

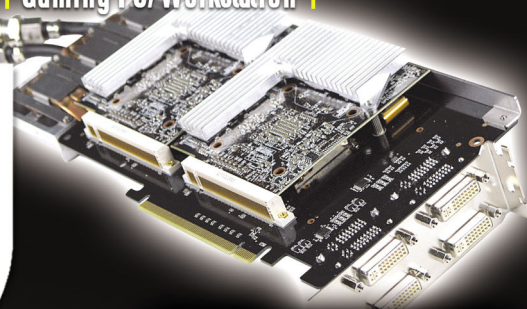
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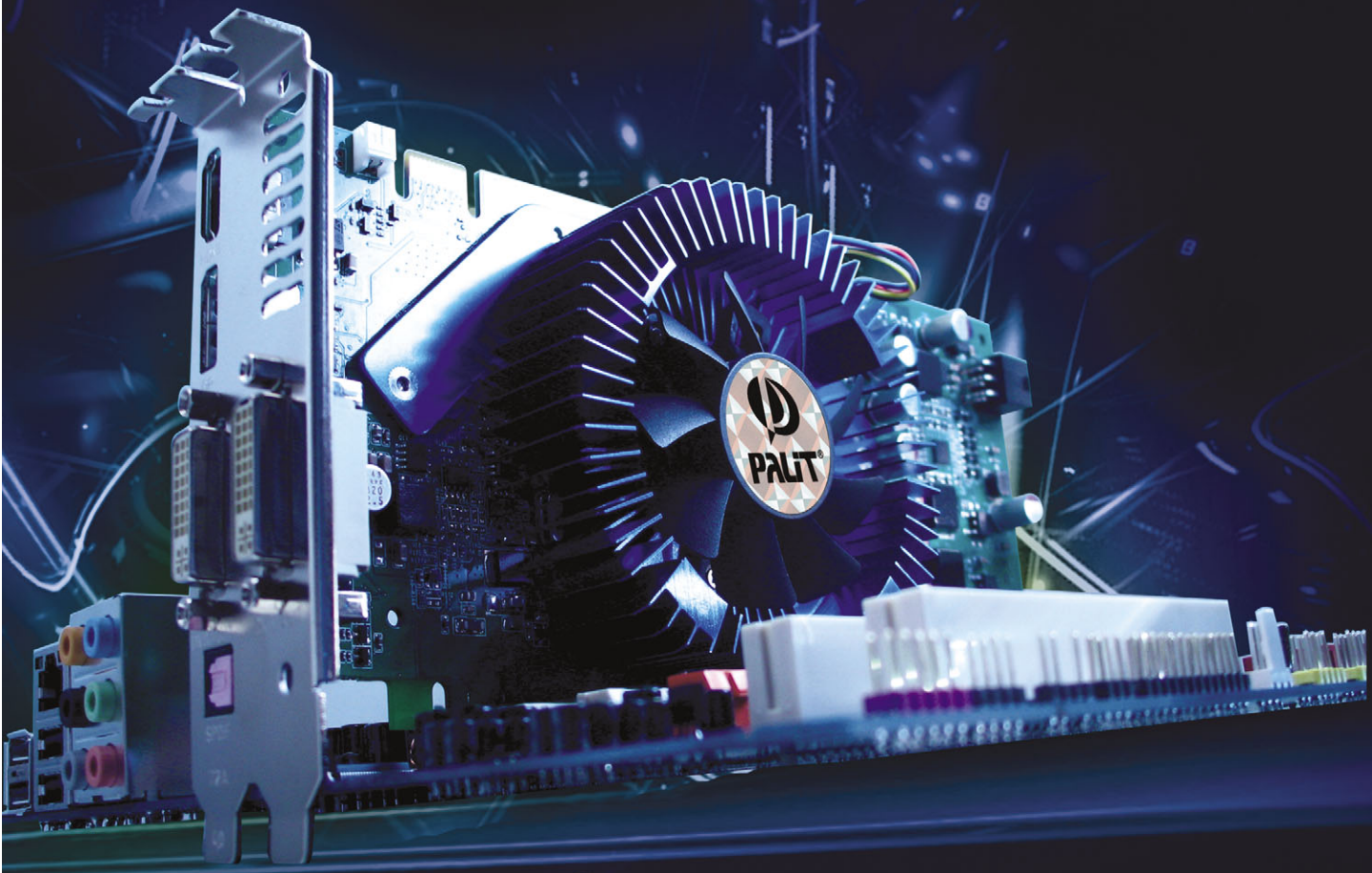


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## EDITOR'S NOTE

It's easy sometimes to get carried away talking about cutting-edge CPUs, graphics cards, and motherboards and forget about some components that may seem a bit more pedestrian at a glance. As we all know, you can drop a ton of jack on a new build in a big hurry, and in many cases making one change requires other expensive upgrades, as well, but calling up your old hard drives for another tour of duty is almost second nature. After all, that three-year-old Raptor is going to work just fine with your new rig regardless of whether you go with AMD or Intel, Nvidia or ATI, right?

But every once in a while, we think it's important to shine the spotlight on these workhorse parts that in the end are so crucial to the basic operation of a modern computer; that's why this month we are taking a look at the current state of PC storage. There are some great new internal drives on the market, external storage options are better than ever, and now that the whole Blu-ray-HD DVD thing is behind us, the optical drive picture is much clearer, as well.

And, of course, we would be remiss if we left out the new darling of PC storage, the SSD. Yes, cost per gigabyte is still high, but it's getting saner all the time; it won't be too long before you will have a legitimately tough decision on your hands when it comes to installing a new boot drive.

So check out our storage extravaganza starting on page 52, and while you're with us, peep our in-depth look at Firefox 3 (page 76) and the White Paper on AMD/ATI's RV770 (page 48). (Have you seen the insane benchmark numbers the 4870 X2 is putting up?) Speaking of GPUs, be sure you take a gander at Asus' most excellent Trinity concept card on page 30; as the name implies, this thing packs three GPUs (Radeon HD 3850s) on a single PCB with custom cooling, and the scores Dave beat out of it over at HotHardware.com are impressive to say the least.

Enjoy, and we'll talk to you again once NFL Kick-off is over and we can sit still long enough to write some more stuff.



Chris Trumble, Publication Editor, *CPU*



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## Wii Us, Xbox 720 & Playstation 4 Coming No Time Soon

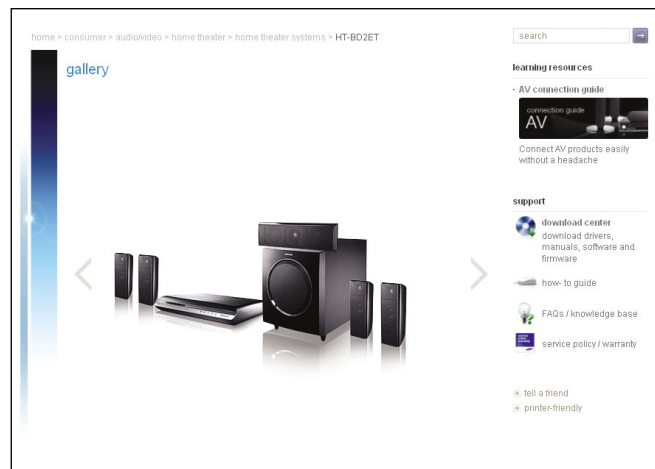
A recent Forbes article hints it may be eight years total before Microsoft, Sony, and Nintendo release new gaming consoles. “Those engines have a lot of steam left in them,” Brian Farrell, THQ CEO, said of current consoles. Jack Tretton, Sony Computer Entertainment of America head, said Sony has a distinct advantage with the PS3 in that “we don’t have to go in a specific direction” as the “fact that we have a high-end machine keeps us from doing bite-sized casual entertainment.” Nintendo President Satoru Iwata, meanwhile, did say Nintendo is already working on a Wii successor, but expectedly, Nintendo isn’t rushing anything to market. “We are always preparing for the next hardware,” Iwata stated. “We are under development . . . but the hardware is a kind of box that consumers reluctantly buy in order to play our games.” ▲

## Brando Entertains With SATA HDD Dock

The latest entry to Brando’s line of SATA HDD docks really rocks, as in a multi-media way. Not only does the company’s SATA HDD Multimedia Dock (\$84) accept any 2.5- or 3.5-inch SATA drive (FAT32 only) in its USB 2.0-connected dock for transfer, back up, and cloning chores, it also includes an SD card slot and component and S-Video connection options (no HDMI yet) to output a nice list of supported audio, video, and photo formats, including MPEG, WMA, WAV, JPEG, GIF, MPEG-1/2/4, Xvid, DivX, and others. Brando also bundles a remote control and AV and USB cables. ▲

## Samsung Does Blu-ray HTB On The Cheap

If you’ve been sitting on the sidelines where a Blu-ray home-theater system is concerned due to cost, Samsung’s new price-friendly HTB may get you in the game. At \$799 the 800-watt, 5.1-channel HT-BD2E blends features of Samsung’s previous 7.1-channel HT-BD2S (\$999) and HT-BD2T (\$1,499). Beyond BonusView capability, the HT-BD2E’s single-disc Blu-ray player does HDMI out (not in) and 1080p DVD upconversion and provides an Ethernet port for firmware updates. Negatives include a passive subwoofer and no DTS-HD Master Audio support, although you get an FM Tuner, two optical digital inputs, and universal remote. ▲





## Pioneer Ups The Blu-ray Disc Ante Again

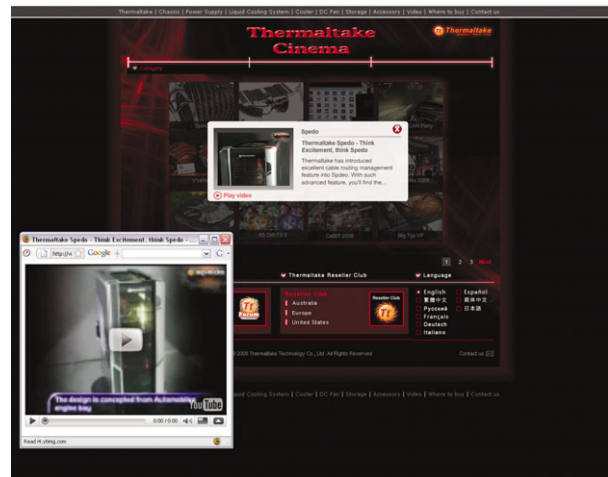
Apparently, producing a 16-layer optical disc capable of storing 400GB of data wasn't good enough for Pioneer. Roughly a month after it announced the feasibility of creating such a Blu-ray disc, Pioneer upped the capacity to 500GB in a presentation at the International Symposium on Optical Memory and Optical Data Storage in late July. Pioneer states that by using proprietary technology and stacking layers of alternating thickness, it can reduce "interlayer crosstalk" on discs, thus making a 20-layer optical disc possible. Current Blu-ray discs come in single-layer 25GB and double-layer 50GB options. The goal now is having 20-layer discs ready between 2010 and 2012. ▲



## HARDWARE MOLE

### Thermaltake Brings Visual "Excitement & Enjoyment"

OK, Thermaltake's new Thermaltake Cinema Web site isn't likely to win any design awards any time soon. Still, if you want to get a quick, visual rundown of the company's hardware offerings, follow Thermaltake's advice and check out Thermaltake Cinema ([video.thermaltake.com](http://video.thermaltake.com)). You'll find "a series of videos that feature Thermaltake's dynamic range of products and services, as well as activities around the world, including exhibitions and competitions" in various languages. Divided into subsections for Latest, Product, Year, and Event, the site is now featuring a fairly extensive look at the upcoming, automotive-inspired Spedo chassis. Purr. ▲



### Best Buy Strikes Up The Band

If recent visits to a local Best Buy haven't clued you in, about 90 stores nationwide are undergoing roughly 2,500 square feet of expansion to create designated areas for selling 1,000-plus guitars, pianos, drum kits, distortion pedals, amplifiers, recording equipment, sheet music, cables, and other music-related gear. The project is expected to make BB the country's second-leading seller of instruments and enhance the lower-end music gear it already offers by adding high-end equipment from the likes of Fender, Gibson, Marshall, Yamaha, Zildjian, and Roland. And you thought the closest you could get to starting a garage band at Best Buy was Rock Band. ▲



### Netbooks Have Desktop Makers Worried

Consumers may be buying netbooks and net-tops in droves, but a *New York Times* article quoting industry analysts states the low-cost devices could threaten the bottom dollar of Microsoft, Intel, HP, Dell, and others due to the devices' low-profit margins and reliance on cloud computing. "When I talk to PC vendors, the No. 1 question I get is, how do I compete with these netbooks when what we really want to do is sell PCs that cost a lot more money?" Forrester Research's J. P. Gownder says. Fujitsu's Paul Moore stated, "We're sitting on the sidelines not because we're lazy. We're sitting on the sidelines because even if this category takes off" it's "a product that essentially has no margin." Creative Strategies analyst Tim Bjarin countered, "HP, Dell, and these other PC makers have learned that if there's consumer interest, you can't just sit back and let someone else steal all the thunder." ▲

## Apple Might Be The Newest Licensee For ARM

It's an intriguing mystery. Apple bought PowerPC chip design firm PA Semi in April for \$278 million. It wasn't clear why. PA Semi's chip hands were veterans who could make Intel-compatible microprocessors. They could also design low-power ARM chips, since many of them created Digital Equipment Corp.'s StrongARM chips many years ago. And they were already working on PowerPC networking chips. But the odds are strong that Apple isn't going to take on Intel in x86 processors. Rather, it likely needs better low-power computing chips for its iPhones and iPods. That may be why ARM Ltd. just announced that it has a new mystery licensee that may bring it considerable revenues in the future in mobile computing. Apple isn't saying anything yet. But the odds are strong that the PA Semi team is hard at work on a low-power ARM-based processor. ▲



## eASIC Shows Off 45-Nanometer Process For Custom Chip Designers

The costs for designing custom ASIC (application specific integrated circuit) chips has risen to a staggering \$65 million, largely due to upfront engineering costs and the long 18-month design cycle. Meanwhile, FPGAs (field-programmable gate arrays) are flexible and can be software-programmed at the last minute. The problem is FPGAs cost too much per chip. eASIC, a Santa Clara, Calif.-startup that has raised \$100 million, has a hybrid of an ASIC and an FPGA. It has a prefabricated design that is cheap and easy to make. But the chip's top layer can be redesigned with a short turnaround time. That allows it to be customized easily. eASIC says it has more than 120 customers, many of them startups that can't afford the costs of ASICs, for its 90-nanometer process. And by this fall, eASIC will leap ahead to 45nm manufacturing. It may be one of the only ways for small companies to get custom chips into the market quickly. ▲

## Nvidia's Emerging Technologies Conference Showcases Visual Startups

There was a time when 50 different graphics chip companies flourished. Now Nvidia is the king of the heap, the last standalone graphics chip maker in the market. But now the entrepreneurs have moved on to the applications of graphics. Visual computing has become such a magnet for innovation that more than 60 companies signed up for Nvidia's Emerging Technologies Summit at its first annual Nvision 08 graphics show. Jeff Herbst, vice president of business development at Nvidia, said his company has invested in a variety of applications companies that exploit Nvidia's chips and its new CUDA programming environment. The startups include game physics companies such as Natural Motion, as well as scientific computing firms such as Elemental Technologies. ▲

## Watching The Chips Fall

Here is pricing information for AMD and Intel CPUs.

\*Retail price  
\*\* Manufacturer's price per 1,000 units  
Other current prices, if indicated, are lowest OEM prices available through Pricegrabber.com

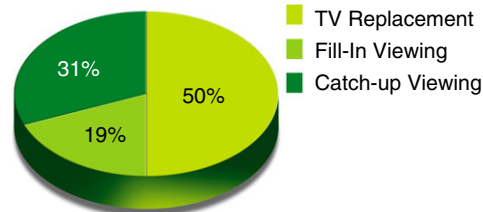
CPU	Released	Original price	Last month's price	Current price
AMD Phenom X3 Triple-Core 8750 2.4 GHz	3/27/2008	\$195**	\$179	\$159
AMD Phenom X3 Triple-Core 8650 2.3 GHz	3/27/2008	\$165**	\$145	\$145
AMD Phenom X3 Triple-Core 8450 2.1 GHz	3/27/2008	\$145**	\$125	\$145
AMD Athlon 64 FX-72	11/30/2006	\$799/pair	\$319	\$319
AMD Athlon 64 FX-74	11/30/2006	\$999/pair	\$279	\$361
AMD Phenom 9500	11/19/2007	\$251**	\$191	\$192
AMD Phenom 9550	3/27/2008	\$195**	\$174	\$190
AMD Phenom 9600	11/19/2007	\$283**	\$157	\$134
AMD Phenom 9600 Black Edition	12/23/2007	\$251**	\$229	\$229
AMD Phenom 9750	3/27/2008	\$215**	\$199	\$210
AMD Phenom 9850 Black Edition	3/27/2008	\$235**	\$205	\$252
AMD Phenom 9950 Black Edition	7/3/2008	\$235**	\$235**	n/a
Intel Core 2 Duo E6700 2.66GHz 4MB cache 1066 MHz FSB 65nm	7/27/2006	\$530**	\$326	\$326
Intel Core 2 Duo E6750	7/16/2007	\$183**	\$151	\$151
Intel Core 2 Duo E6850	7/16/2007	\$266**	\$183	\$183
Intel Core 2 Duo E8190 45nm	1/7/2008	\$163**	\$163**	\$163**
Intel Core 2 Duo E8200 45nm	1/7/2008	\$163**	\$169	\$174
Intel Core 2 Duo E8400 45nm	1/7/2008	\$183**	\$169	\$176
Intel Core 2 Duo E8500 45nm	1/7/2008	\$266**	\$206	\$249
Intel Core 2 Quad Q6600	1/8/2007	\$851**	\$194	\$209
Intel Core 2 Quad Q6700	7/16/2007	\$530**	\$272	\$269
Intel Core 2 Quad Q9300 45nm	1/7/2008	\$266**	\$267	\$269
Intel Core 2 Quad Q9450 45nm	1/7/2008	\$316**	\$396	\$371
Intel Core 2 Quad Q9550 45nm	1/7/2008	\$530**	\$539	\$554
Intel Core 2 Extreme QX6800	7/16/2007	\$999**	\$1,079	\$1,019
Intel Core 2 Extreme QX6850 3.0GHz 8MB cache 1333MHz FSB 65nm	7/16/2007	\$999**	\$1,009	\$1,009
Intel Core 2 Extreme Quad QX9650 3.0GHz 12MB cache 1333MHz FSB 45nm	11/12/2007	\$999**	\$1,019	\$1,019
Intel Core 2 Extreme Quad QX9770 3.2GHz 12MB cache 1600MHz FSB 45nm	2/19/2008	\$1,399**	\$1,469	\$1,454
Intel Core 2 Extreme Quad QX9775 3.2GHz 12MB cache 1600MHz FSB 45nm	2/19/2008	\$1,499**	\$1,549	\$1,548





## Who Is Watching Online TV Anyway?

A survey that IMMI conducted in 2007 and 2008 of 3,000 people in New York, Chicago, Los Angeles, Miami, Houston, and Denver using mobile phones and monitoring software found that well-educated, affluent white women, ages 25 to 44, who were too busy to watch TV shows when they originally aired represent the largest group of online TV viewers. IMMI additionally found 50% of online viewers outright replaced traditional TV viewing with online watching, while 18.7% used online shows to fill in episodes they had viewed before and after on TV. The other 31.3%, meanwhile, watched an episode online that aired previously to episodes they had viewed on TV. ▲



## The Big Dogs Toss Some Interesting Bones

The Internet's big dogs have been barking loudly recently. In August, Mozilla unleashed Snowl, a "prototype Firefox extension that integrates messaging into the browser." Initially, Snowl is supporting RSS/Atom feeds and Twitter in three-pane and River of News interfaces. Google, meanwhile, went wiki in July with Knol (a unit of knowledge), a project that lets anyone write about any subject dear to her heart. Elsewhere, ex-Google staffers were less impressive with the debut of the potentially impressive Cuil, a search engine indexing about 122 billion pages at press time. Some ego surfing, for example, returned just five results vs. 209,000 at Google weeks after Cuil's launch for this writer. Finally, new design touches to Microsoft's Windows, WindowsLive.com, and Windows Mobile sites are not only more visually pleasing but also better at detailing product-related hardware, news, and utilities. ▲

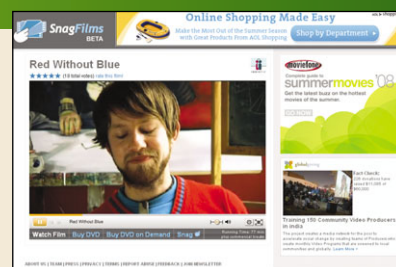
## The Web Giveth Love, Takes It Away

What guy among us hasn't at one time encountered the woman of his dreams only to let her slip away without saying a word? Give Patrick Moberg ([www.patrickmoberg.com](http://www.patrickmoberg.com)) credit. When he saw Camille Hayton on a New York subway in November but subsequently lost her in a crowd, he set about posting a sketch of her on NYgirlsofmydreams.com, urging NYC residents to help him find her. Remarkably, two days later he did, and the couple proceeded to date. Unfortunately, the pair parted ways in late July. Moberg, who has turned away movie offers but written a book about the experience, optimistically wrote, "The whole experience has been an incredible testament to the universal nature of love. As lame and idealistic as it sounds, the world could use more stories like ours." ▲

## SIGHT SEEING

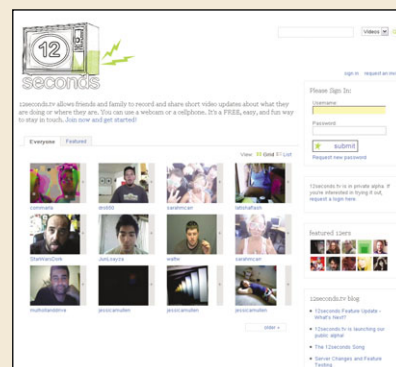
### Become A Filmanthropist At SnagFilms

"At SnagFilms.com, you can watch full-length documentary films for free, but we also make it easy for you to take our films with you and put them anywhere on the Web." If you're a freak for flicks, those words alone should have you typing snagfilms.com into your browser quicker than 30fps. With 250-plus full-length documentaries viewable at the site, as well as on your own site, blog, Facebook, MySpace, etc., the genius of Morgan Spurlock's "Super Size Me," Ondi Timoner's riveting "Dig!", and Elliot Berlin and Joe Fab's endearing "Paper Clips" are a Play button away. The only, er, snag? You supply the popcorn and Junior Mints. ▲



### If You Think Twitter Is Lame ...

... steer clear of 12seconds.tv, a still-in-alpha video-microblogging venture that documents the goings-on of users in 12-second video bursts uploaded from Web cams or mobile phones. Reportedly, users splashed the site with about 7,000 vids in the days after going live in July. For now, usage is invite-only and restricted to those 13 years and older, although you can register an email addy to get your name in the hopper. Already, there are tie-ins to Twitter, Facebook, and MySpace on the home page, and 12seconds.tv reports group and privacy features are in the works. But why just 12 seconds? Because <cough> "anything longer is boring." ▲



## Kroll OnTrack Offers Free File Recovery Trial

Free things are good. Kroll OnTrack seems to think so, too. The maker of data-recovery software recently added to its lineup a free trial of OnTrack EasyRecovery, which comes in Pro (400 file signatures supported) and DataRecovery (any OS and media type) flavors to let users recover one file via Windows and DOS options. Unfortunately, if your recovery needs are more serious, you'll need to fork over for a full copy. Though the company says the trial is intended for use on hard drives not exhibiting malfunctions, you can send Kroll OnTrack problem drives for assessment. Get the trial at [ontrackdatarecovery.com/data-recovery-downloads](http://ontrackdatarecovery.com/data-recovery-downloads). ▲



San Francisco Mayor Gavin Newsome

## San Fran Mayor Comes To The Rescue

Although Terry Childs, a five-year veteran of San Francisco's Technology Department, reportedly was "good at what he did," he'd become "a bit maniacal" prior to taking control of the city's network in mid-July, locking officials out of 60% of stored data. San Francisco Mayor Gavin Newsome ended the madness about 10 days later after a secret meeting with Childs in jail, where Childs remained at press time on \$5 million bail facing felony charges. Childs' defense attorney Erin Crane, meanwhile, stated Childs' fellow employees "had in the past maliciously damaged the system" and "hindered his ability to maintain it" while showing "complete indifference to maintaining it themselves." ▲

## You Can't Judge An OS By Its Name

Tricking 100 or so unsuspecting Windows XP users into believing they'd been using "the next Microsoft OS" dubbed Mojave instead of good ol' Vista wasn't exactly the stuff of Coke vs. Pepsi blindfold tests. Still, Microsoft's trickery-laden marketing campaign from newly hired agency Bradley and Montgomery to bolster Vista's popularity does have its entertaining moments, as witnessed at Mojave-experiment.com. Watching a guy describe Vista as "sexy, subtle, and promising" will bust a gut, after all. Perhaps better is the promise that "The experiment will continue. Stay tuned." Oh, we will. ▲

The "Mojave Experiment"

Welcome to the "Mojave Experiment." What do people think of Windows Vista® when they don't know it's Windows Vista? We disguised Windows Vista as codename "Mojave," the "next Microsoft OS," so regular people who've never used Windows Vista could see what it can do – and decide for themselves. Now **decide for yourself**.

