a pair, and the Asus dual-processor motherboard using the Nvidia 680a chipset is expected to top $300. Consumers will also have to equip a machine with two heatsinks, four sticks of RAM, adequate cooling for the two 125-watt processors, and a power supply capable of running all this plus the GPUs. In the end, such a rig might end up costing at least 25 to 30 percent more than a comparable Intel quad-core machine.

PC analyst Rob Enderle takes a generally bullish stance on the platform, but says the final verdict on AMD's Quad FX won't come until the benchmarks are run.

According to Enderle, for Quad FX to be it success, "it can be slower and less expensive [than Intel's solution], it can be the same speed and less expensive, but it can't be more expensive and slower." He adds that given AMD's target audience, the overkill aspect of the Quad FX actually works to its advantage. Enthusiasts might also be attracted to the ability to build a system with one CPU now and add another later, he says.

Quad FX machines are expected to be available when you read this; look for our coverage of how well the technology stacks up in the next issue of *Maximum PC*.

SPECS

	ATHLON 64 FX-74	ATHLON 64 FX-62	INTEL CORE QX6700
CLOCK SPEED	3GHz	2.8GHz	2.66GHz
L1 CACHE	128KB	128KB	64KB
L2 CACHE	2MB total	2MB total	8MB total
EXECUTION CORES	2	2	4
PROCESS TECHNOLOGY	90nm	90nm	65nm
TRANSISTORS	227 million	227 million	582 million
DIE SIZE	235 mm^2	230mm^2	286mm^2
PRICE PER 1,000	$1,000 (per pair)	$713	$1,000
TDP	125 watts (per CPU)	125 watts	130 watts
DUAL SOCKET COMPATIBLE?	Yes	No	No

Nvidia Buys PortalPlayer

The desktop graphics company aims to make it big in small devices

Nvidia is poised to purchase PortalPlayer, a small-device chipmaker that experienced tremendous success as the primary supplier of chips for Apple's iPod. The $357 million cash deal will allow the desktop graphics giant to diversify its business and address the competitive threat it faces from the recent merger of arch-rival ATI and AMD.

Nvidia has made some advances in the rapidly growing mobile market—it's GoForce chips grace mobile phones from Motorola, Kyocera, and Samsung—but PortalPlayer gives the company entrée into entirely new areas. Besides providing chips for a range of small devices including music players, PDAs, portable game players, and cell phones, PortalPlayer is responsible for the technology behind Windows *SideShow*. Available exclusively through Vista, *SideShow* allows a secondary laptop LCD to display data whether the laptop is on or off.

Do the masses want to check email on a secondary laptop screen? Nvidia hopes so.

ATI Lends GPUs to Science

Folding@Home, the distributed-computing project sponsored by Stanford University is about to get a big boost from its partnership with ATI. Since 2000, F@H has been tapping the spare CPU cycles of hundreds of thousands of idle PCs to study protein folding and better understand the causes of common diseases such as Alzheimer's and Parkinson's. Now a new Folding client (currently in beta) similarly taps the power of ATI's x1900-class cards. The floating-point capabilities of the cards' R580 GPU make it supremely suited for non-graphics related number crunching, more so than a CPU. According to Mike Houston, a Stanford researcher involved with the project, "We are getting 37 TFLOPS from 559 GPUs [as of this printing]; that puts each GPU at ~70X the performance of the average Windows machine CPU donated to the project."

To join *Maximum PC's* folding team, download either the CPU or GPU software from http://folding.stanford.edu/ and register with team 11108.

FPS Action on the Web

Sick of wasting time at work with puzzle and word games? Frag your cube mate instead!

Rasterwerks has built a first-person shooter using Macromedia Director that plays in any Shockwave-equipped browser. Play it at http://tinyurl.com/tzom3.

TOM
HALFHILL

Predictions
for 2007

Drawing upon the same psychic powers that enabled me to predict the Cleveland Indians' victory in the 2006 World Series and the San Francisco 49ers' forthcoming triumph at Super Bowl XLI, here are my predictions for 2007:

► AMD is enjoying a great run, but I foresee 2007 as the year when Intel begins regaining lost ground. Intel's Core 2 is a genuinely good processor core, and Intel will use it to produce highly competitive dual- and quad-core PC processors. But I'm not counting out AMD. Its recent acquisition of ATI was a bold move that shows AMD is still innovating and keeping Intel guessing.

► A startup company currently in stealth mode will publicly announce a new x86-compatible processor in 2007. You might think that Transmeta's suicide charge would have permanently discouraged all the maverick CPU architects and investors in Silicon Valley... but no.

► Something big will happen with Nvidia. The company has reason to be nervous: AMD's acquisition of ATI changed the landscape for graphics processors, and both AMD and Intel are integrating graphics more closely with the CPU. If Intel doesn't acquire Nvidia, then Nvidia must strike out in new directions to survive.

► Microsoft's release of Vista will prompt some users to hoard Windows XP and perhaps even earlier versions of Windows, such as Windows 2000 and 98SE. The reason: digital rights management (DRM). When people discover that Vista is foiling their attempts to use or duplicate copyrighted content—in some cases, even when it should be legal—they will revert to older versions of Windows that don't play Big Brother. Linux is an alternative, at least for a while, but many folks are more comfortable with Windows. With virtualization, it will be easier to keep an older operating system installed on our machines.

► People who never considered buying a Macintosh will change their minds when they discover that Intel-based Macs are better Windows PCs than some Windows PCs. Apple's *Boot Camp* makes dual-boot installations a breeze, and third-party *Parallels Desktop* software can switch between Windows and MacOS X on the fly. The Mac Mini is scarcely larger than an external disk drive and makes a great secondary system.

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

GAME THEORY

THOMAS **MCDONALD**

Harmful to Minors

Anti-gaming legislation is a risk-free way for politicians to burnish their family friendly credentials, so we can expect more in the run-up to the 2008 elections. Utah's amendments to the state's "Materials Harmful to Minors" law (H.B. 257) are a good example of what to expect. Inspired by similar legislation in Louisiana (subsequently blocked by the courts), Utah decided they wanted their own unconstitutional law.

The definition of "harmful to minors" is, naturally, broad enough to capture anything from the latest Rockstar excretions down to *Pooh's Rumbly Tumbly Adventure* (those damn Heffalumps are always bouncing on Tig just when he's about to make a particularly difficult tail jump). Check this out: "Harmful to minors" can mean "that quality of any description or representation, *in whatsoever form*, of inappropriate violence" (emphasis added). The legislation goes on to single out video game violence when it is "patently offensive to prevailing standards in the adult community as a whole with respect to what is suitable material for minors; and, taken as a whole, does not have serious literary, artistic, political, or scientific value for minors."

This pretty much describes everything I find entertaining.

But wait! It gets better! This includes any violence that is "glamorized or gratuitous, used to shock or stimulate, not contextually relevant to the material, is so pervasive that it serves as the thread holding the plot of the material together, trivializes the serious nature of realistic violence, does not demonstrate the consequences or effects of realistic violence, uses brutal weapons designed to inflict the maximum amount of pain and damage, or endorses or glorifies torture or excessive weaponry."

All I have to say is: If a game has all of those things, then order me two copies, please.

The shocking part of this legislation is its attachment to an existing pornography law, thereby redefining games as pornography and making it a crime to allow minors access to them. It does not distinguish between parents who allow their child to play *Half-Life 2* and those who show children hardcore porn.

The amendments are legal garbage that won't survive a court challenge, but that won't keep politicians from pressing ahead in order to score some points off the target-rich video game industry.

Tom McDonald has been covering games for countless magazines and newspapers for 11 years. He lives in the New Jersey Pine Barrens.

Microsoft Takes Its Game Online

Microsoft, long a dominator of desktops is turning its sights to online content-delivery.

As of October, Xbox Live—the online component of the hardware console—had more than 4 million gamers firing up their controllers and logging on via both free and paid-for accounts. Once there, visitors are encouraged to purchase games, videos, and other content from the Xbox Live Marketplace using Microsoft Points, which users purchase with real money.

On the eve of the console's one-year anniversary in late November, the 360 finally opened its digital doors to Hollywood. In addition to gear and guns, gamers can now use points to download television and movie content in either standard or high-definition formats. And we're not talking about crappy reruns: With content from CBS, the Cartoon Network, and Warner Brothers, you can expect to see everything from the popular *Aqua Teen Hunger Force* cartoon to *The Matrix*.

MSN Music used to be Microsoft's end-all solution on the purchasable music front, but the November release of the handheld Zune player conjured up a new entity: the Zune Marketplace. Points can jump platforms, so gamers looking for new tunes can feed their obsessions for gaming, movies, or music from one account.

Vista will take the concept a step further, with the PC- and cell phone-based Live Anywhere platform offering its own marketplace. Rumors abound as to how Zune's going to fit into the mix. But with the points payment system already integrated across platforms, Microsoft might soon have a monopoly on your multimedia.

Piracy Patch

The Motion Picture Association of America is enlisting the Boy Scouts of America in its ongoing fight against piracy. Scouts are now eligible to receive a merit badge (pictured here) for their proven efforts against copyright infringement. Next up: a badge for Scouts who educate their peers about the dangers of mattress tag removal.

PhysX Finds a Home

BioWare has announced plans to integrate Ageia's PhysX technology into its Eclipse Engine, which will power the game developer's highly anticipated RPG *Dragon Age*. This is good news for Ageia, because BioWare tends to license its engines to other A-list developers. It's anyone's guess as to when *Dragon Age* will reach the market—and if it will drive sales of PhysX cards when it does—but the decision was a no-brainer for BioWare: Ageia's SDK is now royalty-free.

Web Reaches New Heights
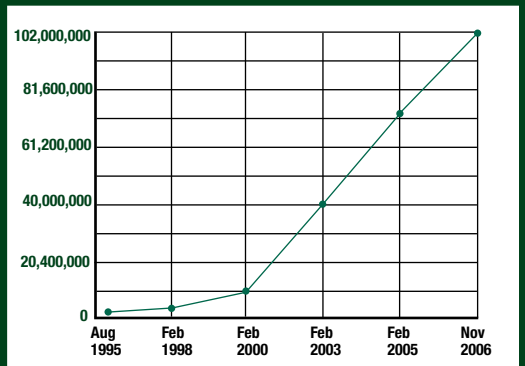
A November 2006 survey by Internet monitoring company Netcraft reveals that there are now more than 100 million websites populating the Internet. Netcraft conducted the first such survey in 1995, at which time there were 18,000-plus sites; the number grew to 50 million in May 2004, and then doubled in size over the last 30 months. Netcraft attributes the dramatic rise to blogs and small business websites.

TESTED & GEEK DISAPPROVED

Miglia Microsound

Ever have a talking doll when you were a kid? (Come on, guys, there were some pull-string GI Joes.) Well, play that sound in your head and you'll comprehend the audio quality of Miglia's Microsound. How fitting that when we plugged it into an editor's iPod Nano and hit play, the first song up was "The Hokey Pokey." $30, www.miglia.com

Steam Picks up...um...Steam

More publishers sign on to distribute titles via Valve's digital service

You remember Steam, the little service Valve rolled out a couple years ago to distribute its games online, right? Well, it's come a long way since its single-title launch with *Counter-Strike*. Steam now sports a catalog of nearly 100 titles, with more games from various publishers coming every day.

In fact, publishers are seeing a new use for Steam: Majesco and Activision are making parts of their back catalogs available on the service. It's nice that classic games like *Psychonauts* and *Call of Duty 2* will be available for easy purchase and download—especially after they've fallen off retail shelves. But we'd much prefer to see games made available for digital download the same day they're available at retail, like we saw with *Medieval II: Total War* and *Dark Messiah of Might and Magic*.

Now on Steam, more than just Valve games!

Adobe Gives; Mozilla Grows

If understanding the relationship between JavaScript, a virtual machine runtime engine, and ECMAScript makes your eyes glaze over faster than a K-Fed concert, try the caveman approach: Adobe donate source code, *Firefox* run faster.

Christmas came early for the Mozilla Foundation, with Santa Adobe coughing up nearly 135,000 lines of source code to the open-source initiative in early November. The gift, Adobe's ActionScript Virtual Machine 2 (AVM2), processes ActionScript language as part of the company's *Flash Player 9*.

The current AVM2 comes with a new Just-In-Time compiler, which speeds up the ActionScript-code-to-machine-instructions conveyer belt. Since ActionScript and JavaScript are close siblings under the ECMAScript standard, this not only allows AVM2 to run both Flash and JavaScript-based applications, but it transfers the benefits as well.

"What that means for users," says Frank Hecker, the Mozilla Foundation's executive director, "is when they go to these fancy-nancy web 2.0 applications—*Gmail*, *Yahoo Mail*, or some other app based on technologies like AJAX—they'll be able to get faster performance."

As *Firefox* is partly written in JavaScript, the increase could show up in the browser itself. Adobe has allegedly seen speedups of up to 10 times in magnitude, based on the company's internal testing of ActionScript applications under the new AVM2.

Users have a bit of time before the Mozilla-based AVM2, code-named "Tamarin," heads into the wild. It's expected to reach computer desktops in 2008.

■■■ FUNSIZE**NEWS**

MICROSOFT RETREATS FROM VISTA RESTRICTIONS
PC home builders and upgraders were rightly outraged at news that Vista's original EULA would only allow users to "reassign the license to another device one time." Fortunately Microsoft has seen fit to appease this fervent yet relatively small part of the customer base by adopting more reasonable wording: "You may uninstall the software and install it on another device for your use." Guess Microsoft isn't totally evil, after all.

PAYPAL PYROTECHNICS
PayPal likely would have preferred a thorough TPing to the explosion that rocked its San Jose offices on Halloween. The powerful bomb blast shattered windows and prompted the evacuation of 1,900 employees, but caused no other damage or injuries. As of press time, no one has been implicated in the attack.
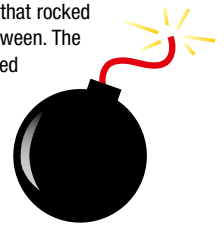
RIAA FOILED
A California woman's successful defense in a lawsuit brought by the RIAA could make it much more difficult for the organization to punish file sharers. Tammie Marson established reasonable doubt about her alleged illegal downloading practices by claiming that her wireless network was not secure and thus vulnerable to use by interlopers. The RIAA dropped its case.

YOUTUBE TO GO
Soon you can have all the delights of YouTube on your cell phone. The company recently announced that it plans to make its video-sharing features available to mobile phones by the end of 2007. Currently, it's possible to upload video from a mobile device to the YouTube website on a PC, but in the next generation, users will be able to send and receive video between phones with a subscription.

MOBILE CPUs

Intel Core Duo **vs.** Intel Core 2 Duo

Everyone not living in a cave knows that Intel's desktop Core 2 Duo rocked the Pentium D and Athlon 64's world. But what about the mobile CPU of the same lineage? We wanted to find out how the Core 2 Duo mobile compares to its predecessor, the Core Duo. Would the difference be as dramatic as on the desktop? The comparison is somewhat complicated by the fact that the mobile-only Core Duo and Core 2 Duo are both descended from the original Pentium M chip, with the deuce sporting a more parallel design and some other minor enhancements.

To see which of the siblings is better, we pitted a 2.16GHz Core Duo T2600 against a Core 2 Duo T7400 using the exact same notebook PC, an iBuyPower HEL-80. This portable supports both CPUs, so it's the perfect way to get an apples-to-apple comparison of the two. The winner gets the performance inheritance while the loser gets to live in a van down by the river.

BY GORDON **MAH UNG**

iBuyPower HEL-80
$1,695, www.ibuypower.com

Core Duo T6200
$423, www.intel.com

round 1 **PRICING**
Both procs sport the same clock speed and are priced the same at $423 (when purchased in lots of 1,000). We found the Core 2 Duo T7400 available for $423 and the Core Duo T2600 for $406 at their lowest. However, most vendors price both processors at about $480. Overall, this category is a wash. **WINNER: TIE**

round 2 **NOTEBOOK AND CHIPSET SUPPORT**
Normally we rap Intel on its knuckles for the nasty habit of always requiring a new chipset to run a new CPU, but Intel did the right thing with the new Core 2 Duo CPUs. Notebooks that use the 945PM and 945GM are technically "drop-in compatible" with either the Core Duo or Core 2 Duo CPUs—after you update the BIOS, natch. Of course, in order to take advantage of the new CPUs, your notebook maker must have planned ahead for the thermal and power differences. Most did, but you should make sure your notebook chassis works before you shell out for an upgrade CPU. **WINNER: TIE**

round 3 FEATURES
This round is like a one-legged man at the ass-kicking contest. The Core Duo is a good CPU; in fact, it's a great processor. And the Core 2 Duo is like a Core Duo, but better. Like its desktop counterpart, the C2D can crunch more math at once thanks to its redesigned core, can hit higher clock speeds thanks to its slightly longer pipeline, and it features twice the cache. The C2D also includes SSE3 "enhancements," which speed up media encoding. For now, the Core 2 Duo is all over the Core Duo in the features department.
WINNER: CORE 2 DUO

round 4 PERFORMANCE
Some CPU skeptics wondered if Intel was speaking the truth when it claimed the Core 2's improved microarchitecture offered 20 percent more performance than the original Core Duo's. After all, Core 2 has far more in common with Core Duo than it did with the pokey Pentium D CPU. Believe it or not, Intel wasn't fibbing. We've got the full scoop on the performance story on the next page, but it's obvious that clock-for-clock, the Core 2 Duo is the better performer.
WINNER: CORE 2 DUO

round 5 BATTERY LIFE
The desktop Core 2 Duo processor wowed us, and it continues to do the same in mobile trim. While we didn't think Intel could improve performance without impacting battery life, our tests show that Intel's Core 2 Duo does just that. It's even built at the same process size, and it doubles the transistor count. That doesn't make sense! Intel says the higher-performance CPU is able to throttle up, perform a task, and throttle back down so quickly that it consumes less power because it isn't running at full speed for as much time as older CPUs. Although the Core Duo offers slightly better battery life, we'd take the single-digit run-time hit for 20 percent more performance any day.
WINNER: CORE 2 DUO

Core 2 Duo T7400
$423, www.intel.com

MOBILE CPUS AT A GLANCE

	INTEL CORE DUO T2600	INTEL CORE 2 DUO T7400
CLOCK SPEED	2.16GHz	2.16GHz
L1 CACHE	64KB	64KB
L2 CACHE	2MB shared	4MB shared
EXECUTION CORES	2	2
PROCESS TECHNOLOGY	65nm	65nm
TRANSISTORS	151.6 million	291 million
DIE SIZE	90.3 ^{2}	144.9 ^{2}
PRICE (PER 1,000)	$423	$423

Testing Methods

Comparing notebook CPUs is more complex than testing desktop chips. You not only want to factor in how fast the CPU is, but also how much power it eats. To get a direct comparison between the CPUs, we got an HL-80 notebook from iBuyPower. The machine came equipped with a 2.16GHz Core 2 Duo T7400, a GeForce Go 7600, 2GB of DDR2/667, a 5,400rpm hard drive, and an Intel 945PM chipset.

When we finished testing the Core 2 T7400, we cracked the machine open, installed a Core Duo T2600, and reran the tests. The bulk of the benchmarks we use target processor performance more than graphics performance, but we did run some gaming benchmarks to see the impact of the CPU swap. The ancient *3DMark2001 SE* benchmark is more of a CPU and chipset performance test these days, as today's graphics chips are far beyond it. The newer *3DMark03* and *05* are heavily constrained by GPU performance, but the CPU tests lean heavily on the processor. We also ran our standard *Quake 4* demo at a low resolution, so the videocard's performance is out of the equation as much as possible. For media encoding, we used *Nero Recode 2* to encode a video to H.264/AVC format.

We also tossed in a couple of new tests from Valve that stress multicore performance. One is a particle test using *Half Life 2's* Source engine. Source isn't currently multithreaded, but a patch due early next year will add quad-core support. Valve also provided the media with a map-compilation benchmark. It's certainly not something a consumer would undertake on a lazy Sunday afternoon, but it's a good predictor of workstation-level tasks. We've found the test to be multithreaded and heavily processor limited. For battery tests, we used BAPCo's *Mobile Mark 2005,* which lets you test how long a notebook will run in a real-world situation. *Mobile Mark* fully discharges and recharges the battery before the benchmark runs. Although *Mobile Mark 2005* also measures the computer's performance, the applications it uses are quite old and not a good predictor of modern computer performance. More important to us is its battery life test.

BENCH**MARKS**

	CORE DUO T2600	CORE 2 DUO T7400	PERCENT DIFFERENCE
3DMARK2001 SE	18,614	**21,118**	13.5%
3DMARK03 OVERALL	7,456	**7,642**	2.5%
3DMARK03 CPU	992	**1,254**	26.4%
3DMARK05 OVERALL	3,123	**3,130**	0.2%
3DMARK05 CPU	5,793	**7,514**	29.7%
QUAKE 4 640X480 (FPS)	100	**104.9**	4.9%
NERO RECODE AVC ENCODING (MIN:SEC)	55:56	**45:53**	21.9%
VALVE PARTICLE PERFORMANCE	32	**40**	25%
VALVE MAP BUILD (MIN:SEC)	6:42	**5:52**	14.2%
PREMIERE PRO (MIN:SEC)	66:34	**44:58**	48.1%
PHOTOSHOP CS2 (MIN:SEC)	6:20	**5:23**	17.6%
MOBILE MARK BATTERY LIFE (MIN)	**201**	189	-2.7%

Best scores are bolded.

And the Winner Is...

Core 2 Duo on the desktop impressed us by blowing away the Pentium D and Athlon 64 in just about every single benchmark we could find. The Core 2 Duo doesn't destroy the Core Duo, but it's definitely faster across the board. We saw Intel's performance claims backed up with benchmarks deltas of 13 to 25 percent—and even a shocking 48-percent difference in our video-editing test. Some of the Core 2 Duo's advantage comes from doubling the L2 cache to 4MB, but the rest is attributable to tweaks Intel made to the Core microarchitecture. It's simply faster clock-for-clock than its sibling.

Although we have concerns about *Mobile Mark 2005's* validity when testing multicore notebooks, it is the industry standard way to measure battery life. According to our *Mobile Mark* battery rundown, you get faster performance with just a minor hit to battery life by moving to Core 2 Duo. That's truly an amazing accomplishment when you think of it—more performance for the same battery consumption. It amounts to a big win for consumers and a big win for Intel. **MPC**

Our consumer advocate investigates...

✓Triton Online Service ✓Coolmax
✓More Bad Sony Batteries

Martini Chorba, **watchdog of the month**

ONLINE DISTRIBUTION GONE BAD

*I bought a copy of **Prey** from the online service Triton, and it seems that Triton went belly up. My game won't run without Triton; am I seriously out of luck?*
— *Jordon Berkove*

Jordon, you've run into one of the stickier aspects of online distribution. With no physical boxed copy or disc, and a requirement that you log into a server to play a game or update it, what do you do if the company goes out of business? Triton did just that in late September, for rather mysterious reasons. Although gamers could buy games—most notably *Prey*—through Triton, the service wasn't quite the same as Valve's popular Steam distribution service. With Steam, you downloaded the entire game before you could play. Triton's system allowed you to play within a few minutes of buying the game by streaming pieces of the game.

The Dog spoke with Royal O'Brien the former CEO and coder behind Triton about what befell the company. O'Brien described Triton as a "great success" but said complications with some of the partners scuttled it. Are gamers out of luck? Surprisingly, no. At least, not according to O'Brien, who said he is personally committed to making as many Triton customers happy as possible. O'Brien said people who purchased *Prey* through Triton will receive a boxed copy of the game directly from the publisher, Take 2. Furthermore, O'Brien is personally writing a patch for Triton customers that will remove the activation and server reliance from any of the 120 titles Triton sold, so those games can still be played online without the machine hitting the server.

For folks who might have lost the game files from their PC after a reformat, O'Brien said he can provide encrypted replacement files. Details about the patch and contact information for consumers should be available at **www.obwando.com** by the time you read this. Why is O'Brien going to such lengths to support Triton customers? "I'm

Triton Player Whats Hot Screen

Triton's online service allowed users to stream games such as *Prey*, but those gamers were left in the lurch when Triton went under.

basically supporting all the people as best I can personally," he said, "[because] if you give your word you're going to do something, you damn well better stick to it."

O'Brien, as well as Take 2, should be commended for their commitment to customer support, but it's not all altruistic. O'Brien said he is working on a sequel to the Triton technology that he hopes to commercialize. Still, O'Brien's actions are righteous and something you don't normally see in these days of declining customer service. The Dog doesn't think other online services will be quite so kind when they go poof, although Valve is taking some encouraging steps with its Steam online service. According to news reports, Valve already has activation-removal patches ready to go should, say, an asteroid or zombie attack hit the company.

WHERE ARE MY EXTRA VOLTS?

I wanted to buy a 1,000 watt Coolmax Green Power [CTG-1000] power supply to use with my new PC, but looking at the specs on a web store, it doesn't seem to have enough power to run the Intel D975XBX board I want to pair it with. Intel's specs state that the maximum amperage draw of this motherboard is 46 amps for 12 volts, so any PSU should have this as a minimum. According to the web store's specs, the 1,000W Coolmax tops out at 19 amps. I recommend that people dig into the specs for both the motherboard and PSU before marrying the two. Can you shed any more light on this?
— *Scott Bruning*

At first, the Dog thought it was crazy that a 1,000-watt PSU would offer only 19 amps of 12-volt power, but it's all in how you read the specs. Most new power supplies use what is known as a split, or multi-rail, design. Instead of carrying power on a single high-amperage rail, power is split between several different rails. According to the web store you looked at, the PSU has two rails. To determine the PSU's total +12-volt output, you have to add up the rails; for this PSU,
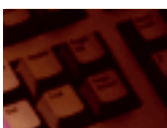
Got a bone to pick with a vendor? Been spiked by a fly-by-night operation? Sic the Dog on them by writing **watchdog@maximumpc.com.** The Dog promises to answer as many letters as possible, but only has four paws to work with.

that's 19 amps doubled for about 456 watts. That's better but something still doesn't smell right.

Taking all of the seller's specs at face value (which you shouldn't do), the Coolmax falls far short. For a comparison, the Dog looked at PC Power and Cooling's new 1KW-SR PSU which uses a single +12 volt rail for 936 watts. Enermax's Galaxy claims 1,020 watts of 12-volt power using five rails, each carrying 17 amps of juice. Even Silverstone's 850-watt PSU would surpass the Coolmax, with 840 watts of 12-volt power using four 22-amp rails. So is Coolmax blatantly ripping off its customers? Looking at the published specs on the online store, one would say yes. But if you go directly to Coolmax's website, you can see the problem: The web store chopped off part of the spec. According to Coolmax, version 2.20 of the CTG-1000 features four separate 12-volt rails, each providing 18 amps of power, or about 850 watts.

Again, this is taking the manufacturer at its word. The Dog is pretty sure the power-output rating represents the best case scenario, and doesn't take into account fluctuations in temperature, which can have a major impact on power output. That's not something that can, nor should, be answered here. Just something to keep in mind. The basic lesson here is that you shouldn't trust the specs given by resellers, or even magazines or websites, for that matter. Mistakes are made. The most accurate specs will always come from the manufacturer. MPC

Don't go by the resellers' word for hardware specs, as they often under- or over-report figures, as with this Coolmax 1,000W PSU, which seems to output just 456 watts of power at 12 volts.

Coolmax's website reports the spec as 850 watts.

Recall Alert

■ You knew Sony's battery recall couldn't end without Sony's own notebooks being affected. And sure enough, the company is now recalling notebook PC batteries that could overheat and cause a fire. The batteries were sold with the following Sony VAIO models: VGN-FE550G, VGN-FE570G, VGN-T240P, VGN-T250, VGN-T250P, VGN-T260P, VGN-T270P, VGN-T340P, VGN-T350, VGN-T350P, VGN-T360P, and VGN-T370P, as well as additional battery-pack models VGP-BPS3A and VGP-BPS2B.

The list of bad battery models are too numerous to list here, so consumers are advised to visit http://esupport.sony.com/battery for more information. Consumers can also call Sony directly at 888-476-6972. Replacement batteries will be provided at no cost to consumers, but they are advised to stop using the bad cell until a replacement arrives.

This time, notebooks from Sony and Gateway are added to the long list of products using bad batteries.

■ Gateway is also now advising its customers about bad batteries. Gateway is recalling about 35,000 Sony lithium-ion batteries that might overheat and pose a fire hazard. The bad batch of batteries were sold with the following Gateway notebook models: CX200, CX210, E100M, M250, M255, M280, M285, M465, M685, MP8708, NX260, NX510, NX560, NX860, NX100, MX1025, MX6918b, and MX1020j. More information about Gateway's recall is available at www.gateway.com/battery or by calling 800-292-6813 between 7 a.m. and 10 p.m. Central standard time, seven days a week.

WELCOME TO THE
Revolution

The era of incremental improvements in PC graphics is over. The debuts of DirectX 10 and the first videocards that take advantage of it are fomenting radical and far-reaching changes in PC gaming   BY MICHAEL BROWN

We're sick to death of console weenies boasting that the Xbox 360 and the PS3 are going to render PC gaming obsolete. Innovations such as DirectX 10 and the introduction of several hot new GPUs available only for the PC will put those poseurs in their place.

These console systems do have impressive graphics—for gamers on a budget. But games running on a full-blown PC can tap into several times the processing horsepower just for graphics, never mind the depth of computational resources available for A.I. routines, physics, and complex audio algorithms. If DirectX 10 delivers on its promise, PC gaming will be better than ever.

We haven't been this excited about a new development in graphics since 3dfx and Rendition showed off their first products. And the best news is that it looks as though the fresh hardware is going to make today's games look better and run faster, too. DirectX 10 demands a lot of power, which means you'll be able turn on a lot of DirectX 9 features simultaneously—high dynamic-range lighting and antialiasing, for example—without taking a performance hit. So even if the development of new DirectX 10 titles lags, or you decide to hold off on moving up to Windows Vista, you'll still benefit from this new generation of videocards.

Unified shader architecture translates to more efficient use of the GPU.

Support for subsurface scattering will deliver more realistic character skins.

The new geometry shader produces sophisticated 3D models.

DirectX 10 Backgrounder

Might this be the only reason anyone will buy Windows Vista?

You're probably familiar with Moore's Law, which holds that the number of transistors on a chip—and by extension, the computational power of integrated circuits—doubles approximately every two years. The graphics-processor designers at ATI and Nvidia are performing at a rate of Moore's Law squared, improving the performance of their products by a rate of double *every* year.

Having this power is fantastic for games, but it's also inherently useful for such specialized purposes as video editing, graphics design, CAD, and many other disciplines. But because Windows historically hasn't demanded all that much GPU power, graphics hasn't been much of a design priority for system manufacturers—that's why Intel has been able to dominate the graphics market by selling integrated graphics offering a fraction of the computational power of even low-end discrete GPUs from ATI and Nvidia.

Windows Vista changes all that, because it depends on the GPU to deliver a day-to-day desktop experience—especially if you buy a version with Aero, Windows' new bells-and-whistles interface. Even without Aero, the new Windows video playback infrastructure relies on the GPU to deliver high-definition video playback. The new Windows Photo Gallery taps GPU power, too. Microsoft created the DirectX 10 collection of application program interfaces—of which Direct3D is the most important—to leverage this processing power.

MEET DIRECTX 10

Microsoft is nothing if not conservative; but every once in a while, the hidebound software giant exposes itself to more than the usual amount of risk in order to embark on a new and strategically important endeavor. DirectX 10 is one such example. Microsoft has completely re-engineered this crucially important collection of APIs in order to strip away every impediment necessitated by maintaining backward compatibility.

There is a downside to this, but there's a tremendous upside for those of us who want to see the state of the art of graphics advance. Let's talk about the downside first—and briefly: You're going to need a new videocard to take full advantage of DirectX 10. For the time being, only two GPUs can lay claim to being DirectX 10 compatible. They're both from Nvidia, and they're both expensive. So while there might be plenty of competition between board vendors selling DirectX 10 videocards, prices will likely remain high because Nvidia has no need to discount the main component that goes into these cards.

DirectX 10 also incorporates some of the advanced tools and application program interfaces from Microsoft's Xbox and Xbox 360, which should simplify the efforts of game developers interested in porting their software from one platform to the other. These will include XACT (Cross-platform Audio Creation Tool), which simplifies the

process of producing audio capable of running on a range of sound hardware; and XInput, so the same game controllers can be used on both the Xbox and a Windows PC. Other legacy DirectX APIs, including DirectPlay, DirectInput, and DirectMusic, have been streamlined and absorbed.

BYE-BYE CAPS BITS

One of Microsoft's most important changes does away with what are known as capabilities (caps) bits. In previous versions of DirectX, software developers couldn't rely on hardware—videocards, most importantly—supporting all the features that DirectX had to offer. In the DirectX 9 era, for example, ATI's Radeon 800-series cards qualified as being DirectX 9-compliant even though they didn't support Shader Model 3.0; by the same token, Nvidia's GeForce 6- and 7-series cards were considered DirectX 9-compliant even though they couldn't perform high dynamic-range lighting and anti-aliasing at the same time. In such instances, capabilities bits within the card informed DirectX which features it *could* support.

There are no caps bits in DirectX 10: In order to be considered compliant, hardware must support *all* the new API's feature set (with a handful of relatively minor exceptions). For the most part, this means support for all aspects of Shader Model 4.0. For game developers, the elimination of caps bits make the job of programming

DIRECTX 9 VS. DIRECTX 10: THE DIFFERENCE IS GRAPHIC

Game developers have squeezed just about everything they can from DirectX 9, but games that take advantage of DirectX 10 and run on DX10 hardware make DX9 games look positively primitive. DX10 games will have a much higher level of detail, better lighting, brighter colors, and much more.

DIRECTX 9

The screenshot above, taken from Funcom's upcoming MMO *Age of Conan: Hyborian Adventures,* is replete with detailed textures and terrific shadows. This is about as good as it gets with DirectX 9.

DIRECTX 10

This screenshot depicting the same scene from the same game shows what DirectX 10 can deliver: Richer color, textures with more detail, and better realism. Notice the shadows, and how smoothly the curves in the arches are rendered.

for the PC nearly as consistent as it is for game consoles.

DEDICATED DOESN'T ALWAYS MEAN SUPERIOR

Hardware that's dedicated to a certain task usually does a better job at that task than multipurpose hardware. In DirectX 9.0, for instance, GPUs have components dedicated to executing vertex-shader code (simple geometry, basically) and others dedicated to running pixel-shader operations. DirectX 10 takes a different approach. It envisions a unified architecture in which any of the GPU's shader-processing units can execute any of the three types of shader code: the aforementioned vertex and pixel instructions, plus the new category of geometry.

Microsoft's reasoning is sound: If a game needs a lot of geometry processing at a particular moment in time, for example, why not dedicate all the GPU's resources to it instead of leaving thousands of transistors standing around with their figurative arms folded saying "Hey, that's not *my* job." Dynamic load balancing and thread arbiters in the GPU will prioritize hardware utilization to ensure that the most important tasks are always performed first. This unified architecture should also enable the graphics pipeline to evolve even more rapidly, because the hardware on which it operates is flexible enough that it can handle new tasks.
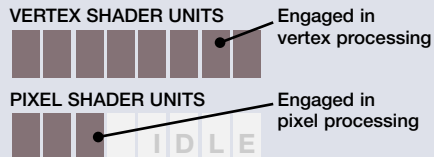
COOL TOOLS

One way to improve 3D graphics performance is to reduce the number of draw calls made to the CPU. This is particularly important in scenes where there are many complex objects, such as jungle foliage or armies arrayed on a battlefield. Direct3D 10 supports a technique known as instancing to accomplish this. Basically, a software application can instruct the GPU to draw the same object multiple times in multiple places without requiring the CPU to intervene.

Texture arrays are then used to avoid having every object in a scene look exactly the same. A texture array allows multiple textures to be loaded into the same resource. When each object is drawn, the program can choose from an index of textures that can be mapped onto it.

We discussed the Direct3D 10 pipeline in some depth in our "2007 Tech Preview" in the Holiday issue, but there's an important aspect of the new Geometry Shader that we

AN ENTIRELY NEW SHADER ARCHITECTURE

Unified shaders make more efficient use of hardware

TRADITIONAL SHADERS

COMPLEX VERTEX PROCESSING

VERTEX SHADER UNITS — Engaged in vertex processing

PIXEL SHADER UNITS — Engaged in pixel processing

IDLE

COMPLEX PIXEL PROCESSING

VERTEX SHADER UNITS — Engaged in vertex processing

IDLE

PIXEL SHADER UNITS — Engaged in pixel processing

UNIFIED SHADERS

COMPLEX VERTEX PROCESSING

UNIFIED SHADER UNITS — Engaged in vertex processing

Engaged in pixel processing

COMPLEX PIXEL PROCESSING

UNIFIED SHADER UNITS — Engaged in pixel processing
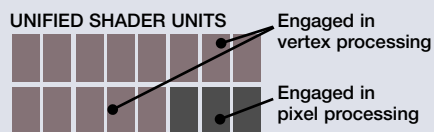
Engaged in vertex processing
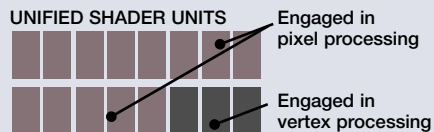
didn't cover: stream output. Previous generations of the Direct3D pipeline functioned in a strictly linear fashion, with instructions entering the top and images emerging from the bottom to be sent to the display. Stream output enables the vertex and geometry shaders to store their results in memory buffers, and then circulate this output back to the top of the pipeline for a second round of processing—with minimal intervention from the CPU. Stream output should increase the GPU's capacity for parallel processing by a significant factor.

SO WHAT'S NEXT?

Microsoft is already hard at work on the next big thing: DirectX 10.1 This point release will include all the image-quality goodness of DX10, and it will add a number of new features that should allow developers and

GPU manufacturers to take PC image quality even further. One of the most significant improvements will impact an application's control over antialiasing. In the current state of affairs, under which AA is either on or off, GPU cycles are frequently wasted on scenes where aliasing isn't going to be noticed anyway. Under DirectX 10.1, developers can control not only both multisample and supersample antialiasing, they can also choose the best sample patterns for each rendering scenario.

We've barely scratched the surface of DirectX 10. With support for shader instructions of unlimited length, improved load balancing between the CPU and GPU, reduced API and driver overhead, and a vision of GPUs offering precision equal to that of CPUs, DX10 and the videocards that support it hold the promise to blow our minds.

Nvidia GeForce 8800

The most powerful graphics processor we've ever tested

Nvidia's GeForce 8800 GTX is the first GPU to support Microsoft's DirectX 10.

Testing incrementally faster and incrementally cheaper DirectX 9 video-cards is pretty boring when you're on the cusp of a new product introduction that's going to change everything. The last time we got excited enough to award a new card a Kick Ass award was when Nvidia introduced the dual-GPU 7950 GX2—nearly six months ago!

Nvidia's GeForce 8800 GTX and 8800 GTS change all that. Each is based on an entirely new architecture—the first from-the-ground-up redesign since Nvidia debuted the GeForce 7800 in November 2005—and each is designed to deliver awesome performance with games designed for Microsoft's DirectX 10 and Shader Model 4.0. These GPUs are *fast*. In our benchmarks, a single GeForce 8800 GTX delivered faster performance than two of the fastest GeForce 7900 GTX cards running in SLI that we've ever tested.

This boost is a happy development. DX10 is so different from DX9 that we had wondered if DX10 GPUs would be fast with DX10 games and slow to mediocre with DX9 titles. Since the 8800 cards are so fast with DX9 games, there's no reason to wait for DX10 software to move up.

STREAM PROCESSORS

The single most significant difference between 8800-series GPUs and everything that preceded them is that they're based on a unified shader architecture. Both GPUs boast a staggering 681 million transistors, and the GTX is outfitted with 128 shader-processing units (Nvidia calls them "stream processors"). The slightly less-powerful 8800 GTS has 96 stream processors. In both situations, each shader unit can be dynamically allocated to execute vertex, pixel, geometry, or even physics instructions.
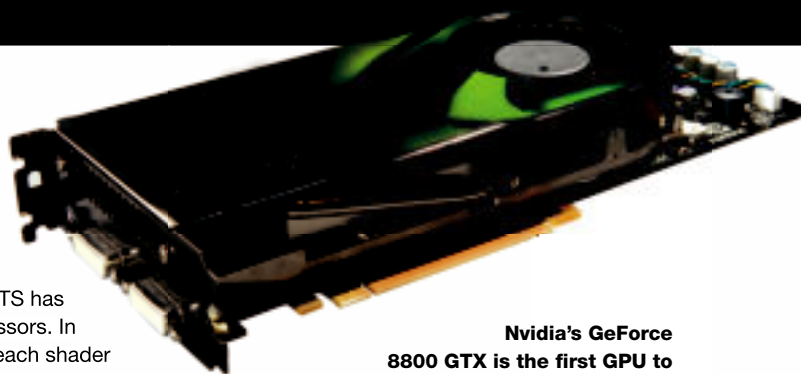
Both 8800 models possess asymmetric clocks, meaning that the stream processors within the cores are clocked higher than the cores themselves. Nvidia's 7-series architecture is similar in that its vertex-shader units are clocked higher than its cores. The GTX's stream processors run at 1.35GHz, while its core hums along at 575MHz; GTS stream processors run at 1.2GHz with a 500MHz core.

The GTX is outfitted with 24 rasterizers (which convert 3D information into 2D pixels) and can output 24 pixels per clock cycle; the GTS is equipped with 20 rasterizers and can output 20 pixels per cycle. Both specs represent a somewhat marginal improvement over the 16-rasterizer 7900 GTX.

After observing ATI's troubled X1900-series launch last year, Nvidia didn't take any chances with new process-size technologies: The 8800 series is fabricated using a 90nm process. The trade-off for Nvidia is yield: Even though these chips are assembled on 300mm wafers, the fabs can fit just 80 die on each one. We expect the company to shift to a smaller, more efficient process size over time.

POWER REQUIREMENTS

Considering the number of transistors on these chips, the 8800 series is remarkably power efficient. Nvidia recommends at least a 450-watt power supply for an 8800 GTX (with a 12-volt current rating of 30 amps) and a 400-watt minimum PSU for the 8800 GTS (with a 12-volt current rating of 26 amps). You'll need much more than that for an SLI rig. Nvidia's not talking about quad SLI; and the company has not made any announcements about a dual-GPU/single-card configuration a la the 7950 GX2.

Each GTX card needs two six-pin power connectors because, Nvidia tells us, the PCI Express specification allows cards to draw only 75 watts through their edge connector and 75 watts through each six-pin power connector (the 8800 GTX draws 165 watts from the power supply).

Whether you'll have enough room inside your case for these cards is a whole other kettle of pixels. Thanks to their thick coolers, both cards consume two slots, and the 10.5-inch-long 8800 GTX just barely fit in the Cooler Master Centurion case we use for our test bed (it wouldn't fit at all had Nvidia not moved the dual power connectors from the end of the card to the top edge).

The 8800 GTS is just slightly shorter at nine inches. Both coolers are relatively quiet, and both cards are outfitted with HDCP support for playing back copy-protected movies.

MEMORABLE MEMORY

Stream Output is just one of the many cool features in DirectX 10. It allows data to be passed directly from the vertex or geometry shaders straight into memory and then back to the top of the pipeline. Stream output will deliver awesome particle and physics effects, but its effectiveness will hinge on having lots of available memory.

And Nvidia delivers: The 8800 GTX has a 384-bit interface to 768MB of memory clocked at 900MHz; the 8800 GTS has a 320-bit interface to 640MB of RAM running at 800MHz. Nvidia says it has no plans to introduce reference-design cards with 512- or 256MB of memory.

We think that's a good idea. Game developers tend to shoot for the lowest common denominator, and we'd rather see them stretch their artistic muscles than squeeze their visions into too-small frame buffers.

GEFORCE 8800 SPEC CHART

	8800 GTS	8800 GTX
NO. OF SHADER UNITS	96	128
CORE CLOCK SPEED	500MHz	575MHz
SHADER-UNIT CLOCK SPEED	1.2GHz	1.35GHz
FRAME BUFFER	640MB GDDR3	768MB GDDR3
MEMORY SPEED	800MHz	900MHz
MEMORY INTERFACE	320-bit	384-bit
NO. OF RASTERIZERS	20	24

PHYSICS PROCESSING

Nvidia and ATI have both been touting the idea of using their GPUs to accelerate physics computations. We've pooh-poohed the concept in the past, because it seemed as though the graphics companies were simply reaching for an excuse to sell more parts. If Nvidia's Quantum Effects technology takes off, we might have to change our tune.

David Kirk, Nvidia's chief scientist, justified our initial skepticism during the company's GeForce 8800 press briefing with his comment that "…previously, you could do only part of the physics processing on the GPU because the underlying hardware wasn't cut out for it." But the parallel-processor nature of Nvidia's new architecture renders it much more adaptable for physics processing; in fact, the company maintains that it has baked some features into the chip that are dedicated to non-graphics processing.

As Kirk explained it, CPUs are not well-suited to physics processing because they can solve only one equation at a time and they execute most instructions out of their cache. This requires a large and complex set of control logic to keep the CPU busy. The unified shader units in the 8800 series can share data via a parallel data cache without even having to use video memory. This is a major shift from Nvidia's previous position of "We can do physics processing, too." With the 8800, they're saying "We've architected this new GPU to do a very good job of physics processing."

It will be difficult to measure Nvidia's claims in the absence of good benchmarking tools—not to mention games that make sufficient use of physics to really matter—but you'll find the results of our hands-on testing of the 8800 GTX on the next page. Turn to our reviews section for more in-depth results.

HOW WILL ATI AND AGEIA RESPOND?

We know that ATI's next graphics processor will feature a unified shader architecture because the company publicly said so way back in April 2006. ATI has also made a lot of noise about its stream-processing initiative, which harnesses the multiple multithreaded cores in its GPUs to run distributed-computing applications such as Folding@Home.

Unfortunately, the only other information we've been able to pry from ATI is that we can expect to hear more about its new GPU—code-named R600—around the time that Windows Vista is released. Our hope is that AMD's acquisition of ATI hasn't been too much of a distraction for the product-management and engineering teams, and that they have tremendously ambitious plans to outdo their arch rivals at Nvidia. Anything less would undoubtedly slow the advance of the state of the art, because no company sees value in competing with itself.