Facts about Windows Vista. [Click for more.](#)

See Windows Vista.

Windows Vista

The Experiment will continue. Stay tuned.

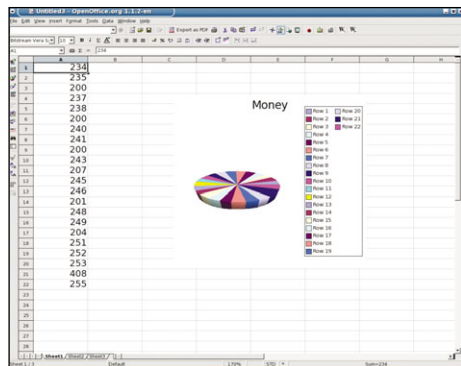
©2008 Microsoft Corporation. All rights reserved. Terms of Use | Privacy Statement  
This site hosted for Microsoft by Bradley and Montgomery



## SOFTWARE SHORTS

## SourceForge “Opens” Up Its Awards

With its 2008 Community Choice Awards held in late July, SourceForge.net for the first time honored open-source projects not hosted at SourceForge.net as in past years. This year's big winner was OpenOffice.org, named Best Project, Best Project For The



Enterprise, and Best Project For Educators. phpMyAdmin, meanwhile, was named Most Likely To Be The Next \$1B Acquisition, while XBMC and VLC took Best Project awards for gamers and multimedia, respectively. At the Best of Open Source Software awards in late August, meanwhile, 60 winners were named in eight categories, with Snort, Splunk, Sugar-CRM, Alfresco, and Asterik all named winners. ▲

## Linux Mobile OS Predicted For Greatness

According to a recent report from ABI Research, mobile Linux OSes will outsell Windows Mobile and other competitors by 2013, with Intel's Moblin, the Nokia-backed Maemo, and LiMo set to gain the lion's share of the MID market. Although just over 305,000 (\$29 million) MIDs are predicted to ship this year, Forward Concepts predicts 39.6 million (\$2.6 billion) units will ship in 2012. ABI forecasts 50 million units the following year. ABI's Stuart Carlaw stated, "Maemo is already in this space thanks to the patronage of Nokia; Moblin will benefit from tight integration with Atom and Intel's drive; and LiMo is actively being positioned for this market." ▲



## Edison Aims To Lessen PC-Related CO2 Emissions

Want to help reduce global computer-generated CO2 emissions? Download Verdiem's free Edison utility ([www.verdiem.com/edison](http://www.verdiem.com/edison)). The 28MB Microsoft-endorsed tool works with Windows XP and Vista rigs, providing a dead-easy interface to set scheduling and power-saving parameters. Verdiem is aiming for 1



million downloads (1% of global PCs) in a year's time to help meet the Climate Savers Computing Initiative's goal to reduce computer-generated CO2 emissions by 54 million tons by 2010. "If

just 1% of all PCs used Edison we could potentially reduce environmental impacts by 7 billion pounds of CO2, which is equal to taking more than a half million cars off the road," stated Verdiem President Kevin Klustner. ▲

BIOS Upgrades Available Online Compiled by Steve Smith

Before you send another motherboard to the landfill, consider upgrading the BIOS and giving your PC a new lease on life. Here are a few recently released upgrades. Readers can check out [www.cpumag.com/cpuoct08/bios](http://www.cpumag.com/cpuoct08/bios) to see our entire upgrade list.

Manufacturer	Model	Version	Date	Description	URL
AASRock	P45TurboTwins2000	1.20	6/27/2008	Updates CPU code	<a href="http://download.asrock.com/bios/775/P45TurboTwins2000(1.20).zip">http://download.asrock.com/bios/775/P45TurboTwins2000(1.20).zip</a>
Asus	Eee PC 900/Linux	0802	7/9/2008	Fixes SDHC card file-copy problem	<a href="http://support.asus.com/download/download.aspx?SLanguage=en-us">http://support.asus.com/download/download.aspx?SLanguage=en-us</a>
Asus	Striker II NSE	0406	7/7/2008	Now CPU multiplier is set to default value after CPR	<a href="http://support.asus.com/download/download.aspx?SLanguage=en-us">http://support.asus.com/download/download.aspx?SLanguage=en-us</a>
Biostar	GF8100 M2+ SE 6.x	N78BM618	6/18/2008	Supports AM2+ CPU	<a href="http://download.biostar.com.tw/upload/Bios/N78BM618.BSS">http://download.biostar.com.tw/upload/Bios/N78BM618.BSS</a>



## Job Of The Month | Blogging For Dollars

Not all bloggers are hobbyists and unpaid Matt Drudge wannabes. A new breed of Internet companies is building networks of niche content blogs with paid writers.

One of the favorite gathering places and a major jobs board for this emerging profession is ProBlogger.com.

One advertiser,

HEF Media, wants to fill its new women's network with posts on everything from gadgets to health issues, crafts to finance for women. Another common job lister, b5media, seeks a Linux expert to conduct interviews with developers. Tech network Blorge.com looks for writers with passion and attitude toward digital imaging and even Vista. Meanwhile, Today.com is all over the map, soliciting fans of sports, acting, religions, "nitelife," "and anything else you can think of," according to its ad.

Yes, "pro bloggers" do get paid but they shouldn't expect to quit their day jobs any time soon. Many "for-pay" sites offer some kind of revenue share on ads that run on your blog pages, while others pay nominal per-post fees. Today.com, for instance, "guarantees" \$1 per 100+ word post and \$2 per thousand page impressions. HEF Media promises 70% of revenue from ads for the first year. Tell your friends and family to click often. ▲

[jobs.problogger.net](http://jobs.problogger.net)



## Raw Numbers

**8,002,530**

Number of Firefox 3 downloads within 24 hours of its release (Mozilla)

[blog.mozilla.com/blog/2008/07/02/were-official/](http://blog.mozilla.com/blog/2008/07/02/were-official/)

**93,248,368**

YouTube viewings of "Evolution of Dance" (YouTube as of 7/22/08)

[www.youtube.com/browse?s=mp&t=a&c=0&l=&b=0](http://www.youtube.com/browse?s=mp&t=a&c=0&l=&b=0)

**\$46,294,800**

Media value of online advertising for Countrywide Home Loans in April 2008 (TNS Media Intelligence)

[www.clickz.com/showPage.html?page=3630105](http://www.clickz.com/showPage.html?page=3630105)

**4.1 million**

Number of 2- to 11-year-olds visiting YouTube each month

[news.cnet.com/8301-10784\\_3-9963543-7.html](http://news.cnet.com/8301-10784_3-9963543-7.html)

**6.9 million**

Number of searches for iPhone-related information in June 2008 (comScore)

[www.comscore.com/press/release.asp?press=2294](http://www.comscore.com/press/release.asp?press=2294)

## Meet The New Web ... Same As The Old Web?

Despite slower speeds and a much smaller screen, the mobile Web boasts similar metrics to its big desktop cousin, according to new research from Quattro Wireless. The company that powers mobile versions of CBS News, NFL.com, and Univision found remarkably similar usage metrics between the high profile "wired Web" and mobile Web sites. Typical users spent 4.2 minutes per visit to a brand's wired Web site and 4.7 minutes at the mobile version, viewing 4.9 pages from the desktop and 3.91 pages on handsets. The one metric that was different between Web and mobile involved advertising. While Web ads attract clicks .2% of the time, mobile Web ads enjoy relatively massive typical "clickthrough rates" of 2.33%.

[tinyurl.com/65krc4](http://tinyurl.com/65krc4)

## India Leads The Asia-Pacific Internet Boom

	Unique Visitors/Apr. '07	Unique Visitors/Apr. '08	% Change
Asia-Pacific	280,418,000	318,623,000	14%
China	90,274,000	102,848,000	14%
Japan	53,685,000	55,260,000	3%
India	22,395,000	28,375,000	27%
South Korea	26,323,000	25,652,000	-3%
Australia	10,048,000	10,904,000	9%
Taiwan	9,245,000	10,388,000	12%
Malaysia	7,462,000	8,327,000	12%
Hong Kong	3,525,000	3,718,000	5%
Singapore	2,216,000	2,298,000	4%
New Zealand	1,937,000	2,161,000	12%

Source: comScore

[www.comscore.com/press/release.asp?press=2295](http://www.comscore.com/press/release.asp?press=2295)

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Legendary Reliability®



# The Saint

by Alex St. John

## Battery Life

This month, I thought it would be interesting to explore how the limits of battery storage capacity are changing computing. It used to be the case that one could assume that any powerful computer at a consumer's disposal was going to be plugged into a wall to get its power. In an environment where access to power is not a significant design limitation, chip designers created monolithic, general-purpose CPUs that were most "efficient" when all of the CPU's transistors could be simultaneously engaged in solving a given problem. Idle transistors on a chip meant precious computing potential was being wasted and was a sign of poor chip design. This mentality had a significant impact on the architecture of the PC; the best way to increase performance was to increase clock rates, use more power for cooling, and try to keep every transistor flooded with processing work all the time.

Today, however, computing needs have changed dramatically. With the exception of gaming, there are virtually no mass-market, computation-intensive applications that demand more processing power. Mobility of computing power has become more valuable than better performance. Today, almost 70% of new PCs sold are laptops. This shift in the market has had an interesting impact on PC architecture. The highly generalized, pipelined chip architectures that served the desktop market well are power hogs in the era of battery-powered computing. My Alienware laptop has a battery pack that weighs as much as a baby manatee and lasts about 45 minutes when the computer is unplugged. I carry two spare batteries in my briefcase when I travel. While our ability to shrink silicon and add transistors to chips has continued to follow Moore's Law, battery power density limits have virtually maxed out and only improve at an incremental pace. Since battery power density limits often correspond to chemical density, batteries with greater storage capacities are often heavier batteries which also limit mobility. The only solution to this conundrum is, of course, to make computers that are somehow more powerful yet require less power.

Interestingly, this is a problem that has been solved very efficiently in computing before.

Our bodies and brains are electrical devices requiring roughly 575 watts of power to survive, in other words less power than a modern desktop computer. How we accomplish this is, of course, an amazingly complex biological feat, but there is one aspect of this process that foreshadows future silicon computer architectures. There's an urban legend out there that we only use 10% of our brains. This "fact" is often used to justify pseudoscience personal development programs designed to

"release" your full intelligence or computing potential. In truth, the partial use of the brain makes enormous sense from a power efficiency point of view. Instead of being a giant general-purpose monolithic computing circuit like early-generation CPUs, the brain is a highly parallel architecture composed of many highly specialized computing circuits. Each circuit is designed to solve a very narrow range of computing problems. Obviously, the brain wouldn't work very well if it was 100% active thinking about everything it could process 100% of the time. The brain conserves power by being highly parallelized and highly modular. There's also a lot of spare brain tissue around as a backup in case you get kicked in the head by a mule and there is no Geek Squad on hand to replace your broken brain with a new one.

Not surprisingly, modern chip architectures are, as I have previously described, increasingly parallel. Why power two or four processing cores simultaneously if you're just using your laptop for email? Also, new chip architectures are increasingly specialized and modular, such that specific circuits are available for highly computation-intensive tasks such as video decoding, 3D rendering, interrupt management, and so on, but can go unpowered when they are not needed for the immediate computing task at hand. In this respect, adding more specialized computing circuits to a computer is a more efficient way of increasing battery life than is adding more battery. This idea is the computing equivalent of modern car engine designs that turn off pistons to conserve fuel when the car is not accelerating. ▲



*Alex St. John was one of the founding creators of Microsoft's DirectX technology. He is the subject of the book "Renegades Of The Empire" about the creation of DirectX and Chromeffects, an early effort by Microsoft to create a multimedia browser. Today Alex is President and CEO of WildTangent Inc., a technology company devoted to delivering CD-ROM quality entertainment content over the Web.*

Send your feedback to  
[thesaint@cpumag.com](mailto:thesaint@cpumag.com)



# DREAM HARDWARE

These Gizmos Don't Sing It, They Bring It



Pushing the envelope. It takes you places you've never been. It also creates a vacuum, drawing midlevel hardware into previously high-end territory. Could there be anything dreamier?

by Marty Sems

## Hasselblad H3DII-50

Striking naked across the boundary between film and digital imaging quality is this medium-format DSLR from Hasselblad ([www.hasselbladusa.com](http://www.hasselbladusa.com)). Using a giant 36 x 48mm CCD sensor from Kodak, the H3DII-50 snaps 50MP images until you run out of storage. (An even larger sensor, the 645, should be unveiled before you read this.) We could throw specs at you, but when a DSLR costs \$39,995 and has an imaging sensor with its own cooling system, you can assume it's a fairly serious piece of kit. Options include a GPS attachment, plus Hasselblad's innovative HTS 1.5 system that brings lens tilt and shift tricks to medium-format cameras.

## Klipsch Palladium P-38F

Trickle-down theory works, at least as applied to tech gizmos. We love it when an innovator follows up an impressive high-end achievement with a lower-cost version. Take Klipsch ([www.klipsch.com](http://www.klipsch.com)) with this new floorstanding speaker (\$12,000 per pair), a direct descendant of the \$20,000 per pair Palladium P-39F. The P-38F's resemblance to its big brother goes deeper than its beautiful, eco-friendly Linia veneer. It uses the same Tractrix horn-loaded midrange and supertweeter as the P-39F, and it underpins them with a trio of 8-inch hybrid woofers. Klipsch also sells a triple 12-inch subwoofer unit and peripheral speakers in the Palladium series, so you can outfit your home theater as easily as your audio sanctum.



## Volkswagen One-Litre Car

Forgive us for taking liberties with the parameters of "dream hardware" for a sec—when a car manages 264mpg on diesel without using even hybrid technology, it gets noticed ([www.volkswagen.com](http://www.volkswagen.com)). This concept car has been in mothballs since 2002, but with the oil crunch and the resurgent green movement, some think that its hour has come 'round at last. With a CFP (carbon fiber-reinforced plastics) monocoque and a reliance on magnesium and titanium parts, the whole two-seat car only weighs about 639 pounds. The "One-Litre" part doesn't refer to the car's 0.3L single-cylinder, but rather to the amount of fuel it takes to drive roughly 100km. Three video cameras take the place of mirrors. A report in the UK's *Car* ([www.carmagazine.co.uk](http://www.carmagazine.co.uk)) predicted a limited production run of modified One-Litres in a couple of years, but VW of America's press and PR director Steve Keyes called the story incorrect. "There are no plans to introduce the car in 2010," he said—which, you'll notice, doesn't exactly say "never ever." ▲





# GeForce Boost vs. Hybrid Graphics

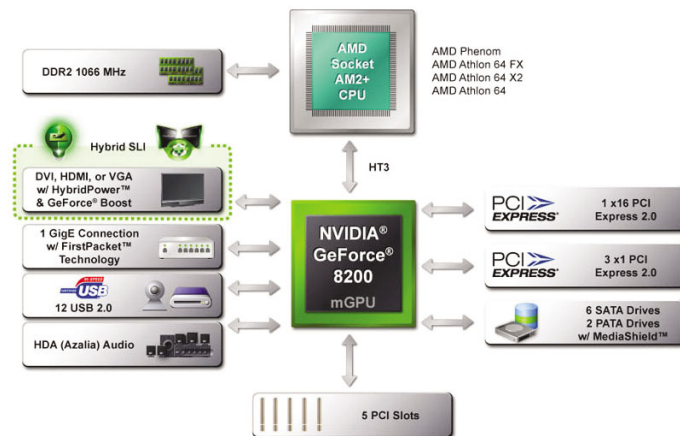
## Integrated Graphics Get Scrappy

Every time a new integrated graphics chipset hits the scene, everyone marvels at how far onboard GPUs have come. Then AMD and Nvidia launch brand-new GPU architectures (usually right around the same time) that put hundreds of frames per second between the quickest add-in boards and whatever integrated core happens to be receiving the rave reviews. As long as manufacturing, thermals, and, ultimately, power determine the number of transistors that go into a piece of core logic, there will always be an unbridgeable chasm between onboard and discrete graphics.

But that isn't stopping Nvidia and AMD from stuffing 3D muscle into their newest chipsets. Earlier this year, AMD set the stage by unveiling its 780G platform. The integrated Radeon HD 3200 core came with 40 stream processors, one texture unit, and one render back-end in a package running at 500MHz. Coincidentally, those specs weren't far off from AMD's entry-level Radeon HD 3450 add-in card, which also has 40 stream processors at its disposal.

Since the 780G debuted, Nvidia has thrown its own hat into the ring. The company's nForce 780a SLI chipset not only incorporates a reasonably competent GPU but also introduces a feature called HybridPower, which works in conjunction with more capable discrete GPUs to cut power draw when serious rendering muscle isn't needed.

Of course, there are big differences between AMD's 780G and Nvidia's 780a SLI. Although the two are competing to team up with a Socket AM2+ Phenom processor, 780G-based boards sell for less than \$100 to mainstream buyers interested in the onboard core as a primary adapter.



Block diagram of Nvidia's GeForce 8300 single-chip platform.

Meanwhile, 780a SLI motherboards hover around the \$200 mark, attracting energy-conscious enthusiasts with a beefy discrete GPU looking to save power through Nvidia's HybridPower technology.

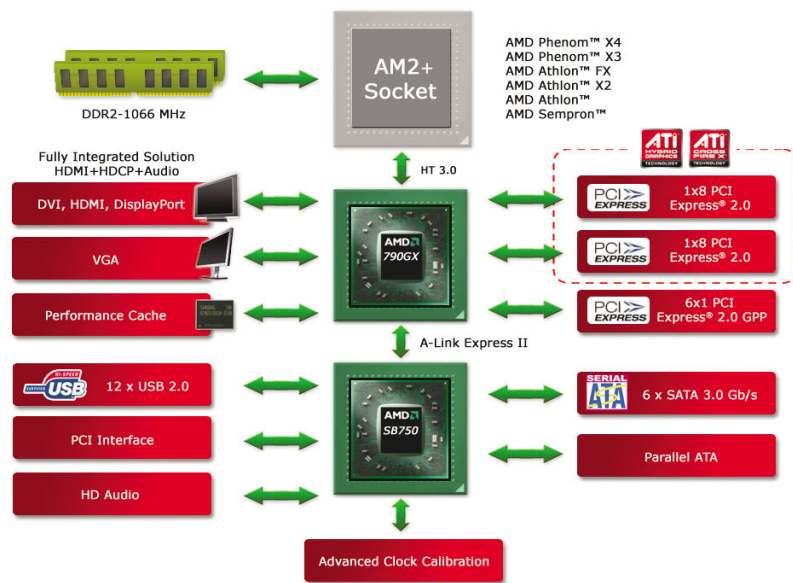
The line between AMD's entry-level efforts and Nvidia's high-end aspirations is blurring this month, though. Nvidia launches its attack on AMD with its GeForce 8300, a single-chip product able to bring down motherboard prices to 780G territory while still supporting features found in the 780a SLI. AMD returns fire with its 790GX chipset, increasing graphics performance, adding a new south-bridge, and targeting a higher-end group of buyers more likely to use its multi-GPU CrossFireX technology.

### An Integrated Arms Race: GeForce 8300

Nvidia incorporated several good ideas into its 780a SLI platform, but the chipset remains in integrated graphics limbo. As an enthusiast, do you pay \$200 for a

motherboard with integrated graphics, hoping to save a couple of bucks per month on the power bill by throttling down your discrete video cards when they're idle? Forking over a premium upfront to save over the long term seems like a tough sell, and we'd probably pass on the offer.

The GeForce 8300 sweeps that conundrum under the rug by offering similar functionality on boards priced closer to \$100. The platform's graphics component borrows from Nvidia's GeForce 8400, proffering DirectX 10 and OpenGL 2.0 support. The 500MHz core delivers moderate performance, thanks to 16 stream processors running at 1.5GHz. Perhaps more impressive, though, is the chip's repertoire of hardware-based video decoding features, which reportedly offload the entire job of Blu-ray content playback. Nvidia also matches AMD's support for dual independent display outputs, with VGA, DVI, and HDMI connections. Just bear in mind that only one digital output can be used at a time.



Block diagram of AMD's 790GX with flexible PCI-E 2.0 connectivity.

The GeForce 8300 is a single-chip design, so one piece of silicon contains not only the integrated graphics core but also PCI-Express, storage controller, Gigabit Ethernet, audio, and USB 2.0—impressive, given Nvidia's reliance on 80nm manufacturing.

Thanks to the 19 lanes of PCI-E 2.0 connectivity, the door is open to a couple of interesting capabilities first seen on the nForce 780a SLI. The first is GeForce Boost, a feature that harnesses the onboard GPU's rendering power and a similarly low-end discrete card, such as the GeForce 8500 GT, to deliver SLI-like functionality on the cheap (and only under Windows Vista). Of course, very few people would pay \$200 for a 780a SLI motherboard and then spend \$60 on a budget video card just to enable GeForce Boost. However, the scenario is a bit more practical with a \$100 GeForce 8300-based board.

Power users should be even more excited about HybridPower support, though. Plug a high-powered discrete GeForce card (such as the 9800 GTX or GTX 280) into an 8300-based motherboard, and the platform will switch off your add-in card when it isn't needed, instead using the built-in graphics core and minimizing power consumption. Fire up a game, and control switches back to discrete board. Although

the feature was attractive when it launched alongside nForce 780a SLI, it's even more accessible now through less-expensive GeForce 8300-based systems.

Because 16 lanes of the GeForce 8300's PCI-E 2.0 connectivity are inflexible, motherboard manufacturers can't divide them into a pair of x8 links for true SLI support. So, with one x16 slot dedicated to a single card, three PCI-E 2.0 lanes remain for attaching peripherals.

### AMD's Answer: 790GX

As Nvidia steps down from its enthusiast-oriented 780a SLI to the GeForce 8300, AMD is going the other direction. The company's 780G hit its target market squarely, giving the mainstream a real reason to buy affordable motherboards and Phenom processors. But with the launch of Nvidia's GeForce 8300, sporting its GeForce Boost and HybridPower features, AMD needed something even more compelling to shore up its position. The new 790GX chipset goes a long way to fill the gap in between 780G and 790FX (the latter being AMD's enthusiast offering).

In some ways, 790GX is even better. You see, AMD has a hard time positioning even the fastest quad-core Phenoms as true enthusiast processors because Intel's

Core 2 Quads are better performers and overclockers. On a more platform-related note, the SB700 southbridge complementing the current crop of 790FX boards has endured the same criticisms leveled at AMD's last-generation SB600. Mainly, its storage performance stinks. The 790GX strives to solve both issues using an updated SB750 southbridge.

If your first reaction was like ours, you probably asked, "What does the southbridge have to do with overclocking?" Indeed, the concept is bizarre. But the best explanation we've heard thus far comes from an AMD rep who, when asked if the company planned to divulge details of the processor/southbridge interaction, explains, "The processor has a series of tumblers that weren't being accessed before. The SB750 unlocks those tumblers to facilitate new overclocking heights." AMD calls its low-level tweaking technology Advanced Clock Calibration, and it works best with unlocked Black Edition processors (although anyone with a Phenom can take advantage of the feature for an extra bit of performance). However the technology functions, AMD says Advanced Clock Calibration can attempt to push Phenom CPUs further than ever using more aggressive settings and lower voltages.

The SB750 also features better storage functionality. It still offers six 3Gbps SATA connectors and adds RAID 5 support to RAID 0, 1, and 10 support that existed on the SB700. HD Audio, 12 USB 2.0 ports, and a standard PCI interface round out the SB750's spec sheet.

There are four PCI-E lanes that connect AMD's SB750 to its brand-new 790GX northbridge, the chipset's centerpiece. Because the 790GX is manufactured at 55nm (the same process used on 780G), it's hardly a surprise that the RV610 graphics core drives this platform, as well. But whereas the entry-level 780G runs at 500MHz, 790GX hums along at 700MHz. Performance is further enhanced through the use of side-port memory. The 780G also supports this motherboard-based cache technology, but there aren't many vendors willing to absorb the cost of a 64MB or 128MB memory chip on a \$70 board. Because



790GX platforms are quite a bit pricier, it makes sense to use a little local DDR3 (which runs at speeds of up to 1,333MHz) to accelerate graphics performance by 10 to 15%.