It's more difficult to predict how the 8800 series will impact Ageia. Physics remains a wide-open field that game developers have yet to exploit. We remain believers in the concept of building dedicated hardware for such a resource-intensive task, but it's been more than six months since Ageia introduced its PhysX PPU and we still don't have the killer app to justify buying a card equipped with one.

INSIDE THE GEFORCE 8800 GTX

This block diagram illustrates the highly parallel nature of the GeForce 8800's architecture. Instructions from the host CPU are fed to an input assembler, which issues a vertex thread to be processed by the shader core. Once a vertex instruction has been executed, the thread processor sends the result on either for geometry processing (where entirely new vertices might be created—or destroyed) or for pixel-shading.

The GPU can also temporarily store computational results in L1 or L2 cache and then route them back to the top of the shader core, where they'll be repeatedly dispatched, processed, and re-looped until all shader operations have been completed and the resulting pixel fragment is sent on to the rasterizer.
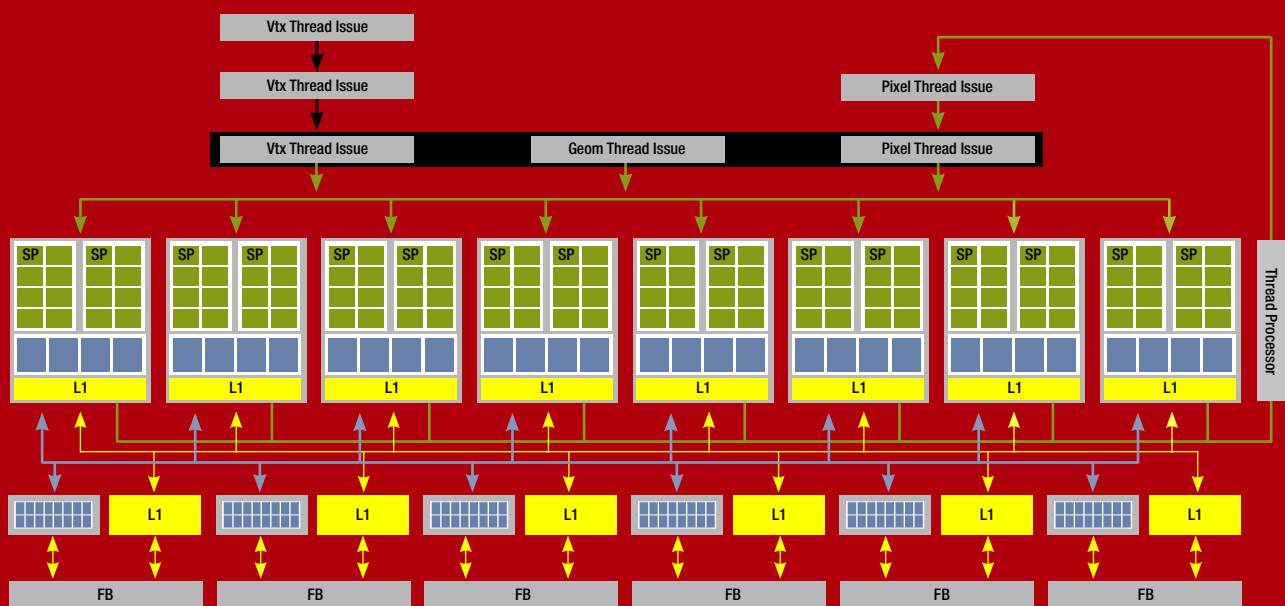
Hands-on with the First DirectX 10 Videocard

So, Nvidia has won the race to produce the first DirectX 10 videocard. The GPU and the card on which it's mounted are physically huge, there's tons of memory, and the list of specs and features is impressive. But the only way to tell what Nvidia has wrought is to test the bugger, and we have—as much as is possible.

You'll find a more in-depth look at the GeForce 8800 GTX and the GeForce 8800 GTS in the Reviews section, but we couldn't resist providing some highlights of our time with the top-shelf GTX version here. This GPU is certainly fast with DirectX 9 games. In fact, a single 8800 GTX proved to be faster on every benchmark than a single Radeon X1950 XTX, GeForce 7900 GTX, or GeForce 7950 GX2. It also delivered better benchmark results than two X1950 XTXs running in CrossFire and a pair of 7900 GTXs in SLI.

But ATI's Radeon X1950 XTX and Nvidia's GeForce 7900 GTX are arguably fast enough for today's games—even at the 1920x1200 resolution we test at. And since Vista has not yet arrived and there are no DirectX 10 games available, just what benefit is to be derived from even more speed? We found that the answer lies not in sheer frame rate but in image quality. You might have to wait for games developed for Shader Model 4.0, but you won't have to wait to turn on or turn up all the visual enhancements for today's games running Shader Model 3.0.

Nvidia's 7-series GeForce cards, for instance, can't run high dynamic-range lighting and perform antialiasing at the same time. The 8800 can, and while the GPU took a performance hit when we enabled 4x antialiasing and 16x anisotropic filtering in *3DMark06,* it still delivered faster benchmark results than a GeForce 7950 GX2 running with zero AA and only 8x aniso.

ATI's Radeon X1900 series doesn't suffer from such a limitation, but ATI's top-end part can't hold a candle to the 8800 GTX while performing both these tasks at once. When we enabled soft shadows, 4x antialiasing, and 16x anisotropic filtering in *FEAR,* for example, the 8800 GTX delivered a benchmark result that was five frames per second faster than the X1950 XTX's score while running without any AA at all.

HOW WE TEST

In the absence of Vista, DirectX 10, Shader Model 4.0, and games designed to run in such an environment, all we can do to measure the prowess of Nvidia's GeForce 8800 GTX is to run benchmarks designed for DirectX 9 and Shader Model 3.0. And based on the numbers we're seeing, Nvidia has much to be proud of.

The new chip is not only faster than any preceding GPU, it's dramatically faster. In nearly all our benchmarks, we realized a 2x increase or came very close to it. Game 1 and Game 2 from *3DMark06* use Shader Model 3.0 for all its worth, so we're accustomed to seeing low frame rates because we test at such a high resolution: 1920x1200. To see a performance delta just shy of 2x in Game 2—and *more* than 2x in Game 1—is nothing short of remarkable.

Game 2 depicts many thin horizontal and vertical lines, which look extremely jagged without antialiasing. We couldn't run this benchmark with AA turned on with previous generations of Nvidia GPUs, so we didn't with ATI's, either. Similar limitations apply to benchmarking *FEAR* and *Company of Heroes.* Now that the GPUs from both camps support the simultaneous use of HDR and AA, we'll enable both features in every benchmark that supports them.

We'll also run *Quake 4* in Ultra Quality mode whenever we test videocards with 512MB or larger frame buffers. This mode uses higher-quality textures to deliver much-improved image quality. We'll continue to test with 4x AA when the benchmark offers us the choice, but we'll boost anisotropic filtering to 16x.

We're also moving our videocard testing from a 2.6GHz AMD FX-60 platform to one based on Intel's Core 2 Extreme. Time constraints prevented us from retesting the GeForce 7900 GTX, GeForce 7950 GX2, and Radeon X1950 XTX cards with Conroe, but we did benchmark the 8800 GTX with both platforms for an apples-to-apples comparison.

BENCHMARK RESULTS

We won't know how well the GeForce 8800 series performs with Direct3D 10 games until we have some Pixel Shader 4.0 games to test it with. But, we know this card is a barn-burner when it comes to running today's Direct3D 9 games and benchmarks; in fact, it's faster than two super-fast 7900 GTX cards running in SLI in most situations.

TEST BED: AMD FX-60 (2.6GHZ)

	ASUS EN8800 GTX	XFX 7900 GTX XXX EDITION	XFX 7900 GTX XXX EDITION SLI	EVGA 7950 GX2	ATI RADEON X1950 GTX
3DMARK06 HDR/SM3 #1 (FPS)	33.6	15.0	27.2	19.3	18.4
3DMARK06 HDR/SM3 #2 (FPS)	38.2	20.7	38.2	27.3	20.0
QUAKE 4 (FPS)	98.4	66.7	113.8	89.3	66.3
COMPANY OF HEROES (FPS)	77.2	38.1	DID NOT TEST	DID NOT TEST	32.4
FEAR (FPS)	71	42	70	57	35
HQV SCORE	113	88	88	88	118

TEST BED: INTEL CORE 2 EXTREME X6800 W/ASUS EN8800 GTX

	HIGH QUALITY, 4X AA, 8X ANISO	ULTRA QUALITY, 4X AA, 16X ANISO	FRAME-RATE HIT		SOFT SHADOWS ON, AA DISABLED, 8X ANISO	SOFT SHADOWS ON, 4X AA, 16X ANISO	FRAME-RATE HIT
QUAKE 4	102.9	93.2	9%	FEAR	77	43	43%

Top benchmark: Best scores are bolded. Tested with an Asus A8N32-SLI motherboard with a dual-core 2.6GHz Athlon 64 FX-60 CPU and 2GB of Corsair DDR400 RAM. Bottom benchmarks: Tested with an EVGA nForce 680i SLI motherboard with a 2.93GHz Intel Core 2 Extreme X6800 CPU and 2GB of Corsair DDR2 RAM. All benchmarks run at the default resolution of a 23-inch ViewSonic VP2330wb display: 1920x1200.

And Now: The Eye Candy

Now that we've seen how fast the first DirectX 10 videocard can be with current-generation games, let's take a look at what we can expect from next-gen titles. We selected each of these screenshots to represent one new visual effect that's not currently achievable with DirectX 9.

SIGNIFICANTLY IMPROVED INSTANCING

Increases the number and diversity of objects in games such as Supreme Commander

RTS games have lagged in visual quality compared to first-person shooters because the games must render so many objects. Developers must choose between limiting the number of units onscreen at any one moment or rendering lots that look nearly identical. Boring.

In Gas Powered Games' *Supreme Commander*, you'll be able to deploy hundreds of very different units all at one time, thanks to DirectX 10's improved instancing routines. First introduced with DirectX 9, instancing enables developers to create one object model and have it drawn many times using just one "draw" call; however, each object's movement and orientation were similar. DirectX 10 liberates programmers from the restriction of simple cloning by allowing them to assign each instanced object with a texture selected from a texture array. And to ensure that each object behaves as well as looks different, DirectX 10 supports a large palette of animation routines.

SUPREME COMMANDER

PROCEDURALLY GENERATED EFFECTS

Real-time geometry creation simulates nature

NVIDIA'S WATERFALL DEMO
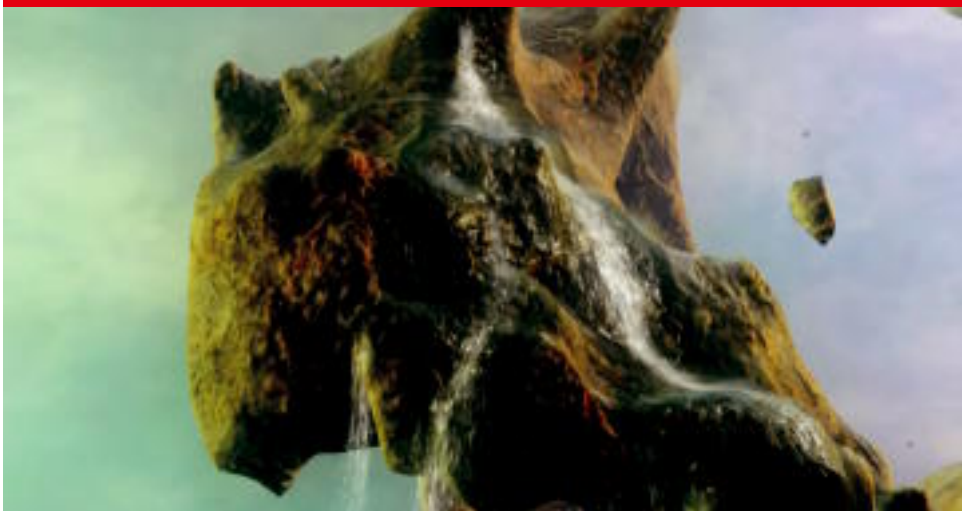
DirectX 9 supports procedurally generated effects, but all objects must be based on pre-fabricated vertex or texture data. The presence of a geometry shader in DirectX 10 allows the GPU to generate new data, which enables developers to create visual effects based on real-time calculations.

In this Nvidia-provided demo, a column of rock continuously "grows" from the top of the screen. Waterfalls can emerge from any point on the column and cascade down its face, forming pools on flat surfaces. Vines crawl across its face, thicken and branch out over time, and gradually decay until they disappear. Pixel-shader routines, meanwhile, give the object its rich texture and high definition.

Note the glistening textures indicating where water has moved across the surface. In the demo, these slowly fade to a duller finish as the waterfall dries up and ceases to flow. Procedurally generated effects should be a boon to games like Will Wright's upcoming *Spore*.

BETTER-LOOKING SKIN TEXTURES

New lighting models will deliver heightened realism

Human and animal skin is one of the most difficult textures to render because of the way it both absorbs and reflects light. Some light is reflected off the surface of skin, but much passes through the first few layers, bounces around at irregular angles, and then re-emerges. The phenomenon is known as sub-surface scattering, and it's notoriously difficult to render because in the real world, the light that re-emerges is tinted by the blood in the dermis.

Most lighting models are designed for hard surfaces and don't take sub-surface scattering into account. The fact that DirectX 10's Shader Model 4.0 supports immensely complex shader routines, coupled with its vision of a unified architecture in which all of the GPU's shader-processing units can be dedicated to either pixel, vertex, or geometry shading will enable developers to create extremely sophisticated lighting models.

Note the realistic depiction of the skin and eyes in the star of Nvidia's "Froggy" demo.

NVIDIA'S FROGGY DEMO

REALISTIC PHYSICS

People, animals, and objects will display complex movements

COMPANY OF HEROES

There's currently no DirectPhysics API in DX10, but we expect game developers will make extensive use of Direct3D 10's support for geometry shaders and its stream output features (discussed elsewhere in this story) to deliver highly realistic physics in their games.

Relic Entertainment's *Company of Heroes* is already a shining example of a game with destructible environments, and it makes terrific use of physics. Relic's upcoming DirectX 10 patch promises to render the game even more realistic, with shrapnel and other particles flying everywhere.

If Ageia winds up folding its tent, it won't be because of DirectX 10, but in spite of it: There's nothing in DX10 that would prevent a game from executing physics routines on Ageia's PPU should developers decide to go down that path. The problem is that we've seen precious little movement on the accelerated physics front. MPC

Windows Vi

Microsoft's next-gen Windows has finally arrived. We give the long-delayed OS an in-depth road test to see if it lives up to the hype and deserves to be your next operating system

Desktop Background

sta: THE FINAL VERDICT

BY WILL SMITH

It's been five long, virus-infested years since Microsoft launched Windows XP—an epoch in modern computing terms. We've been using XP for so long now that it's tough to even remember the dark days of Windows 98. At the end of January, Microsoft is finally going to ship Windows Vista, but we have plenty of questions about the nascent OS, and we're sure you do too.

Does Vista deliver enough of an improvement over XP to justify its high cost? Does Vista represent the kind of revolution that Microsoft has been touting, or is it just another ME-style incremental update? Do you need to upgrade now, or should you wait until your next hardware upgrade? Will Vista even run well on your current hardware? Is the OS good for gaming? With DirectX 10 exclusive to Vista, do we really even have a choice?

Over the last six months, we've spent thousands of hours using Vista betas and release candidates, rebuilding machine after machine, and reinstalling the OS dozens of times, and we've spent the last two weeks hammering at the version of Vista Microsoft released to manufacturers. At long last we're ready to render our verdict on the fruits of Microsoft's labors.

VISTA'S VARIOUS VERSIONS

There are four flavors of Windows Vista available at retail for home and business users. Which one is right for you?

VISTA HOME BASIC	VISTA HOME PREMIUM	VISTA BUSINESS	VISTA ULTIMATE
► No Aero Glass	► Aero Glass	► Aero Glass	► Aero Glass
► No Media Center	► Media Center	► No Media Center	► Media Center
► No Mobility Center	► Mobility Center	► Mobility Center	► Mobility Center
► No Xbox connectivity	► Xbox connectivity	► No Xbox connectivity	► Xbox connectivity
► No drive encryption	► No drive encryption	► Drive encryption	► Drive encryption
► Can't connect to Windows Domains	► Can't connect to Windows Domains	► Can connect to Windows Domains	► Can connect to Windows Domains
Full version: $200 **Upgrade: $100**	**Full version: $240** **Upgrade: $160**	**Full version: $300** **Upgrade: $200**	**Full version: $400** **Upgrade: $260**

What We Like About Vista

There's a lot to like about Windows Vista. Here's the quick rundown of everything we dig about Microsoft's new OS

INTEGRATED APPLICATIONS

Vista comes with more new applications than any previous version of Windows, ever. In addition to updated versions of old standbys like *Windows Media Player*, *Windows Movie Maker,* and *Internet Explorer,* Vista ships with apps that handle photo management, disc burning, and even spyware protection. These applications provide a decent base level of functionality for everyone—giving every user the tools to use their PC to edit photos, listen to music, make and watch movies, and share their content with pals.

Basic functionality is great for the technically disinclined, but power users need more. Some of the included apps truly kick ass. The simplicity and power of the *Windows Calendar* program takes all the right cues from Apple's *iCal* program. It's easy to use, but powerful enough to help you categorize and keep track of all your day-to-day appointments and activities. In an unusual move for Microsoft, it even works with open standards, so you can publish your calendar online in non-proprietary formats.

Vista also includes improvements to tired old ponies, such as *Windows Media Player*, *Internet Explorer*, and *Outlook Express* (now called *Windows Mail*). *Media Player's* new stripped-down interface is a welcome change. Instead of removing functionality willy-nilly, menus have been consolidated and the entire interface was redesigned from the ground up. While we have a few minor gripes with *Windows Mail* (why don't filters work on IMAP accounts?), overall the new app is a welcome improvement over *Outlook Express.* Heck, even *Internet Explorer 7* is significantly better than the previous version. Granted, we won't be dropping *Firefox* anytime soon, but for *IE* diehards, 7 is a major advance.

There are definitely some low points as well. The *Photo Gallery* app omits basic features—such as resizing images— and the disc-burning app is woefully inadequate for anything more advanced than burning pictures to a disc. But getting even a couple of decent apps with the OS is a welcome surprise.

SECURITY ENHANCEMENTS

One of Microsoft's main goals with Vista was to staunch the never-ending tide of security problems that have plagued Windows XP. Part of the problem with XP is that crucial code was carried over from now-ancient versions of Windows. Microsoft completely rewrote the most vulnerable parts of the operating system, primarily to reduce the problems that lead to the most common types of attacks in XP, such as buffer overruns. We won't really know for several months or even years, however, whether the measures Microsoft has put in place—including several human and automated checks on every line of code—are adequate.

Microsoft also completely revamped the way permissions work in Vista. Unlike Windows XP, where virtually every user outside of a corporate environment ran as an Administrator, in Vista you should run as a limited user most of the time, and only run as an admin when an application needs to install or update itself. By locking down the permissions for the system folders, such as Program Files and Windows,

ANATOMY OF THE VISTA DESKTOP

Some features have to be seen to be believed. Here are a few of the most visually splenderific features in Vista

SEARCH: Vista's integrated desktop search engine has entry windows almost everywhere (our only complaint is that there isn't a search box readily available on the desktop). We frequently found ourselves typing an app name or control panel function because it was faster to search than browse.

SIDEBAR: While the sidebar is the default home for Vista's Widget-like Gadgets, you can drag and drop them anywhere on your desktop as well.
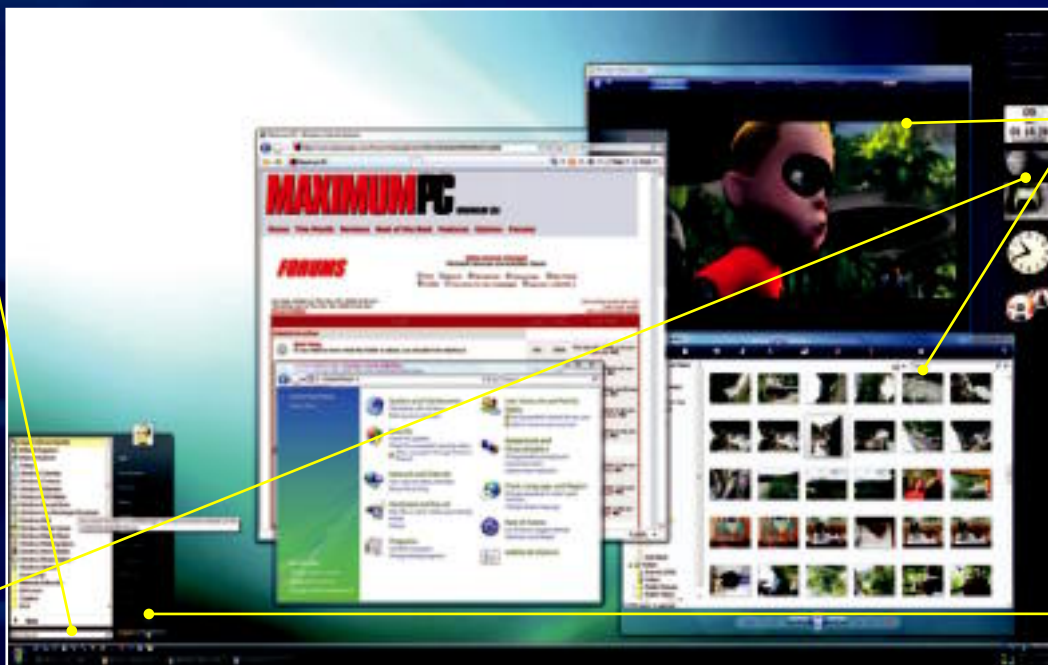
WINDOWS: Every window on a Vista machine is a transparent work of art, and because it's rendered using your 3D card's muscle, you'll never see any weird "hall of mirrors" redraw errors on Vista, even when you're playing video or using 3D applications.

START MENU: The newly redesigned start menu puts all your applications in one "convenient" menu, instead of the nested pop-ups used in XP. It's still a pain in the ass to navigate, however, once you've installed 15 or so apps.

the potential negative impact of accidentally installing malware is much reduced. On XP, once you install one bad app, you've opened the gates to dozens of others. The bad app can (and will) install other malware applications, which will do the same thing in turn. Just a few hours after installing a simple weather-monitoring utility, your system could be infested with dozens of types of spyware and malware, rendering it unusable.

In Vista, even if you install one piece of malware, you'll be prompted before the installer can write to the Program Files directory. Once the install is done and the app runs, it will be running at a lower permission level, without access to C:/Program Files/. When it tries to install new malware, it will actually save those apps in a sub-folder of your Profile (C:/Users/username/Appdata/Local/VirtualStore). So the worst-case scenario is that while your user profile will be infected, your system won't be.

Vista contains some other nifty security tricks. Certain high-risk applications—*Internet Explorer* and *Messenger* are two—run at an even lower permission level than your other apps. They're explicitly prohibited from writing to any areas that aren't necessary for their operation. So even if an exploit infects *IE,* the infected application won't be able to do anything.

There are some compatibility problems with the new security measures—when you make changes this drastic, there are bound to be—but Vista looks like it will be a significant improvement to XP.

TELEMETRY

Another huge potential improvement to Vista is its integrated telemetry. Built into the new OS are tools that measure the time it takes your rig to perform common tasks. Everything from the time it takes to boot your PC to the launch time of your browser are constantly tracked. The idea is that whenever something causes Vista's performance to nosedive, you'll be able to pinpoint a new application or driver as the culprit, and fix the problem immediately. The OS also tracks crashes, so if your machine starts to show behaviors that could indicate a larger problem, you will hopefully get an early warning.

The Performance and Reliability tracking system isn't perfect. It doesn't seem to discern the difference between serious application crashes—say a printer driver repeatedly crashing—and less significant crashes, such as a media player that chokes on a bad file. However, any extra tools to help troubleshoot PC problems are certainly welcome!

AERO GLASS

We've already talked ad nauseum about Vista's new interface. Now that the video drivers are maturing, we're going to say that it's pretty awesome—especially for users with multiple displays. The new Aero Glass GUI works with most any graphics card that supports Direct3D 9 pixel shaders; we've tested it with everything back to a Radeon 9500, with decent results.

What's the hard benefit? Accelerated video is rendered directly to the screen's frame buffer; Vista doesn't use kludgey overlays that cause tearing and can't be moved easily. In addition, because the new renderer was created from the ground up to work with multiple displays, 3D acceleration and video playback both work on your secondary and even tertiary screens.

MOBILITY CENTER

For years, our favorite laptop manufacturers have integrated all the power-consumption and road-warrior options in one handy control panel. With Vista, that functionality is part of the package. Adjust everything from your screen's brightness, to your Wi-Fi card's status, to the display you're using, from one handy Windows control panel.

Vista also improves the low-power modes supported by most PCs. Instead of separate Suspend and Hibernate modes, Vista includes one hybrid Sleep mode. When the PC first goes to Sleep, it will drop to whatever Suspend mode it supports. Then, after a specified period of time, Windows will automatically Hibernate, just the way you'd expect it to. When you return to your PC, it will boot up in much less time than it would from a cold restart.

WHIZ-BANG FEATURES

One of our major complaints about Vista is its lack of bling. Transparent window edges are cool, but they're not *sexy*. While we'd like to see a little more Minority Report-style badass interface design, Vista isn't completely devoid of whiz-bang features. It has the Sidebar, a Konfabulator clone, complete with a wide selection of available widgets to tell you everything from the current weather outside to the launch date of the Nintendo Wii in Europe.

Then there's the secondary SideShow LCD. We've already seen a couple of laptop prototypes that sport small external screens. Vista is able to display Sidebar gadgets on that screen, even if the PC is in standby mode. We haven't had an opportunity to test the technology yet, but we expect to see the first SideShow-enabled laptops shipping in January, and we'll give you the full details then.

DIRECTX 10 GAMING

We dedicated an entire feature this month to DirectX 10 gaming (see page 26), so we won't repeat too much here. Suffice it to say, the only place you'll be able to play DirectX 10 games in their full glory is on Vista. Games will work on XP in fallback DirectX 9 modes, but eventually, all gamers are going to be forced to upgrade to the new OS.

MEDIA CENTER
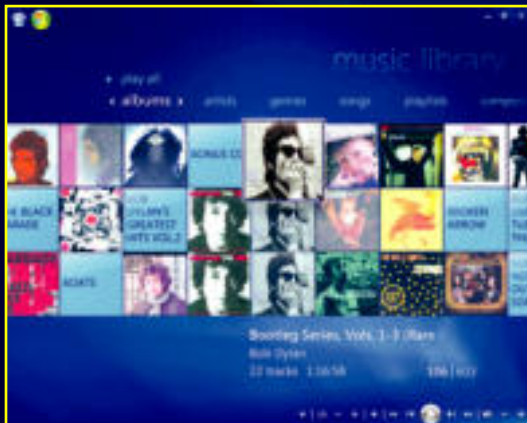
Media Center is encumbered with tons of unpleasant DRM, it automatically deletes some recordings after a few weeks, and it's not the most intuitive 10-foot interface. But the new version of Media Center is built into Vista Home Premium and Ultimate, so it's tough to argue with free.

What We Hate About Vista

Of course, Microsoft's new OS isn't perfect. Here are the things in Vista that concern us

User Account Control is a decent idea, but we question some aspects of its implementation and wonder if it will really curb the malware problem.

USER ACCOUNT CONTROL GOOFINESS

While User Account Control will help constrain malware, we're not thrilled with its actual implementation. For one thing, it's annoying. Some application install-ers—hello *iTunes*—prompt you three times for Administrator rights during the install process. Whether this is Microsoft's fault or Apple's, it shouldn't work this way.

Furthermore, requesting Admin cre-dentials with a simple Allow/Don't Allow prompt strikes us as a little insecure. On most other OSes with similar permission schemes, when you need to elevate an application to Admin status, you need to type in either your password or the Admin password. Most users—think: your mom—will quickly be trained to simply click the Allow button whenever it pops up. These are the people who desperately need to be protected from spyware.

Then there are the incompatibil-ity issues. Applications as common as *Punkbuster*—a popular anti-cheat program for online games—have problems run-ning properly in Vista with UAC enabled. When you connect to a game server in a *Punkbuster* app under Vista, if the app isn't running as an Admin, the server will kick you for running with *Punkbuster* dis-abled. In order to play *Punkbuster* games, you always have to run the game in ques-tion as an administrator.

UPSELLING AN OS SUCKS

We don't like upsells. We don't want the extended warranty, we don't super-size our order, and we sure as hell don't want three different versions of Windows for con-sumers. We only want one, and we want it to offer all the stuff we need.

By bundling features like Media Center, domain con-nectivity, and Aero Glass with the higher-priced versions of Windows, Microsoft is doing nothing more than creating extra revenue opportunities for an already overpriced product. Windows Vista Ultimate costs $400 (Home Premium costs a mere $240). There are lots of little differences, but the main distinction is that Ultimate can con-nect to a Windows Domain and Home Premium can't. Sure, Ultimate is going to come with ephemeral "Vista Ultimate Extras," but Microsoft hasn't told anyone what those will be, or even given any exam-ples. Naturally, it will be simple to upgrade Vista from inside Home Basic or Premium, if you're willing to shell out the extra cash.

The pricing issue becomes even more insane when you look at the cost of other OSes. Linux is free. Apple's OS X costs as little as $40. Is Windows really worth that much more cash than the competitors?

BIG BROTHER SHENANIGANS

Dear Microsoft,
We've been using *Firefox* for the bet-ter part of three years now. Same for *Thunderbird*. Our bookmarks are in *Firefox*, and our email is in *Thunderbird*.
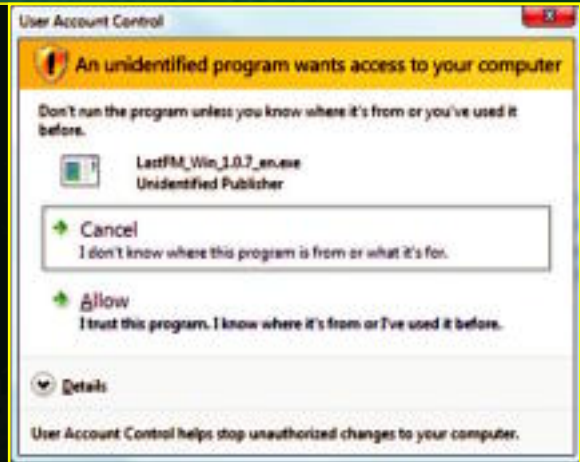
If you really want us to switch back from those products, you need to make it easy for us, by including filters and tools to convert our mail and bookmarks from your competition.

Also, we don't appreciate the inclu-sion of DRM.
Sincerely,
Maximum PC

ANEMIC INTEGRATED APPS

We've already mentioned the Photo Management app that won't resize photos, but we're also perturbed by the instant messaging app that only sup-ports Microsoft's IM protocol, and the movie making program that only out-puts to Microsoft's video format. We're not asking for support for Apple's for-mats, we'd just like to be able to read and write industry standard formats, such as MPEG-2 and Divx, and talk to AIM users. **MPC**

The Bottom Line on Vista

Sure, Microsoft took three years longer on Vista than it should have, and there are definitely some serious problems with the OS, including Microsoft's less-than-generous pricing scheme and potential DRM hassles. That said, anyone who wants to play DirectX 10 games—such as *Crysis, Hellgate: London*, and *Flight Sim X*—will eventually be forced to abandon XP. And frankly, there's a lot to like about Vista. We love the advanced multi-monitor support, we dig the responsiveness of the Aero Glass UI, and we don't mind the User Access Control hassles too much.

Vista isn't the best OS in every category—OS X handles applica-tion management and permissions better, Linux is lighter-weight and comes with a nearly infinite supply of fully functional applications—but it is definitely a leader in a few categories, namely gaming and desktop rendering. While it's true that we could be stuck with much worse, we also see lots of room for improvement.

WINDOWS VISTA

+ HOBSON'S CHOICE
More secure, better per-forming UI, good array of integrated applications.

− SOPHIE'S CHOICE
Some security features seem goofy. We waited five years for this?

Think Linux

RTUALITY

We show you how virtual machines let you easily run multiple OSes on a single PC, and how you can make the most of them

BY PAUL LILLY

You consider yourself hardcore, right? After all, your processor smokes along at 500MHz faster than stock, you voided the warranty on that new videocard within seconds of hitting the control panel and cranking up its clock speeds, and you've dived head first into water cooling. But not so fast, budding enthusiast. You haven't fully left behind Noobville and entered the elite ranks of Geekdom until you've played with virtual machines.

By emulating a specific set of hardware, virtual machine (VM) software allows you to run one or more operating systems inside your existing OS, in essence creating separate PCs within your PC. So when HaX0rJ0e starts ranting and raving on your forum about the superiority of Linux, a virtual machine makes it possible to see what the fuss is about without having to nuke your OS or even bother repartitioning your hard drive to create a dual-boot environment.

But VMs are not just for those who fear commitment. We love being the first to test new beta software, but we're not so keen on some of the aftereffects. With a VM installed, we can test every app that catches our eye, and should a program prove to be a bug-ridden mess, our squeaky-clean installation of XP remains intact. And you don't need to be an IT professional to know the value of VMs for tech support.

To get started, you'll need a separate license for every OS you plan to run—even though they're running on a single PC, they count as separate installs; and we recommend that your PC be equipped with at least a 1GHz processor and 512MB RAM. Finally, you'll need to choose a VM software package. On the next page, we review three of the most popular VM apps, then we show you how to set up our favorite and suggest specific uses for your new virtual machine.

Three Virtual Machines, One Real Winner

Microsoft Virtual PC 2004
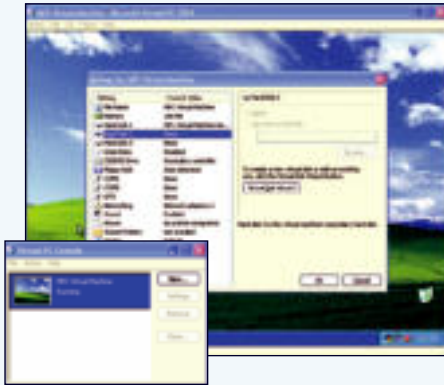
Microsoft recently dropped its $130 asking price for *Virtual PC 2004* and now offers it for free, but it's not destined for abandonware; the programmers at Redmond are working on a 2007 version, which will incorporate full Vista support (and remain free, as well).

It might often be true that you get what you pay for, but *Virtual PC 2004* works surprisingly well despite being gratis. Setting up a virtual copy of Windows XP was cake, and you're given a fair amount of customization options. Up to three hard drives can be added, and we successfully configured a home network with file sharing. And once we installed the additions package (also free), we could move the mouse pointer seamlessly between the VM and our desktop, as well as resize the VM just like any other window. Neato!

Where *Virtual PC 2004* stumbles is in its Linux support. While it's possible to get several different Linux distros to work, be prepared to spend time troubleshooting. We had a rough time getting Ubuntu installed—a problem we traced back to the S3 Trio emulation, which doesn't support 24-bit color even though the real chipset does. The VM is also slow compared with the other two apps here, and forget about using USB devices outside of a keyboard and mouse—they're just not supported. Still, for Windows-only use, it's tough to beat the price.

MICROSOFT VIRTUAL PC 2004 **7**

**Free, www.microsoft.com/virtualpc/**

VMWare Workstation 5.5
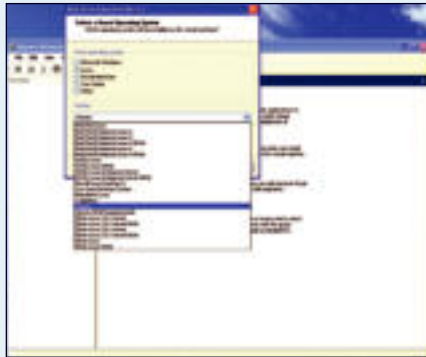
At $200, *VMWare Workstation 5.5* is the highest-priced software package in our roundup, but it's also the most fully featured. We were delighted to see the love for Linux, with several distros supported during setup via a pull-down menu. And if your distro isn't listed, *VMWare* lets you select by kernel rather than the standard "Other Linux" option (also listed). Equally robust are the Windows options, ranging from 3.1 up to Vista x64 Edition.

Installation was a breeze, and you're given the ability to clone your VM with the click of a button, which can then be shared and loaded with other copies of *VMWare* without having to install and configure Windows each time. For personal backups, you can take a snapshot of your system and revert back to it should something go awry. And unlike previous versions, you can take multiple snapshots and save them separately rather than overwriting. You can even add hardware devices to the emulation layer, such as additional hard drives, a floppy drive, or an optical drive.

VMWare also gave us the least trouble when it came to using USB devices. Flash memory keys and digital cameras were detected and functioned just as they do on our host OS. But even so, $200 is a steep asking price, and why limit users to 4GB of RAM across all VMs?

VMWARE WORKSTATION 5.5 **8**

$200, www.vmware.com

Parallels Workstation 2.2
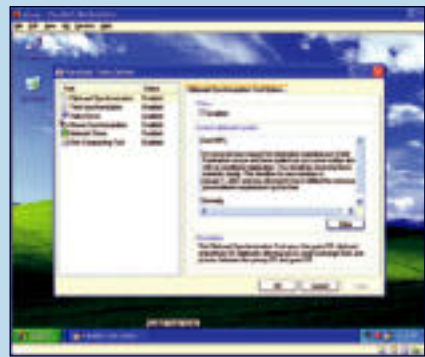
Parallels strikes the perfect balance between the two other VM apps here—broad functionality at a price that's easy to swallow.

Picking up where *Virtual PC 2004* leaves off, *Parallels* offers a wider range of Linux options, though not quite as many as *VMWare's*. But as with *VMWare*, you can choose by kernel or simply by "Other Linux" if your distro isn't listed.

From a performance standpoint, *Parallels* responds a smidge quicker than *VPC04* when opening programs or dabbling in content creation. And like *VMWare*, you can clone setups for easy deployment. For even greater functionality, install the free tools add-on to move the mouse between host and guest OS, keep the time in sync between the VM and your host PC, and even carry over your clipboard's contents from one OS to the other!

Unlike *VPC04*, USB devices are supported in *Parallels*, but using them wasn't easy. Our flash key was detected, but unusable; and when we hooked up our digital camera, the virtual PC blue-screened. D'oh! Even still, *Parallels* delivers a good balance of price and performance, so we can live with quirky USB support. There's enough value here to warrant a purchase over Microsoft's freebie.

PARALLELS WORKSTATION 2.2 **8**

$50, www.parallels.com

Set up a Parallels/Windows XP VM

Three steps to getting your virtual machine up and running

Step 1: Create Your Virtual Machine

Once you've downloaded and installed *Parallels* on your host PC, you're ready to create your first virtual machine. Clicking "New VM" brings up three options: Typical, Custom, or Blank. We like being in control, so we'll choose custom. On the next screen are two pull-down menus asking about the guest OS. We're installing Windows XP, so select Windows as the type and XP for the version.

Next you'll configure the RAM and hard drive. The more RAM you allocate for your virtual machine, the more responsive it will be, but there's no need to overdo it—*Parallels* does a good job of making do with modest resources. We recommend 512MB if you're equipped with 2GB, or 256MB if you have 1GB in your rig. For the hard drive, the default 8GB partition should be plenty to get you started, but if you know you'll need more space,
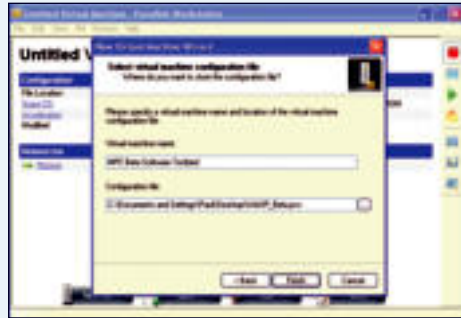

Give your virtual machines descriptive names, such as "MPC Beta Software Testbed," that represent what you'll be doing with them.

alter the size to fit your needs, or you can just add more partitions later. Finally, choose a name and location for your virtual machine.

Step 2: Change the Boot Order

Just as with your real PC, you need to configure your virtual system to boot from the optical drive in order to install Windows. Click the Edit button on your newly created VM, which brings up a screen very similar to the Device Manager. We're interested in the middle tab labeled Booting Options. Change the boot sequence so the optical is first. Now you're ready to pop in your Windows XP CD, click the power-on button located on the right-hand side of the window, and install Windows as you normally would. Don't forget that you need to have a separate license for each copy of Windows you plan to install. Hey, we didn't write the rules!
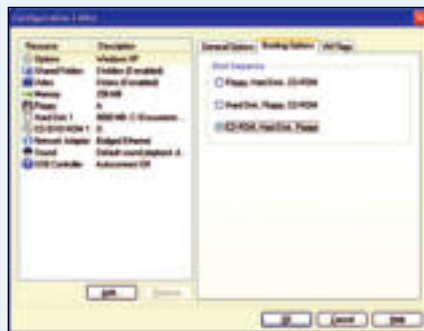
Before firing up your virtual machine for the first time, you'll need to tell it to boot from the optical drive in order to install Windows.

Step 2: Install Drivers

You're almost ready to rock 'n' roll. *Parallels* will install with basic drivers, but for advanced functionality, you'll need to install Parallels Tools. Installing the tools allows you to sync the clipboard between your host and guest OS, customize the network adapter for improved performance, tweak the video adapter to allow you to move the mouse cursor seamlessly in and out of the VM box, and a handful of other goodies. Hit Ctrl+Alt to release the mouse cursor and navigate to VM in the menu bar. Follow the prompts and when finished, you'll be ready to get down with your virtual machine and boogie!
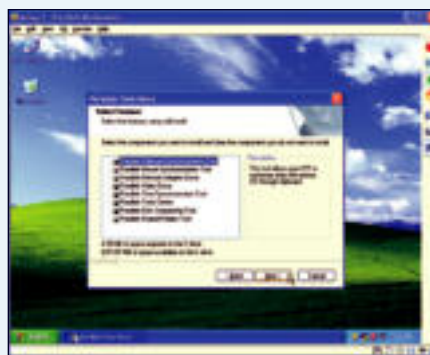
To get the most out of your VM box, be sure to install the optional tools package.

Advanced CPU Support

Anytime hardware emulation takes place, you can expect to take a performance hit compared with running on native hardware. Virtual machine apps are coded to minimize this effect, but there's only so much that can be done on a software level. If a business wants to upgrade its servers yet still maintain support for legacy applications through virtualization, the performance hit incurred could prevent this from being a viable option. Support for virtualization needs to be integrated on the hardware level, and that's exactly what Intel and AMD have been doing. The virtualization extensions in their current processor lineups have the potential to significantly improve performance when emulating an OS. The benefits will be known for sure as new versions of VM software that support CPU virtualization are released.

Today's virtual machines use a virtual machine manager (VMM) to communicate with the processor and keep the emulated components separate from the real hardware. Visualize a work environment in which the boss (CPU) speaks a different language than one of the employees (virtual machine), who brought along a translator (VMM) to help him communicate. It works, but if the boss were to learn some of the employee's language, the give and take process of communication would move along much more quickly. In a way, this is what AMD and Intel have done with the virtualization tech in their new processors.

Use Your VM as a Safety Sandbox

Before going buck-wild testing potentially unsavory applications, put up a wall of protection

Virtual machines make ideal platforms for playing with beta software or potentially harmful applications; and for the most part, they stay contained within their own hard-drive image. But malicious code can still make its way onto the host operating system. The last thing you want to do is compromise your main rig, so grab the bull by the horns and take a proactive approach.

For all intents and purposes, your VM box is another system on your network and needs to be treated as such. Just as you do with every PC you own, update Windows on your virtual machine with the latest patches and hotfixes. Always keep a firewall up and running whenever you're connected to the Internet, and keep malware at bay with regular antivirus and anti-spyware scans. We list several of our favorites in the November 2006 issue cover story ("Fix Your PC!").

Once you've migrated your good computing habits over to the VM box, pat yourself on the back, and then customize the network options. Because you're going to use this VM as a safety sandbox, there's no need to enable file and printer sharing, as this makes your host PC vulnerable should your VM become corrupt. Navigate to the Control Panel from the
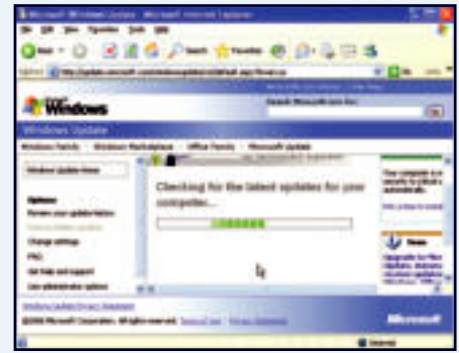
What applies to your main PC also applies to your virtual machine. Run Windows Update and keep your installation patched!

Start menu and click Network and Internet Connections. Select Network Connections, right click the LAN icon, and select Properties. Uncheck file and printer sharing. Congratulations, you're now ready to ride recklessly into the sunset!

VM as Virtual Test Bed

Raised and groomed on Windows XP? A virtual machine presents a cost-effective way to expand your OS horizons!

Here's what it boils down to: You regularly visit computer forums where you converge with other like-minded geeks and discuss everything from the newest videocards to what AMD and Intel have up their sleeves for next quarter. But every once in awhile, in the middle of getting your geek on, the conversation gets interrupted by a select group of users intent on spreading the utopian open-source gospel known as Linux. Tired of just not *getting it*, you decide to take the plunge, when the realization hits: You don't have a spare PC handy, oh no! Thanks to virtual machines, you don't need one. Throw your distro of choice onto a VM and see what all the ruckus is about. And it's not just for the curious, web developers can run a standard Linux Apache server and write code on the same rig, negating the need for an expensive staging server!

The appeal of a virtual machine extends beyond Linux duties, too. Nostalgia buffs can throw an older version of Windows onto a VM and get reacquainted with those long-lost apps of yore. Or don your developer hat and test out your killer program across a variety of platforms for maximum compatibility.

And finally, as regards that friend or relative who bought a PC back when *Duke Nukem 3D* was the hottest FPS on the block and hasn't updated it since: You can still be the go-

Want to enjoy Windows 98 and XP at the same time? Only a virtual machine makes this ménage à trois possible!

to guy for solving the latest computer crisis (oh joy!) with a virtual machine that lets you stay on top of your troubleshooting game, even for ancient versions of Windows. **MPC**

Avoid Virtual Vexation!