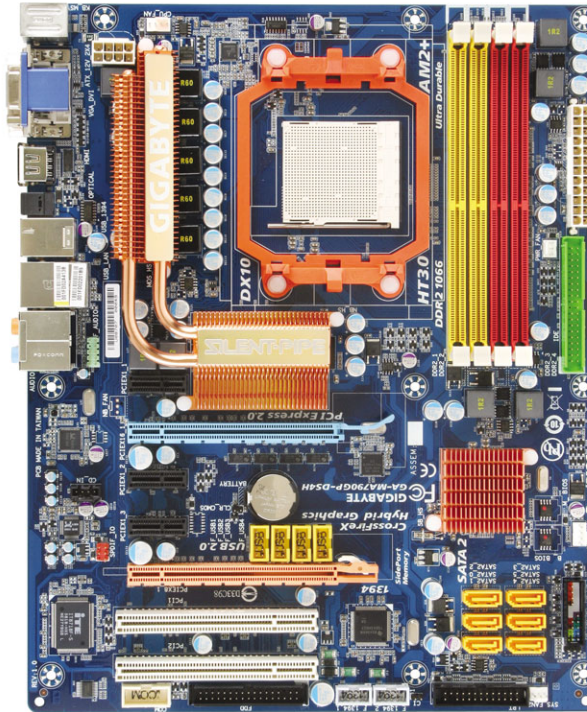
Gamers who'd like a little more power than the 40-shader integrated core can muster can step up to Hybrid CrossFireX, which teams the built-in GPU with an add-in card of comparable pedigree, such as a Radeon HD 3450 or 3470. Although the frame rate boost isn't earth-shattering and you'll still likely need to turn down detail settings as low as they'll go in the latest titles, at least games are playable. When even more rendering horsepower is needed, tap into the northbridge's 16 lanes of PCI-E 2.0 connectivity. AMD's 780G offered an x16 graphics slot, but the 790GX's link can be split into two x8 links, yielding CrossFireX support through a pair of discrete cards.

Sadly, 790GX can't mimic Nvidia's HybridPower feature by cutting back the energy draw of add-in graphics cards during idle periods. The chipset is nevertheless a big step forward for AMD. It reaffirms AMD's place in the integrated graphics market, patches up weaknesses (storage), and adds a much-needed enthusiast twist (Advanced Clock Calibration) to the Phenom family.

### Gigabyte MA790GP-DS4H

Carefully situated in the upper band of Gigabyte's Socket AM2+ lineup, the MA790GP-DS4H qualifies as a performance mainstream board: It's better than a midrange board but not exactly enthusiast-class.

Gigabyte took advantage of the 790GX launch to address an issue that haunted 780G. A number of mainstream boards were known to fail with 125W and 140W processors installed due to over-worked power circuitry. Because one of the MA790GP-DS4H's main selling points is support for Advanced Clock Calibration through the SB750 southbridge, it clearly needed to work with the latest Black Edition Phenom X4s. Thanks to a 4+1-phase design, you won't have a problem with any of the quad-core chips currently available.



### MA790GP-DS4H

\$150

Gigabyte

[www.giga-byte.us](http://www.giga-byte.us)

### Specs: 790GX

northbridge; SB750

southbridge; Max

memory: 16GB (DDR2-

1066) Video outputs:

DVI, HDMI, VGA; Slots:

2 PCI-E x16, 3 PCI-E

x1, 2 PCI; 128MB

DDR3 side-port

memory

The board enables plenty of display options. The integrated core is attached to back-panel VGA, DVI, and HDMI ports. Gigabyte tacks on 128MB of DDR3 side-port memory to augment graphics performance beyond the 700MHz RV610 core. Other graphics options are Hybrid CrossFireX route (by adding a Radeon HD 3450 or 3470 card to the first PCI-E x16 slot, which runs at x16 signaling rates when only one board is attached) and true CrossFireX. We wouldn't expect anyone to drop a pair of Radeon HD 4870s into the board's PCI-E slots, but a couple of Radeon HD 4850s at less than \$200 each makes sense in this performance platform. All of the MA790GP-DS4H's cooling is passive—likely a testament to AMD's 55nm process and resultant thermal profile.

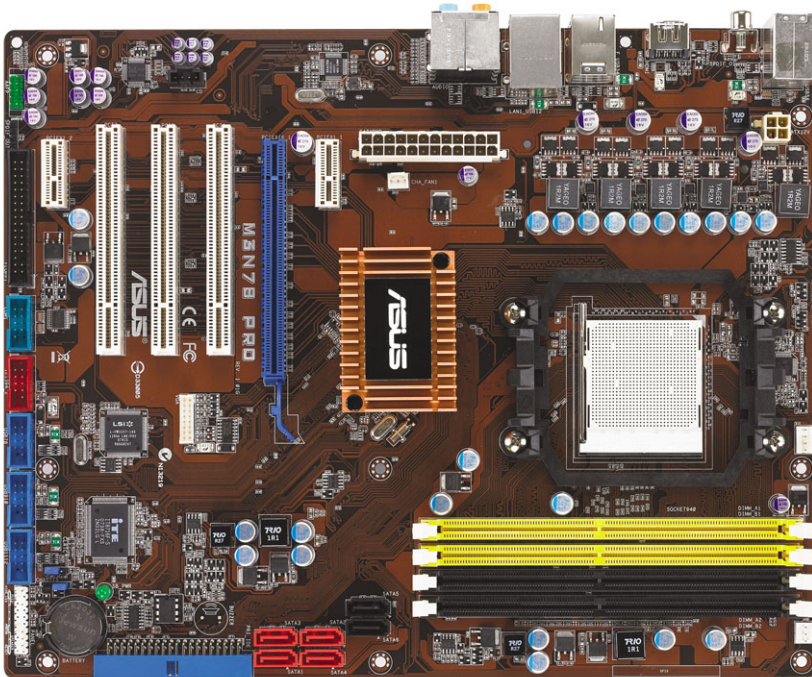
The board's level of integration helps contribute to its value. All six of the SB750's SATA ports are enabled internally (no eSATA) with RAID 0, 1, 10, and 5 support through AMD's bundled RAIDXpert software. Realtek's ALC889A codec delivers 7.1-channel analog output, optical audio output, and the Dolby Home Theater software package found on many of Gigabyte's other motherboards. A Gigabit Ethernet controller, FireWire enabled

through a Texas Instruments chip, and the DualBIOS feature rounds out the MA790GP-DS4H's list of extras.

### Asus M3N78 Pro

Technically, the GeForce 8300 chipset is in a class just beneath AMD's 790GX. How can we tell? Gigabyte's MA790GP-DS4H sells for about \$150, while the Asus M3N78 PRO goes for right around \$100. The platform is no entry-level slacker, though. In fact, Asus very confidently claims support for the fastest 140W processors through its own 4+1 phase power design. At the same time, given a somewhat Spartan motherboard layout with minimal use of fancy copper cooling and heatpipes, the M3N78 Pro is still clearly a mainstream piece of hardware.

Perhaps the most notable difference between this board and Gigabyte's 790GX offering is its single PCI-E x16 slot. Whereas the 790GX's x16 slot can be divided into two x8 links, the GeForce 8300's link is hardwired. To get dual-card SLI support, you'll need to step up to the 750a SLI or 780a SLI platforms. The board's GeForce 8300 chipset does support Hybrid SLI, however, paving the

**M3N78 PRO**

\$105

ASUS

[www.asus.com](http://www.asus.com)

**Specs:** GeForce 8300 northbridge (no south-bridge); DVI, HDMI, VGA outputs; Slots: 1 PCI-E x16, 2 x PCI Express x1, 3 x PCI; DDR2-1066 memory support; integrated Gigabit Ethernet.

way for nearly as many display options as the MA790GP-DS4H.

You can stick with the integrated GeForce 8300 core and have enough power for moderate gaming. But even casual gamers will probably want more performance. GeForce Boost, one component of the Windows Vista-only Hybrid SLI, lets you drop a GeForce 8400 GS or 8500 GT onto the M3N78 PRO for a cooperative effort between the built-in and discrete engines. Finally, the second-gen PCI-E x16 link can drive a higher-end card. Just bear in mind that if you're interested in taking advantage of Hybrid-Power, you'll need a compatible add-in card, as well.

Flip the M3N78 Pro around, and you'll find a surprisingly sparse rear I/O cluster. Although it includes six USB 2.0 ports, Gigabit Ethernet, FireWire, and lots of audio connectivity, Asus only integrates an HDMI output on the back panel. The GeForce 8300 integrated core boasts two integrated display controllers though, so Asus also bundles a VGA output bracket and HDMI-to-DVI adapter, as well. Like AMD's 790GX, the GeForce 8300 can drive dual displays (one digital, one analog) simultaneously. It's also worth noting that the DVI connection is of the

single-link sort, limiting output resolution to 1,920 x 1,200.

Most of the M3N78 Pro's other features are mostly a product of the GeForce 8300 chipset. Six SATA 3Gbps ports support RAID 0, 1, 10, and 5 configurations. Realtek's 8211GL complements Nvidia's own Gigabit MAC, and 12 USB 2.0 ports are spread between the board's I/O panel and onboard headers. Asus also adds an LSI FireWire controller and Realtek 8-channel HD Audio codec to the package.

### AMD 790GX vs. Nvidia GeForce 8300: An IGP Throwdown

At least on paper, the battle between AMD's latest integrated platform and Nvidia's less-powerful built-in graphics core should be very one-sided. The 780G was already a force, operating at 500MHz without side-port memory. Now that the 790GX cruises along at 700MHz and has as much as 128MB of DDR3 running point for it, performance should be significantly higher.

Indeed, with a Radeon HD 3300 core, AMD's offering serves up the best gaming performance in synthetics like 3DMark Vantage, FPS games such as Half Life 2: Episode 2, and RTS titles such as World in Conflict. That's not to say the GeForce

8300 is a slouch. In Vantage, it only slightly trails the AMD 780G platform with side-port memory. And it does respectably in the other two gaming apps used for testing, delivering frame rates we'd consider borderline playable at 1,024 x 768 with low quality settings selected.

The performance situation changes significantly when you add a discrete card to each platform. We dropped a Radeon HD 3470 into Gigabyte's MA790GP-DS4H at the request of AMD. Purportedly, that's the most balanced complement to the chipset's core. Total cost for the motherboard and graphics combination is in the \$200 range. Next, we added a GeForce 8500 GT to our Asus M3N78 PRO, bringing the total for that pair up to roughly \$175. The 8500 GT is the fastest card with support for GeForce Boost.

Vantage shows the two integrated chipsets neck-and-neck, Nvidia with a slight edge. Half-Life 2 is incredibly smooth on the 790GX. In fact, you could conceivably start turning on more eye candy without dipping below playable frame rates. But the scales tip the other way with World in Conflict. The GeForce Boost combo hits 71fps frames per second (up from 36fps with only integrated graphics), while the 790GX + Radeon HD 3470 scores 65. Of



course, the 790GX can step up another notch with two discrete cards in Cross-FireX, something the GeForce 8300 board can't match.

Beyond gaming performance, the 790GX and GeForce 8300 are also well-equipped for video playback. Using a quad-core Phenom X4 9850 Black Edition running at 2.5GHz in each reference board, we measured CPU utilization over 60 seconds of Blu-ray playback. The 790GX did a slightly better job offloading the task, leaving just 2% of the job to host processing. Nvidia's GeForce 8300 also performed well, cutting the load of watching Blu-ray media to 2.5%. We also asked each chipset to convert 48 seconds of HDTV programming to MPEG-2, and the 790GX completed the job in 5:20. The GeForce 8300 took eight seconds longer to finish the same task.

Finally, we measured the idle and load power consumption of both platforms. Idling, the 790GX eats up about 80W, making it the more energy-efficient of the two. In comparison, the GeForce 8300 uses about 90W. With a full load of Cinebench and 3DMark Vantage running, the tables turn in Nvidia's favor. The 790GX uses 211W, while the GeForce 8300 hovers around 188W.

Even more interesting than those numbers, however, is how Windows Vista handles power consumption on both integrated chipsets. Choose "High Performance," and the installed Phenom runs at full speed all of the time. Step down to "Balanced" mode, and AMD's Cool'n'Quiet technology takes control, facilitating clock throttling and support for C1e. Drop to "Power Saving" in Vista, and the consumption numbers fall a full 100W under load as frequencies remain aggressively throttled down. On either of these two chipsets, pick your power settings carefully, as they affect consumption and performance very significantly.

### Picking The Right Integrated Chipset

In just one year, the integrated chipset market has matured far beyond basic core logic with a graphics core tacked on. Today's platforms feature 3D capabilities ripped straight from AMD's and Nvidia's

## GeForce 8300 Vs. 790GX: A Head-To-Head Comparison

	Nvidia GeForce 8300 Integrated [Hybrid**]	AMD 790GX Integrated [Hybrid***]
<b>3DMark Vantage</b>	1900 [4874]	2509 [4716]
<b>Half Life 2: Episode 2</b>	26.6 [45.2]	44.1 [73.7]
<b>World in Conflict</b>	34 [69]	49 [63]
<b>Power Consumption (Integrated)</b>		
<b>Load</b>	188W	211W
<b>Idle</b>	90W	80W
<b>CPU Utilization (quad-core, DVD playback)</b>		
<b>H.264 Conversion (minutes:seconds)</b>	5:28	5:20
<b>Platform</b>		
<b>Price</b>	\$105	\$150
<b>CPUs</b>	●●●	●●●●
*Games tested at resolution.		
**GeForce 8500 GT added.		
***Radeon HD 3470 added.		

respective add-in card lineups, including hardware acceleration of Blu-ray playback and twin display outputs. (Please give us dual *digital* outputs in the next generation chipsets, though.) They incorporate advanced storage controllers with RAID 0, 1, 10, and 5 support. In AMD's 790GX, you get Advanced Clock Calibration for enhanced overclocking. In Nvidia's 8300, HybridPower is the real crown jewel. Regardless, today's integrated chipsets are far from entry-level.

If we have to pick a favorite, the 790GX gets our nod. Its integrated core hasn't changed any since the 780G's debut, but a 200MHz clock speed bump and an almost

universal adoption of side-port memory by motherboard vendors yields a solid increase in graphics performance. Add a Radeon HD 3470 in Hybrid Cross-FireX and you'll see another modest frame rate increase.

Notably missing from the package is an energy-saving technology like Hybrid-Power, though—a big disadvantage when compared to Nvidia's offering. Nevertheless, our Gigabyte MA790GP-DS4H, in its default configuration, delivers a loaded spec sheet able to keep us excited about integrated graphics. And, with the addition of an inexpensive Radeon HD 3470, it's fast enough to enable resolutions above 800 x 600 without having to turn off all of the eye candy in today's games.

Nvidia's GeForce 8300 is an impressive contender, too. It might not be as adept at gaming, but toss a GeForce 8500 GT into its PCI-E slot and you're suddenly flying through the benchmarks (comparatively speaking). We don't really see anyone taking advantage of Hybrid Power using a GeForce 9-series or GTX 260: For that, an enthusiast would likely step up to the 780a SLI chipset. But as a play on all-around, solid integrated graphics performance on the cheap, the 8300 is impressive. ▲

by Paul Cross



Advanced Clock Calibration, enabled through AMD's OverDrive utility, helps unlock the overclocking potential of Phenom processors.



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# Antec Twelve Hundred

The Antec Twelve Hundred isn't named the Ultimate Gaming Case just for kicks. On the contrary, the polished black full-tower asserts itself with the cooling capabilities and expandability that gamers and enthusiasts often dream of.

The number of fans cooling the Twelve Hundred will blow you away (no pun intended). Most impressive is the 200mm fan occupying most of the case's top. Two 120mm fans reside in the back, and there are three more 120mm fans, complete with removable, washable filters, beneath the honeycombed grating on the front panel. There are brackets for additional 120mm fans in the middle of the case, as well as on the side panel. All but the optional fans have separate speed controls, letting you regulate the airflow in the case.

I used the Twelve Hundred to torture test Antec's Signature 850 PSU, and even with our system maxed out, it ran cool. Not surprisingly, the moment I sped up the fans, the Twelve Hundred transformed into a jet engine.

The Twelve Hundred's 3.5-inch internal drive bays are split into three removable cages and can house three HDDs each, or, with the included adapter, an FDD. There are seven expansion slots and a bottom-mounted PSU slot that can house, with minimal effort, even 9.5-inch PSUs. The Twelve Hundred can accommodate ATX (and smaller) motherboards and 10.5-inch



graphics cards. However, space between the GPU and the middle drive cage was so slim that you'll have to make the cable connections before re-inserting the cage.

Overall, the Antec Twelve Hundred was easy to work with and lived up to its expansion and cooling promises, proving to be a great case for gamers and enthusiast builders. ▲

by Kris Glaser

**Specs:** Bays: 3 5.25-inch external, 9 3.5-inch internal, 1 3.5-inch external. Fans: 1 200mm, 5 (+2 optional) 120mm. Front ports: 2 USB, 1 eSATA, Audio I/O

## Twelve Hundred

\$209.95

Antec

www.antec.com



# Antec Signature 850

Beneath its glossy black surface, the Antec Signature 850 PSU (model SG-850) is a powerhouse that promises high performance and reliability.

The SG-850 sports an 80mm fan with PWM (pulse width modulation), which controls the speed of the PSU's fan and makes it run quietly. Despite

during our stress tests. Our other testing specs included a 2.4GHz AMD Phenom 8750 triple-core processor; two 1TB HDDs and an additional (and dinky) 40GB HD; 2GB of DDR2; and a DVD drive.

We loaded up our system by simultaneously running three instances of Prime95 (one for each core), looping 3D Mark06 (rather than 3D Mark

Vantage, which will only loop three times), and playing a music CD—all continuously for five hours.

Although our well-ventilated Antec Twelve Hundred case helped, the Signature 850 didn't seem to have any trouble keeping up. Our test system wasn't as grueling as it could have been, but the Signature 850's performance reassured us that it would be ready for

future upgrades that would require heavier loads.

Antec's Signature 850 was a sturdy PSU that didn't let us down. ▲

by Kris Glaser

## Signature 850

\$299

Antec

www.antec.com



its high wattage, the Signature 850 is 80 Plus-certified, making this PSU energy-efficient. Its cabling is also partially modular, with mesh sleeving on all the cables.

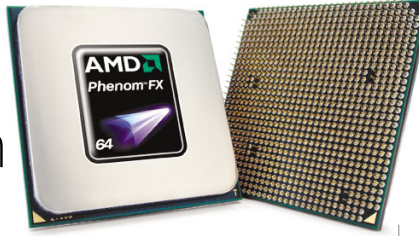
Being SLI-certified, the Signature 850 is equipped to handle dual GeForce 9800 GX2 graphics cards, though we used a single (yet massive) GeForce GTX 280

## Specs:

Rated continuous (W):	850 (50 C)
12V Rails:	4
+12V continuous (A):	2 @ 22A, 2 @ 25A
+5 continuous (A):	25A
+3.3 continuous (A):	25A
SLI certified:	Yes
Max wattage tested:	362
Power factor tested:	.98
Efficiency rating (as advertised):	82%
Cable side:	Motherboard
Fan location:	Side
Fan(s):	1x 80mm
PCI-E:	2
Main 12V:	20+4 pin
8-pin EPS 12V:	3
4-pin 12V:	1
SATA:	9
4-pin Molex:	9
Floppy:	1
Length (including cable bend):	8.5 inches
Warranty:	Five years

CPU RANKING ○ 0 = ABSOLUTELY WORTHLESS | ●●● 2.5 = ABSOLUTELY AVERAGE | ●●●●● 5 = ABSOLUTELY PERFECT

# AMD Phenom X4 9950 Black Edition



The Phenom X4 9950 Black Edition is currently AMD's fastest processor, and on its own merit, it's a nice CPU. It's inexpensive yet sports some quality features, such as a 4GHz HT link and stock 2.6GHz clock speed. And although the 9950 BE is not an overclocker's dream by any means—good luck pushing it much past 3GHz—it has an unlocked multiplier, which affords the OC-minded more options.

However, if you're the owner of a 9850 Black Edition and fear you should've waited for the 9950, fret not; you're not missing out on much. The two differ only in that the former is a touch faster (2.6GHz compared to 2.5GHz) and has a 140W TDP vs. the 9850's 125W TDP. Granted, the 9850 is about to be locked down, so kiss the Black Edition and its unlocked multiplier goodbye. But if you

## Phenom X4 9950 Black Edition

\$235

AMD

www.amd.com



**Specs:** Socket AM2+; Clock speed: 2.6GHz; HyperTransport Link: 4GHz; 65nm process; Cache: 2MB total dedicated L2 cache, 2MB L3 cache; 140W max TDP

already have a 9850 BE, the 9950 BE is not a significantly better CPU.

Bottom line: The 9950 is a decent processor, but it offers no substantive improvements over the 9850 BE. The 9950 is now the fastest Phenom on the market, outstripping the rest of them by a step or two, but it's really just the 9850 BE with a better haircut. ▲

by Seth Colaner

## AMD Phenom X4 9950 BE

### 3DMark Vantage

Overall	P5336
GPU	4730
CPU	8666

### PCMark Vantage Pro

Overall	5160
Memories	4176
TV And Movies	3996
Gaming	5276
Music	4825
Communications	5071
Productivity	4843
HDD	4306

Dr. DivX 2.0.1\*

5:56

WinRAR 3.71\*

2:48

### Cinebench 10\*

Multithreaded (min:sec) 1:45

Multithreaded (score) 8383

POV-Ray 3.7 Beta\*\* 1511.84pps

### Crysis 1.1\*\*\*

Low quality 90.60

Medium quality 55.06

High quality 36.81

Very High quality 22.48

\* minutes:seconds

\*\* pixels per second

\*\*\* Games tested at 1,280x1,024



## Phenom X4 9350e

\$195

AMD

www.amd.com



**Specs:** Socket AM2+; Clock speed: 2GHz; HyperTransport Link: 3.6GHz; 65nm process; Cache: 2MB total dedicated L2 cache, 2MB L3 cache; 65W max TDP

# AMD Phenom X4 9350e

With the release of the Phenom X4 9350e (and its little sibling, the 9150e), AMD has produced a set of CPUs to complement its 780G chipset. Together, they complete an energy-efficient, low-power, low-noise platform for home-theater or SFF PCs.

Clocked at 2GHz and with a TDP of only 65W, the 9350e is designed for energy efficiency, not performance, yet it did well in benchmark tests. For instance, I was a bit surprised to see that the 9350e scored playable frame rates on Crysis, even at a high-quality setting.

This processor is powerful enough to satisfy any home-theater needs, and it can handle DX10 gaming, too. Yet it stays cool enough to keep the case fans inactive most of the time. Pair the 9350e with the 780G chipset's impressive integrated graphics and low power draw, and you've got yourself a "cool 'n' quiet" and solidly performing HTPC rig for very little dough.

Nice one, AMD. ▲

by Seth Colaner

## AMD Phenom X4 9350e

### 3DMark Vantage

Overall	P5099
GPU	4710
CPU	6778

### PCMark Vantage Pro

Overall	4396
Memories	3209
TV And Movies	3654
Gaming	4314
Music	3928
Communications	4051
Productivity	4266
HDD	4291

Dr. DivX 2.0.1\*

7:43

WinRAR 3.71\*

3:11

### Cinebench 10\*

Multithreaded (min:sec) 2:16

Multithreaded (score) 6465

POV-Ray 3.7 Beta\*\* 1162.91pp2

### Crysis 1.1\*\*\*

Low quality 75.77

Medium quality 65.27

High quality 46.94

Very High quality 22.10

\* minutes:seconds

\*\* pixels per second

\*\*\* Games tested at 1,280 x 1,024



# Art Lebedev Studio Optimus Maximus

Even before Russian designer Artemy Lebedev released the 113-key Optimus Maximus in 2007, the hype machine hailed the keyboard as the best ever. The Optimus certainly has a price worthy of such a claim. Hype aside, the Optimus may not really be “a million keyboards in one,” but make no mistake; it is a one-in-a-million board.

Within each of the board’s keys is a 48- x 48-pixel OLED, giving you seemingly endless language and character set configurations via the excellent, downloadable Optimus Configurator app. I configured the Optimus, for example, to display and perform designated functions depending on if Firefox, Internet Explorer, Word, etc. was active. An integrated SD slot (512MB card included) saves these layout configurations to memory, but even the default settings are “ooh” and “ah” worthy. Pressing CAPS LOCK, for example, displays each key as

capped. Pressing NUM LOCK similarly toggles the numeric keypad key between displaying numbers and navigation icons.

The possibilities go on. Any language your OS supports, Optimus can, too. Prefer a Dvorak layout? Done. Fancy a Half-Life or Photoshop layout? Presto. Want to embed a JPEG of your daughter in the Spacebar? I did it in seconds. I also configured a looping AVI (10fps max) of her sister in the ENTER key. I embedded a Gmail icon in another key to launch my account, designed a logo in Paint that I displayed on another key, and monitored my PC’s free memory and CPU performance on two other keys.

For all its functionality (and there’s a lot), the Optimus is oddly a poor choice for typing. Slick and far too stiff, the board’s mechanical

micro-keyswitches consistently produced a stream of irritating typos—even days after consistent use—that had me cursing under my breath. Additionally, the board is huge (1.5 x 21.14 x 6.8 inches [HxWxD]), so prepare to sacrifice desk space.

Still, though I can’t imagine spending more on a keyboard than my last PC, the Optimus Maximus is truly the supreme choice for tweekers. ▲

by Blaine Flamig



## Optimus Maximus

\$1,864.35

Art Lebedev Studio

www.artlebedev.com



**Specs:** 20,000 hours OLED glow life; 160-degree viewing angle; SD card slot; two USB 2.0 ports; USB and DC power connections required; one-year warranty

# Olympus LS-10 Linear PCM Recorder

“Digital recording that sounds better than a CD” is how Olympus touts the LS-10, which records MP3, WMA, or uncompressed WAV files via two integrated stereo mics. Students, journalists, podcasters, and musicians should also know this compact beauty is shirt-pocket-friendly, one-handed operational, and records audio that approaches studio levels at an alluring sub-\$400 price.