If there were such a thing as Homeland PC Security, we could always assume a state of code red and dispense with the other colors. Not only are we constantly at threat from cyber evil-doers who would like nothing more than to steal our identities or harm our computers, but defective hardware and poorly programmed software can take out a system in a flash. And whether disaster befalls your host PC or your virtual machine, you better have a backup in place.

There are two ways to back up your virtual machine. The first is to create a clone of your existing configuration. We recommend doing this after a fresh OS installation on your VM, and again after you've customized your install. Open *Parallels Workstation* and click VM in the menu bar. Select Clone VM and follow the prompts. This process will create a complete backup of your entire virtual machine, which you'll need to save in a secure location.

Alternately you can physically back up the configuration file and hard drive image. These can be found by navigating to C:\Documents and Settings\YOUR USERNAME\My Documents\Parallels Virtual Machines, or perform a desktop search for *.pvs and *.hdd. Make note of the directory or directories you found them in and then back up the appropriate files.
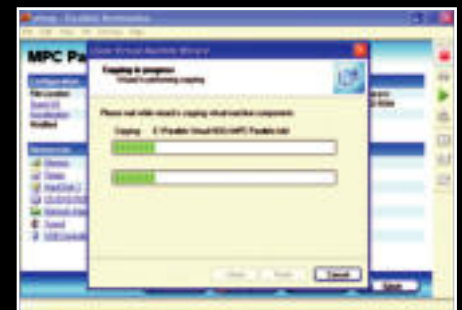
A clone can't save you a bundle on your car insurance, but it can save you from a full-blown OS reinstallation.

Host Your **Blog** at Home

LiveJournal, Xanga, Blogger: your days are numbered. With a few mouse-clicks and a little manual config, hosting your own blog is as easy as writing one.

TIME 00:50 HOURS:MINUTES

So you have a blog. Cool, but let's face it, that's just not very unique in the modern-day web world. Everyone blogs; heck even your Xbox 360 has its own self-updating blog!

One way to set yourself apart from the hordes, and steer clear of restrictive hosting providers, is to use your own gear to run your own blog. You not only earn more geek street-cred, but self-hosting your blog opens the door to limitless configuration options—whether you're using *Notepad* to edit bare-bones HTML documents, or setting up the latest *Wordpress* plugins.

If you've never built your own server, or if you find the concept of an Apache installation terrifying, don't sweat it. We're going to help you shortcut the configuration headache, so you don't have to emo-blog about it later.

BY DAVID **MURPHY**

WHAT YOU NEED

BROADBAND INTERNET CONNECTION

A CHEAP PC
A laptop works too, but it's not ideal

XAMPP
Free, www.apachefriends.org, or on this month's CD

WORDPRESS
Free, www.wordpress.org

DynDNS UPDATER
Free, www.dyndns.com

K2
Free, www.getk2.com

I Getting the Hardware Up-to-Speed

For the backbone of your blog, hardware doesn't really matter as much as you might think. You can run a web server on an old-school CPU and a craptastic videocard; you can run it on a dual-core rig with SLI graphics. As long as you aren't planning to use your web server as a gaming rig, you can spend as much or as little on hardware as your bank account permits.

Regardless of the hardware you use, you need to be aware of a few important setup issues. Remember, you're going to be running a web server; when it's offline, so is your blog. So while you'll want to have Windows automatically update and install the latest patches on your box,

be sure to set an ideal time. And don't forget the time-zone issue. If you're running a blog on the west coast, arbitrarily setting your computer to update at 3 a.m. because it "seems late" could render your blog inaccessible to the east coasters who like a little Web 2.0 with their morning lattes.

It's important to keep your virus scanner up and running on your web server, but you're better off scheduling a daily, midnight drive scan, as opposed to kicking on the real-time protection. What you trade away in security, you gain by maximizing your system resources—this is crucial if you're using a lower-end rig to power your blog, especially if you feel like multitasking the computer as a file dump or video streamer.

Don't schedule your updates for midday, or else your computer could reset itself during prime blog-watching time.

2 Opening the Software End

Before you really start tinkering with your machine, you're going to want to establish a functioning, nonrestricted connection between your server and the Internet. Typically, something's blocking the path: a software firewall, a home router, or both.

While there are a number of software firewalls you can have on your machine, including the default Windows firewall, the port-opening procedure is similar for all. In Windows' case, open the firewall control panel and click the Exceptions tab. Click "Add Port" and enter the following: HTTP (80), HTTPS (443), MYSQL (3306).

Now is a good time to get a static IP address for your machine. Without it, your router could reassign a different IP to your server, nullifying the entire point of port forwarding on the router. Click the Start button, then Run, and type in `cmd`. Hit Enter, which pulls up a command prompt in its

own window. Type `ipconfig /all`, and look for the Local Area Connection section. Write down your IP address, Subnet Mask, Default Gateway, and all the IP addresses under "DNS servers." Close the window and go to the Control Panel's Network Connections menu. Right-click Local Area Connection and select Properties. Find the menu option for TCP/IP, select it, and click the Properties button.

You should now see a window that most likely has "Obtain an IP address automatically" selected. Click "Use the following…" for both sections, and begin entering the information you just wrote down. The only change should come in the IP address field, where you'll want to pick an unlikely number far above your current IP—if the IP you wrote down is 192.168.0.1, for example, enter 192.168.0.250. Fire up your web browser to make sure you can still connect to the net, and you're good to go.

Opening your ports on the software side is usually only half the battle.

3 Opening the Hardware Gate

Hardware routers come in all sorts of shapes, sizes, default administrative IPs, and port-forwarding configurations. You'll want to consult your router's manual as to the specific way to configure your device for port forwarding, but in general, it's pretty similar to how you set up your software firewall.

You'll have to enter a particular IP address into your browser to access your router's configuration screen (usually it's 192.168.0.1), and somewhere in there will be a menu for port forwarding. Type in the static IP

address you just configured for your PC in the Windows network settings (our example was 192.168.0.2), and forward the TCP ports 80, 443, and 3306 to that IP.

Now that you're done playing with IPs, you should hit up DynDNS (**www.dyndns.com**) and register for its free static DNS service. Download and run the site's update client, and your DynDNS web address (e.g., **example.is-a-chef.org**) will always point to the IP address of your router, which will forward the traffic requests right to your web server.

The free DynDNS service allows you to maintain the same URL for your website even if your ISP keeps giving your server different IP addresses.

4 The Server Runneth Over

After all that networking configuration, installing the server applications themselves is a piece of cake. In just three clicks of the default Next button, *XAMPP* will unload the big guns—Apache, MySQL, and PHP—onto your system. While it's chugging along, go get a drink or something; on an average machine, the installa-

tion takes about five minutes or so. Be sure to install the *XAMPP* components as Windows services when prompted.

Once that's done, pull up your web browser and point it to **http://localhost**. Select your language, and you'll find yourself on the *XAMPP* main screen. Click Status, and if everything installed

correctly, the top five components—at minimum—will be green-lit. Now click the Security link in the left-hand frame, and you'll find that your *XAMPP* setup lacks any password-based security what-soever. Click the link below the table, and you'll be given the option to pass-word-lock your MySQL root and *XAMPP* configuration. Double-click the tray icon, restart MySQL, and you're set.

A successful XAMPP installation looks like this, but you've still got a little ways to go before you're done.

5 Installing Wordpress

Unzip the *Wordpress* files to your /htdocs directory, a subset of wherever you installed *XAMPP*. While that's happening, fire up the *XAMPP* main screen in your brows-er and click phpMyAdmin under the Tools menu. Once you've logged in, look for the Create New Database prompt. Then type `wordpress`, and select "utf8_unicode_ci" instead of "collation."

Head over to your /htdocs directory, and pull up "wp-config-sample.php" in *Wordpad*. Type in your MySQL username (root) and

password, then save the file and rename it wp-config.php. Go back to **http://localhost** in your browser, where you'll get a prompt to auto-install *Wordpress*. When it finishes, log into your new *Wordpress* installation and click the Options tab. Under Wordpress Address, type in the URL that you'll use to access your blog, which is usually the same as your DynDNS Internet address. Most people will put the same info in the Blog Address field as well.

Setting up the *Wordpress* database in MySQL is as easy as typing in the name and clicking Create, but don't forget to select "utf8_unicode_ci."

6 Getting Stylish

By now, *Wordpress* is basically good to go, but you don't want a default-looking blog; you want a fancy blog. In that case, we recom-mend you grab *K2* (**getk2.com**), a template that goes on top of your *Wordpress* installation and

Use the blog, Luke; *K2* wins major geek points for having a *Star Wars*-based "scheme" as one of its two default themes.

adds a bunch of advanced functionality. The easy part comes on the installation side; just unzip the *K2* package to your /wp-content/themes/ directory. Point your browser to your *Wordpress* configuration page (**wp-admin**), click the Presentation tab, and select K2 as your current theme.

From there, you can hit up the K2 Options Panel to set the theme, or overall look of your blog, and manage the specifics of your blog's header and sidebar modules. If you're really adventurous, you can edit your site's CSS templates directly. But one of the nice things about *K2* is that it eliminates the need to get elbow-deep in code, especially when you want to install new *K2*-compatible plugins. With one quick download and a few clicks of the mouse, you can throw just about any added functionality you want into your blog. MPC

OUR TOP PLUGIN RECOMMENDATIONS

► **SOCIABLE:** Gives your read-ers an easy way to pimp your posts to the Web 2.0 world.

► **AKISMET:** Automatically nukes spam comments.

► **FlickrRSS:** Add flickr photos to your blog and give them their own RSS feed.

► **TIME SINCE:** Shows the time since your last update. For shame!

► **POPULARITY CONTEST:** Lets you know which posts are getting all the eyeballs.

Ask the Doctor

Diagnosing and curing your PC problems

UPGRADE INDIGESTION

I recently upgraded my computer with an Asus P5ND2-SLI motherboard, a 2.8GHz Pentium D processor, and an XFX GeForce 7600 GT XXX Edition videocard. I kept my old 420-watt power supply, optical drive, and hard drive. My new computer runs fine, except for these problems: 1) My keyboard and laser mouse don't power down when I shut down my computer (the keyboard's F-Lock light stays lit, as does the mouse's laser). 2) My hard drive appears when I click the "Safely Remove Hardware" icon in the Windows toolbar. This isn't really a problem, but it's annoying. 3) When I plug my MP3 player and flash-memory USB drive into my USB port, the computer reports that they've malfunctioned. What's your diagnosis?
—Josh Li

The Doc's diagnosis is that there's probably nothing seriously wrong with your rig. If you simply plugged your old hard drive into the new system, you're asking for trouble; you should consider performing a clean install. If that's not the case, see if these remedies alleviate your problems: The mouse and keyboard issues are probably due to having the BIOS option to wake on mouse or keyboard enabled (the computer can't sense them unless they're powered up). If disabling this setting in the BIOS doesn't resolve the problem, the motherboard might be designed to provide power to certain USB ports even when the rest of the machine is shut down. Try switching USB ports.

You might be able to solve your hard drive problem by uninstalling your nForce drivers and reinstalling the latest version. The Doc has heard of this issue before, typically when SATA drives are installed but the user has also installed Nvidia's IDE driver. If driver reinstallation doesn't do the trick, try running your system without the IDE driver. Finally, USB port failure is a common symptom of overclocking gone too far. If you're not overclocking, or if resetting to stock speeds doesn't clear things up, you should consider performing a clean install of Windows XP. You don't need USB 2.0 drivers if you've patched XP with Service Pack 1 or 2, so don't install them if you have.

STARFORCE SCOURGE

Last spring, the optical drive in my two-year-old Panasonic laptop started to fail. It would have cost $900 for a replacement DVD-combo single-layer 1X drive (and void my warranty), or I could send my laptop in for repair, which would have been a

It's too late for *Splinter Cell: Chaos Theory*, but UbiSoft fortunately stopped using StarForce copy-protection in its games as of May 2006—it's known to wreak havoc on PCs.

great hardship for my business. So after reading the April 2006 "Build Your Own Laptop" story, I replaced the optical drive in my laptop with a DVD double-layer writer as shown, using the same NEC drive, ND-6750A. All went well, except it takes 30 seconds longer to boot, will not boot from CD, and worst of all, when I change out discs for data reads, "My Computer" hangs on opening and requires that I turn off power to reboot.

My workaround was to reboot the laptop when changing discs. Then I read the "Second Opinion" by Chad Greiner in the November 2006 issue and I was enlightened. I had a game or two that used the StarForce copy protection scheme. First I deleted the StarForce drivers from Device Manager ("Show hidden drivers"). No joy. So I set another restore point, edited StarForce out of my registry, and moved the drivers out of Windows. After reboot I started the game; StarForce reinstalled (reboot again). The hanging problem with "My Computer" is now fixed, but "My Computer" still reports the optical disc incorrectly; it shows the disc that was loaded on boot as the current disc name. But that's minor. Thank you, Doctor.
—Johnnie Alderson

The Doctor agrees: StarForce is evil.

TROUBLESHOOTING 101

In July, I bought an Asus A8N-VM-CSM motherboard, two 512MB sticks of PC3200 RAM, an Athlon 64 3200+ CPU, and an AOpen 400W power supply. Everything was going great until the other day. Now, when I turn on the computer all I get is the hard drive light, which stays on. A computer tech service tells me it could be that the motherboard, RAM, or videocard has gone bad. One guy said it could even be the hard drive. I'm not even getting the BIOS message. The service

charges $50 or more to troubleshoot computers. Can you give me your opinion of what it might be?
—Gordon Temple

It could indeed be the motherboard, RAM, or hard drive, but that's like saying the problem could be the computer. Before you ask the shop to troubleshoot your machine, there are a few things you can try yourself. First, take off the side of the case with the machine plugged in and power it up. Check to see if the CPU fan is spooling up and if the drives are spinning. If they're not, the Doctor would suspect a power supply issue. Make sure the main power connector—that big plug going into the mobo—is firmly in place, as is the square ATX 12V connector. Also make sure the power cables going into the optical drive and hard drive are firmly in place. Try to boot. If the PC doesn't boot, pull the AC cable, wait one minute, and short the jumper to reset the CMOS. Try booting the machine again. Because the HD activity light is "stuck," try pulling the cables going to the optical drive and hard drive and boot again to see if it's something as simple as a bad cable stopping the boot. The Doc doesn't think so, but it's worth a shot. If it doesn't work, unplug all of the extra power cables in the machine going to the drives, fans, or any other items you have, unplug any USB devices, and disconnect the hard drive and optical drive cables from the motherboard, but make sure the monitor cable is plugged in. If the machine doesn't fire up with the extra components unplugged, pull out one of the RAM modules and try to boot the machine (make sure the machine is completely powered down and the PSU is discharged by unplugging the AC cord for a couple of minutes). If it still fails, put the module you just pulled back into the box, remove the other module, and try to boot again.

At this point, you're getting down to a bad board, bad CPU, or bad PSU. CPU failures are very rare, but it could be something as simple as the thermal paste on the CPU drying out. This would cause the chip to overheat within a few seconds and shut down, but normally the HD LED would not be on in these situations. If you've gone this far with no POST, the Doc's gut instinct says it's a bad power supply. **MPC**

White Paper: Voice over Internet Protocol

Internet-based telephone service has come of age—it isn't just for über-geeks and any more.

BY GORD **GOBLE**

All this talk of Voice over Internet Protocol (VoIP), broadband phone, digital voice, computer telephony, and the like is enough to leave Ma Bell spinning in her anti-trustified grave. Although each of these terms is merely a different way to describe the technology that makes Internet phone calls a reality, we can hardly assuage her concern over the whole concept.

VoIP, as it's most commonly known, is here to stay. It's gaining popularity, it's growing more sophisticated, and it most surely will continue to challenge POTS (plain old telephone service) in the months and years ahead.
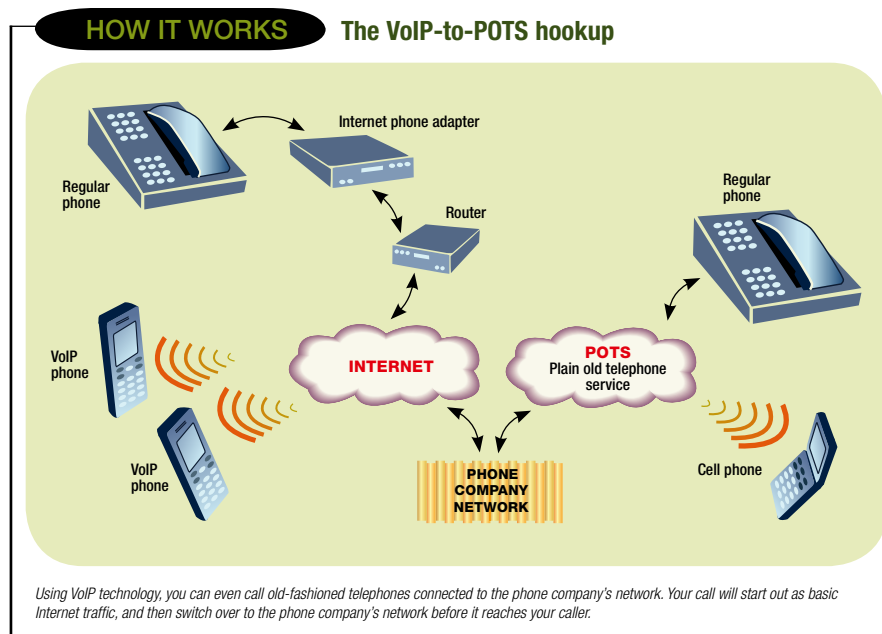
Just how big has VoIP become in the overall telephone market? Prominent VoIP purveyor Skype claims almost 300 million downloads of its eponymous free software, and *Skype*-centric blogs throw around milestones such as a purported recent peak of 8 million concurrent users.

Skype's much-hyped competitor Vonage says it reached 2 million *paid* subscriber lines in September of 2006. Does this mean hundreds of millions of people have dumped their traditional telephone service in favor of the Internet variety? Not on your life, but figures such as this certainly give Ma and all her baby Bells pause. The question isn't whether VoIP will eventually kill off traditional telephone technology, but when.

VoIP isn't merely a new face on ancient POTS technology; it's a truly different concept based on the more efficient communication protocol upon which the Internet functions. Comparing the two methods fundamentally boils down to comparing these two concepts.

PATH OF LEAST RESISTANCE

When you place any telephone call, you initiate a series of events that begins with the digitizing of your speech. Your voice's waveforms are captured via an analog-to-digital conversion process at 8,000 samples per second; that signal is compressed and sent on its way. The opposite process occurs at the receiving end: the digital sample is converted back into analog. It's *how* that data moves across the Internet that distinguishes POTS from VoIP.

POTS uses a technique known as circuit switching. When this type of a call is placed, a direct path is opened between the calling and receiving telephones. The delay you sometimes experience when placing calls over long distances is simply the telephone system hunting for that direct path.

Once established, this two-way circuit becomes exclusive to that call. Even though just half the connection is typically utilized at any one time (because one person is listening while the other is speaking); and even during periods of silence, when no one is speaking, the circuit remains open until one of the parties hangs up and breaks the connection. Callers on a circuit-switching network essentially "rent" their own private data highway for the duration of their conversation.

Circuit-switching technology is reliable, virtually error-free, and once the connection is established, fast. It's also inefficient—and that's not a good thing when you consider that the standard telephone system is already taxed to the max.

BREAK IT DOWN

Data moves over the Internet using packet-switching technology and is much more efficient than circuit switching, so it's understandable that VoIP would use the same protocol. Packet switching dynamically allocates bandwidth, so it's consumed only when it's needed: If no data is being sent, because one or neither party is speaking, no bandwidth is consumed. When data does need to be transmitted, the sending computer chops it up into small chunks known as packets.

Each packet represents less than 100ms of audio content encoded in hundreds or low thousands of bytes. The packets are then transported via the fastest route available at the time. Using packet switching, numerous simultaneous calls consume less bandwidth than a single call initiated using circuit switching.

Once these packets arrive on the Internet, they appear and are treated no differently than the packets representing video, photographs, or email zooming through the Internet's pipelines—which

HOW IT WORKS The VoIP-to-POTS hookup

Using VoIP technology, you can even call old-fashioned telephones connected to the phone company's network. Your call will start out as basic Internet traffic, and then switch over to the phone company's network before it reaches your caller.

means the packets could arrive at their destination in a disorganized jumble.

To account for this, each packet contains a header in addition to its digitized-voice payload. The header is less than 100 bytes of data that describes where the packet originated, where it's going, and how and where it should appear in relation to the other packets arriving from the same origin. The receiving device reads these headers, organizes the packets into the appropriate order, and converts the digital payload back into an analog audio signal.

There are downsides to VoIP—it's not the ultimate panacea for those whose jobs or lifestyles entail frequent telephone use. VoIP is less impervious to service interruptions than the conventional phone system, for example. Because your VoIP hardware depends on electrical power from utility companies, its vulnerable to power outages (conventional copper-wire phone lines carry a small amount of electricity that's independent of the power grid). Packet loss and latency can also effect VoIP quality and reliability. Lastly, not all VoIP services offer E911 service (an FCC-mandated means of connecting to the 911 emergency-response system); and those that do can't connect you to a 911 operator if your power is out during an emergency.

SERVICE PROVIDERS

There are a number of ways to jump on the VoIP bandwagon, but peer-to-peer is the easiest and least expensive. Based on the same principles as P2P file-sharing apps, P2P VoIP asks only that you have a broadband Internet connection and a mic-equipped headset. *Skype*, the most celebrated P2P VoIP solution, permits free computer-to-computer calling between *Skype* users anywhere in the world. *Skype* charges by the minute for calls made to traditional landline phones or cell phones. The company also earns revenue from value-added products and services, including voice mail, hardware sales, and incoming calls originating on landlines.

Vonage is the leading commercial VoIP service provider and relies on your conventional phone, which you plug into an analog phone adapter. The only freebies you'll find here are calls from one Vonage member to another, although both members must first sign up for one of the company's paid services. But if you have typical calling habits, you might find Vonage to be a cost-effective alternative to traditional phone service; moreover, you get to keep your current telephone number—something *Skype* can't yet offer. **MPC**

Xbox 360 Gamepad for Windows

There's a bunch of circuits, analog and digital controls, and even a couple of motors under the hood of the Xbox 360 gamepad. We put one under the knife to show you how it all works.

FORCE-FEEDBACK MOTORS: The 360 case houses twin motors in the handles that deliver the "rumble" effect you feel in supported games. Each motor vibrates a crescent-shaped weight with variable frequency, replicating the recoil of a shotgun blast in *Doom 3* or a bone-crushing tackle in *Madden 2007*.