The LS-10’s exceptional ease of use comes by way of a backlit 1.8-inch LCD, jog dial, intuitive menus, and smart design touches. On the LS-10’s left, for example, you can manually adjust recording levels, set microphone sensitivity to Low (indoors/band demos) or High (outdoors/conferences), and activate a Low Cut filter that minimizes low-frequency levels. A List

button displays recordings, which save up to five folders (200 files each). An additional Music folder holds transferred songs for playback via headphones or the LS-10’s two stereo speakers (decent quality; weak volume). There’s also a configurable Fn button; tripod connector; mini USB port; and mic, line-in, 3.5mm headphone, and remote jacks.

WAV recordings top out at 96KHz, 24-bit; MP3s at 320Kbps; and WMAs at 160Kbps. My indoor (office, living room, conference room) and outdoor (backyard, street

intersection, ballpark) recordings possessed impressive clarity, solid volume levels, and a wealth of surprising sound nuances. A WAV recording from my backyard, for example, captured the low-level humming and buzzing of a guitar amp and the bright chirping of birds with equal clarity. Files I burned to CD were also impressive. Overall, I preferred manually adjusting recording levels over auto adjustments.

Olympus includes Steinberg Cubase LE4 editing software and integrates hit-and-miss Reverb (Normal, Studio, Hall, Club, Dome) and Euphony (Normal, Natural, Wide, Power) playback effects. A Zoom Mic setting can also apply Wide (surround sound), Standard, Narrow, and Zoom parameters to recordings. Despite lacking extras (namely XLR jacks) that some more-expensive competitors offer, the LS-10 provides numerous high-end features at a price that’s not high end. ▲



## LS-10

\$399.99

Olympus

www.olympusamerica.com



**Specs:** Two wind screens included; Rated battery life: 12 hours (2 AA); 2GB onboard storage; stores up to 3:10 (hours:minutes) uncompressed WAV files; SD slot (supports up to 8GB cards)

by Blaine Flamig

CPU RANKING ○ 0 = ABSOLUTELY WORTHLESS | ●●● 2.5 = ABSOLUTELY AVERAGE | ●●●●● 5 = ABSOLUTELY PERFECT

# Samsung Instinct SPH-M800

Ever since the first-generation iPhone came out just over a year ago, it has been generating quite the buzz in the cell phone industry. In response, many cell phone manufacturers and carriers have added new phones and features in hopes of competing with Apple's popular multimedia phone. One such phone is the Samsung Instinct, which is available exclusively through Sprint.

The Samsung Instinct incorporates some of the cool touch functions reminiscent of the iPhone's controls, including finger scrolling and sliding buttons. In addition, the phone has haptic feedback, which means the phone vibrates when you press a button or tap an icon on screen with either your fingernail or the pad of your finger. This is nice—it makes

the soft buttons feel more like hardware buttons.

You'll also find a full HTML Web browser on the phone. When opened, the Web browser will change the phone's display orientation to landscape. Various views and controls within the browser make it very usable. For example, you can zoom in and out of a page or view an overview of the page. You can also toggle between a standard view and a mobile view for a single-column rendition of the page.

Call quality on the Instinct was good, even when using a Bluetooth car kit. The Instinct also incorporates its own version of visual voicemail, making it easy to see and check messages. For



## Instinct SPH-M800

\$449.99

Samsung

www.samsungmobileusa.com



data access, the Instinct supports EVDO Rev. A speeds where available.

Unlike the high price of the iPhone, the price of the Instinct drops to a mere \$129.99 with a contract and other discounts. To take advantage of all of the phone's features, you'll need a Simply Everything plan, which starts at \$69.99 for 450 anytime minutes, unlimited mobile Internet, messaging, and more.

Which is better? The iPhone or the Instinct? At the end of the day, it really comes down to personal preference, choice of network, and budget. Bottom line: Unless you're an Apple freak, the Instinct is definitely worth a look. ▲

by Jennifer Johnson

**Specs:** 4.6 x 2.2 x 0.5 inches (HxWxD); 4.5 ounces; up to 5.75 hours talk time; GPS navigation; 2MP camera with video; Bluetooth; 2GB microSD memory card included; two standard lithium-ion batteries; 3.5mm stereo headset jack; personal organizer

# Gateway P-7811FX

Gateway's first Montevina notebook is here. I recently got my hands on the P-7811FX, complete with Intel Centrino 2 technology and an Intel Core 2 Duo P8400 processor. This notebook also has a good balance of multimedia features, including a 1.3MP Web cam, 5-in-1 media card reader, and 802.11 Draft-N. There's also a backlit panel for easy access to multimedia controls.

Gateway markets this laptop as offering the latest high-performance technology at an affordable price. I'd say this claim is true. The P-7811FX's scores compare to those of the Alienware Area-51 m15x. (See page 32 in the May 2008 issue.) Of course, the hardware between the two notebooks varies, as does the price. The P-7811FX costs less than half of the Area-51 m15x, which cost \$4,789 at the time of my review.

Centrino 2 offers a big improvement in terms of efficiency. Although the P-7811FX's

## P-7811FX

\$1,399.99

(as tested)

Gateway

www.gateway.com



P8400 processor is slightly slower than the Area-51 m15x's X9000, you get better performance (on certain tasks) and significant efficiency enhancements: The X9000 has a TDP of 44W TDP, compared to the P8400's 25W TDP.

This notebook not only packs some power but also looks good. The vibrant 17-inch screen displayed crisp graphics, while the copper accents surrounding the keyboard caught my co-worker's eye. I also liked the look of the raised, distinctive keys. ▲

by Jennifer Johnson

**Specs:** CPU: 2.26GHz Intel Core 2 Duo P8400; Memory: 4GB DDR3-800 (dual-channel); HDD: 200GB at 7,200rpm; GPU: Nvidia GeForce 9800M GTS 512MB of GDDR3; OS: Windows Vista Home Premium 64-bit SP1

## Benchmark Results

### 3DMark Vantage 1.0.0

Overall	P3070
GPU	2790
CPU	4396

### Cinebench 10

Multithreaded (min:sec)	2:47
Multithreaded (score)	5275

### Dr. DivX 2.0.1\*

	6:17
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### PCMark Vantage Pro 1.0

Overall	4147
Memories	3290
TV And Movies	3021
Gaming	3901
Music	3628
Communications	4089
Productivity	3605
HDD	3853

### POV-Ray 3.7 Beta\*\*

	1055.53
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### WinRAR 3.71 \*

	3:13
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### S.T.A.L.K.E.R.

	36.461
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### World In Conflict

	14
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\* minutes:seconds

\*\* pixels per second

\*\*\* Games tested at notebook's native resolution: 1,920 x 1,200

CPU RANKING ○ 0 = ABSOLUTELY WORTHLESS | ●●● 2.5 = ABSOLUTELY AVERAGE | ●●●●● 5 = ABSOLUTELY PERFECT



# AVADirect SFF Gaming PC/Workstation

The SFF Gaming PC/Workstation from AVADirect is targeted at graphics/math professionals and performance enthusiasts who want a portable system that has the power to deliver good gaming frame rates, as well as animate graphics, compile video, and render 3D models.

This rig is designed for travel. A sturdy, mid-tower Silverstone Sugo SG04B-H, which features a die-cast aluminum carrying handle, lets AVADirect pack this system with top-notch hardware without abandoning a portable form factor. I was initially worried the crowded mid-tower wouldn't have enough airflow to vent out the hot air, but the two 120mm, 1,200rpm fans at the front of the really drove the air to the 80mm rear and 120mm side-panel fans.

For processing power, AVADirect included dual Intel Xeon 5450 processors that are cooled by Swiftech MCX-VPro heatsinks. The MCX-VPro's thick, long aluminum pins took up a lot of free space near the processor block, but the memory, video card, and storage drives were situated away from the processors, so working inside the case was doable. 16GB of Kingston DDR2-667MHz dual-rank (doubles the amount of RAM chips by using the back-side of the RAM) ValueRAM and three 1TB Seagate Barracuda ES.2 SAS drives in a RAID 5 configuration cover both workstation performance and data protection needs, while an XFX GeForce GTX 280 gives this system gaming power.

Considering the SFF Gaming PC/Workstation only had one graphics card, 12.66fps in Crysis and 28fps in World in Conflict are impressive. When we backed the resolution down to 1,900 x 1,200, it produced playable frame rates of 35fps in Crysis and 65fps in World in Conflict. In terms of image rendering, its 22452 multithreaded score in Cinebench 10 and 5097.9pps in POV-Ray 3.7 beta are some of the highest results we've seen. The same can also be said for this rig's SiSoft Sandra Lite scores, which are highlighted



## AVADirect SFF Gaming PC/Workstation

\$6,290 (as tested)

AVADirect

[www.avadirect.com](http://www.avadirect.com)



by 99,271 Dhrystone ALU and 78,174 Whetstone iSSE3 marks.

As a workstation, its SPECviewperf 10 results are much lower than you'd see with a workstation graphics card, such as the Quadro FX 5600, but the GTX 280 does not include any of the application-specific driver configurations or tuned hardware that you'd typically find on a workstation graphics card, so the numbers aren't surprising. More importantly, the SPECviewperf 10 results show that you could perform professional workstation tasks on the go, albeit much less quickly than a traditional workstation (which are also available from AVADirect).

With the SFF Gaming PC/Workstation's portable design and powerful hardware, it's a good fit for power users who need a system that can do a little bit of everything. The sturdy, SFF design also helps accommodate those who want to take the rig to a LAN party or run workstation applications away from home. ▲

by Nathan Lake

**Specs:** CPU: 3GHz Intel Xeon X5450 (2x); Motherboard: SuperMicro X7DCA-L (Intel 5400 chipset); RAM: 16GB Kingston ValueRAM (dual-rank) DDR2-667; HDD: 1TB Seagate Barracuda ES.2 (3x; RAID 5); GPU: XFX GeForce GTX 280; PSU: Silverstone Strider ST1000-NV (1,000W); OS: Windows Vista Ultimate (64-bit)

## Benchmark Results

### AVADirect SFF Gaming PC/Workstation

#### 3DMark Vantage 1.0

Overall	P11512
GPU Score	9835
CPU Score	23561

#### Cinebench 10\*

Multithreaded (score)	22452
Multithreaded (min:sec)	0:39

#### SiSoft Sandra Lite XII SP1

##### Processor Arithmetic

Dhystone ALU (MIPS)	99,271
Whetstone iSSE3 (MFLOPS)	78,174

##### Processor MultiMedia

Integer x8 iSSE3 (itps)	791,209
Floating Point x8 iSSE2 (itps)	512,436

##### Memory Bandwidth

Integer Buffered iSSE2 (GBps)	5.71
Floating Point Buffered iSSE2 (GBps)	5.71

Dr. Divx 2.0.1*	4:30
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POV-Ray 3.7 Beta**	5097.9
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PCMark Vantage Pro 1.0	
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Overall	5944
Memories	5014
TV And Movies	4869
Gaming	5056
Music	4330
Communications	5000
Productivity	6129
HDD	3448

WinRAR 3.71*	2:22
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SPECviewperf 10***	
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3dsmax-04	9.02
catia-02	9.12
ensight-03	n/a
maya-02	16.09
proe-04	5.45
sw-01	9.46
tcvis-01	2.66
ugnx-01	N/A

Crysis 1.1	12.66
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Company of Heroes 2.1.0.2 (4XAA)	49.9
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World in Conflict 1.005 (4XAA/16XAF)	28
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S.T.A.L.K.E.R 1.005	65
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* minutes:seconds	
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** pixels per second	
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*** frames per second	
-----------------------	--

Games tested at 2,560 x 1,600.	
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# NZXT Khaos

There was a time when NZXT's cases were known more for their outlandish front bezels than anything else. But in the last year or so, the company seems to have turned over a new leaf, introducing a handful of products with more subdued aesthetics. The latest addition to NZXT's product lineup for example, the Khaos, features a near-symmetrical design with what is essentially a perfectly flat front bezel save for curved, protruding fins at its top and bottom.

The Khaos' main appeal isn't its more subdued look, however. It's the case's extremely high-quality construction and enthusiast class features. Although there are a myriad of aluminum full towers on

the market, few are quite as sturdy as the Khaos, thanks to the 2mm and 3mm thick panels used throughout its construction. Many of the seams on the Khaos are also welded, which further adds to the case's strength.

In addition to its relatively high-quality build, the Khaos also features provisions for two bottom-mounted power supplies (a secondary PSU trigger is included) and seven 120mm cooling fans. Four fans (two intake, two exhaust) are included, and there's a bracket that can accommodate three more for additional motherboard and

video card cooling.

On its exterior, the Khaos' top and bottom panels sport a finned heatsink-like



**Khaos**  
\$439  
NZXT

www.nzxt.com



design, presumably to aid in cooling. There are wheels and a handle affixed to the case, as well, which make it relatively easy to move around for such a large enclosure. Its back panel has two holes with rubber grommets to accommodate tubing from a liquid-cooling kit. An I/O panel with USB, audio, FireWire, and eSATA ports resides on the top panel, adjacent to the power and reset switches. And the case's side panels have horizontal vents running down the middle. Finally, a pair of hinged, 5.25-inch drive bay covers to "stealth" any mounted optical drives are also included.

The Khaos isn't a tool-less case, but its large size and open design make it easy to work with. It may not be quite as refined as products from Silverstone or Lian-Li, but the NZXT Khaos deserves a mention among ultra premium brands such as these, and its price is a reflection of this status. ▲

by Marco Chiappetta

**Specs:** ATX Full Tower; Material: Aluminum; Motherboard compatibility: ATX, Micro ATX, Baby AT; Bays: 5 external 5.25-inch, 8 internal 3.5-inch, 1 external 3.5-inch; Expansion slots: 7

# Corsair Dominator TW3X2G2133C9DF

Corsair continues its seemingly never-ending assault on the high-end memory market with yet another premium DDR3 kit rated to operate at a much higher frequency than much of the competition. As its name implies, the Corsair Dominator series TW3X2G2133C9DF is a 2GB memory kit rated for operation at 2,133MHz with a CAS latency of 9. Like all of the other members of the Dominator series, the DIMMs in this kit feature the company's excellent DHX cooling technology. Other specs include a rather demanding 2.0V requirement (for DDR3 anyway) and support for EPP 2.0.

I tested the Corsair Dominator TW3X2G2133C9DF memory kit in an Asus Striker II Extreme nForce 790i SLI



**Dominator**  
TW3X2G2133C9DF

\$529

Corsair

www.corsairmemory.com



Ultra-based motherboard, powered by a Core 2 Extreme QX9650 processor, a GeForce 8800 GTX, and Windows Vista Ultimate 64-bit. Although the motherboard recognized support for EPP 2.0, it seemed unable to run the memory at 2,133MHz. By manually tweaking settings, however, I was able to hit 2,050MHz with the motherboard running in Unlinked mode, which is no small feat. With the

RAM running at 2,050MHz, it offered up about 7GBps of memory bandwidth in SiSoft Sandra XII SP2 and 121.6fps in a low-resolution, low-quality Crysis benchmark.

The TW3X2G2133C9DF memory kit didn't fully cooperate with our test system, but it's still a killer product. The kit is obviously geared for hardcore overclockers, though. Those who run their systems at stock speeds need not apply. ▲

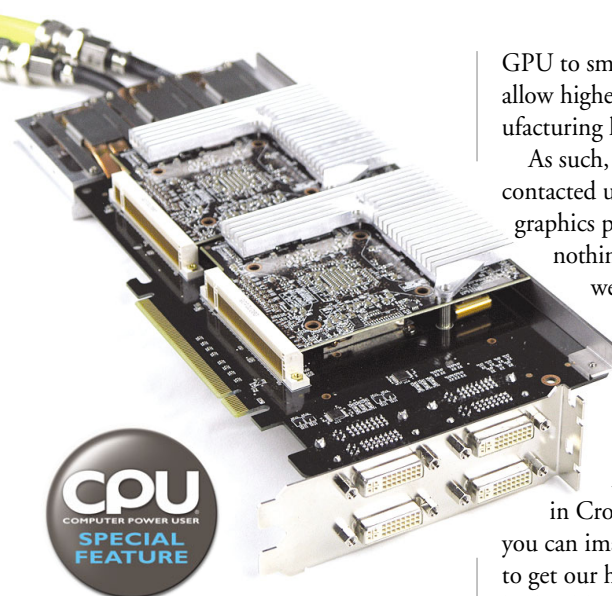
by Marco Chiappetta

**Specs:** Capacity: 2,048MB (2 x 1,024MB); Frequency: 2,133MHz (PC3-17066); Latencies: 9 (CAS), 9 (RAS Precharge), 9 (RAS to CAS), 24 (RAS Activate to Precharge), 2T (Command rate); Voltage: 2.0V; lifetime warranty



# Asus Trinity

## Three GPUs, One PCB



Asus has been well known over the years as being a leading ODM for many top-tier computer manufacturers, from motherboards and graphics cards to notebooks and other types of SFF systems. Although motherboards and graphics cards have historically been an Asus core competency, Asus is also well known for its ability to execute on new, leading-edge design architectures that push the envelope beyond the standard reference design from OEMs such as Nvidia, AMD, and Intel. Often, with its significant in-house engineering resources, Asus is also the first to market some new innovation or design twist in graphics or motherboards.

Though multi-GPU graphics cards are nothing new, reference designs that employ more than one GPU on a single board are few and far between. You can probably count on one hand the number of products like Nvidia's dual-GPU-based GeForce 9800 GX2 or AMD's Radeon HD 4870 X2. However, as of late, AMD specifically has been rather vocal about the future of graphics moving away from the single, billions-of-transistors, monster

GPU to smaller multi-GPU designs that allow higher efficiencies at the wafer manufacturing level.

As such, it was no surprise when Asus contacted us regarding a wild new 3D graphics product that was intended to be nothing more than a "Hey, look what we can do" proof of concept.

Asus developed a prototype graphics card code-named Trinity that was built with not just two GPUs on board, but a trio of AMD ATI Radeon HD 3850 GPUs in CrossFireX on a single card. As you can imagine, we were pretty fired up to get our hands on this thing for a closer look, although we should underscore again that *this card will never ship as a retail product* and is more of a test vehicle than anything else.

The Asus Trinity is a single-card design that extends well beyond the standard ATX motherboard depth and consumes two slots in terms of real estate in the card slot area. What you see on the top and back sides of the card are actually MXM (Mobile PCI-E Module) graphics modules slots hosting three horizontally mounted mobile GPU graphics modules. Some of you may be thinking Nvidia developed the MXM mobile graphics form factor and interface standard for its own use, but recall that ATI also decided to follow it for some of its mobile offerings, as well; it really isn't anything more innovative than bringing out PCI-E links on a simple card edge "gold fingers" design.

If you look closely, sandwiched between the daughter card modules and

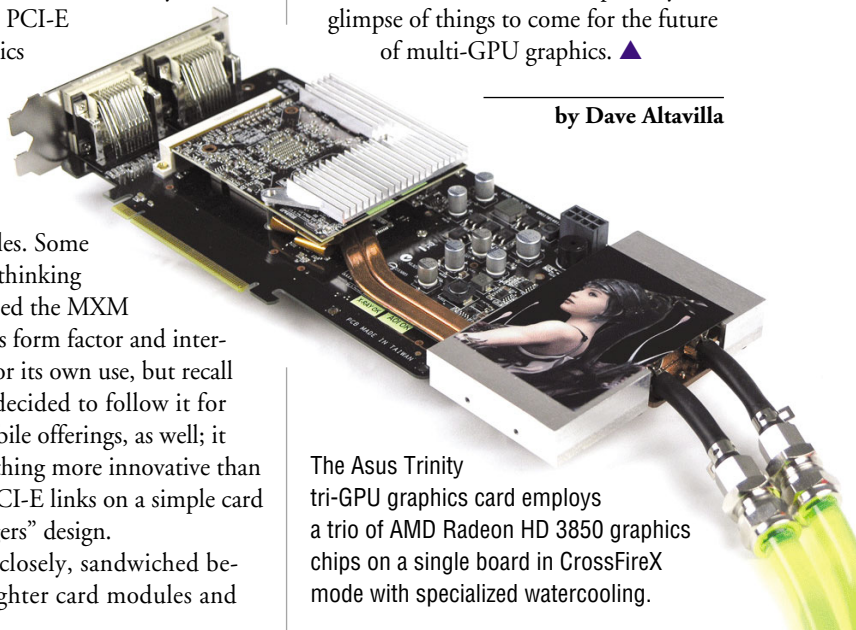
the main PCB are traditional AMD ATI CrossFire ribbon cables. Also, although we weren't daring enough to actually pull this one-of-a-kind prototype apart to confirm this, there must be a PCI-E switch under the Trinity's hood, allowing a single x16 PEG slot link to be divided up amongst the three Radeon HD 3850 GPUs.

Finally, you'll also notice the Trinity has some exotic cooling going on, with a custom heatpipe and heatsink design that connects to liquid-cooling hoses. In fact, Asus shipped us Trinity along with a Thermaltake Bigwater 760i liquid-cooling kit. There's no question that this graphics card is way out there, in terms of both its board design and its base multi-GPU architecture.

Now obviously, a three-way CrossFireX configuration on a single board has never been done. In addition, efficient GPU performance scaling, especially in certain game engines, can be hit or miss. We begged Asus to let us run a few numbers on Trinity. For starters, we pulled down 16888 3DMarks in 3DMark06 and were then greeted by 50.1fps in Company of Heroes at 1,680 x 1,050 with 4X antialiasing. And believe it or not, it could play Crysis at 1,680 x 1,050 with medium image quality, clocking in 42.84fps. That's not bad for a prototype card with prototype drivers.

The Asus Trinity was definitely a fun diversion from the norm and possibly a glimpse of things to come for the future of multi-GPU graphics. ▲

by Dave Altavilla



The Asus Trinity tri-GPU graphics card employs a trio of AMD Radeon HD 3850 graphics chips on a single board in CrossFireX mode with specialized watercooling.

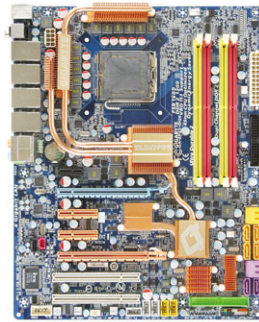
# Gigabyte GA-EP45-DQ6

When I see a piece of hardware with some kind of energy-saving feature(s), I usually assume an “E” in the name is a synonym for “weak.” In the case of the Gigabyte EP45-DQ6, however, the “E” stands for “efficient.”

The board features two PCI-E 2.0 slots and Cross-FireX support, and with support for up to 1,600MHz FSB, 16GB of memory, and four—count ’em, four—Gigabit Ethernet ports, which Gigabyte claims can be teamed together to function as a single connection to increase the overall throughput fourfold, the EP45-DQ6 wants not for power and speed.

Yet the EP45-DQ6’s 65nm P45 chipset coupled with the DES (Dynamic Energy Saver) Advanced technology, which throttles power when the CPU load is low, saves energy. You can even use DES Advanced if the system’s been overclocked.

The board also includes a tantalizing number of BIOS options for overclocking,



## Gigabyte GA-EP45-DQ6

\$268

Gigabyte

www.gigabyte.us



including incremental voltage boosts, which we used in conjunction with a reduced multiplier to push

the EP45-DQ6’s FSB to 458MHz and an impressive increase in overall 3DMark Vantage scores (14,264 compared to 10,909 with the default 333MHz FSB).

The EP45-DQ6 works smarter, not harder. It’s a solid board that will satisfy enthusiasts without upping the electric bill. Game green, friends. ▲

by Seth Colaner

## Gigabyte GA-EP45-DQ6

### 3DMark Vantage

Overall P5534

GPU 4753

CPU 10909

### PCMark Vantage Pro

Overall 5349

Memories 3516

TV And Movies 4297

Gaming 4748

Music 4857

Communications 4999

Productivity 4610

HDD 4345

Dr. DivX 2.0.1\* 4:36

WinRAR 3.71\* 2:37

### Cinebench 10\*

Multithreaded (min:sec) 1:24

Multithreaded (score) 10431

POV-Ray 3.7 Beta\*\* 1666.59pps\*\*

### Crysis 1.1

1,280 x 1,024,

Low quality 117.11fps

\* minutes:seconds \*\* pixels per second

**Test system specs:** Processor: 3GHz Intel Core 2 Extreme X9650; RAM: 4GB OCZ Technology DDR2 PC2-6400 SLI-Ready Edition; Graphics: Nvidia GeForce 8800 GT; Hard drive: 150GB Western Digital Raptor 1500

**Specs:** Socket 775; Chipset: Intel P45 Express; 1,600 MHz FSB; Max memory: 16GB DDR2-1200; Audio: Realtek ALC889A 7.1; Slots: 2 PCI-E 2.0 (x16 or dual-x8), 2 PCI-E x4, 1 PCI x1, 2 PCI; Ports: 10 SATA, 10 USB 2.0, 1 FireWire, 4 Gigabit Ethernet

# Thermaltake BlacX HDD Docking Station (ST0005U)

The popularity of external storage is probably all too familiar to you by now. However, this doesn’t discredit the ingenuity behind Thermaltake’s BlacX HDD Docking Station.