ANALOG THUMBSTICKS: The 360 pad has two analog thumbsticks that are extremely sensitive and can provide very subtle input data. The sticks are analog rather than digital because this allows the pad to transmit small changes in each stick's position to the PC more accurately. The same goes for the twin analog triggers on the other side of the pad (not shown). An onboard chip translates the analog input data to digital before it is transmitted to the PC, off-loading work from the host CPU and providing more precise in-game controls.
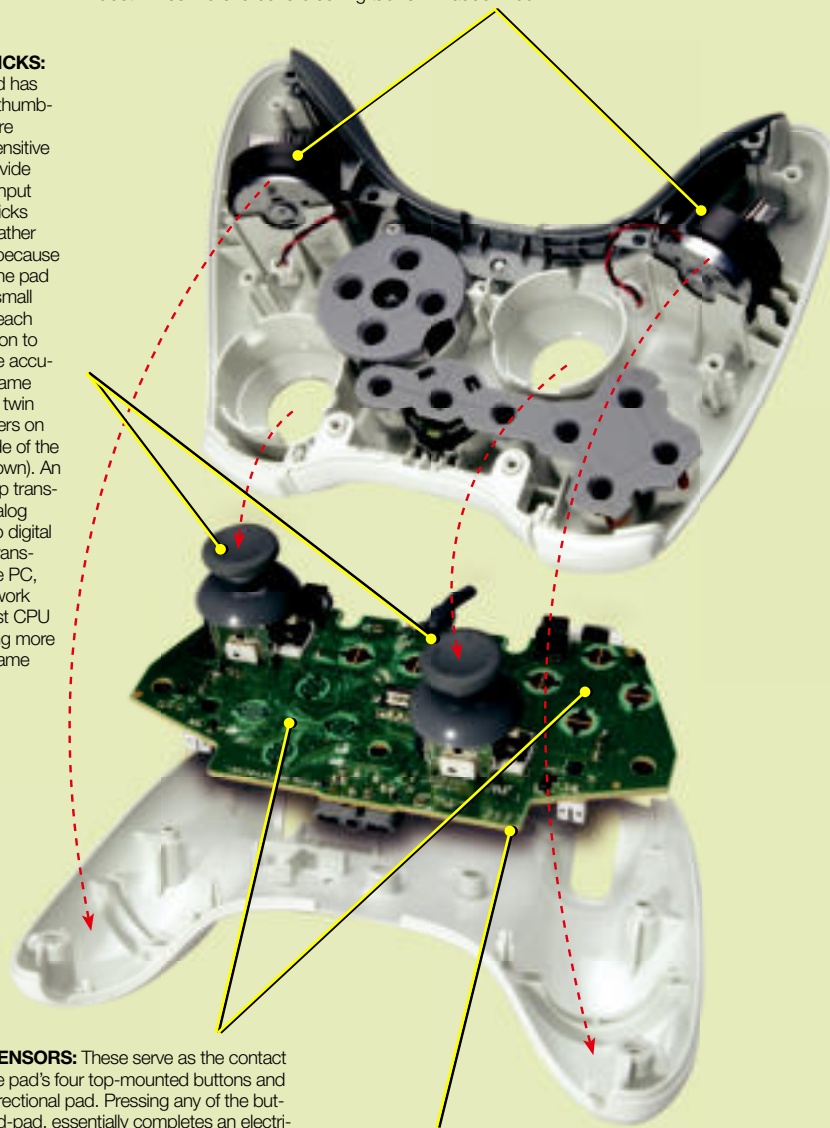
BUTTON SENSORS: These serve as the contact points for the pad's four top-mounted buttons and eight-way directional pad. Pressing any of the buttons, or the d-pad, essentially completes an electrical circuit which the host PC then recognizes as the appropriate in-game command: fire, duck, punch, etc. How long you hold down each button can provide different input feedback. For example, tap the "x" button and you'll lob a soft pass in *Madden*; hold it down to fire a bullet pass.

LOGIC BOARD: This printed circuit board contains the sensors for all of the pad's digital buttons, twin analog triggers, and twin analog thumbsticks. The circuit board houses an intricate network of printed wires that connect to contact terminals, where button presses are registered.

WILL **SMITH**

Tests
Windows Vista

OS evaluation requires a wide variety of
hardware and a lengthy testing period

**Testing a new operating system takes lots of time and hardware. We
did most of our tests on four main configs representing a good mix of
Intel, AMD, ATI, and Nvidia part.**

During the last six months, I've run Vista on all types of
hardware—from ancient Pentium 4 rigs up to the latest
dual cores. And I've come to the conclusion that a rela-
tively modern system with plenty of memory (1GB is the minimum
I'd recommend), a 2GHz processor, and a DirectX 9-compatible
videocard will capably run the OS. Although, I don't know if it's
worth the hassle for a machine that is more than a year or so old.

For my Vista testing purposes, I primarily used four machines.
The first is my rig at home—an Athlon 64 X2 4800+ with 2GB of
DDR400 and a pair of GeForce 7800 GTX 512MB cards running
in SLI. The second is my IT-issued work machine—a 3.2GHz
Pentium D 840 with 2GB of DDR2 and a GeForce 7800 GT board.
The third is an older Dell XPS laptop with a 2.13GHz Pentium M
770, 1GB of DDR memory, and a GeForce Go 6800 Ultra video-
card. The final rig is an Athlon FX-60 with 2GB of DDR400 and
a pair of videocards—one Radeon X1950 XT and one Radeon
X1600—for multi-monitor support. I also built up a couple of older
Athlon XP and Pentium 4 machines to test performance with AGP.
I tested both clean installs and XP upgrades using the final Vista
RTM builds, and spent time using all three consumer editions of

Vista—Home Basic, Home Premium, and Ultimate.

We haven't done comprehensive testing of Vista vs. XP per-
formance yet—the application benchmarks don't work yet and the
videocard drivers still have some maturing to do. In fact, that sort of
sums up the entire Vista experience as I write this, 10 days before
the November 30 only-for-IT-guys launch of the OS—Vista might
be ready, but the supporting cast just isn't quite there yet. I've got
high hopes that by the time Vista's available for sale to consumers
at the end of January, the videocard drivers, software applications,
and other goofy problems will be fixed. Still, I highly recommend that
even the most enthusiastic upgrader hold off at least a month or two
before making the jump to Vista.

Gordon Mah Ung
Talks about Testing USB Thumb Drives

How we determine a flash drive's speed

A USB drive might be nothing more than a wad of NAND flash
memory mounted on a PCB with memory controller and USB
connector, but that doesn't make all thumb drives the same.

Manufacturers have to pair the right memory controller with the
right memory chips to hit a targeted speed and keep within a bud-
get. The question is, do you design your key to speedily swallow big
hairy gigabyte files or take on tons of tiny *Word* doc files?

Unfortunately, you can't get a drive that's fast at both large files
and small files today. With that in mind, our new USB thumb drive
benchmarks test read and write performance for both small- and
large-file performance. We test small-file transfer times by moving

10,315 *Word* docs. That may sound like a nutty number of files, but
it's actually real-world—that's our entire archive of *Maximum PC*
articles in *Word* format, and it's not unrealistic for a person to want
those files for research.

For our medium-size file test, we use 234 JPG files taken with an
8MP digital SLR. The total size is 746MB and it's what an average
person could accumulate in a session or two of shooting. For our
large-file test, we use a 1.4GB image file created with *Norton Ghost*,
as well as the full *Battlefield 2* 1.4 patch.

To prevent OS caching from impacting the results, we reboot
between each test. All of the keys are formatted to their maximum
capacity using FAT32. We also run *SiSoft Sandra 2007's* removable
storage benchmark to confirm our results.

Out of curiosity, we also tested the thumb drives we reviewed
this month (page 73) for compatibility with Microsoft Vista's Ready
Boost—which purportedly speeds up application loading. This
wasn't factored into the drives' verdicts, since we don't really know if
Ready Boost is worth fooling with yet, but the Corsair Flash Voyager
and Kingston DataTraveler Secure both passed, while the Patriot
Xporter XT didn't. We'll have more on Ready Boost in a future issue.

How We Test

Real-world benchmarks. Real-world results

Computer performance used to be measured with synthetic tests that had little or no bearing on real-world performance. Even worse, when hardware vendors started tailoring their drivers for these synthetic tests, the performance in actual games and applications sometimes dropped.

At *Maximum PC,* our mantra for testing has always been "real world." We use tests that reflect tasks power users perform every single day. With that in mind, here are the six benchmarks we use to test every system we review.

SYSmark2004 SE: This is an update of the *SYSmark2004* benchmark, which uses a suite of such common applications as Microsoft *Word, Excel, PowerPoint*, Macromedia *Dreamweaver*, *Flash,* and *Winzip* to test general performance. It isn't heavy in multithreading, but it does feature multitasking tests.

Adobe Premiere Pro 2.0: We finally ditched our old standard-def *Premiere* test for one that uses high-def source material. The test is multithreaded, uses the GPU for transitions, and is brutal. It takes about an hour on our zero-point to render a short two minute, 46 second benchmark movie in the program.

Adobe Photoshop CS2: We start with

a RAW photo shot with a Canon EOS 20D, and apply a crapload of filters and other tasks from *CS2* to see just how fast a rig can chew through the workload. Because we use every filter we can, the test is more fair and balanced than the usual cherry picking of *Photoshop* tests.
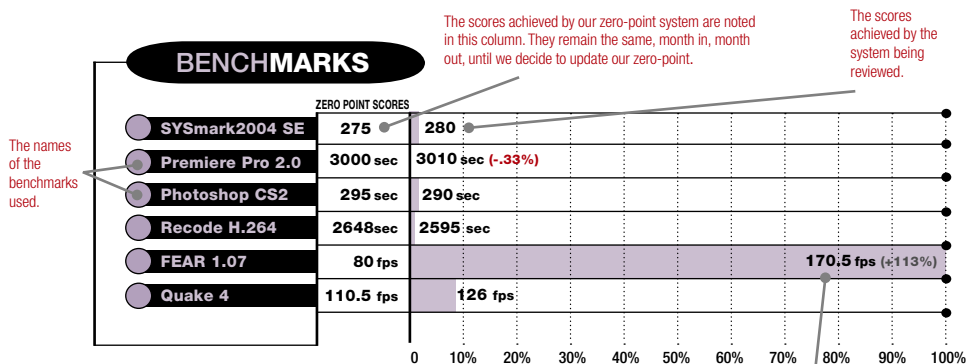
Ahead Nero Recode 2.0: *Nero Recode 2.0* is one of the fastest video-transcoding utilities. We copy unencrypted VOB files to the hard drive, then convert the movie to an H.264 file formatted for the Apple iPod's screen. The version included with *Nero 7.5*, is the only multithreaded H.264 encoder we've found thus far and is optimized for dual-core CPUs.

Quake 4: Based on the *Doom 3* engine, *Quake 4* is a popular OpenGL game. We run our test at 1600x1200 with 4x antialiasing and 4x anisotropic filtering. Generally, more robust OpenGL drivers yield better performance. We use a custom timedemo recorded using the 1.2 patch, which supports Hyper-Threading and dual-core processors.

FEAR: Monolith's *FEAR* is a cutting-edge DirectX game that pushes PCs and graphics hardware to the limit. We run *FEAR* at 1600x1200 with soft shadows, physics, and audio acceleration enabled, using the 1.07 patch.

How to Read Our Benchmark Chart

Maximum PC's test beds double as zero-point systems, against which all review systems are compared. Here's how to read our benchmark chart.

The scores achieved by our zero-point system are noted in this column. They remain the same, month in, month out, until we decide to update our zero-point.

The scores achieved by the system being reviewed.

The names of the benchmarks used.

BENCHMARKS

	ZERO POINT SCORES	
SYSmark2004 SE	275	280
Premiere Pro 2.0	3000 sec	3010 sec (-.33%)
Photoshop CS2	295 sec	290 sec
Recode H.264	2648 sec	2595 sec
FEAR 1.07	80 fps	170.5 fps (+113%)
Quake 4	110.5 fps	126 fps

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

Our current desktop test bed is a Windows XP SP2 machine, using a dual-core 2.6GHz Athlon 64 FX-60, 2GB of Corsair DDR400 RAM on an Asus A8N32-SLI motherboard, two GeForce 7900 GTX videocards in SLI mode, a Western Digital 4000KD hard drive, a Sound Blaster X-Fi soundcard, and a PC Power and Cooling Turbo Cool 850 PSU.

Every month we remind readers of our key zero-point components.

The bar graph indicates how much faster the review system performed in respect to the zero-point system. If a system exceeds the zero-point performance by more than 100 percent, the graph will show a full-width bar and a plus sign.

Maingear F131

So fast, it made the Kessel Run in less than 12 parsecs

Hoo-hoo! That's an exact recreation of the noise we made when opening the box containing Maingear's F131 desktop rig. But "rig" might be too generic a description for the bright-blue machine; "behemoth" seems more appropriate. For in every direction—processor power, graphics, and even the freakin' weight of the beast—the F131 seems to dwarf its competition.

But while the F131 will always hold a special place in our heart as the first quad-core machine to give the Maximum PC Lab its number, the experience was a wee bit short of a perfect date. The F131 is fast—oh, is it fast—but do its assets justify $6,500 worth of hard-earned cash? If you're a play-er—a game player, that is.

As mentioned, the F131 rolls with a quad-core setup on top of an EVGA moth-erboard running Nvidia's nForce 680i SLI chipset. The four cores on the Intel Core 2 Extreme QX6700 let you run either one multithreaded app or four resource-hogging, single-threaded applications concurrently at 2.66GHz. But if that's the ice cream, then Maingear's overclock to 3.47GHz is the sweet, sweet fudgy topping.

Instead of sprinkles, Maingear drops two, sugary lumps into the mix: a pair of GeForce 8800 GTX cards in an SLI configuration. Add in two 1GB sticks of Corsair Dominator DDR2 RAM running at 1,155MHz, and your gaming dreams are absolutely answered. The F131 spit out nigh-unbelievable numbers in our benchmarks, charging through *FEAR* at 146 frames per second, and nearly hitting 200fps in *Quake 4*. That's hella fast, yo, and it beats the current record-holder, Dell's XPS 700 (103fps for *FEAR* and 153fps for *Quake 4*).

We're inclined to believe that the insane gaming performance is mainly a result of the Nvidia cards. On the applications side, the F131 made a nice little sploosh, but it hardly blew its competitors out of the water. In fact, the system clocked speeds compa-rable to some of the other high-performance machines we've tested—including PCs run-ning Intel Core 2 Extremes at stock-clock levels with RAIDed hard drives.

Whenever the F131 topped a machine in our *Photoshop* test, it typically fell behind in our *Premiere Pro* benchmark, or vice versa. *SYSmark* scores were similarly unimpressive. It's not that they weren't fast, we just didn't see as big of a competitive boost for applica-tions as we saw for gaming. We attribute this mainly to the simple fact that the F131's two hard drives are linked up SATA 2-style, not in a RAID configuration. Sure, you get nearly a terabyte of space—900 gigs, to be specific—but at the expense of some speed.

Of course, we ran these benchmarks in an environment that's yet to technologically realize the wonders of quad-core perfor-mance. Most of today's applications are optimized to run on a single thread; the few that venture beyond that wall really only dip into dual-thread territory. Once truly mul-tithreaded applications (and games) come along, we expect the overclocked Maingear to utterly destroy the benchmarks of its dual-core brethren.

You're basically investing in a the future when you shell out $6,500 for the F131. But that's a good thing, as the machine's plenty capable of handling just about anything you throw at it today. And when more demand-

The case's paint job may be a bit ho-hum, but it's what's inside that mat-ters most: raw, overclocked speed. And pretty lights.

Two Nvidia GeForce 8800 GTX cards power the F131's punishing FPS count, and they're more than ready for DirectX 10.

UNDER THE HOOD

BRAINS

CPU	Intel Core 2 Extreme QX6700 (OC'd to 3.47GHz)
MOBO	EVGA Nvidia nForce 680i SLI
RAM	2GB Corsair (two 1GB sticks)
LAN	Dual Gigabit LAN
HARD DRIVES	One 150GB Raptor, (10,000rpm SATA), one 750GB Seagate (7,200rpm SATA)
OPTICAL	Plextor PX-760A 18x Double-Layer DVDRW

BEAUTY

VIDEOCARD	Two GeForce 8800 GTXs in SLI (576MHz core/900MHz RAM)
SOUNDCARD	Sound Blaster X-Fi XtremeMusic
CASE	Maingear

BOOT: 35 sec.	DOWN: 15 sec.

BENCHMARKS
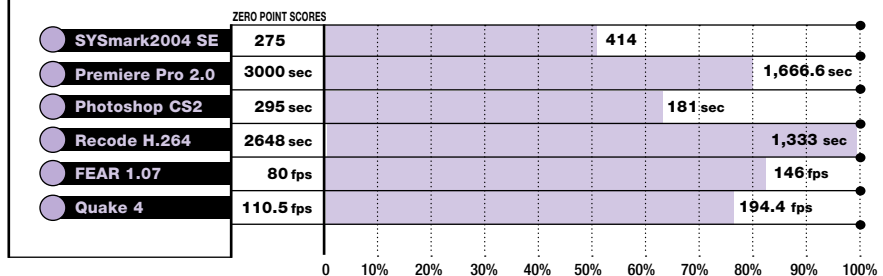
ZERO POINT SCORES

SYSmark2004 SE	275	414
Premiere Pro 2.0	3000 sec	1,666.6 sec
Photoshop CS2	295 sec	181 sec
Recode H.264	2648 sec	1,333 sec
FEAR 1.07	80 fps	146 fps
Quake 4	110.5 fps	194.4 fps

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

Our current desktop test bed is a Windows XP SP2 machine, using a dual-core 2.6GHz Athlon 64 FX-60, 2GB of Corsair DDR400 RAM on an Asus A8N32-SLI motherboard, two GeForce 7900 GTX videocards in SLI mode, a Western Digital 4000KD hard drive, a Sound Blaster X-Fi soundcard, and a PC Power and Cooling Turbo Cool 850 PSU.

ing games come along, you'll be ready; the GeForce 8800s already support DirectX 10, so you'll be prepared for *Crysis* and *Hellgate London*, as well as games like *Company of Heroes* that will be updated to support DirectX 10 later this year.

Plus, you could always tweak the speed of the included videocards. While we didn't get one—much to our sadness—Maingear says it's now shipping the F131 with overclocked 8800 GTXs. We have to ding the machine slightly for its setup upon arrival: a CPU voltage issue prevented us from successfully running our full benchmark suite at first. However, Maingear deserves props for sending us a fix for the voltage problem remotely, just a

few hours after we sent a puzzled email.

As for the makeup of the case itself, we feel that the system's blue paint job is just average. The lame "MAINGEAR" sticker running vertically down the case's side further loses the rig style points.

On the inside, though, the F131 is a tight ship. Components and cables are well-hidden, and two huge-ass, crazy-loud 140mm fans suck air in and out the case. We question why Maingear didn't just go for a total water-cooled setup, especially since Maingear used a Coolit Freezone to chill the CPU.

Still, when you're running with a frame rate in the hundreds on some of today's most punishing games, we doubt that fan

noise will be much of a concern. You're certainly getting what you pay for with the F131. With just a wee bit of additional tweaking, this machine would be perfect.

—**DAVID MURPHY**

MAINGEAR F131

➕ ROAD RUNNER

Oh man, PC gaming doesn't get much speedier than this.

➖ COYOTE

A wee loud, no OC'd video-cards, and no Raid. Boo-urns to the big case sticker.

9

MAXIMUM PC KICKASS

$6,497, www.maingear.com

Asus EN8800 GTX

A screamer with DX9; a question mark with DX10

Being an early adopter means taking chances. And since the Nvidia GeForce 8800 GTX GPU at the heart of Asus' EN8800 GTX hits the market well in advance of DirectX 10, Vista, and DirectX 10 games, early adopters buying this pricey slab of technology will give the wheel of fortune a mighty spin because no one has a clue how it will perform with DirectX 10 software.

We covered the 8800 GTX's speeds and feeds in some detail in the DirectX 10 feature story also in this issue (page 26), so we won't spend a lot of time covering the same ground here. But after thoroughly benchmarking this beast with DirectX 9 titles, we can tell you this: The EN8800 GTX is one powerful videocard.

We're not talking marginally faster than the best cards preceding it. We're talking 50- to 100-percent faster than the fastest GeForce 7900 GTX card we've ever tested. We're talking as much as 25-percent faster than two of those cards running in SLI. We're talking fast enough to get impressive frame rates playing *FEAR* at 2560x1600 on a 30-inch panel—with 4x antialiasing, 16x aniso, *and* soft shadows enabled.

This card is not only faster, it's also more capable than Nvidia's previous best. The high end of Nvidia's 7-series cards were quick for their day, typically hitting high-water marks ahead of ATI's best, but they weren't capable of rendering AA and high dynamic-range lighting at the same time. The 8800 GTX has no such limitation. Nvidia is so proud of this development that it coined a goofy marketing name to describe it: the Lumenex Engine.

Nvidia claims its new processors can deliver 16x full-screen multisampled AA for nearly the same performance hit as older boards took to perform 4x multisampled AA. This advance is the result of a newly developed algorithm called Coverage Sampling Anti-Aliasing (CSAA). The new GPU also supports transparency antialiasing to eliminate jagged edges on alpha (transparent) textures commonly used in the rendering of foliage, chain-link fence, and similar objects. When we put Nvidia's claims to the test, we found that enabling the feature in the driver while dialing the application's AA setting to 4x resulted in much-improved image quality with no more than a 5-percent performance hit. Impressive. Nvidia delivers dramatically better anisotropic texture filtering than previous generations, too.

The 8800 GTX (and the 8800 GTS reviewed on page 70) supports high dynamic-range (HDR) lighting with 128-bits of precision (32 bits for each color component: red, green, blue, and alpha). Another significant improvement to the GeForce 8800 is its 10-bit display pipeline, which allows the GPU to display more than a billion colors, compared to the 16.7-million color palette that an 8-bit pipeline can deliver. Nvidia is catching up to ATI on this last score, although the price of 10-bit displays keeps them out of reach for most consumers.

The new GPU scores significantly higher on the punishing *HQV* video playback test, too. Nvidia finally decided to give its *PureVideo* software away with the card, unlike with early versions of the product. Enable hardware acceleration in your video-player software and turn on noise reduction in the Nvidia control panel, and you'll be treated to great video playback. But ATI hasn't been idle on the video front, either. After a series of driver tweaks in its latest versions of the *Avivo* software, we now score ATI's high-end cards just a wee bit higher than the 8800.

Circling back to the opening of this review, perhaps Dirty Harry said it best: "You've got to ask yourself one question: 'Do I feel lucky?' Well, do ya?" This is the best DX9 part we've ever seen; will we be able to say the same about its DX10 capabilities? Right now, we're feeling pretty lucky.

—**MICHAEL BROWN**

Asus' EN8800 GTX destroys every DX9 performance record we've seen, but we'll have to wait to see how it handles DX10 software.

BENCH**MARKS**

	ASUS EN8800 GTX (1920 X1200)	ASUS EN8800 SLI (2560 X1600)
3DMARK06 GAME1 (FPS)	25.7	28.8
3DMARK06 GAME1 (FPS)	23.6	26.2
COMPANY OF HEROES (FPS)	82.9	92.9
FEAR (FPS)	43.0	65.0
HQV VIDEO	113	113

3DMark06 benchmarks run with 4x AA and 16x aniso; FEAR run with soft shadows on, 4x AA, and 16x aniso; Company of Heroes run with all settings at max and AA enabled. Tested with an EVGA nForce 680i SLI motherboard with a 2.93GHz Intel Core 2 Extreme X6800 CPU and 2GB of Corsair DDR2 RAM.

ASUS EN8800 GTX

+ DIRTY HARRY
Compatible with DX10; bitchin'-fast with DX9 software; loads of memory; quiet.

– HARRY & THE HENDERSONS
DX10 performance is unknown (and for now, unknowable); pricey.

9

MAXIMUM PC KICKASS

$660, www.asus.com

Motherboard Mania

It's Intel vs. Nvidia to determine which mobo is right for your quad core

Foxconn plays the straight man next to the two more charismatic nForce boards.

D espite the hardware upgrade itch that had your skin crawling for the last six months, you held out. And the hardware gods have rewarded your patience with quad-core processors and DirectX 10 videocards. Now, all you need is the right motherboard. To find the best of the best, we pitted Intel's venerable 975X chipset against Nvidia's long-over-due nForce 590 SLI Intel Edition and the hot-new nForce 680i SLI chipset. Read on to find out which one will carry you to hardware nirvana.

—GORDON MAH UNG

FOXCONN 975X7AB-8EKRS2H

It's no secret that Nvidia had a heavy hand in designing Foxconn's excellent AM2 Athlon 64/nForce 590 SLI board, but Foxconn's Intel-powered 975X7AB-8EKRS2H board suffers for a lack of Nvidia-applied polish.

Beyond the PCB-mounted power-on switch, the 975X7AB is surprisingly pedes-trian for a company that's pushing to make inroads into the enthusiast market. In fact, Intel's *own* 975X board looks like a party animal next to the 975X7AB. The BIOS in our 975X7AB board doesn't even support DDR2/800 speeds without forcing you to overclock. Granted, Intel hasn't blessed DDR2/800 on the 975X, but even Intel's own board includes it as a wink, wink, nod, nod feature.

The lack of support for DDR2/800 is probably what holds the 975X7AB back in performance. Although it comes close to the Asus 590 SLI board in some bench-marks, and even bests it in a couple, the nForce boards are the overall performance leaders. The saving grace for the 975X7AB is that while it lost, it didn't lose by that much. Of course, when you factor in the 975X's inability to run SLI (or rather, SLI won't run with 975X), this board just isn't that appetizing.

Also a negative is the Realtek ALC882M codec, which we busted for cheating on EAX audio rendering (see In the Lab, December 2006). To see if the problem still exists, we installed the lat-est drivers from Foxconn and listened in earnest to see if Realtek had corrected the problems we discerned last month. The latest drivers seem to add a degree of audio positioning that was lacking in our earlier tests, but it still doesn't seem very precise to our ears. We recommend using a soundcard with Realtek mobos. It's a shame, really, as the broken EAX support mars this board's otherwise full-featured audio package. The 975X7AB supports Dolby Digital Live as well as a couple other virtual speaker configurations.

We've been impressed by Foxconn boards in the past, but this one doesn't wow us. There are simply better boards to be had.

FOXCONN 975X7AB-8EKRS2H

+ PURELL
PCB-mounted power button and normal-size chipset heatsink.

– PURE EVIL
Feels like a budget board without the budget price.

6

$200, www.foxconn.com

ASUS P5N32-SLI PREMIUM

We think we're seeing a pretty solid pattern here. As is true of the *Star Trek* movies, it's possible that only the even-numbered Nvidia chipsets are worth a damn. The original nForce was a beta product. The nForce2 was great. The nForce3 sucked eggs. The nForce4 SLI kicked much booty. And then there's the nForce 590 SLI Intel Edition, which was hyped more than a David Blaine stunt, and might be just as anti-climac-tic. Originally scheduled for availability in August, boards using the laggard chipset didn't appear until late October—just before boards using the newer nForce 680i were released. What's the point?

That's not to take away from Asus' P5N32-SLI Premium board. The board

BENCHMARKS

	FOXCONN	ASUS	EVGA
CHIPSET	Intel 975X	Nvidia 590 SLI Intel Edition	Nvidia 680i SLI
SISOFT 2007 (MB/S)	5,432	5,705	**5,830**
QUAKE 4 12X10 (FPS)	142.3	143.7	**147.2**
3DMARK2001SE	46,092	**46,642**	46,530
3DMARK03 OV	25,562	**25,681**	25,672
3DMARK05	11,343	**11,456**	**11,457**
3DMARK06	6,371	**6,398**	**6,397**
FEAR 1.07 (FPS)	**313**	279	275
PC MARK 2005 OVERALL	7,987	7,774	**8,153**
PC MARK 2005 RAM	5,871	**6,154**	**6,157**
PC MARK 2005 GPU	8,991	9,007	**9,113**
PC MARK 2005 HDD	5,738	**6,147**	6,089
VALVE PARTICLE TEST	**54**	48	**55**

Best scores are bolded. We used a 2.93GHz Intel Core 2 Extreme X6800, 2GB of Corsair DDR2/800, a Western Digital 400GB SATA drive, a GeForce 7900 GTX card, and a 1KW PC Power and Cooling PSU.

Mysterious delays made us wonder if the nForce 590 SLI Intel Edition chipset was more of an nFarce.

The sleek, black PCB, thorough documentation, and over-clocking features make EVGA's 680i board a winner.

is what we've come to expect from the company—packed with thoughtful touches such as quick connects for the front-panel connectors, onboard 802.11b/g Wi-Fi, and eSATA. There's SLI support and even an audio riser card using an Analog Devices 1988B codec. The riser card theoretically gets the codecs up and away from the electrically noisy motherboard plane, and EAX support actually works, unlike with the Realtek parts. Asus also addressed the problems we've had with SATA port configuration in the past. All six SATA ports are available, even when two dual-slot GPUs are in place. The board has three physical x16 slots, with two running at full speed and the third functioning as a x8 slot.

Labeling the 590 SLI IE an nFarce for its late arrival is unfair. Sure, boards using the chipset were late, but that doesn't mean the chipset is bad. On the performance front, the P5N32-SLI Premium held its own against the newer chipset. Its new sibling leads in some benchmarks, but both nForce offerings lead the 975X board overall. Nvidia and Asus both admit that the 590's main weakness is its overclocking performance. You can crank up the clocks some, but not as high as on the 680i or even most 975X-based boards.

Our own experience with early engi-neering samples back that up. We've been able to hit mild overclocks with the 590 IE SLI, but not the spicy-hot speeds that enthusiasts crave. That makes the P5N32-SLI Premium a competent board for a gamer who doesn't overclock. But the 680i's arrival makes this board an even tougher sell. It's like a 2006 model car sitting among a row of 2007s at the car dealership—it just isn't going to get much notice.

EVGA NFORCE 680I

Nvidia's first attempt at playing motherboard maker (with its AMD AM2 boards) was good, but there was definitely room for improve-ment. With the 680i, Nvidia gives the mobo game another go, and dives even deeper. Not content to just design boards, Nvidia is now manufacturing them too. These boards are in turn sold through partners, such as the EVGA board reviewed here.

The EVGA 680i has all the features an enthusiast could ask for. It offers SLI with full x16 support. It includes the outbound pack-et-prioritizing hardware firewall, LAN teaming, and tons of RAID options. And Nvidia's RAID controller lets you change ports on the board from SATA mode to RAID mode without bork-ing your Windows install.

For being EVGA's first 680i mobo, it's pretty well thought out. SATA ports are prop-erly placed so you can access them all even in an SLI setup. The chipset cooler runs in two modes: By default it uses a passive solu-tion, but water-cooling enthusiasts can add the clip-on fan for more cooling performance.

Neither the board-mounted power or reset buttons are new features, nor is the POST LED, but we appreciate the presence of all three. The EVGA board's documenta-tion of POST codes is more thorough than most motherboards', explaining most of the

errors you'll see should your system hang. Of course, we still prefer the plain-language boot errors that Asus uses on its Republic of Gamers boards.

Like Foxconn's board, EVGA's mobo fea-tures Realtek codecs, which have issues ren-dering EAX audio. We brought our concerns to Nvidia's attention and the company is looking into the problem. In the meantime, we recommend that you buy a good soundcard if you buy this board.

To judge the performance of these three boards, we used the same hardware set for each and manually set the RAM timings. Generally, with the same CPU, similar RAM timings, and same graph-ics drivers, you don't see much variation, even between different chipsets. And true enough, we found that while the nForce 680i board leads the pack, it doesn't blow away the Asus and Foxconn boards.

By offering a combination of solid per-formance, SLI support, and the ability to run dual and quad cores, EVGA's nForce 680i could be the ultimate Core 2 motherboard to have. Our only real concern is longevity. We count on mobo makers to offer BIOS updates for at least two years, but will EVGA and Nvidia have the attention span to push new BIOSes for this board in 18 months? We won't know that until 2008.

ASUS P5N32-SLI PREMIUM

+ MUNCHOS
SLI, Wi-Fi, and the good-ness of the Nvidia south bridge in one board.

− FUNIONS
Doesn't overclock as well as 680i or 975X.

7

$235, www.asus.com

EVGA NFORCE 680i SLI

+ GREEN LANTERN
Supports SLI, is packed with features, and the south bridge overclocks like crazy.

− GREEN GIANT
Realtek sound sucks.

9

MAXIMUM PC KICKASS

$300, www.EVGA.com

HIS X1950 Pro IceQ3 Turbo

Overclocked—and overpriced

Our enthusiasm for ATI's new X1950 Pro GPU is tempered by the fact that the chip is incompatible with DirectX 10. And our enthusiasm for the clock-speed boost and advanced cooling that HIS graced this card with is tempered by the fact that it's street-priced $60 higher than other third-party X1950 Pro cards.
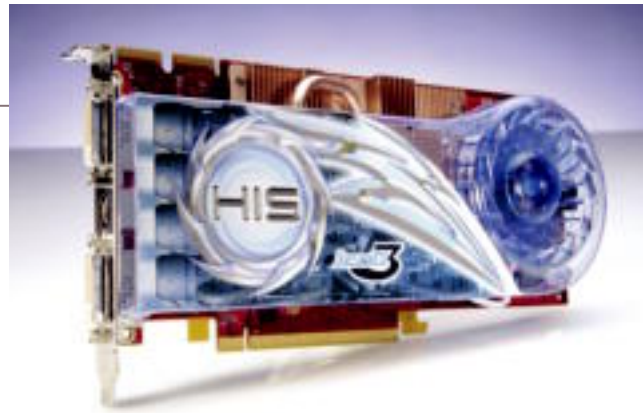
If the fancy cooling and the overclocking it enables (HIS runs the core at 620MHz, compared with 575MHz stock; the 256MB of memory runs at 740MHz, compared with 690MHz stock) delivered significantly improved performance, we'd be all over it. But we achieved only mildly stronger benchmarks results with the IceQ3 than we did with ATI's reference design.

As with HIS' earlier X1900 XTX IceQ3, the copper heatsink covering the GPU is physically separated from the one attached to the memory. This prevents heat from transferring from one component to the other. And the bi-directional fan, set far back

Higher clock speeds don't translate into the stellar benchmark results that would justify the 30-percent price premium HIS expects this card to fetch.

on the card, draws air from both sides and exhausts warm air out the chassis. The trade-off, however, is that this apparatus consumes two slots. ATI's reference-design cards are svelte single-slotters, and we found them to be only slightly louder.

We were going to try ATI's Overdrive feature to see if we could take the card even further, but we discovered that Overdrive does not appear in the Catalyst toolbar when the HIS card is installed. Catalyst Control Center automatically shuts off access to Overdrive if the card manufacturer departs from ATI's reference design. In this case, HIS apparently uses a thermal ASIC that the driver doesn't recognize.

HIS sent us only one card, so we paired it with a ref-design X1950 Pro to test CrossFire. The internal CrossFire connections are a huge improvement over the previous dongle design, but performance was the same as or slightly slower than what we saw running two stock X1950 Pro cards. Bottom line: We're not impressed.

—MICHAEL BROWN

BENCH**MARKS**

	HIS X1950	EVGA 7900 GS	HIS X1950 PRO IN CROSSFIRE	EVGA 7900 GS IN SLI
3DMARK06 GAME 1 (FPS)	**14.0**	10.0	**24.6**	18.2
3DMARK06 GAME 2 (FPS)	**15.3**	14.5	27.8	**32.3**
QUAKE 4 (FPS)	**45.3**	44.0	77.8	**81.6**
COMPANY OF HEROES (FPS)	24.0	**24.5**	17.7	**25.0**
FEAR (FPS)	25.0	**27.0**	36.0	**53.0**

Best scores are bolded. Videocard benchmarks obtained with A8R32-MVP Deluxe and Asus A8N32-SLI Deluxe motherboards, respectively, using the native resolution of a 23-inch ViewSonic VP2330wb display (1920x1200). 3DMark06 HDR Games: Tested with antialiasing turned off and anisotropic filtering set to 8x. Quake 4: Tested with 4x AA and 8x aniso. Company of Heroes: Tested with AA off and all other values set to high. FEAR: AA off, 8x aniso, soft shadows on.

HIS X1950 PRO ICEQ3 **6**

$260, www.hisdigital.com

BFG GeForce 8800 GTS

As close as you'll get to a midrange DX10 videocard, for now

Power users contemplating the purchase of BFG's GeForce 8800 GTS face the same conundrum as those purchasing a card based on the 8800 GTX: No one knows how either product will perform with DirectX 10. As we observed with the GTX, however, the GTS is a flat-out screamer when it comes to DX9 software.

The GTS is outfitted with fewer stream-processor units (96 versus 128), less memory (384MB versus 768MB), and a narrower memory interface (320- versus 384-bit) than the GTX. But the price tag on this card brings it slightly out of the stratospheric heights of cards based on Nvidia's more powerful 8800 GTX. That's not to say it's inexpensive—unless you consider $500 pocket change. Still, if you bought one of these today and a second one to run in SLI after prices drop, you could outrun a single 8800 GTX card.

The 8800 GTS delivers all the image-quality benefits that the GTX lards on—most of which are unobtainable with Nvidia's 7-series: You can turn on AA and HDR lighting at the same time, you can enable noise reduction and edge enhancement while playing back video, and anisotropic

Anyone looking for a midrange DX10 videocard will have to wait until Nvidia recoups a portion of its four-year R&D investment: Cards based on the second-tier 8800 GTS are fetching $500.

filtering is much improved over Nvidia's previous-generation parts.

Turning all these features on does entail a frame rate hit, but it's not enough to impact gameplay. BFG's GTS card ran *FEAR*, for instance, at a perfectly playable 32fps at a widescreen resolution of 1920x1200 with soft shadows turned on, 4x AA, and 16x aniso. Add a second card and you'll get about the same frame rate at 2560x1600. Frame-rate junkies can turn off AA and dial back aniso to 8x to play the game at 55fps with a single card.

Yes, Nvidia has a winner on its hands. We can't wait to see how ATI responds.

—MICHAEL BROWN

BENCH**MARKS**

	BFG GEFORECE 8800 GTS (1920 X 1200)	BFG GEFORCE 8800 GTS SLI (2560 X 1600)
3DMARK06 GAME1 (FPS)	18.5	33.8
3DMARK06 GAME1 (FPS)	17.2	32.4
COMPANY OF HEROES (FPS)	56.3	104.4
FEAR (FPS)	32.0	51.0
HQV VIDEO	113	113

3DMark06 benchmarks run with 4x AA and 16x aniso; FEAR run with soft shadows on, 4x AA, and 16x aniso; Company of Heroes run with all settings at max and AA enabled. Tested with an EVGA nForce 680i SLI motherboard with a 2.93GHz Intel Core 2 Extreme X6800 CPU and 2GB of Corsair DDR2 RAM.

BFG GEFORCE 8800 GTS **9**

$500, www.bfg.com

MAXIMUM PC KICKASS

Buffalo LinkStation Pro

The LS-320GL blows away other consumer NAS units

Buffalo's original LinkStation network-storage device (reviewed September 2004) gave consumers an easy way to hang 120GB on their network without having to break the bank—if they were willing to live with the slow performance.

Buffalo's sequel, the LinkStation Pro, is designed to address the performance issues that nag most consumer-level NAS devices. Indeed, Buffalo claims that its new unit's faster processor, Gigabit support, and speedier SATA drive make the LinkStation Pro as fast as a USB 2.0 hard drive.

To test the drive's speed, we compared it to a 400GB Western Digital SATA drive connected to a Wiebetech SATADock V4 USB converter. Both drives were tested using our Athlon 64 FX-60 test bed with a 150GB, 10,000rpm Raptor drive installed as a source drive. Our PC and the LinkStation Pro were plugged into our corporate network which uses enterprise-grade Gigabit switches. We enabled jumbo frames and set the frame size to 9,000 bytes for both our Nvidia NIC and the LinkStation Pro.

Copying the same files we use for our USB thumb drive tests, we found Buffalo's claims to be a little exaggerated. Buffalo's NAS box was best at reading large files stored on it, as opposed to writing large files, and took just 24 percent longer than the USB drive at that task. When writing the same files, the unit was about 50 percent slower than the USB drive. In read and write tests of smaller files, Buff's unit was about 50 percent slower as well. So perhaps Buffalo overstates its performance claims—then again, a USB 2.0 hard drive can be anything from a 10,000rpm desktop drive to a 4,200rpm notebook PC drive—but we're still duly impressed by the LinkStation Pro's

The LinkStation Pro can write 2GB of files in less than two minutes.

performance. It plain smokes all of the other consumer-level NAS units we've tested, which take 20 minutes to write 2GB, not two minutes.

The device is available in capacities from 250GB to 750GB; we tested the 320GB version. Like the original LinkStation, a pair of USB ports on the unit let you schedule timed backups to an attached USB drive. Oddly, there's no print server support. That's OK, we'll take performance over a print server any day.

—GORDON MAH UNG

LINKSTATION PRO	**9**
$300, www.buffalotech.com	

Roku SoundBridge Radio

Wanna wake up to Wi-Fi?

It's hard to imagine a middle-class American's bedroom that's not equipped with a clock radio. Millions of us rely on these inexpensive devices to wake us from our slumber. Roku's SoundBridge Radio takes this low-fi concept into the Wi-Fi age.

There's just one big problem: Integrating this audio-streaming device into your wireless network will severely compromise your ability to keep intruders *out* of it. The only wireless security the SoundBridge Radio supports is the easily cracked WEP. (If you think cracking WEP is difficult, just Google "How to crack WEP.") And you can't get around the security hole by hard-wiring the radio into your network; unlike Roku's other boxes, this one doesn't have an Ethernet jack.

But before we go into full Bam Bam mode, let's examine this product's positive attributes, which include a terrific 280x32 vacuum fluorescent display, an equally good browser, and an above-average remote control. Unlike other streaming boxes we've seen, you can operate nearly all of the SoundBridge Radio's functions using buttons on the device itself.

A 20-watt digital amplifier drives two full-range speakers, while a second 30-watt digital amp enables a small subwoofer to deliver generous bass. The multipurpose 400MHz Blackfin embedded processor Roku chose for the SoundBridge Radio doesn't sound as luscious as the 24-bit Burr-Brown DAC that Slim Devices uses for the Squeezebox; and it's nowhere near the quality of a Sonos system. You can't use an outboard converter because Roku doesn't provide a digital-audio output.

Despite these shortcomings, we were pleasantly surprised by the broad dynamic range with which the Roku delivered the Lossless WMA-encoded ver-

Roku's inclusion of an AM/FM tuner is a puzzling feature in an otherwise middle-of-the-road audio-streaming box.

sion of Afro Celt Sound System's "Seed." But we're talking about a strictly near-field listening experience—the only way to connect external powered speakers is via the headphone jack.

Roku doesn't provide server software to run on your host PC, but the SoundBridge Radio is compatible with *Windows Media Connect*, *Rhapsody*, and *iTunes*. It can stream Internet radio and DRM-encrusted PlaysForSure music, but not similarly-encumbered songs purchased from iTunes. And like any good clock radio, it has a snooze bar.

—MICHAEL BROWN

SOUNDBRIDGE RADIO	**6**
$400, www.rokulabs.com	

Memory Key à Trois

This threesome of thumb drives is a mixed bag

You won't be able to find a drive that offers more gigs per buck than the rubber-coated Xporter XT.

You're not supposed to speak ill of the dead, so we'll point out the one good thing we can say about the floppy drive: It was reliably generic—it didn't matter who made the thing. That's not so with USB thumb drives, which are constantly getting faster, bigger, cheaper, and more distinct.

—GORDON MAH UNG

CORSAIR FLASH VOYAGER 8GB

Corsair's Flash Voyager isn't the largest thumb drive around, but it sure is affordable, as well as speedy. In our tests, the Voyager ran away from all the others here in large-file transfers, and only Kingston's drive could match it in

An 8GB thumb drive that costs what a 4GB model did last year makes us happy.

medium-size JPG file copies.

Indeed, the Voyager only fell down hard in one area: our small-file transfer test, in which we copy several thousand archived *Word* documents to the drive. The Voyager, which spanks the others when swallowing a *Norton Ghost* image or a half-gig game patch, slows to a crawl copying 500MB worth of text files.

To be fair, almost every key we've tested blows chunks in this respect. Corsair would likely say that an 8GB key gets used for large-file transfers, not *Word* files. Still, it's something

to think about when you're waiting for that folder of *Office* docs to copy over at 5 p.m. on Friday.

The Voyager supports Corsair's *TrueCrypt* security using 256-bit encryption but, oddly, our drive didn't ship with the utility. Corsair said it was an error and that shipping product would include the app.

Despite the Voyager's issues with small-file transfers, we're still fans. After all, you can transfer an entire DVD to it in mere minutes and still have room left over.

PATRIOT XPORTER XT 4GB

The Patriot Xporter XT offers the same capacity at less than half the price of Kingston's drive (reviewed next). Unfortunately, that's the only stand-out feature we could find.

Like Corsair's Flash Voyager, the Xporter XT is dreadfully slow at writing small files, but unlike the Voyager, it doesn't make up for that weakness with especially speedy large- and medium-file transfers. The Xporter XT also can't compare to Kingston's offering, which too is just fair at large- and medium-size files, but crazy-fast with small files.

Don't get us wrong, the Xporter XT is no slouch. It's close in write performance to the OCZ Rally and the SanDisk Cruzer that we rated highly in November. But that was before the 8GB Corsair and 4GB Kingston keys arrived. And given the Xporter XT's lack of *U3* support or basic encryption utilities, we think there are better choices out there.

KINGSTON DATATRAVELER SECURE 4GB

Kingston's DataTraveler Secure is billed as an "enterprise-grade" flash drive.

The pricey DataTraveler Secure offers great performance with all file sizes.

Translated for civvies, that means 256-bit AES hardware encryption, an IPX8 waterproof rating, and a titanium shell. Oh yeah, and optimization for small files. While almost every key we've tested in the last few months choked on the 10,000 *Word* docs we feed them during testing, the DataTraveler Secure was able to write that onslaught of files in three minutes instead of the usual 20 minutes.

That's a huge difference, and for someone who needs to grab 500MB of small *Office* files off the server at the end of the day, it's well worth the extra bucks Kingston charges. And we do mean extra. Based on street pricing and formatted capacity, the Kingston key costs you around $61 per gig compared to $21 for Corsair's drive. Even the SanDisk Cruzer that we looked at in November is cheap by comparison.

Still, that's the price you pay for small-file performance. In other words, it's a drive that's not only good at writing AVI files but also DOC files. And for the office drone, that's probably money well spent.

CORSAIR FLASH VOYAGER 8GB

+ THUMB
Fastest at writing large files.

− INDEX FINGER
Chokes on kilobyte-size files.

9

MAXIMUM PC
KICKASS

$170, www.corsairmemory.com

PATRIOT XPORTER XT 4GB

+ FEET
Lowest cost per gigabyte on the street.

− METERS
Gets aced by the competition in performance.