The BlacX is a brilliantly simple solution: It’s designed for quick access to the data on a hard drive without busting open your system’s chassis and manually installing the drive. There are two other details that you shouldn’t overlook. Instead of jerking your drive out of the station, press the eject button to detach it, Pop-Tart style. Plus, the BlacX supports hot-swapping hard drives. And if you’re worried about cooling issues, don’t: The BlacX itself didn’t generate any excess heat.

Saying that you install the BlacX is definitely a stretch: We were finished once we plugged in the power adapter and connected the station via USB cable. Next, we inserted our SATA hard drive (think NES game cartridge) and powered up the BlacX. Our PC recognized the drive almost immediately. We opened My Computer and were good to go.

Thermaltake has actually released three models of the BlacX, two of which are practically twins, save for the exclusion of eSATA connector on the N0028USU.



The BlacX SE looks noticeably different than the former two: Its circular base features four USB 2.0 ports and a large, textured eject button. It essentially performs the same function as the other docking stations. All three models support SATA drives up to 1TB. ▲

by Joanna Safford

## Thermaltake BlacX HDD Docking Station (ST0005U)

\$64.99

Thermaltake

www.thermaltakeusa.com



**Specs:** Interface: eSATA, USB 2.0; HDD capacity: 2.5 and 3.5-inch SATA HDD; 480Mbps max transfer rate; OS support: Windows 95/98/2000/XP/Vista, Mac 10.3 and later



# Anand's Corner

by Anand Lal Shimpi

## The iPhone 3G: Still Great & Still Imperfect

I'll take years for Apple to match the hype and uncertainty that surrounded the first one, as it was a once-in-a-blue-moon revolutionary device, doomed to be followed up by evolutionary iterations every year.

2008 marks the first such evolutionary iteration with the introduction of the iPhone 3G. As the name implies, the iPhone 3G enables support for 3G wireless networks, but there is more that comes with the new phone.

The iPhone 3G is cheaper up front, selling for \$199 or \$299, depending on configuration (8GB or 16GB), but AT&T's data plans have gone up in price, making the total cost of ownership higher over a two-year period compared to the original iPhone. The monthly fees aren't terrible for a data plan, but they aren't economical; you'll pay the standard amount for a voice plan plus an extra \$30 per month for unlimited data. If you want ungodly expensive text messages, they will cost you an additional \$5 to \$20 every month. It's the pricier data plans that negate the lower cost of the phone, but the difference doesn't amount to that much more over two years. Just don't be fooled, the new iPhone isn't exactly any cheaper than the old one, it's simply on a deferred payment plan.

The addition of 3G support makes things faster, but how much really depends on where you are and how you use your phone. The first factor is very important, because there are areas where AT&T lacks 3G coverage. There's a very popular beach town around two hours from my home called Wilmington. It seems like everyone I meet these days is either from there or lived there for a period of time. There's a big school down there, the University of North Carolina at Wilmington, and it's a fun place to visit. The problem? There's absolutely no 3G coverage, which is odd given that the town's full of college students eager to shell out tuition money for shiny new iPhones.

Most metropolitan areas I've traveled to, however, do have reasonable 3G coverage,

which brings us to the usage factor. 3G can easily offer two to 10 times the download speed of Edge, but you notice it most on larger, image-heavy Web sites rather than small sites constituted mostly of text. 3G is always faster, but it doesn't give you the Wi-Fi experience.

The new iPhone ships with network-assisted GPS, but no turn-by-turn voice direction software. This ultimately amounts to a GPS feature that's great if you have a navigator in the car with you, or a nice walking GPS, but not much else. It's good at telling you where you are, but don't throw away your Tom Tom just yet.

The iPhone 3G ships with the long-anticipated 2.0 firmware (also available for the original phone). The app store is the biggest addition, allowing you to download and install third-party applications without jailbreaking your phone. The quality of the applications ranges from downright poor to decent, with a few selections reaching first-party quality. Most of them tend to be battery hogs, though; as useful as the AIM app is, for example, it will eat through your battery in a couple hours of steady use.

The 3G's battery life in general is terrible. The old iPhone would get me through a day ending at 5 p.m. (unfortunately my days end closer to 10 p.m. when I'm traveling), but the iPhone 3G won't even get me that far. I need at least two full charges a day while traveling, which can be difficult if I'm spending much of my time in airports. There's no replaceable battery, either, so you'll occasionally find yourself searching for power outlets.

Ultimately, the iPhone 3G amounts to little more than an incremental improvement over the original phone. The iPhone continues to be the premier smartphone out there, but Apple needs to be careful; adding complaints alongside desire is a risky approach to incremental improvement. If the increments are small enough, and the complaints pile up high enough, Apple's wonderphone may lose its appeal. ▲



*Anand Lal Shimpi has turned a fledgling personal page on GeoCities.com into one of the world's most visited and trusted PC hardware sites. Anand started his site in 1997 at just 14 years old and has since been featured in USA Today, CBS' "48 Hours," and Fortune. His site—[www.anandtech.com](http://www.anandtech.com)—receives more than 55 million page views and is read by more than 2 million readers per month.*

Talk back to Anand at [anand@cpumag.com](mailto:anand@cpumag.com)

# The Shark Tank

by Alex "Sharky" Ross

## Radeon's Sneak Attack

These are not the best of times for AMD financially speaking, with its stock hitting a five-year low point. Even its long-time CEO Hector Ruiz has just recently been substituted. AMD clearly over-paid for ATI, but stock prices and finances aside, the merger is only now starting to give us enthusiasts something of note. The critically acclaimed Radeon HD 4850 and 4870 (based upon the scaleable RV770 technology) has finally put ATI back in the game in the mid-range sector, and in a very big way. Despite the company's apparent surrender at the high-end 3D card sector, it seems that AMD is about to make a U-turn.

Currently in the works and slated for a late summer release is a high-end part called the Radeon HD 4870 X2 (codenamed the R700). The GPU utilized isn't actually new but rather a pair of mid-range RV770 chips joined together as a single-slot solution on a behemoth of a board, over 10 inches long with a pair of PCI-E auxiliary power plugs and an 8-pin, as well as a 6-pin, power connector. The large copper heat sink covers both GPUs with an exhaust port and fan designed to keep things cool enough.

Utilizing a new PCI-E 2.0 compliant bridge chip, the 20GBps of bandwidth between the two GPUs is significantly improved over the previous Radeon HD 3870 X2's 6GBps. With twin RV770s on-board, the horsepower on-tap is brutal for a single card with 1600 stream processors, 80 texture units, and 32 ROPs. Each of those HD 4870's sports a 1GB frame buffer for a total of 2GB of memory running at 900MHz with a 3600MTps.

Unfortunately for us technology-hungry buffs, the aforementioned 2GB is just a number, not actually shared. Hopefully that technology will hit the scene someday. Engineering samples are currently clocked at 750MHz just like the single HD 4870, but that is subject to change. Based on those settings, some preliminary numbers and demos have shown games (in high resolutions and with heavy AF and AA settings) such as Age of Conan and Race Driver GRID considerably ahead of a pair

of Nvidia GTX 280's running SLI. Most of the preliminary data has shown a single HD 4870 X2 scaling well with a pair of HD 4870s running in CrossFire mode. This will bode well for those of you insane enough to pair up two HD 4870 X2s in CrossFireX mode.

It's still early days yet, and AMD has a lot of work to do in terms of working with game developers for support and

new/updated CrossFire profiles for upcoming titles in their drivers (not to mention a few more BIOS revisions). Nvidia is still king in terms of game developer relations and has been for a very long time. Hand-picked benchmarks won't be enough, and if enthusiasts are indeed to risk shelling out over \$500 on a high-end Radeon board again, they will expect that same level of scaling in more than just a few games. Putting up with bugs, paper-releases, and/or overclocked preview cards had better not be in the cards (pun intended) this time around.

If history is anything to go by, Nvidia is obviously going to attempt to hit back. It won't be easy though. It's been a while since Nvidia has even remotely felt threatened at the high end, however, the company has also hit the news wires recently for the wrong reasons. With weaker than expected sales of their latest GT2xx-based series combined with a lukewarm reception from the media, investors have been taking note. Worse still is the reported problem of its mobile GPU chips and expected \$200 million worth of warranty replacements (not to mention the probable loss in OEM confidence). These factors have all contributed to the company's stunning single-day 33% loss in share price. And when you're down, you can always rely on Rambus steaming in with a multimillion dollar patent-infringement lawsuit. Quite where all of this leaves Nvidia's financial and R&D resources for a quick response isn't clear just yet. ▲



*Disrupting Reuters' newswire with a cheery Christmas greeting at age six, Alex "Sharky" Ross became an avid computer user/labuser, eventually founding popular hardware testing/review Web site SharkyExtreme.com. Exposing shoddy manufacturing practices and rubbish-spouting marketing weasels while championing innovative products, illuminating new technology, and pioneering real-world testing methods was just a front for playing with the best toys. The site acquired, he left in 2001. A London native and London School of Economics graduate, Alex currently overclocks/tunes Porsche 996 Turbos with [www.sharkwerks.com](http://www.sharkwerks.com) when he's not tweaking PCs.*

Email me at [sharky@cpumag.com](mailto:sharky@cpumag.com)



# PC Modder

## Tips & Tutorials

Modding does the body good. A PC's body anyway, inside and out. Here you'll find hardware, firmware, tools, tips, and tutorials for modding your rig's performance and appearance. Send us your own mod-related tips and ideas at [modding@cpumag.com](mailto:modding@cpumag.com).

### Mods & Ends

#### NZXT Sentry LX Multifunction Fan Controller

NZXT builds on the success of the popular Sentry 1 multifunction fan controller with the new, more capable Sentry LX (\$59.99; [www.nzxt.com](http://www.nzxt.com)). Unlike the older Sentry 1, which controlled only two fans, the Sentry LX can monitor and control up to five. The Sentry LX also includes five thermal probes for monitoring the temperatures of different components or zones within a case, and it can operate in Manual or Auto mode, which gives you the ability to either tweak fan speeds manually or have the Sentry LX throttle them based on the temperatures gathered by the included thermal probes. The Sentry LX has an alarm feature that provides instant notification if temperatures rise above a designated level, as well.



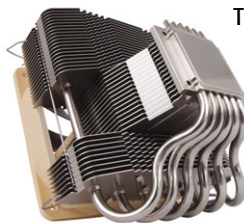
NZXT's Sentry LX can control a number of fans and includes five thermal probes for temperature monitoring.

The NZXT Sentry LX features a large LCD screen that displays fan speeds and thermal data. It requires two adjacent 5.25-inch drive bays. If you're in need of a multifunction fan controller and the large LCD appeals to you, the Sentry LX should serve you well.

#### Noctua NH-C12P

In the market for a powerful, yet quiet CPU cooler? Look no further than the Noctua NH-C12P. The NH-C12P

(\$69.90; [www.xoxide.com](http://www.xoxide.com)) features a mammoth heatsink, complete with six heatpipes that are soldered directly to the cooler's wide-spaced cooling fins. According to Noctua, the NH-C12P also features a "C-type" design with what the company calls Airflow-Gaps; when used with a downward-facing fan, the unit provides improved air flow for components located near the motherboard's CPU socket.



The Noctua NH-C12P CPU cooler is quiet, powerful, and compatible with a broad range of Intel and AMD processors.

The NH-C12P includes an NF-P12 120mm fan, which features Noctua's high-quality SSO-bearing and uses Noctua's "SecuFirm" multisocket mounting system (a patented system that's more secure than others) that's compatible with LGA 775, AM2, and AM2+ sockets. Some Noctua NT-H1 thermal compound is included, as well.

#### OCZAlchemy Series Elixir Keyboard

Over the past couple of years, OCZ has steadily diversified its product offerings to include not only memory but also power supplies, cooling devices, DIY notebooks, and mice. Now, the company can add keyboards to its résumé. OCZ's Alchemy Series Elixir Keyboard (\$29.99; [www.ocztechnology.com](http://www.ocztechnology.com)) is the company's first keyboard targeted strictly at hardcore gamers. The Elixir features a



OCZ's Alchemy Series Elixir Keyboard is targeted squarely at PC gamers who seek high performance and reliability.

USB interface, membrane tactile switches, and a rubberized coating on all of its keys.

Although designed for gamers, the Elixir's 10 blue macro keys (which can each have three user-defined profiles) can be programmed for virtually any key combination, which may come in handy in applications that require relatively complex keyboard shortcuts. The Elixir also sports seven Internet-related hotkeys, eight keys for multimedia/media player control, and a mode selection switch that lets you toggle between a standard-use configuration or a customized gaming mode. It may not make you the next Fatal1ty, but the OCZ's Alchemy Series Elixir Keyboard is definitely a step up from any generic keyboard.

### Fashionably Fresh Firmware

#### Linksys WRT610N Wireless Broadband Router (v1.00.00.17)

The latest update for the Linksys WRT610N Wireless Broadband Router fixes a reboot problem when running the LELA (Linksys Easy Link Advisor) configuration wizard.

[www.linksys.com](http://www.linksys.com)

#### Pioneer BDC-202 (v1.07)

A firmware update for the Pioneer BDC-202 internal SATA, combo Blu-ray/DVD burner adds support for LTH (low to high) BD-R Media.

[www.pioneerelectronics.com](http://www.pioneerelectronics.com)

#### Synology Disk Station DS508 (vDSM 2.0-0640)

An update for the Synology Disk Station DS508 NAS device improves compatibility with Mac OS clients, bolsters M4A format support on Audio Station, and broadens MySQL database compatibility with phpMyAdmin.

[www.synology.com](http://www.synology.com)

# Remote Possibilities

## Our Quick & Easy Remote PC Starter

After watching “The Thomas Crown Affair” recently and seeing Rene Russo stealthily root through the Crown’s office until she found a hidden remote switch, which opened a hidden compartment on the wall, we thought to ourselves, “We want that!”


Instead of a remote switch that opens a hidden compartment, wouldn’t it be great to have the ability to turn a PC on or off remotely (either simply for convenience or possibly to prevent unwanted snoopers from messing with the system)? After all, a snoop can’t turn the system on if he can’t find the power switch.

Remotely controlling a PC’s power state is doable with some readily available products . . . after a bit of modding, of course. Logisys, for example, sells an inexpensive kit that includes a pair of wireless remotes and a 12V receiver designed for PC applications. It’s intended to be used to remotely power up fans or case lighting, but since when do we modders use anything as intended?

With the goal of powering up a system using a remote control, we’re going to tackle this mod in three phases and take you through the process step-by-step. The three phases will include getting power to the remote control receiver, connecting the receiver’s output leads to a relay, and finally, connecting the relay’s switched output to a motherboard’s power switch header.

### The Parts Pile

The Logisys RM01 remote receiver we used for this mod has five leads connected to it. One of them is blue; it’s the remote antenna, and we won’t be touching that one. The others consist of two black ground wires, a red 12V input, and a white 12V output. The 12V input needs a constant supply of power for the receiver to operate.



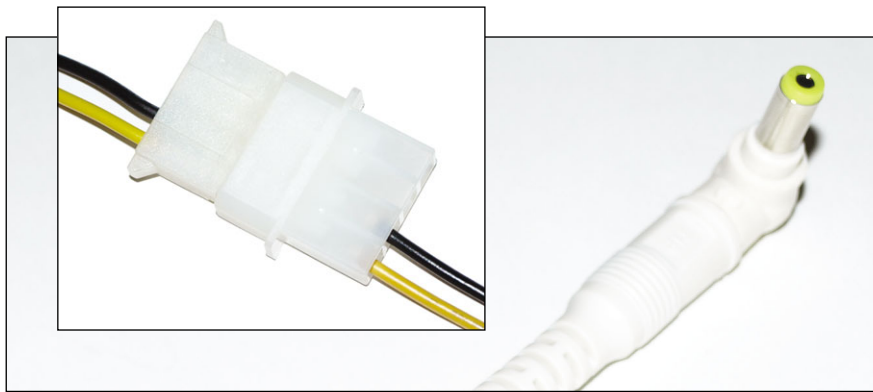
We used a Logisys model RM01 12V/6A receiver with remote controls, a relay, some spare parts, and a little ingenuity to create a device to wirelessly power up a system using the included key fobs.

Normally, this isn’t a problem: we’d simply plug the receiver into their system’s PSU, but because we need the receiver to essentially trigger the PSU we’ll need an alternate power source. To that end, we acquired an ordinary, run-of-the-mill 120VAC-to-12V DC wall wart adapter that we could modify for our purposes. While we were at it, we also grabbed a standard 4-pin Molex power extension cable and a two-pin connector from a spare parts pile.

To modify the 12V power adapter, we cut the end off its cable and were left with

two wires. We then used a multimeter to figure out the polarity. (The striped wire, or ribbed wire in the pair is usually positive.) With that knowledge in tow, we then modded the Molex extension cable. We only needed the 12V yellow and black ground wires for this mod (the yellow wire is +12V, and the black wire is a ground), so we cut the extension cable in half and removed the 5V red and additional black ground wire to simplify the design and clean things up a bit. We connected the yellow wire coming from the male Molex connector to the positive wire coming from the 12V power





Because of the fact that the receiver included with the Logisys RM01 remote control kit requires a constant 12V power feed, we couldn't use the system's host PSU for power. Instead, we removed the connector from a common 12V wall wart power adapter and spliced on a standard male Molex plug. The matching female receptacle was attached to the RM01 receiver and the adapter provides a constant source of power.

adapter. We attached the ground wire from the connector to the adapter's negative wire. What we ended up with was a 12V wall wart with a male 4-pin Molex connector attached to its leads.

Next, we took the female Molex connector (the second half of the extension cable) and connected its yellow wire to the 12V input on the Logisys receiver and its black wire to one of the receiver's ground leads. Now, we could plug the 12V adapter into a wall outlet, connect the male and female Molex connectors together, and power would be supplied to the receiver. Phase one complete.

### Wired Connections For Our Wireless Starter

Phase two of this mod requires a standard 12V SPST (single pole, single throw) relay, which is available at virtually any auto parts or electronics retailer, and four crimp-on connectors compatible with the relay. We're going to use the relay to convert the Logisys receiver's 12V output into a switched signal that can be used to power up a system by way of a motherboard's power switch header.

To wire the relay, we stripped about .25-inch of sheathing from the ends of the white (12V output) and ground

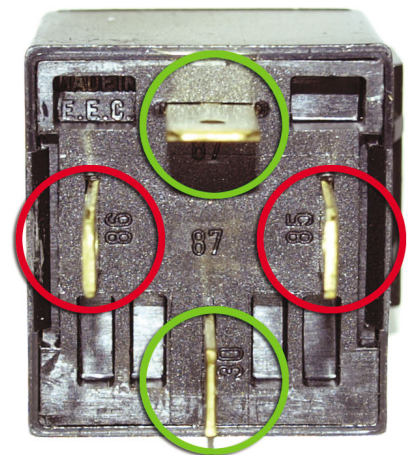
wires coming from the receiver. Then, we crimped connectors onto the ends of the two wires that would fit the leads on the relay. A typical SPST relay will have four contacts—two for voltage input and two for the switched output. On our relay, the two parallel contacts on opposing sides, numbered 85 and 86 (circled in red in the illustration) were for the voltage input. The other two contacts, numbered 87 and 30 (circled in green) were the switched outputs. Many relays are likely to have similar numbering for their contacts, but it's always best to check the schematic supplied with your particular relay to be sure.

We connected the white and black leads coming from the Logisys receiver to the voltage input contacts on the relay, connecting the white and ground wires to contacts 86 and 85, respectively. (It's important to get the polarity right on the voltage inputs.) Now, when the receiver gets an "On" signal from one of the remotes, power is sent through its output into the relay, which in turn flips the relay's internal switch. Phase two complete.

## Alternate Methods: Pros & Cons

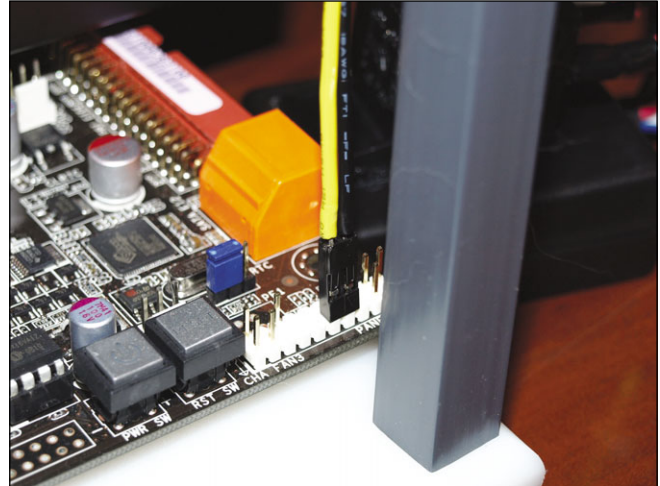
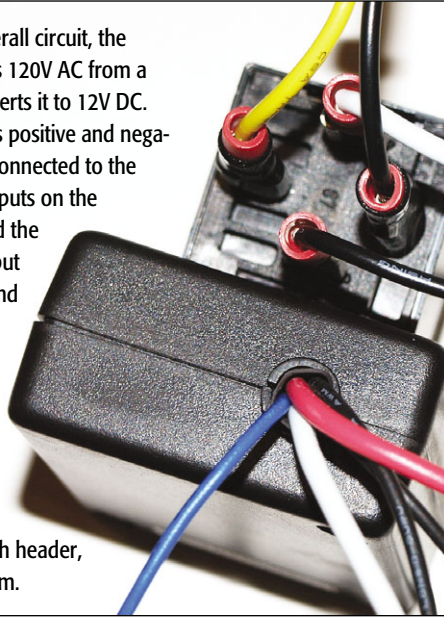
More experienced modders may be wondering why we chose to wire this mod as we did, because there are a number of different ways we could have achieved a similar result. For example, we could have wired the relay's switched outputs directly to pins 5 (common ground) and 16 (PS\_ON#) on the system's 24-Pin ATX power connector to fire up the system. Or we could have assembled a constant-to-momentary relay circuit using the right diode, resistor, and capacitor combination to eliminate the need to press the remote's On and Off buttons any time we wanted to power the system up or down.

The reason we wired the system the way we did was because both of these alternate methods would have required us to sacrifice some functionality. Had we wired the relay directly to the PSU, pressing the Off button would have immediately powered down the system, similar to pulling the power cord from the wall, which is undesirable. And had we used a constant-to-momentary relay circuit configuration, we would have lost the ability to hard reset the system, which requires a user to hold down the power button for a few seconds. With the circuit configured as we have detailed in this article, there is no loss of functionality, with the only downside being that we have to hit two buttons to properly power the system up or down. In our opinion, that was a worthwhile tradeoff. ▲



We used a standard 12V Bosch relay to convert the Logisys RM01's 12V output to a switched signal. When the remote's On button is pressed, it sends a power-on signal to the receiver. The receiver then powers up; its output engages the relay; and the relay in turn effectively flips the switch that powers up the system. The connectors circled in red on the relay are used for the 12V input and the connectors circled in green signify the switched output.

In the complete, overall circuit, the power adapter takes 120V AC from a wall outlet and converts it to 12V DC. The power adapter's positive and negative leads are then connected to the +12V and ground inputs on the Logisys receiver, and the receiver's +12V output and additional ground leads are connected to the relay. When the relay receives power, its switched output, which is connected to the motherboard's power switch header, powers up the system.



We salvaged a two-prong connector from the power switch of an old case and wired it to the relay. When the final assembly is connected to a motherboard's power switch header, it acts just like a power switch on a case, save for the fact that it is not momentary.

The final step in this mod is connecting the relay's switched output to the motherboard's power switch header. To do so, we cannibalized the necessary two-prong connector and wires from an old case. We then removed some sheathing from the end of the wires and crimped on some connectors that would let us attach them to the relay. We then simply connected the wires to the relay's switched output (contacts 87 and 30).

As a precaution, we also planned to slide some heat-shrink tubing over the relay's contacts to insulate them all once the final

assembly was tested and complete. Because the contacts had a lot of exposed metal, we thought it best to cover them up with the shrink tubing to minimize the risk of a short circuit. For the sake of illustration in this article, we've left them bare.

Now, we had power coming from the 12V adapter into the receiver; the receiver's outputs were connected to the relay's inputs; and the relay's switched output was outfitted with some wires and a two-pin connector. We plugged the two-pin connector into the motherboard's power switch header to complete phase three.

### Fire It Up!

Something we had to keep in mind with this mod was that a PC's power switch is momentary. That is to say the switch is closed (or on) only when the power button is being pressed. With the remote setup we assembled, the relay, which acts as the power switch, would remain closed, or on, any time the remote's on button was pressed and would remain open until the off button was pressed. So, if we pressed the remote's On button and left it, it would be like we were constantly holding our case's power button, which would only serve to shut the system down in a few seconds. Our solution was to press the remote's On button, wait a second for the system to power up, and then press the remote's Off button. Doing so makes the relay act like a momentary switch, allowing the system to power up like normal. Following the same procedure (pressing the On button immediately followed by the Off button) also allowed us to soft power-down the system once it had booted into Windows. Success!