7

$100, www.patriotmem.com

KINGSTON DATATRAVELER 4GB

+ USB
Fastest key for small-file writes that we've ever tested.

− PS/2
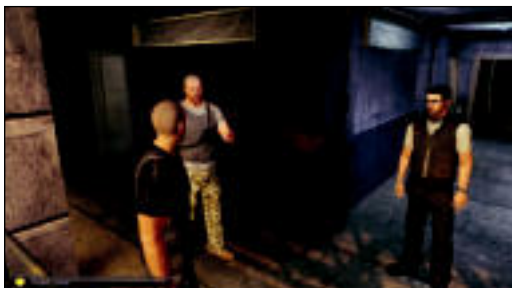The chunky design and Beverly Hills pricing makes this a tough key to swallow.

9

MAXIMUM PC
KICKASS

$244, www.kingston.com

Splinter Cell: Double Agent

Keeping two masters happy is never simple, especially if you're a super-spy

L ongtime readers will know that we're big fans of the adventures of Sam Fisher. There's something eminently satisfying about using a combination of stealthy moves, acrobatics, and super-spy gadgets to get into places where you're not supposed to be and take things you're not supposed to have. It's just fun.

In *Double Agent*, the series' fourth install-ment, you go deep undercover, infiltrating a terrorist organization. In order to maintain the trust of both your NSA employers and the ter-rorist leaders, you'll need to complete objec-tives for both organizations. Naturally, it's not

Double Agent presents you with a series of difficult decisions: Do you let an innocent man live or do you kill him to gain the terrorists' trust and save millions more lives?

During your missions in the terrorist HQ, you have to be careful to avoid arousing suspicion.

simple. Frequently the NSA's instructions and the terrorists' objectives are mutually exclu-sive—one side might want someone killed, while the other wants him to live. You'll have to find ways to keep both masters happy, or deal with the consequences.

The scenarios you're presented with are by no means cut and dried; the game puts you in situations ripped from the best episodes of *24*. You'll be forced to decide whether you want to sacrifice the lives of a few innocent people in order to save thou-sands more.

The HQ missions are another big advancement in *Double Agent*. These mis-sions take place in the terrorist HQ, and again you're given two sets of tasks. The tasks, which you can complete in any order you like, range from entertaining mini-

games, to spending time at the firing range, to collecting intel on key terrorists. The catch is that you're on the clock. If you don't complete all the assigned tasks in the pre-scribed length of time (or if you get caught doing something suspicious), the terrorists won't be happy with you. And no one wants to have testy terrorists after them.

The HQ missions add a ton of replayability. There's virtually no chance you'll be able to complete all the tasks on the first go-round. Exploring the headquarters build-ing, discovering ways to access the restricted areas, and collecting complete profiles on all of the ter-rorists presents a serious challenge.

While the single-player cam-paign is great fun, we're pretty pissed about the stripped-down multiplayer. The PC version of the game completely lacks the co-op game that entranced us in *Chaos Theory*, and the revolutionary mercenary-vs.-spy multiplayer that we loved in *Pandora Tomorrow* is a pale shadow of its former splendor. Instead of doing battle with oodles of high-tech gadgets, spies are limited to one tool (and no rifle—not even the non-lethal one from previous installments) and mercs get noth-ing more than their rifle and a few grenades. Without the challenge of placing wall mines, sensors, and other gadgets, matches where you play as a merc get tedious quickly. We'd be more inclined to forgive the newbtastic changes, if they actually made the game more accessible to newbs. Unfortunately, the multiplayer modes still have a treacher-ous learning curve.

Ubi Shanghai did include a series of cooperative spy-vs.-AI merc missions, but the merc AI seems impossible to escape when you're spotted. Their omniscience makes it difficult to avoid their perfect aim. Hopefully, in the next edition of the game, we'll see a return to the classic merc-vs.-spy gameplay—complete with lots of gadgets and a more fun experience for mercs.

—WILL SMITH

The AI you'll do battle against in the cooperative missions is insanely overpow-ered. You should be ready to get your ass kicked repeatedly.

SPLINTER CELL: DOUBLE AGENT

+ SPYING
Single-player campaign is great. We love choosing who lives and who dies!

– SPIED ON
Where are the kick-ass merc-vs.-spy multiplayer, the co-op missions, and the remappable controls?

8

$50, www.splintercell.com

Reservoir Dogs

Michael Madsen didn't need to sink this low

We don't know who owns the rights to Quentin Tarantino's classic jewel-heist-gone-awry film, but licensing the gaming rights to *Reservoir Dogs* is probably the worst decision that studio executive ever made. While much is revealed about the hapless heist carried out by the well-dressed gentlemen known as Mr. Blonde, Mr. Blue, Mr. Brown, Mr. Orange, Mr. Pink, and Mr. White, the game lacks the slick style and distinguished character portrayals that made the 1992 movie so memorable.

The game's 15 campaigns are split between two gameplay modes, but both modes suffer from unacceptable and unrecoverable faults. Most of your time is spent replaying the getaway from the diamond store in the third person, navigating a completely linear path through warehouses, narrow alleyways, and fenced-off streets. With the po-po hot on your trail, you're required to take hostages and threaten cops into submission. In theory, you could get through entire levels without pulling the trigger, switching hostages as they wear out. But in practice, we found that cops were all too happy to shoot us even as we held up human shields.

In the driving portion of the game, too-loose controls ruin the experience. We could barely keep the car stable as we sped along a completely restricted path. Reckless driving is rewarded with adrenaline boosts for speed, but the AI pursuers always managed to cheat their way back within a few yards of our position. It doesn't help that many of these "tracks" are just rehashes of each other, which also holds true for the third-person levels.

Of the main cast, only Michael Madsen returns to reprise his role as Mr.

By the end of the game, we were praying the cops would shoot us to put us out of our misery.

Blonde. The rest of the characters neither sound nor look like their movie counterparts, which just detached us from the story. Tarantino-esque dialogue helps a little, but we felt more like we were watching a fan-made tribute to the movie as opposed to being part of it. You do find out where Mr. Pink hid the goods and exactly what went down off-camera, but these bits were kept hidden for a reason, and exploring them is treading on sacred ground.

We're struggling to find any reason to recommend this half-baked console port. This is money better spent on the DVD of the film, even if you already have a copy.

—NORMAN CHAN

RESERVOIR DOGS	**3**
$30, www.reservoirdogsgame.com, ESRB: M	

Sid Meier's Railroads!

A simplified simulation for the model train crowd

Like most games bearing his name, *Sid Meier's Railroads!* is wonderfully simple to learn, but extraordinarily difficult to master. There's no canned storyline to follow, just seven scenarios that plant you in Germany, France, Great Britain, or different regions of the United States, and start you off with a single terminal in a random town. Hover over it, and icons representing the goods supplied and demanded by the local populace appear, helping you connect neighboring towns for travel and mail delivery, send rails out to annexes for food and fossil fuels, and buy up local industries like automobile plants and paper mills to expand your influence.

For all the complexity of business, most time is spent laying track and defining routes for your growing fleet of engines to traverse in pursuit of random delivery quests and the highest payouts. The elegant interface grants easy access to everything, from profitability and maintenance reports to market prices on materials and the effects of efficiency-boosting patents. There are, however, some maddening artificial limits, like the requirement that you manually connect every last inch of your track in one vast contiguous web.

Long-time supporters of the genre will be sorely disappointed if they expect a sequel to *Railroad Tycoon 3*. All the corporate raiding aspects have been whittled to a nub, and while setting down rails means simply clicking and dragging across surprisingly small maps, you too often wind up at the mercy of some dreadfully poor path-finding issues that send trains into commerce-killing deadlocks despite the obvious presence of alternate routes mere pixels away. Crash bugs and obvious money-generat-

Triple-tracking your busiest routes becomes a necessity if you don't want locomotives getting stuck in a staring contest.

ing exploits likewise mar an otherwise engaging multiplayer experience, while odd graphics glitches such as flickering foliage disrupt the admirably detailed presentation. Hopefully a patch will fix these issues.

Despite its irritating bugs and AI fumbling, *Railroads!* still manages to be enormously addictive, deep, and endlessly replayable. If you give yourself enough time to accommodate its quirks, you'll find the hours tick by with disturbing speed, even if you'll occasionally wonder why you put up with the amateurish anomalies.

—CAMERON LEWIS

SID MEIER'S RAILROADS	**7**
$40, www.2kgames.com/railroads, ESRB: E	

Win Rig of the Month
AND WIN BIG!

IF YOUR MODDED PC IS CHOSEN AS A RIG OF THE MONTH, IT WILL:

▶ **1** Be featured before all the world in *Maximum PC*
  2 Win you a $500 gift certificate for Buy.com

SO WHAT'S STOPPING YOU?

TO ENTER: Your submission packet must contain your name, street address, and daytime phone number; no fewer than three high-res JPEGs (minimum size 1024x768) of your modified PC; and a 300-word description of what your PC represents and how it was modified. Emailed submissions should be sent to **rig@maximumpc.com.** Snail mail submissions should be sent to Rig of the Month, c/o Maximum PC, 4000 Shoreline Court, Suite 400, South San Francisco, CA 94080.

The judges will be *Maximum PC* editors, and they will base their decision on the following criteria: creativity and craftsmanship.

ONE ENTRY PER HOUSEHOLD. Your contest entry will be valid until (1) six months after its submission or (2) February 1, 2007, whichever date is earlier. Each month a winner will be chosen from the existing pool of valid entries, and featured in the Rig of the Month department of the magazine. The final winner in this contest will be announced in the April 2007 issue. Each of the judging criteria (creativity and craftsmanship) will be weighed equally at 50 percent. By entering this contest you agree that Future US, Inc. may use your name and your mod's likeness for promotional purposes without further payment. All prizes will be awarded and no minimum number of entries is required. Prizes won by minors will be awarded to their parents or legal guardians. Future US, Inc. is not responsible for damages or expenses that the winners might incur as a result of the Contest or the receipt of a prize, and winners are responsible for income taxes based on the value of the prize received. A list of winners may also be obtained by sending a stamped, self-addressed envelope to Future US, Inc. c/o Maximum PC Rig of the Month, 4000 Shoreline Ct, Suite 400, South San Francisco, CA 94080. This contest is limited to residents of the United States. No purchase necessary; void in Arizona, Maryland, Vermont, Puerto Rico, and where prohibited by law.

We tackle tough reader questions on...

Intel Name Confusion ✓Quad vs. Dual ✓Podcast Tips ✓Overdrive Pricing ✓Cubits

CORE CONFUSION

*In the December Issue of **Maximum PC** there is a mistake on the quad-core CPU name. You called it the QX6800, but it's really the QX6700. There is no such CPU as the QX6800.*

—Kuen Fai Yiu

SENIOR EDITOR GORDON MAH UNG RESPONDS: You got us. I would swear on a stack of Kentsfield CPUs that the processor was referred to numerous times at Intel Developers Forum as the Core 2 Extreme QX6800, but it must have been a brain fart on my part, because Intel officially lists it as the QX6700. Intel even claims it never called the chip the QX6800, only the QX6700. Of course, there might have been something in the water that week: Some website coverage of IDF also refers to the chip as the QX6800.

BLEEDING EDGE OR STUPID EDGE?

I was surprised when you said "buy the quad-core CPU today" because "it will actually get faster as future applications utilize more cores" ["Best of the Best," December 2006].

Why buy the brand-new, bleeding-edge CPU right now when it's only going to come into its prime months from now? Why pay the huge price premium when you can buy the same CPU months later for much less and get the performance that it lacks now? I know you guys are all about power, but I didn't think you had entirely tossed price-vs.-performance considerations out the window.

— Alex Aberle

SENIOR EDITOR GORDON MAH UNG RESPONDS: Alex, we made the recommendation because it was the "Best of the Best of 2006," not the "Cheapest of the Best." And when looking at the best CPUs of the year, the quad-core

CUTCOPYPASTE

Our review of D-Link's RangeBooster N650 in the Holiday 2006 issue incorrectly reported that the Atheros Xspan chip this Wi-Fi router uses does not support WEP encryption. The problem was actually with D-Link's firmware, which has since been updated.

2.66GHz Intel Core 2 Extreme QX68…, err, QX6700 is a $1,000 CPU (wholesale prices). The dual-core 2.93GHz Core 2 Extreme X6800 is also $1,000. I'd give up 267MHz for two more execution cores any day of the week.

MORE PODCASTING TIPS

I really enjoyed your article on setting up a podcast [Holiday 2006], but as a podcaster myself, I have a few more tips that can help out the newcomers.

*First, you don't need to pay a dime to host your podcast. The Internet Archive (**www.archive. org**) allows you to upload media content (including MP3s) that you've created and it will host it and provide all the bandwidth free of charge. I'm using it to host all my episodes and it works great. There's even a utility called **ccPublisher** that will upload your MP3 file and help mark it with a Creative Commons license.*

Granted, you'll still need to include the link in your feed, but offloading the MP3 hosting saves a boatload on bandwidth costs.

*Also, there was a big bug in your method for recording podcasts. **Skype** works great—I use it myself—but if you hook up your computer's audio output to the recording computer's input, you'll get a great conversation... without yourself in it.*

*The easy solution is to just load up **Skype** on the recording computer and invite it to a conference call. Then open up the Windows Recording Mixer, change the recording source to "System Mixer," "What U Hear," or a similar setting. Then go back to **Skype** and tell it to "mute the microphone." Then hit the record button and you're good to go. The only bad thing is that one of your five available conference slots is taken up by the recorder.*

A more complicated solution involves recording only your voice on your machine, everyone else's voice on the second machine, and then merging the two in post production.

*Another great (and free!) tool is **The Levelator** from GigaVox Media (**www.gigavoxmedia.com**), which takes your raw WAV file and evens out the levels of all the voices. It makes your final mixdown much, much easier on the ears.*

—Bob Somers
SteamPodcast.com

To Die For

Congratulations to Zachary Barnes for being the first reader to correctly identify the die shot in our Holiday issue "Gift for Geeks" feature. It was indeed a Pentium 4 Willamette CPU. As winner of the contest, Zachary will receive this basket of goodies—which includes a P4 Willamette!—lovingly collected from our Lab and assembled into a fine care package. Keep an eye out for similar contests in future issues.

MORE ON THE VISTA ACTIVATION QUAGMIRE

I have heard that Microsoft has relented on the EULA language for Vista ("Microsoft's Licensing Madness," December 2006). Please keep this matter alive as my purchase decision will depend on this exact restriction. I, as well as many others, will not buy an operating system that will become worthless so quickly, and I have no faith whatsoever in Microsoft's re-activation algorithm. My XP version just went dead again after zero hardware changes since the last re-activation; the only change was new Nvidia drivers.

—Sam Chase

EDITOR IN CHIEF WILL SMITH RESPONDS: Microsoft has indeed dropped the inane one-transfer clause from the Vista license. We've also completed preliminary testing on the activation process for the final version of Vista (release candidates and betas required activation, but installs with valid keys were never denied). We've reinstalled the final code on the same hardware several times with the same serial number, without having to call or contact Microsoft's activation hotline.

MAGNIFICENT SIX?

I was excited to read the roundup of gaming PCs for under $2,500 in your December 2006 issue ["The Magnificent Seven"]. I was especially excited about the Overdrive PC you reviewed. But when I went to the company's website and built the same machine, it cost $3,100! I don't know how you got it for $2,500. Whose mother did you threaten to get that price?

— Jimmy Latteri

SENIOR EDITOR GORDON MAH UNG RESPONDS: All of the system vendors in the roundup were required to have their systems on sale as of November 1. Three of the vendors were late on their sale dates, with Overdrive being the latest. What caused the holdup? Were they unwilling to sell at the prices quoted to us for the reviews? We're not sure, but we suspect the culprit was mostly bureaucracy. Once we reminded the vendors of the terms of the roundup, they immediately corrected their prices to reflect the published price limit. We haven't heard from any other readers who were unable to

purchase a system at the quoted price, but please let us know if you can't.

TONY, ARE YOU A CYLON?

A "cubit" is a measure of distance, not a form of currency as you claimed in your midrange PC review ["The Magnificent Seven," December 2006]. As a Steely Dan fan, I recommend "piastre" (or piaster), but there is also "dinar," "escudo," and my second-favorite "Oat Bin Hoard" as obscure monetary references.

—Tony

SENIOR EDITOR GORDON "APOLLO" UNG RESPONDS: Sorry, Tony, cubits have been the official currency of the 12 colonies for more than 3,000 yahrens now. Maybe if your colony had decided to stick with the program instead of cutting and running to Earth, you'd know that.

THE DOG'S NOSE KNOWS

This has little or nothing to do with computers, but for the sake of accuracy I thought I'd mention this.

In the article "Piracy Gone to the Dogs" (QuickStart, December 2006), you suggested (tongue in cheek, I'm sure) disguising bootleg DVDs from the prying nose of police dogs by masking their scent with air freshener. As a retired civilian police employee, I am familiar with canines and how they smell, er, detect odors. Dogs can distinguish up to seven separate odors at one time. For instance, you and I smell beef stew. The dog smells beef, potatoes, carrots, bay leaves, and so on. Drug dealers have attempted to hide marijuana by packing it with pepper or some other spice, but it doesn't work. The pooch sniffs the car and says to himself, "Hmmmmm. I smell pepper... and marijuana!" He then trots back to the police car, sits next to the door where the bad guy is, rolls his eyes at him and utters a sarcastic, "Duh." The same thing could happen with the DVDs. "I smell air freshener, pepper, sauerkraut extract, old socks, a dead fish, and bootleg DVDs. Now where's my treat?"

—Andy Barber

EDITOR IN CHIEF WILL SMITH RESPONDS: Thanks for the heads up, Andy! `MPC`

COMING NEXT MONTH

IN MAXIMUMPC's

FOR NOVELTY PURPOSES ONLY

FEBRUARY ISSUE

- **LEAN MACHINE!**
  Buy the components, then build the ultimate budget gaming rig with our expert guide.

- **10 REASONS YOU DON'T NEED VISTA!**
  We're not in a hurry to upgrade to Vista, you shouldn't be either!
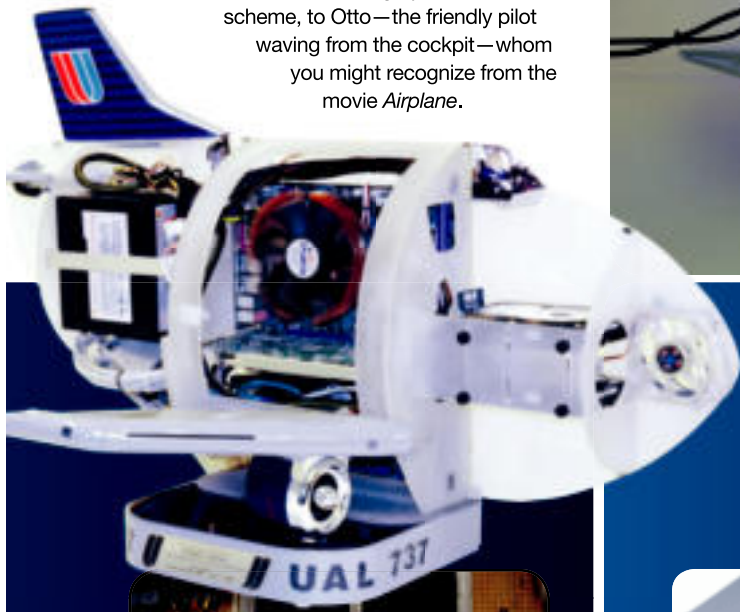
- **WEB BROWSER BATTLE**
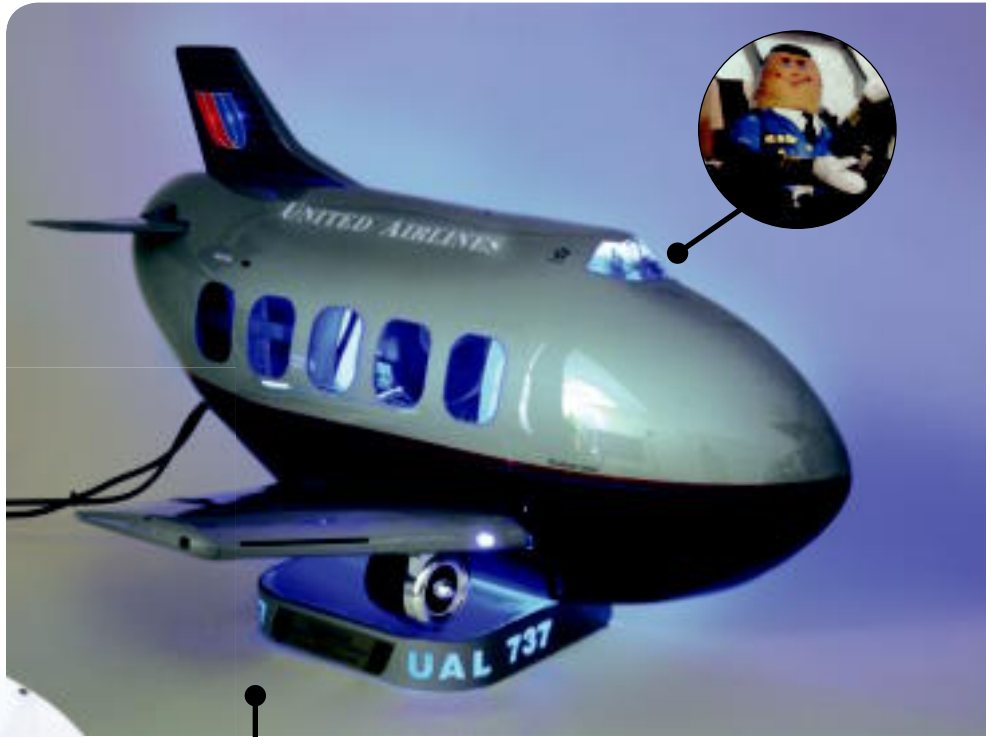 *Firefox, Internet Explorer, Opera…* oh my! Which browser will win? Come back next month to find out.

BRIAN CARTER'S
UAL 737

It must do a dad proud to sit before a PC that honors his 35-year career as a United Airlines mechanic and know it's the product of his son's devotion and hard work. Brian Carter modeled this rig after the Boeing 737s his father primarily worked on, although he did give the plane's proportions a pudgy, cartoonish quality in order to keep the size small yet still fit in all the parts. Details are nonetheless authentic, from navigational lights on the wings and tail, to the old-school blue and gray United color scheme, to Otto—the friendly pilot waving from the cockpit—whom you might recognize from the movie *Airplane*.

It was relatively easy for Carter to create a bank of windows in the plane's side—he simply taped off squares of the clear acrylic before applying the body paint.

Carter made only half a plane so the rig could sit against a wall or be hung—at a tilt, as though taking off, is how he imagined it. After taping off the "United" brand, Carter frosted the 1/4-inch Plexiglas for a peek-a-boo effect.

Carter first created a cast for the body out of fiber board, wire mesh, and plaster. Then, using a vacuum-forming table that he made himself, he was able to heat and manipulate Plexiglas into the exact shape.

The wing conceals a slot-fed DVD/CD drive, as well as the receiver for the cordless mouse and keyboard. The Coolermaster Jet-7 underneath the wing serves as an intake fan.

For his winning entry, Brian Carter wins a $500 gift certificate for TigerDirect to fund his modding madness! See all the hardware deals at www.tigerdirect.com, and turn to page 92 for contest rules.