Finally, all we had to do was hide the remote end in our desk to complete our transformation into Thomas Crown. Now, if we could only get Rene Russo to come over. . . . ▲

by Marco Chiappetta

## Parts List

We used a combination of equipment purchased at retail and parts salvaged from the junk pile to perform this remote PC power switch mod. The complete breakdown of parts was as follows:

Logisys RM01 12V/6A relay with remote controls	\$14.99
12VDC/30A SPST automotive relay	\$6.79
120VAC-to-12V DC power adapter*	\$19.99
Crimp-on connectors	\$0.79
Heat-shrink tubing	\$1.99
4-Pin Molex power connector extension cable**	\$0
2-pin receptacle**	\$0

\*120VAC-to-12VDC power adapters are quite common. If you have any random wall warts sitting in a junk drawer somewhere, there's a good chance one of them will work for this mod.

\*\*Salvaged from parts



# Mad Reader **MOD**

## WCCC\_9,000

A successful mod strikes the perfect balance between form and function, and it's plain to see that Justin Diduch's WCCC\_9,000, named for Justin's Seattle-based West Coast Custom Computers shop, is cover-of-Forbes material when it comes to a job well done. For the WCCC\_9,000, Justin took an Antec 900 case and sliced off the case's 200mm fan-equipped top panel and replaced it with a beveled piece of quarter-inch thick smoked acrylic. Justin mounted a 2 x 120mm radiator to the acrylic panel and then bolted a 200mm Koolance reservoir to the top of the radiator. The pair of 120mm fans sport blue LEDs and reside inside the case on the underside of the acrylic panel to push air through the radiator. Justin installed a second 2 x 120mm radiator vertically, behind the 5.25-inch drive bays and aluminum modder's mesh front grille.

Justin liberated the 5-inch LCD from the headrest of a wrecked Acura Legend, which he found rotting in a Seattle-area junkyard. Justin created the mounting bracket for the LCD out of a pair of Lian-Li 5.25-inch bay covers and another piece of acrylic. Justin designed and configured a custom frontend using the system monitoring software Serious Samurize ([www.samurize.com](http://www.samurize.com)) to display CPU and GPU clocks, core temperatures, remaining HDD space on the WCCC\_9,000's dual 500GB Seagate SATA II HDDs, and system voltages. The front end is polling data once a second from SpeedFan ([www.almico.com](http://www.almico.com)), RivaTuner ([www.guru3d.com](http://www.guru3d.com)), and a couple of WMI (Windows Management Instrumentation) monitors.

Justin cut the Antec 900's dual pane side panel so that it has a single large window and then covered it with another slab of acrylic. The side panel fan is a 220mm Koolance fan equipped with blue LEDs. The right side panel currently features a Crysis vinyl wrap, but Justin said it may feature a screenshot from Far Cry 2 very soon.

Justin used the Asus P5N-D SLI as his machine's foundation and installed an Intel Core 2 Duo E7200 into the WCCC\_9,000, overclocking it to an impressive 4GHz. The system features 4GB Patriot Viper DDR2 1,066MHz memory, an XFX 9600GT with the core, shaders, and memory clocked at 800, 1,800, and 2,000MHz, respectively. A Thermaltake 750W Toughpower PSU powers the system. Justin used several Koolance waterblocks in the system, including a GPU-200, CPU-340, and three CHC-125s to cool the Asus P5N-D SLI's northbridge and southbridge chips.

The most difficult part of the mod was cable management. All told, Justin estimates that he spent about 60 hours on the WCCC\_9,000, and it really shows. ▲







The right side panel features a Crys-themed vinyl wrap. Justin prefers vinyl over airbrushing because it's more durable and able to survive plenty of trips to LAN parties.

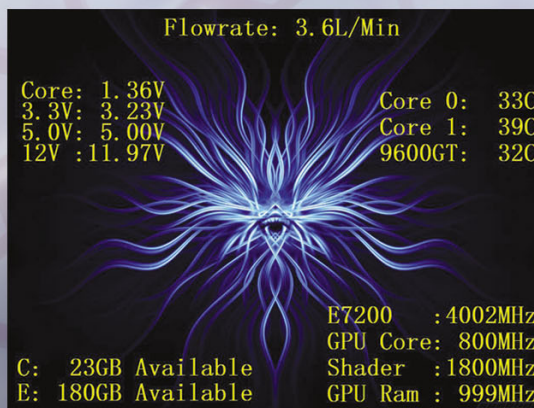
To accommodate the liquid cooling hardware, Justin cut and shrink-wrapped any unnecessary PSU cables and tucked them inside the PSU's case.



Justin painted the case interior and wire mesh accent pieces using Ford blue metal flake automotive paint to match the blue liquid and LEDs.



The 200mm Koolance reservoir sitting on top of the radiator pulses with blue liquid.



This is a screenshot of Justin's customized system monitoring interface.

## Give Us Your Mod

Have a computer mod that will bring tears to our eyes? Email photos and a description to [madreadermod@cpumag.com](mailto:madreadermod@cpumag.com).

We're looking for rigs that are recognizable as PCs; your Wookiee mod won't find a home here.

If we include your system in our "Mad Reader Mod" section, we'll help you load up your modder's toolbox with \$1,500 and a one-year subscription to *CPU*.



# A Gamer's Dozen

## PDXLAN 12 SERVES UP THE PWN

It's a bit tricky to say that PDXLAN 12 was bigger than ever. For the past several years, the event's founder, organizer, and full-time LAN-planner Matt Conwell (aka Vector) has capped PDXLAN at 500 attendees, and the twelfth iteration was no exception. But we're going to say it anyway: PDXLAN 12 was bigger than ever. The event sold out in March, four months before the July 18th event and faster than any previous PDXLAN to date. When the doors to the Portland Airport Holiday Inn Convention Center opened, more than 150 gamers were still on the waiting list for a spot at one of the event's many tables.

### Building A Better LAN

If you ask Vector what he thinks a LAN party should be, PDXLAN is his answer. "It's about community, it's about grassroots, it's about having fun with your friends for four days. It's time set away from life for gaming." PDXLAN styles itself as a mix between the intimate, self-organized LANs of less than 20 close friends and the large corporate LANs, such as CPL (Cyberathlete Professional League; thecpl.com) and QuakeCon, which typically host thousands of gamers, professional and otherwise, from all over the world. "I think a LAN gets messed up when it becomes too corporate, when [the LAN's organizer] puts corporate interests before the interests of the gamers. The customer has to come first, and the attendees are the customers. You have to make sure they're happy first," Vector says. PDXLAN has its share of international attendees, but professional gamers aren't what PDXLAN is all about. As Vector puts it, "I don't care who's the best at Counter Strike, I just want people to have fun." And there's plenty of fun to be had at PDXLAN.

But the business of running a LAN party isn't all fun and games. When we asked how he turns a convention facility at the Holiday Inn into a 500-person LAN party, Vector told us he starts by representing every square foot of the conference room as evenly spaced squares in Excel and then uses highlighting to determine the final layout. "I can tell you where every outlet is in the room, and out of the more than 300 outlets we have, I can tell you where each one of them maps to in the circuit breaker room." Despite the seeming complexity of networking 500 seats in a single room, Vector explains that it's actually a rather simple endeavor, thanks to his network-in-a-box. "We have basically all the switches, the entire network core—everything—all in one box, so we can ship it anywhere in the country, and it's the same network wherever we go."

But Vector doesn't do it alone; 30 to 40 volunteers step up to help out, and Vector gets a helping hand or two from a host of

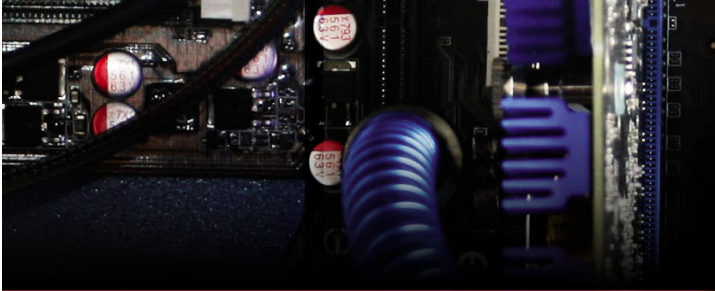
sponsors. CPU was in good company, with the likes of Intel (which supplied a dozens of gaming machines for tournament play), Antec, Palit, Danger Den, Patriot Memory, Nvidia, Bawls, Crucial, West Coast Custom Computers, and Zotac, to name several. Ahem, Maximum PC also sponsored the event, but wasn't on hand to go head-on against Team CPU.

Gamers  
play  
Frontlines:  
Fuel of  
War while  
drinking  
Bawls: Fuel  
of Gamers.

This gamer  
installs a  
CPU cooler  
mid-LAN.



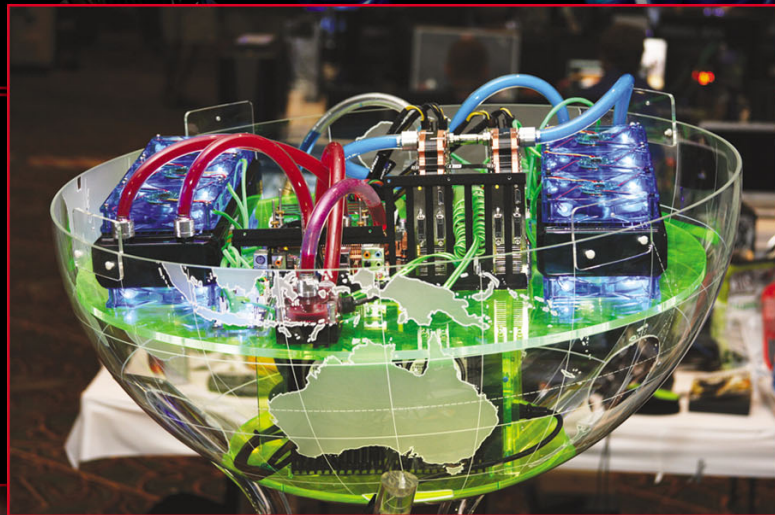




Richard "DarthBeavis" Surroz abstained from the Antec Nine Hundred modding contest, but showed off his environmentally conscious earth-shaped mod.

## More Than Just Gaming

In addition to the obligatory FPS and RTS tournaments; PDXLAN 12 was also host to a range of contests that veered sharply from the beaten path. This year





PDXLAN overtaxed the node setup for the Portland metropolitan area, so Comcast stepped in to deliver the bandwidth.



saw the first ever five-on-five dodgeball tournament, hosted by Crucial, which took place in the convention center parking lot. Intel and Danger Den hosted the dress-like-a-ninja contest, at which much pirate-bashing occurred. The winning ninja walked away with some booty—er, goodies from the sponsors. PDXLAN 12 also launched the first ever trebuchet contest in which teams of up to two were tasked with constructing a 3-foot-tall trebuchet to compete in distance and accuracy trials. As evidenced by the few attendees wearing aviator sunglasses and practicing a blank countenance, PDXLAN also featured a poker tournament.

PDXLAN 12 introduced MMOs to the mix. The first ever PDXMMO was held simultaneously with PDXLAN in the adjacent Holiday Inn ballroom. PDXMMO gamers had their own dedicated Comcast cable modems for playing MMOs and hosting multiplayer RPG sessions. The PDXMMO gamers pillaged Azeroth in a World of Warcraft tournament and indulged in hours of Age of Conan, Diablo, and EverQuest, among others.

## Nine Hundred Modding 101

CPU's mod contest this year was a throwback to the modding competitions of yore, where modders modified a standard case rather than simply installing a computer into a unique or improvised enclosure. Six contestants felt they could improve upon the design of the Antec Nine Hundred, but, according to the rules, over 60% of the case had to remain when all was said and done. If we didn't see an Antec Nine Hundred peeking out from beneath the Bondo and modder's mesh, the artist had gone too far. Luckily, all entries adhered to the rules. Turn to page 38 for the full story on Justin Diduch's impressive water-cooled winning WCCC\_9,000. ▲

by Andrew Leibman

CPU's mod contest finalists all made creative use of the Antec Nine Hundred.



## PDXLAN 12 By The Numbers

Attendance Fee:	Free Stuff:	Total Value Of Freebies:	Raffle, Tournaments, contests, and prizes:	Free Pizzas:	Amps Of Power Per Seat:	Cans Of Bawls:	Milligrams of Caffeine:
<b>\$60</b> (first 400 attendees to sign up)	<b>\$130</b> worth of swag for each attendee	<b>\$65,000</b>	<b>\$130,000</b>	<b>100</b>	<b>3.4</b>	<b>7,680</b>	<b>783,360</b>
<b>\$65</b> (last 100 to sign up)							



## The best gaming systems run with **DOMINATOR**

*"The XPS 730-series platform is the ideal place for Dell to showcase the best that PC performance hardware has to offer, we had very aggressive performance goals for this platform, including the ability to run 4GB of overclocked main memory with rock-solid stability. Corsair's DOMINATOR DDR3 modules were the only logical choice for the best-in-class performance memory required for the Dell XPS 730."*

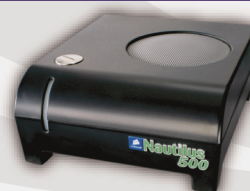
Patrick Desbois, Dell XPS Gaming Engineering



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“ We would always recommend a hardware RAID-based solution for anyone considering anything beyond RAID 0 or 1. ”

*Each month we dig deep into the mailbag here at CPU in an effort to answer your most pressing technical questions. Want some advice on your next purchase or upgrade? Have a ghost in your machine? Are BSODs making your life miserable? CPU's "Advanced Q&A Corner" is here for you.*

**Chris F. asked:** I replaced the hard drive in my computer recently because I needed more space and want to sell the old drive just to make a couple of bucks. But a friend of mine told me that even if I delete the partition on the drive and reformat it, someone could still recover my personal data if they wanted to. Is this true? And if so, what can I do to completely blank the drive to make sure no one can get their hands on my files? I don't want to sell an old hard drive for \$10 only to have some stranger looking at my family photos or accessing my tax records.



Hard Disk Scrubber is a handy, free utility that can completely destroy data stored on a hard drive. Just be prepared to wait awhile for a completely scrubbing.

**A:** Your friend is absolutely right, Chris. Even if you delete your original partition, create a new one, and reformat the drive, data once stored on it can still be restored with the proper tools. To truly “erase” the data that was once stored on the drive, not only does it need to be deleted, but it must be overwritten a number of times with other data. In fact, many experts recommend a drive be completely overwritten seven times to adequately obliterate old data. For the utmost in security, it's probably a good idea to heed this advice before selling an old drive, but you don't necessarily have to go to such extreme measures if you're just looking to unload an old drive for a few dollars on eBay. The likelihood that someone looking to purchase a cheap, used hard drive would

have the expensive equipment necessary to recover data from a cleaned hard drive on hand is very slim.

Thankfully though, there are some free tools out there that will scrub a drive clean for you with minimal effort. One such tool, the aptly named Hard Drive Scrubber, is readily available online and is very easy to use. All you have to do is reconnect your old drive to a PC already running Windows, run the application, select the old drive, and perform a heavy scrub of the drive.

When you perform a heavy scrub of the drive, the first pass will overwrite all of the data with binary 0s, the second pass will overwrite all of the data with binary 1s, and the final pass will overwrite the data with random garbage. If the heavy scrub option, however, is left unchecked, the data will only be overwritten once with random garbage. Although the Hard Drive Scrubber application has options within its menu to also delete files on the drive, we'd recommend replacing the old drive's MBR, deleting its original partitions, and creating a single clean partition before running the program to save time. A heavy scrub of a relatively big drive can take many hours, so be prepared to leave your machine running for as long as is necessary to completely wipe out your drive. You can save even more time by choosing the program's Fast option, but that will consume more system resources during the process.

**Terry E. asked:** My home-built system has been stable and reliable for several years, but as I was using it one night, everything went dark on my screen. The fans and case lights still come on and the drives spin up, but it will not post. I narrowed the failure down to the CPU, PSU, or motherboard. I had some spare components and the motherboard turned out to be the point of failure. Normally, this would not be completely catastrophic for me. I would just look at it as a great excuse to upgrade. My concern is that I have a RAID 5 array supported by the onboard RAID controller, and I would really like to recover my valuable data.

My system specs are: AMD Athlon X2 4800+, ASUS A8N-SLI Premium (has a SIIG3114 SATA RAID chip), one WD Raptor 36GB 10K RPM HDD [boot / OS drive], four Western Digital 500GB HDD [WD5000YS] in RAID 5, 4GB RAM [Crucial], BFG 7900 GT OC video card, and an Enermax 535W PSU.

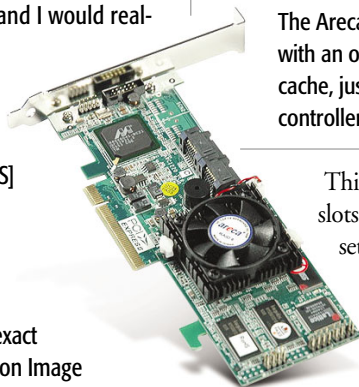
I am guessing that if there is any hope of reviving my RAID array, I will need to replace the motherboard with as near an exact match as possible. How exact would this need to be? I assume I need the same Silicon Image SATA Link chip, but are there other components I would have to match also? If so, how can I identify the right part(s)? Also, as this is a software-based RAID solution, will all the configuration information be retained on the drives, or will I need to reconfigure the RAID BIOS in order for it to see the existing volume? Is there any way to recover the needed settings from my now dead motherboard?

To avoid this in the future, I am thinking of going to a hardware RAID solution. Do you have any favorite, affordable cards? If I do go this route, do I need to have two cards supporting mirrored arrays in order to prevent the RAID controller from being a single point of failure and ending up back in the same situation I am in now or would just having a spare card as backup be sufficient for recovery?

**A:** Those are all excellent questions Terry, and we feel your pain. One of the inherent risks with going RAID is volume migration when hardware upgrades are required, especially if you didn't get a chance to back up your critical data beforehand. That said, we're a little surprised you were running a RAID 5 setup on an integrated software RAID-based controller. RAID 5 requires a fair amount of CPU overhead for parity calculations, and performance on integrated motherboard controllers is typically pretty abysmal. We would always recommend a hardware RAID-based solution for anyone considering anything beyond RAID 0 or 1. That said, you are where you are now, and we'll certainly offer what we can to help you out here.

Your initial instincts are correct with respect to the hardware replacement and the likelihood of recovering your data. The best chance for you to recreate that RAID 5 volume is to replace the motherboard with an identical model and preferably even the same revision of the board. The next option, as you noted, would be to find another board with at least the same SIIG controller chip. Your chances are good that you'll be able to re-initialize or rebuild your array on the same controller, but if that new motherboard doesn't use the same version of the RAID BIOS for the controller, you may be out of luck there too. Either way, with the same SIIG 3114 chip, as long as you don't have data corruption across multiple drives somehow, you should be in pretty good shape. When you go into the RAID BIOS of the new board, the controller should see the old array, and it should be already configured or at least have the option to rebuild it.

In terms of hardware RAID controllers (and we're definitely fans of hardware-based RAID 5 for the power user's desktop), we'd suggest taking a look at the Areca ARC-1210 PCI Express RAID card.



The Areca ARC-1210 RAID controller is a hardware-based solution with an on-board Intel IOP332 processor and 256MB of DRAM cache, just the thing for RAID 5 setups that software-based RAID controllers fall short on.

This card could slip into one of your two PCI-E X16 slots and offer you a performance boost in a RAID 5 setup due to its on-board Intel IOP332 RAID processor and 256MB of RAM. You can find these online for around \$289. It's a bit pricey but with its X8 PCI Express link, RAID processor and on-board DRAM cache, we think it's well worth it.

Another option would be a 3-Ware/AMCC 9650SE-4LPML card. The nice thing about this card is that it will drop into the spare X4 PCI-E slot you have on the Asus A8N SLI Premium (should you replace the board with the same model) and still leave that X16 slot open for another graphics card. The 9650 will run you about \$329. ▲

by Dave Altavilla and Marco Chiappetta,  
the experts over at HotHardware.com

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# The Tesla Roadster: A Quiet, Eco-Friendly Ride

As a kid, Christmas morning was especially great when you knew there was a cool toy waiting under the tree. However, after unwrapping the gift, nothing tempered your excitement like seeing "Batteries Not Included" printed on the toy's box.

When it comes to one of the coolest toys available today for adults, however, the batteries (more than 6,800 of them) are always included.

Tesla Motors ([www.teslamotors.com](http://www.teslamotors.com)) began shipping the Tesla Roadster, a high-powered electric vehicle (EV), to customers in July, bringing an eco-friendly, battery-powered sports car to drivers for the first time. The Roadster truly breaks the mold of what we've come to know about EVs, basing its

design on a Lotus Elise sports car and running at a top speed of 125 mph.

Throw in the fact that the Roadster has no harmful emissions, and it's easy to see why the hype over the Roadster is incredibly high.

## The Basics

Tesla began taking orders for the Roadster several months ago and has pre-sold hundreds of vehicles priced around \$100,000. The company, which has two service centers in California with plans for several more in large cities in the United States, purposely started slowly with production of the Roadster.

"In large measure, we're deliberately limiting the production until we install our own born-and-bred final transmission

by mid-September, at which time production will start to ramp up, leading toward a monthly rate of over 100 cars in December," Tesla Motors president and CEO Ze'ev Drori told customers in July.

Compared to gasoline-powered vehicles, EVs are amazingly simple. The Roadster has four primary systems: The battery pack, the Power Electronics Module (PEM), the AC inductive electric motor, and a transmission system.

## Battery Safety

Tesla calls its battery pack the ESS (Energy Storage System). It makes use of

## Battery Pack (The ESS)

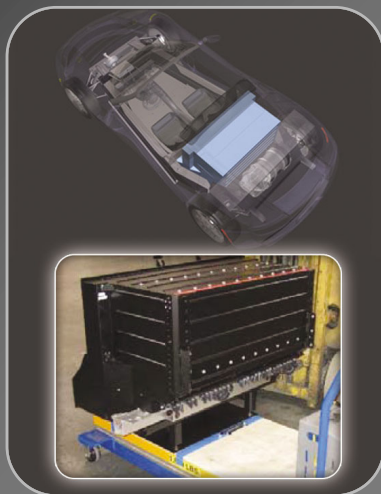
The Roadster contains 6,831 Li-ion battery cells, each of which is slightly larger than an alkaline AA battery. Each cell, called the 18650, measures about 0.7 inches in diameter and 2.5 inches in length. Tesla groups the cells into 11 sectors (621 batteries in each sector). A processor controls each sector. The entire battery package weighs nearly 1,000 pounds (more than one-third of the entire vehicle's 2,690 pounds). The blue area shows the location of the ESS in the vehicle's back end; the photo at right shows the battery pack itself on a blue cart (with the silver manifold under the pack).

The cells can deliver a combined 410 volts to the AC induction motor in the Roadster. The ESS can propel the Roadster from 0 mph to 60 mph in about four seconds. (However, because

of changes to the transmission system, the real-world 0-to-60 measurement with the first Roadsters is closer to six seconds; future Roadsters should have an improved transmission system.) The ESS stores about 53 kilowatt hours of electrical power, which is equivalent to about 2.1 gallons of gasoline (giving the Roadster an estimated mpg measurement of about 100 to 120 miles per gallon).

Tesla engineers use a equal mix of water and glycol to serve as the cooling fluid running throughout the battery pack and the manifold. Because Tesla uses several thousand individual battery cells, the Roadster's battery pack has a high volume-to-surface ratio, which allows for more efficient cooling. The cooling fluid works more efficiently when it has more surface area from which to pull the heat away. Tesla estimates its combined battery surface area with its design

at about 27 square meters. Using a different design, perhaps with two dozen large, block-shaped batteries in the Roadster, could yield as little as 3 or 4 square meters of surface area. Large, block-shaped batteries also could be subject to hot-spot areas, which could lead to failure. ▲



Source: Tesla Motors

## The Motor



The AC inductive electric motor (stored in the trunk, as shown in the illustration at left) weighs only about 115 pounds and is the size of a watermelon (as shown in the illustration at right). Tesla's engineers also focused on the motor's efficiency; they estimate the motor is able to use 85% to 95% of the electrical power to actually move the vehicle. Lower efficiencies would simply create unwanted additional heat.

The air-cooled motor receives AC voltage (that the PEM converts from DC voltage) from the battery pack. It runs quietly, sometimes emitting a slight whine. Those who've driven the Roadster say it requires a slight driving adjustment to control speed with the quiet electric motor because they're used to receiving noise and vibration feedback from gasoline-powered motors as they accelerate. ▲

Source: Tesla Motors

lithium-ion (Li-ion) battery technology. Li-ion batteries appear in a variety of products, including laptops and cell phones.

Tesla designed the ESS with an emphasis on safety, because Li-ion batteries can suffer from thermal runaway when mishandled or misused. Unlike the plastic casing for the battery in a laptop computer, for example, Tesla chose aluminum to enclose each of the 6,831 AA-sized batteries, which provides greater protection. To further protect the cells, a steel can surrounds each individual cell, protecting it from outside physical forces. (The steel also provides thermal conductivity, dissipating heat efficiently, which extends the life of each cell.)

Tesla uses several microprocessors, printed circuit boards, a CAN (controller-area network) bus, and a 12-volt power supply within the battery pack to manage operation and to protect against failure. Several passive safety systems exist, as well, meaning that if a collision causes some active systems to fail, the

battery pack will cease operation without reliance on other systems.

Tesla built three additional primary levels of internal protection into each cell.

**Chemicals and materials.** Tesla chose proprietary chemical and material compositions within each cell that lessen risks from flammability and from thermal runaway (by increasing the temperature required to initiate thermal runaway).

**CID.** The CID (current interrupt device) shields each cell from excessive internal pressure, usually the result of high temperatures. If the CID fails from excessive pressure, the cell immediately shuts down.

**PTC.** The PTC (positive temperature coefficient) limits current on each individual cell, preventing short-circuiting. The PTC operates without reliance on any other system.

### Charging Up

With drivers now using the first Roadsters, Tesla's concept of the electric car is receiving more publicity than ever.

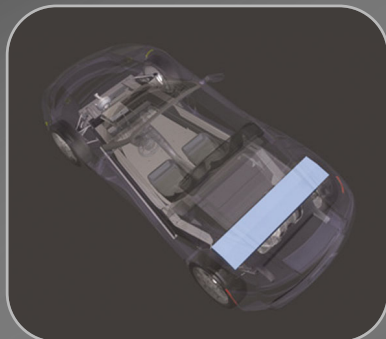
Drivers who've studied EVs will be impressed with the advancements Tesla has developed in the areas of acceleration (0mph to 60mph in four to six seconds), distance (220 miles on one charge), and battery life (more than 100,000 miles).

More improvements undoubtedly will occur in the next few years. With its current 220-mile limit, you probably can't take the first generation Roadster to grandma's house and back in one day, but, for most drivers, it's a viable option for driving to work and returning home. Plugging the Roadster in at home will be a lot less painful to your pocketbook versus filling up your gas-powered car, and the benefits to the environment are easy to see.

Timing is everything in the business world, and, with obscene gas prices and vehicle emissions grabbing headlines, the Tesla Roadster's initial appearance on the roads is timed almost as well as its ability to go from 0 to 60. ▲

by Kyle Schurman

## The PEM



When you press on the Roadster's accelerator pedal, a pair of potentiometers measure the distance the pedal is depressed, relaying the information to the PEM (Power Electronics Module, shown in blue in this illustration), which is also in the trunk near the battery pack and the motor. The PEM converts the appropriate amount of DC voltage from the battery pack to AC voltage, sending it to the motor using 72 insulated gate bipolar transistors. The PEM also controls the motor's RPMs and the vehicle's regenerative braking system, which captures the kinetic energy used to brake the vehicle and sends it back to the battery pack. The PEM monitors system temperatures, as well. ▲

Source: Tesla Motors

## Touchscreen

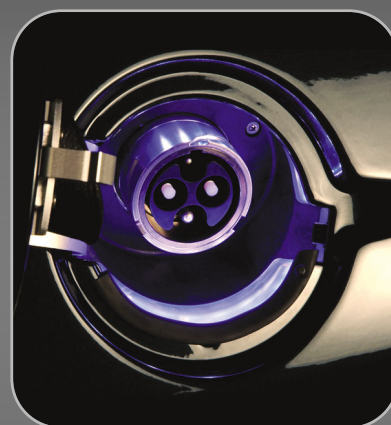


The touchscreen interface allows you to control when a recharge takes place (for example, you may want to program the Roadster to charge during off-peak electrical grid hours, when prices of electricity might be cheaper). The touchscreen also displays information about the car's subsystems. Located on the dashboard between the two front seats, it's the primary method for interacting with the Roadster's systems.

The touchscreen also indicates the number of miles you can drive on the electrical power remaining in the battery pack. ▲

Source: Tesla Motors

## Charging Plug



It might look like a gas tank cover, but it contains the outlet for connecting the Roadster to a power source.

Fully recharging the Roadster requires three and a half hours, but only if you have a 220-volt, 70-amp outlet installed in your garage. By using a converter kit, you can use any electrical outlet, but outlets that deliver less power will require longer charge times.

The Roadster does require less time to recharge if the battery pack isn't completely drained of stored power. ▲

Source: Tesla Motors



# Performance Drives ATI/AMD's 4800 Series

For companies, especially high-tech companies, surprising your customers with better-than-expected capabilities in a new product is the ultimate goal. Surprising your own engineers and designers is another good goal, although it's naturally a little more difficult.

ATI/AMD may have done both with its 4800 series of video cards, announced in late June. The company's initial cards included the Radeon HD 4850 and Radeon HD 4870, to be followed by the HD 4850X2 and HD 4870X2 (each using two GPUs). The new ATI cards make use of the new RV770 GPU architecture.

David Baumann, product manager for the RV770, says ATI's engineers focused on improving the performance per watt of

power used and performance per square millimeter of die size beginning with the 3800 series and continuing with the 4800 series. With the release of the 4800 series, ATI claims a four-fold improvement in both performance areas over the 2900 series, released in the summer of 2007.

"It was only a year ago that we released the 2900. It's been a busy year," Baumann says. "We did expect to get some significant gains from the 2900 with performance per watt. The focus of engineering was maximizing everything. We did get better gains than we expected to."

## Comparing Die Sizes

Unlike competitor Nvidia, which released its GTX 200 series a month

ahead of the 4800 series, ATI chose to use a small die size of 260 square mm, containing 956 million transistors. (Nvidia's GPU is the largest ever made at 576 square mm, containing 1.4 billion transistors). ATI also used a 55-micron manufacturing process versus the 65nm process Nvidia used.

By using a smaller die size, ATI can squeeze more chips out of a wafer, which can yield lower prices.

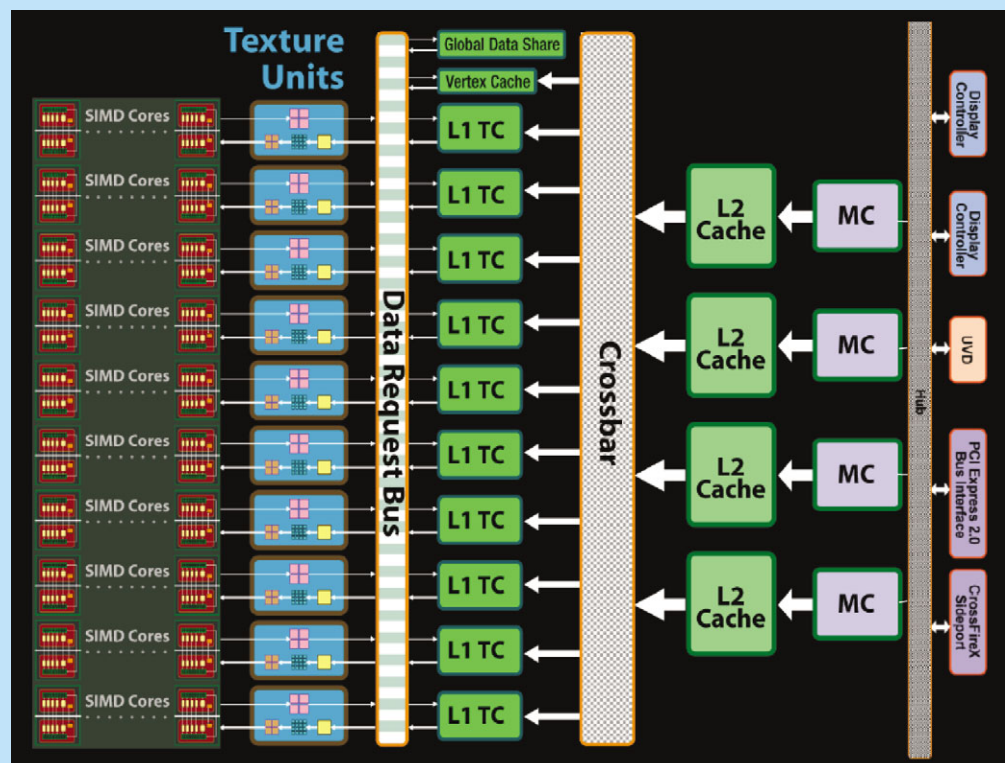
"With the 3800, we flipped our trend and had half the die size" of the 2900, Baumann says. "The 4800 continues that trend, although we have increased over the 3800's die size slightly (from 190 square mm to 260 square mm). . . . We have a massive bandwidth capability,

## RV770's Architecture

ATI made several changes to its architecture with the RV770 chip (found in the 4850 and 4870 boards).

"It took a significant effort in engineering and performance per watt, and it's paid off pretty well," ATI's Baumann says.

Let's take a closer look at the key components in the chip's architecture. ▲



Source: ATI/AMD

while remaining at a good price point. We also don't have to build huge chips. We're targeting very key price points with exceptional performance in those price points."

### Using GDDR5

With its 4870 board, ATI decided to introduce GDDR5 memory to video cards. (The 4850 board makes use of standard GDDR3 memory.)

"To get the level of performance we are at, we had to push the memory limits as far as we could with GDDR5," Baumann says. "Without using GDDR5, there's no way we could've gotten the bandwidth we

## TeraFLOPS Processing Power

The first computer to surpass 1 teraFLOPS of processing power was the Sandia National Laboratories' ASCI Red supercomputer in 1997 (pictured above), which—in its final configuration—made use of 9,298 Pentium II processors in more than 100 cabinets, and occupied an extremely large room (about 2,500 square feet).

Today, the Radeon 4870 HD board also offers more than 1 teraFLOPS (1 trillion Floating-point Operations Per Second) of processing power.

The ASCI Red required about 500kW of power to operate and another 500kW of power for cooling (for a total of about 1 million watts of power). The 4870 has a maximum power requirement of 160W.

"We're getting the same capability of processing power a little more than 10 years later in an easily attainable format," Baumann says. ▲

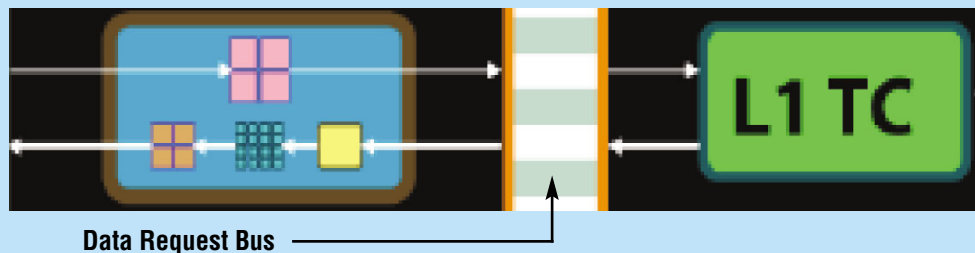
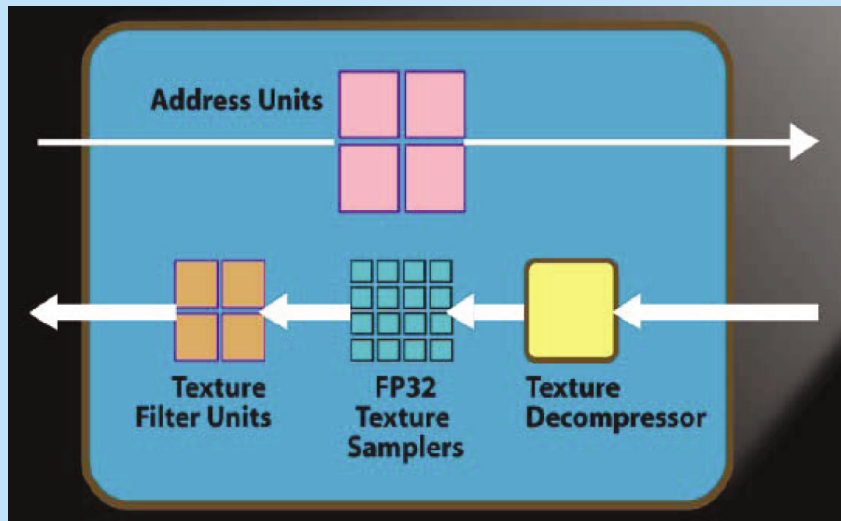


Sources: ATI/AMD, Sandia National Labs

## Texture Units

The RV770 contains four address units and four texture filter units, creating a 1-to-1 ratio, which is advantageous for avoiding latency issues. The RV770 can perform up to 160 fetches per clock. ▲

In this illustration, you can see the L1 texture cache in relation to each texture unit. Each L1 cache offers a bandwidth of 480GBps. With the L1 aligned with each SIMD and texture unit, ATI claims it now has double the effective storage per L1 cache unit as it did with the RV670. ▲





needed without increasing the die size itself and increasing the cost.”

Introducing a new type of memory in a key product certainly carries some

risks for ATI, but Baumann says the memory manufacturers were prepared to meet the company’s needs, which lowered the risks.

“GDDR5 is such a big inflection point for all of the vendors,” he says. By using it first, “we just get a six-month jump on everybody else in working with it. Yes, we

## L2 Cache

Each of the four L2 cache areas is aligned with each of the four memory controllers. The RV770 offers a bandwidth of up to 384GBps between the L1 and L2 cache areas.

“We split the L2 cache according to memory partitions,” Baumann says. “We get more cache hits with this generation. There’s a very high utilization on it. . . . L1 and L2 caches provide good rates.” ▲

## Stream Processing Units And SIMD Cores

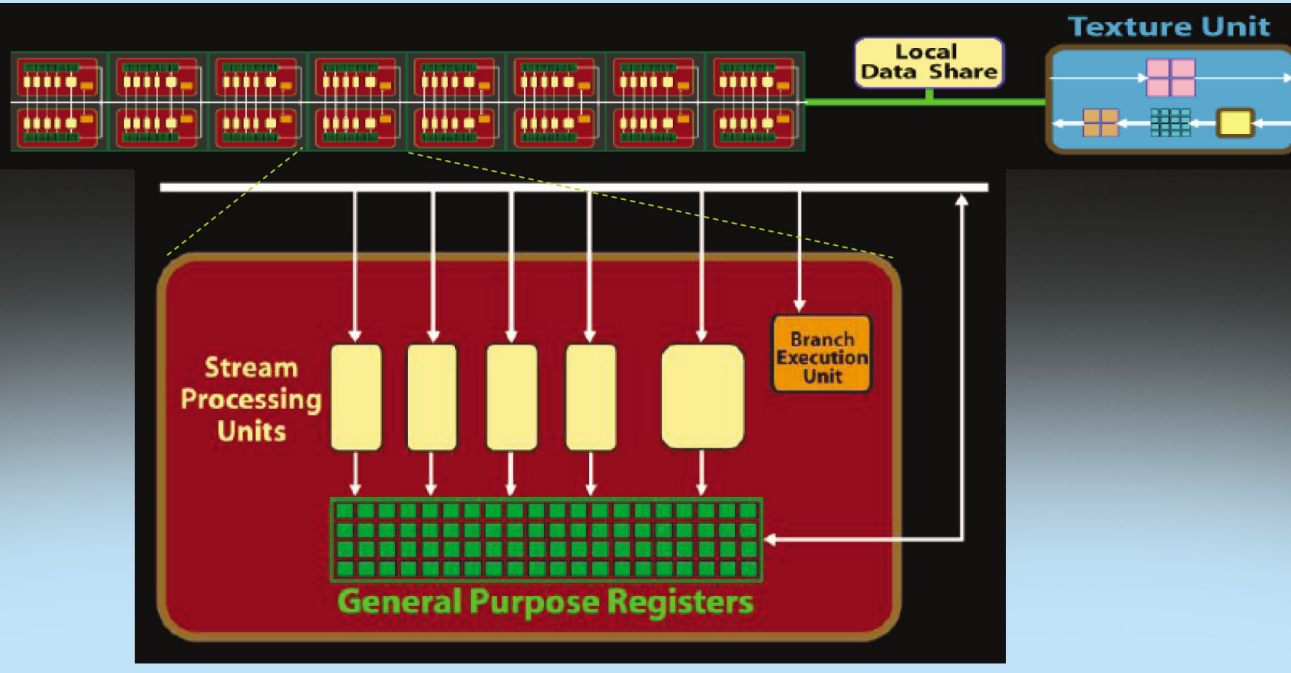
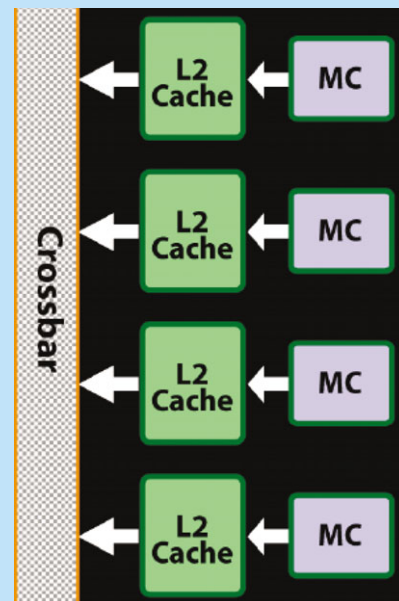
In this illustration, the SIMD core is shown in the upper portion, consisting of 16 streaming processors, a local shared memory area, and a texture unit. Each SIMD core also has access to an L1 cache. Within each streaming processor (in the lower portion of the diagram) are five streaming processor units (SPUs), one branch execution unit, and registers. ATI has included 10 SIMD cores within the RV770, which yields 800 SPUs per chip (compared to 320 streaming units in the RV670).

The changes ATI engineers made to the SIMD cores in the RV770 provide significantly improved performance. For example, when one SIMD finishes processing its data, the results are stored on the GPU in the global data share area (shown in the overall illustration of the architecture), rather than being stored off-chip, meaning the next SIMD that needs that data can access it more quickly.

“It’s an advancement of the architecture, but we had to significantly change it to reach our own goals,” Baumann says. “We

had to change the SIMD cores and to reorganize the texture units to get more performance out of them.”

The engineers also have made major changes to the SPUs within each streaming processor. In the RV670, only one of the five SPUs was able to perform integer math. (Baumann says the engineers called that SPU the “fat unit.”) With the new generation, however, all five SPUs can perform integer math, to better work with DX10.1. ▲



were pushing the envelope, but it hasn't deterred us in any way."

### High-End Performance

All of the changes with the RV770 have yielded cards with strong measurements. The 4800 series cards are capable

of at least 1 trillion floating point operations (teraFLOPS) per second. With improvements in antialiasing over previous generations, especially at 8xMSAA, Baumann says running the 4800 series cards at the maximum settings is more realistic than with past ATI cards.

"We knew we were underperforming in high-quality settings. We've completely turned this around. There's no reason not to turn on the 'high-IQ' settings," Baumann says. ▲

by Kyle Schurman

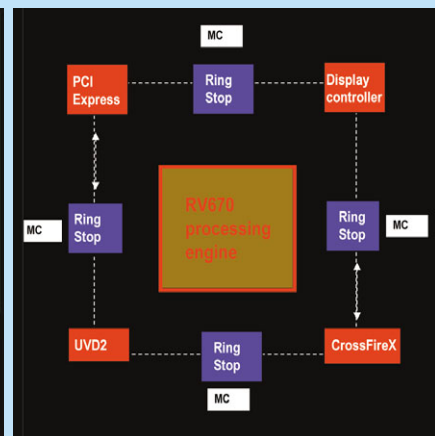
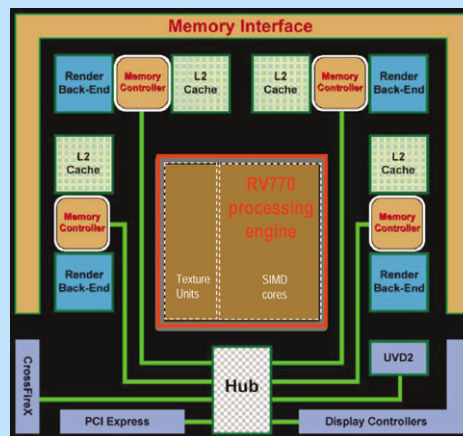
## Switched Hub Versus Ring Bus

With the new GPU, ATI/AMD moved completely away from the ring bus architecture it used in some versions of the RV670 GPU.

The RV770's architecture uses a switched hub and a distributed design to move data. By moving the controllers to the edges of the chip, they're closer to the aspects of the chip that use the most bandwidth. The ring bus worked poorly with low-bandwidth data and wasted power. The switched hub in the RV770 makes better use of power and reduces latency.

"In the RV770, we've alleviated the need for the ring," Baumann says. "We have a fully distributed memory controller. We're still using a distributed memory controller

without the need for the ring. . . . The 10 SIMD cores are aligned in the center of the die. We have control logic around that. The edges are where the I/O elements need to be." ▲



Source: ATI/AMD

## Dynamic Power Management

The 4800 series makes use of an on-chip microcontroller to monitor the chip's power usage with little management from drivers or software. With this type of power management system and other chip improvements, ATI claims double the performance per watt versus the 3800 series and about four times the performance per watt of the 2900 series.

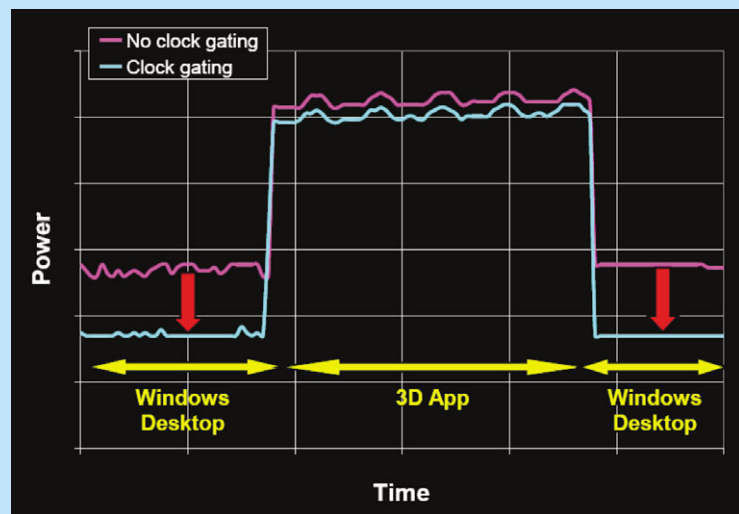
The microcontroller can control power management by lowering memory clock speeds, lowering voltages, controlling the fan, and clock gating. (Clock gating is a power-saving technique that disables portions of a chip's circuitry not in use.) Controlling clock gating in the 4800 series shows the most improvement in power savings when minimal graphics rendering is required.

As shown in this graph, the microcontroller boosts the available power when it senses the chip needs to boost memory speed or activate more areas of the chip because a 3D application is active. When only the Windows desktop is active, the microcontroller can lower the power requirements.

"It understands how much traffic is being moved, and how much of the chip is being utilized," Baumann says. "It then can determine the proper power state, and it's all handled on the chip. If one area of the chip isn't in use, it can turn off the transistors in that area."

The Radeon HD 4870 has a maximum power usage of 160W, while the HD 4850 requires up to 110W.

"Obviously, we're using much less [power] than that at non-peak performance," Baumann says. ▲



Source: ATI/AMD



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# THE DATA RENAISSANCE

## HOW STORAGE GOT ITS GROOVE BACK

In the family of PC hardware, storage components are almost always the ugly ducklings, and for good reason. With the rare exception of drives such as the wind-dowered Raptor X of yesteryear, hard drives and burners are the brick-shaped louts you tuck away in your case, letting them perform their respective tasks in relative obscurity.

Even the job of storing data is, by and large, brutally pedestrian. Sure, you have speed freaks who live and die by their striped arrays. There are the “mission-critical” folks who won’t sleep at night without knowing their bits are safe on a mirrored array and then backed up to an external drive. Then you have the rare breed of storage savant (or “nut,” depending on your persuasion) with a handful of SCSI drives in an exotic array most users wouldn’t even think would be possible in a desktop system, a BD-RE drive paired with a lightning-fast DVD burner, and a few eSATA external drives thrown in just for kicks. But even the sum of these data devotees pales in comparison to the legions of users (and that includes power users!) who are content simply with having enough storage for their data and a means to back up that data.

And until recently, the advancements in storage technology have been nothing to write home about, either. We’ve seen HDD manufacturers churn out denser and denser platters, the painfully protracted battle between Blu-ray and HD DVD finally cease, and eSATA make its way from cool concept to terrific interface. Storage has always been improving, but developments that turn heads are few and far between.

As far as actually storing your data is concerned, we’ve seen fairly dramatic improvements over the last year. The biggest of these, perhaps, is that solid-state drives are *almost* a viable option for average consumers. The cost per gigabyte of these drives has dropped from “crazy expensive” to simply “expensive”; the proliferation of

MLC (multilevel cell) SSDs alongside SLC (single-level cell) SSDs has dropped the price further, albeit at the expense of performance.

Meanwhile, Western Digital refreshed its popular Raptor line with the VelociRaptor, and the company claims this new species is 35% faster than earlier generations. And with two form factors, it’s friendly for both desktop and enterprise crowds. (WD doesn’t recommend stuffing this prehistoric bird of prey-named drive in your laptop.) WD and a host of other companies have released low-power HDDs that, while not bigger or faster, will make you feel like an ecological do-gooder, saving the planet one file write at a time.

If internal storage ain’t your bag, external drives should get some love in the near future, too. USB 3.0 is right around the corner and could be here as early as next year. It ought to be at least 10 times faster than USB 2.0. A faster generation of FireWire is also in the offing. Both of these new specs will be a welcome improvement, as USB 2.0 and FireWire 800 are starting to show their wear.

We have an impressive platter (no pun intended, really) of articles for you this month, each showcasing a different category of storage products. So even if you just scored a couple of 1TB drives for your system, there’s a plethora of external drives and disc burners in the pages ahead. Both SLC and MLC SSDs receive the *CPU* treatment, so check out our coverage of these flashy (pun sort of intended) drives, too. And of course, we have more than a bit (lame pun definitely intended) of space devoted to our faithful HDDs.

Let’s kick things off with a primer that covers the state of the storage industry more in-depth. A number of the industry’s giants have weighed in on the subject of storage, and we’ll bring you up to speed on what’s developing for HDDs, SSDs, and ODDs. And be sure to check out our Dream Build on page 58; check out the ultimate storage monster we’ve created—on paper, anyway—when we throw fiscal caution to the wind. It’s a good time to be in the market for more storage, so let’s dig in. ▲

by Vince Cogley



# STORAGE UNLEASHED

## NEW TECH SHATTERS THE STATUS QUO

Storage is crucial. You have to put your data someplace. Whether it's magnetic, solid-state, or optical, you want your storage to be fast and cheap (and more importantly, reliable).

The trend is ever upward in capacity and speed, even as the overall price per GB of storage continues to fall, with certain exceptions. Any user knows that bigger numbers are better when it comes to capacity, cache sizes, and most benchmarks.

That's the easy part. But as a power user, you want to know more about the tech underlying the trends. This information

can guide your current and future purchases, and potentially help you avoid shelling out big bucks on an expensive flash in the pan.

### Hard Drives

The mass storage foundation of the vast majority of PCs is a hard disk drive. A slow drive can turn a thoroughbred system into a real pig, so you want a drive with high read and write rates, as well as low seek and access times. If you're in the market, turn to "Send In The Platters!" on page 59 for our latest reviews.

As ever, capacity jumps are followed in the next generation by drives that post the same numbers with fewer hard disks. Fewer platters mean less noise, heat, and power consumption. Thus, today you'll find Hitachi's 1TB Deskstar 7K1000.B, a three-platter revision of its original five-disk terabyte drive.

PMR (perpendicular magnetic recording) is still driving these increases in AD (areal density), and will continue to pay dividends for some time. Seagate combined a higher AD with a four-platter design to take its Barracuda 7200.11 up a big notch, from 1TB to 1.5TB, and has slated a 2TB drive for next year. However, you can expect even bigger jumps in the future, as drive manufacturers seek to extend their capacity lead over SSDs.

Advancements in data density also allowed Western Digital to drop down to a 2.5-inch form factor for the 300GB successor to its 3.5-inch Raptor. The smaller platters facilitate quicker data

accesses, as the 10,000rpm VelociRaptor's read heads don't have as far to sweep across the disks.

Spindle speeds remain the same among desktops: 7,200rpm for speedy capacity, 10,000rpm for pricey performance at the expense of storage space, and 5,400rpm for low-buck capacity at the expense of speed. As for notebooks, 5,400rpm and 7,200rpm 2.5-inch drives are widespread. Mobile CE drives with 1.8-inch disks typically run at 3,600rpm or 4,200rpm.

A new twist (cough) is variable rotational speed. A few drives, such as Hitachi's 7K1000.B, can reduce rpms to save power—using about 54% less than in its traditional idle state, according to Hitachi. By slowing the drive's platters instead of spinning them down entirely, a PC can "wake up" much faster. However, control of this feature may be reserved for system manufacturers, not end users.

To try and fend off the SSD menace, many high-capacity hard drives now come with big 32MB caches, which boost write rates and, somewhat, read operations. These buffers are made of DRAM, which is much cheaper and faster than the NAND flash memory in SSDs. However, DRAM is volatile, so it can't remember data after the hard drive powers down, and thus can't help the drive to shorten boot times as hybrid hard drives theoretically can. (See the "Whither Hybrids?" sidebar in this article).

Automatic encryption is another feature prized by business and government users. Also, most manufacturers, such as



Seagate's Barracuda 7200.11 leaps ahead to 1.5TB.



Western Digital, outfit particular notebook drives with sensitive accelerometers. Should the user drop his laptop, the drive will immediately park its heads to avoid a damaging impact with the platters.

**Server drives.** 2.5-inch drives for energy- and space-efficient blade servers have joined standard 3.5-inch drives in the data center. Server drives use Fibre Channel or SAS (serial-attached SCSI) interfaces, as well as SATA at the low end.

Spindle speeds typically range from 10,000rpm, such as in the freshly unsunk WD VelociRaptor, to 15,000rpm, as in Seagate's Cheetah 15K.6 and Hitachi's Ultrastar 15K450. However, a few 7,200rpm drives have been optimized for 24/7 server duty, such as Hitachi's E7K1000.

Server drives typically feature long warranties, vibration compensation, staggered spinup to avoid toasting power supplies at bootup, RAID optimizations such as Samsung's CCTL (Command Completion Time Limit), and command queuing to prioritize outstanding data requests.

**External drives.** Portable and external drives are repackaged laptop and desktop drives, respectively, and thus can benefit directly from enhancements such as drop detection. A USB 2.0, bus-powered, 2.5-inch drive is your best bet for a notebook on the go. For desktop duty, go with the speed-transparent eSATA (or FireWire 800 if that's your Mac's top port). If you can wait a few months, watch for 4.8Gbps USB 3.0 and 1.6 and 3.2Gbps versions of FireWire.

**Future.** The encroachment of SSDs has spurred HDD manufacturers to new heights. Some novel tech on the horizon promises to goose capacity and, perhaps, performance.

"If you look out into the years beyond 2010, let's say—and we always keep changing these dates depending on how much more mileage we can get out of the current technology—we're going to need another series of assists to get up to the next levels of capacity," says Larry Swezey, director of hard drive marketing and strategy for Hitachi GST.

One such assist is patterned media. Using technology such as LVL (low-viscosity

## Whither Hybrids?

It seemed like a no-brainer. SSDs offer amazingly fast access to data compared to hard drives, but cost ridiculously more per GB. Also, few SSDs had enough capacity to rival hard drives at the time Samsung, Seagate, Microsoft, and others were drawing up plans for an alternative type of drive.

That alternative was a hybrid drive—a notebook model married to 128 to 256MB of NAND memory. For a modest price premium, a hybrid is supposed to provide the benefits of both worlds. Unfortunately, that vision hasn't panned out as expected.

"As with any new technology the adoption curve is not as fast as we'd like," admits Seagate's Joni Clark. The company declined to provide sales figures.

Hitachi GST's Larry Swezey is even more damning. "We didn't see as an industry the benefit from (hybrids) for a variety of reasons," he says. "And so hybrid, I don't think, in its present state and form, is really going to go anyplace. Certainly we don't have any plans for a next-generation hybrid drive announcement."

So what went awry? The first wave of drives hasn't met the market's expectations, which were admittedly high. Any improvements to boot times, battery life, and overall speed weren't obvious to every user. It probably didn't help that only the unpopular Windows Vista supported hybrids (to a limited extent), a situation that persists to this day. Finally, even spirited proponent Seagate didn't care to comment on reports from the field that attempts to recover data from failed hybrid drives using traditional recovery methods are often fraught with frustration.

But let's be fair. Every new storage technology has teething pains. Both NAND and hard drives continue to improve, so it stands to reason that future hybrids might advance apace (assuming, of course, that the price of flash doesn't plummet low enough to render quaint the idea of a hard drive in a notebook).

The real key, however, seems to be OS support. If Windows, Linux, and OS X each could take full advantage of hybrid's potential, this "Jan Brady" technology could outshine big sister Marcia.

"I think we remain optimistic that flash, in combination with a hard drive, could improve performance," Swezey allows. "So, more long-term, we're looking at that."

"And there's sort of a performance-vs.-cost tradeoff that you have to keep in mind because obviously we have a very competitive industry as it is now. To add a tremendous amount of cost is probably not going to work unless the customer can see a true value."

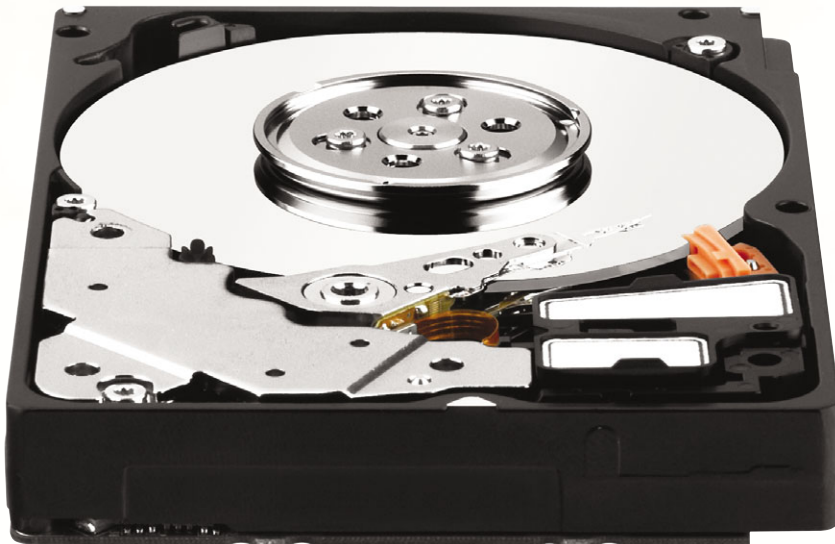
"Hybrid hard drives will mature by being more OS-independent and they will be more flexible with the key attributes that customers are looking for," says Clark. "You might see performance-oriented drives, high reliability, or a combination of power, performance and reliability. The right mix will depend on the application."

"Whether it's hybrid, SSD, or HDDs, we plan to be there with a solution." ▲



Hybrid drives, such as this Momentus 5400 PSD from Seagate, haven't exactly turned the notebook market on its ear yet.





Western Digital's 10,000rpm VelociRaptor, a 2.5-inch drive sold attached to a 3.5-inch heatsink for the enthusiast market, has now been turned loose on blade servers.

liquid) imprint lithography, manufacturers chemically etch physical markers at intervals on a disk. This pattern of virtual signposts keeps the heads apprised of their exact locations, making denser reads and writes less problematic.

"Patterned media enables us to utilize the space on the media even more efficiently," says Seagate product marketing manager Joni Clark. "(It) is an option we are exploring that will also drive areal density increases."

"As the densities grow, the magnetic grains on the media have to shrink," Swezey says. "Patterned media allows you to get a finer control over how closely you can pack (data) tracks together. It allows you to reduce the effects of interference from one track on another, just because of the greater precision on which you can lay

the tracks. That's . . . really going to be one of the keys to getting to the higher TPI [tracks per inch] levels we need for the next generation of capacity points.

"We're certainly not signaling yet a huge shift over to patterned media, but I would tell you that it's one of the likely technologies that you will see . . . probably . . . beyond 2010."

It's easier to write data to certain materials when they're heated, which brings us to heat-assisted magnetic recording (HAMR, in Seagate parlance).

"HAMR uses a laser to heat the recording media and can write to the media more precisely where traditional magnetic drives cannot," says Clark. Even if a write head couldn't be made as tiny as a disk's areal density would require, using HAMR, its relatively large electromagnetic

field would affect only the pinpoint of the recording layer heated by the laser.

Swezey says that Hitachi foresees using heat-assisted recording in conjunction with other technologies once the cost of production becomes economical. "That's probably a little bit further out in time, but definitely yes."

"While Seagate has successfully demonstrated the principles behind HAMR technology, it will not design HAMR into the disk drives for a few more years," says Clark. "Seagate is obviously still reaping rewards from perpendicular recording and hopes to continue leveraging perpendicular for several more product families."

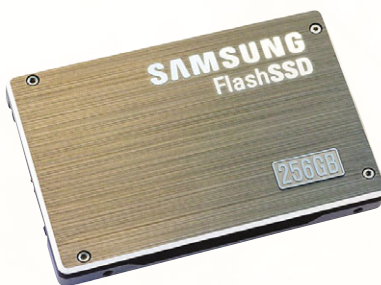
## SSDs

By now, most hardware enthusiasts have informed opinions about SSDs. On the two extreme ends of the forum spectrum, either solid-state disks have already made hard disk drives extinct (and good riddance), or the technology is an expensive novelty with abysmal service life and no chance of approaching hard drives' cost-per-GB supremacy.

The truth is probably a little left of center: Hard drives and solid-state disks will coexist for a while, but eventually, rotational media will probably be consigned to stationary systems where mass storage counts. Assuming that non-volatile flash technology progresses as it should and prices drop to less alarming levels, most of your portable and performance storage needs will be handled in silicon someday.

"Laptops will go from CTO [configure-to-order] to SSD-only," says Samsung spokesperson Karen Xie. Next, notebooks will come with custom storage implementations such as flash memory mounted on a DIMM or the motherboard, Xie says. SSDs' attributes shine most brightly in laptops (and servers), which are leading desktops in the drives' adoption. In fact, 35% of notebooks will have SSDs by 2012, according to iSuppli. The percentage today is in the low single digits.

Silence, ruggedness, cool operation—these benefits aren't open to debate. On the other hand, several of SSDs' other talking points are taking criticism from the field. For one thing, not all notebooks outfitted

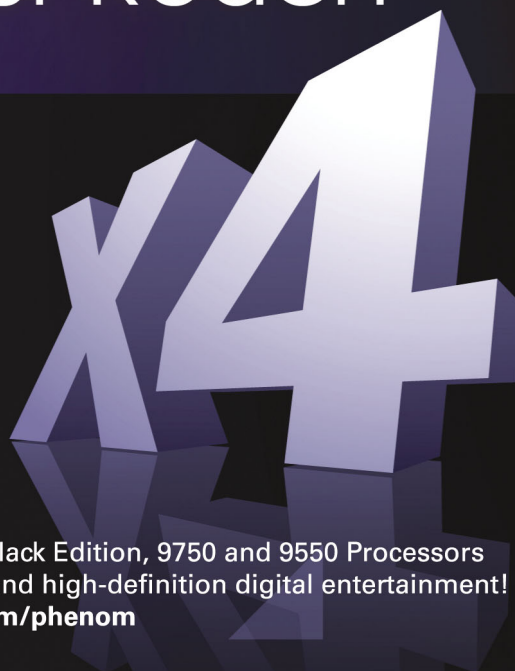


Samsung claims that its new MLC-based 256GB SSD can hit 200MBps reads and 160MBps writes.



LG has been instrumental in pushing down BD drive prices. The BE06 is a \$429.95 external burner.

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with an expensive solid-state disk perform as well as they would with a current-generation hard drive. Despite compatibility with ATA, SSDs are somewhat hindered by their addressing structure, which can be very inefficient at writing small files. Also, improvements in power savings aren't a given with an SSD, as these are heavily dependent on various settings, the OS, and usage patterns. Even boot time is up for grabs. (See "Totally Solid" on page 67.)

One definite bonus, according to OCG spokesperson Jessica Luken, is that SSDs never need to be defragmented. Without spinning media, fragmented files take virtually no longer to access than contiguously stored files. In fact, defragging "can decrease the longevity of the drive," Luken continues, a point that speaks to SSDs' Achilles' heel: service life.

NAND cells stop working after a high number of write operations, and so manufacturers imbue their SSDs with wear-leveling algorithms. These spread the writes (reads don't hurt the drive) over all parts of the array in an effort to keep particular cells from wearing out early. Therefore, the more capacity in the drive, SuperTalent indicates, the longer it should last.

Thanks to wear-leveling, many SSDs may last as long as a typical hard drive under normal conditions, but usage pattern is key. For instance, Windows Vista is notorious for disk thrashing, so you should modify its default behavior if you install an SSD. Help may be on the way from Samsung and Sun Microsystems, as they've developed a new form of SLC (single-level cell) NAND memory with up to five times the normal service life.

To be fair, the SSD is a young development. They're improving all the time. The frontier is still open not only for better memory—Samsung, Toshiba, SanDisk, and Hynix are all reportedly developing NAND that can store 3 bits per cell, in contrast to 1-bit-per-cell SLC or current 2-bits-per-cell MLC—but also for progress in controller design, driver support, OS support (specifically, disabling the latency compensation mechanism geared toward hard drives in the I/O scheduler), power conservation states, interface streamlining, and of course small file writes. Also, new

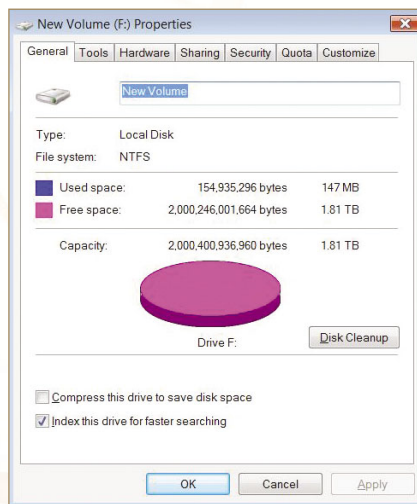
## Dream Build

Depending on our budget, there are a number of ways we would approach the storage requirements of a desktop PC for productivity, media, and games. Tell us that cost is no object, however, and we'd probably go for something like this:

- 2x 64GB Samsung 2.5" SLC SSDs in RAID 0 for super-fast read access to the OS, applications, and games
- 300GB VelociRaptor HDD for a write-friendly video editing/media transcoding workspace
- 1.5TB Seagate Barracuda 7200.11 for mass storage of photos, archived video, music, and documents
- LG GBW-H20L BD-RE in hopes that the recordable media will someday become cost-effective and ubiquitous, but mainly for sneaking in Blu-ray movies once in awhile
- Samsung SH-S223F 22X DVD burner for accelerated CD and DVD burns
- Synology Disk Station DS108j for backups over a network, media streaming, printer sharing, and remote file access (outfitted with a second 1.5TB Seagate 7200.11, pending compatibility test) ▲

designs such as those using the ABL (all-bit line) architecture might improve SSD performance by a factor of three or more.

"We are continually working to optimize the synergy among all parts of the



Truly colossal volumes are just a two-drive RAID away.

SSD to optimize the performance and reliability," says Samsung's Xie.

In case you're still wondering just how comprehensively SSDs have impacted the storage market, take it from the best-selling manufacturer of hard drives, Seagate. CEO Bill Watkins says to expect the first Seagate server SSD next year.

Hitachi, too, is exploring flash. "The important thing . . . would be to enter with a real leading product," Swezey says. "I think at last count, there were over 60 companies who had announced SSD-type products, so it's kind of a real full market right now, and if you're going to enter, you want to make sure that you can have something different.

"If anything, it's pushed us to accelerate our capacity growth on the larger side of hard drives. So I think there's very much a profitable coexistence there."

For benchmark data on five intriguing SSDs, turn to "Totally Solid" on page 67.

## Optical Drives

ODDs still play a major role in offline storage and media distribution (authorized or not). Although broadband download speeds, iPods, and dirt-cheap hard drive capacity have obviated the need for DVDs and CDs in many respects, and despite BD's high prices, it's too soon to write off optical formats entirely.

Still, there's little happening now that BD killed HD DVD, which never established a recordable presence in PCs. ("Foreign" formats such as HD VMD, TeraDisc, and the always-around-the-corner holographic disc aren't even on most U.S. users' radar.) Dropping prices on drives and players are helping BD to grow its market share. Factors against BD growth include immobile prices on blank and pre-recorded media.

We get into several drives' personal space in "Red Vs. Blu" on page 70.

## What's In Store

Competition is good. If the savage incursion of flash translates to cheaper DVR storage today and faster computers tomorrow, we have good reason to cheer. ▲

by Marty Sems



# DISEND IN THE PLATTERS

## PROOF THAT INTERNAL HDDS ARE ALIVE & SPINNING

**H**ard drives are so underappreciated. It only seems natural for power users to focus on processors and graphics cards. But when Vista decides the time is right for a little indexing or Outlook digs in for a bit of auto-archiving and suddenly your system is slammed, remember that a speedy storage subsystem plays a key role in balancing out those quad-core processors and tandem GPUs.

We talked to four different storage vendors for this piece, asking each one about their favorite trends and products in the current market. Surprisingly, we received unique answers from the quartet, and as a result, the drives that landed in our lab cover a wide spectrum of form factors, serial interfaces, power levels, and capacities. We got our hands on several of the latest models and took them for a proverbial spin. Seagate's exciting new 1.5TB drive was still receiving a bit of polish, but we did get the opportunity to peek at its vitals and came away impressed.

### Hitachi Travelstar 7K320

Hitachi has a reputation for setting the capacity bar, a particularly good thing when it comes to mobility. The company currently offers a 500GB Travelstar 5K500, but it uses a 5,400rpm spindle speed. If you want the performance of a 7,200rpm disk,

you'll need to give up a little capacity and spring for the 320GB Travelstar 7K320.

The compromise is well worth making. In testing, we found the 7K320 to be competitive with Western Digital's 320GB Scorpio Black, laying down slightly faster average reads in HD Tach, and somewhat lower IOPs in IOMeter. The speed of a 2.5-inch 7,200rpm drive isn't directly comparable to a desktop offering spinning at the same speed, as you can tell by comparing Hitachi's 7K320 numbers to WD's RE3. However, there is a notable difference in sustained performance versus competing 5,400rpm drives.

Despite its 3Gbps interface, 7,200rpm spindle, and 16MB cache, the 7K320 manages to maintain impressive power consumption numbers, averaging 1W at idle and 1.8W for reads and writes. Noise also isn't a problem for the drive, which typically generates 2.5 bels at idle—the same as WD's 7,200rpm contender.

Given a price tag just north of the Western Digital Scorpio Black, we'd like to see Hitachi at least match WD's five-year warranty coverage. Instead, the Travelstar is protected for three years. Performance, power consumption, and reliability figures are all in line with competing drives, but we're also fans of Hitachi's resilience. It can take 400G

operating shock (2ms) and 1,000G non-operating impacts (1ms).

If you like the Travelstar's specs but need a 2.5-inch drive with a higher-duty cycle, check out Hitachi's Enhanced Availability models, which offers similar capabilities and 24/7 uptime.

### Seagate Savvio 15K.1

Not all 2.5-inch hard drives are destined to find homes in notebooks. Some, like Seagate's Savvio 15K.1, are much more comfortable in dense storage servers. The drive family's spec sheet tells the story. First, the Savvio 15K.1 centers on a



### Travelstar 7K320

\$189

Hitachi

[www.hitachigst.com](http://www.hitachigst.com)

● ● ●

**Specs:** 320GB; 7,200rpm; 3Gbps SATA interface; 16MB cache; three-year warranty; 2.5 bels @ idle; 4.2ms average latency





**Savvio 15K.1**  
\$419  
Seagate  
www.seagate.com

**Specs:** 73GB;  
15,000rpm; 3Gbps  
SAS interface; 16MB  
cache; five-year  
warranty; 3.1 bels  
@ idle; 2.0ms  
average latency



**Cheetah 15K.6**  
\$630  
Seagate  
www.seagate.com

**Specs:** 450GB;  
15,000rpm; 3Gbps  
SAS interface; 16MB  
cache; five-year  
warranty; 3.6 bels  
@ idle; 2.0ms  
average latency



**WD5002ABYS**  
\$129  
Western Digital  
www.wdc.com

**Specs:** 500GB;  
7,200rpm; 3Gbps  
SATA interface;  
16MB cache; five-  
year warranty; 2.5  
bels @ idle; 4.2ms  
average latency

3Gbps SAS serial interface, a purely enterprise connection designed for high performance. It also spins at 15,000rpm, which is more than twice as fast as the quickest laptop drives. At the same time, it's able to withstand the subtle vibrations of a server loaded with additional storage.

Because of its enterprise pedigree, you have to expect Seagate to make some concessions in the name of raw throughput, a compact form factor, and 24/7 availability. Noise is one. At idle, you can expect the nearly 15mm tall drive to generate 3.1 bels. Power consumption is, expectedly,

the other compromise. The 15K.1 uses more power than your average notebook or desktop drive, gobbling up close to 6W when idling. Still, Seagate says that's at least 30% less power than a 3.5-inch disk spinning at 15,000rpm.

The Savvio's fast interface, high-speed spindle, and 16MB cache come together to enable remarkable performance. Seagate claims seek times around 3ms and sustained transfer rates as high as 112MBps. We measured the average I/O response around 9.84ms with sustained reads of 87MBps—better numbers than any of the SATA disks in our roundup (special thanks to Adaptec for providing its 5805 RAID controller for testing).

Speed like that doesn't come without a heavy premium. Savvio 15K.1 73GB drives sell for a bit more than \$400. As you can imagine, in a 16-drive storage server, the cost of dependable storage adds up quickly. Then again, if a dense array of 2.5-inch disks saves you from having to buy a second machine or JBOD, there's still value in the smaller drives. Moreover, the flexibility of serial storage is such that you can mix and match SAS and SATA in the same machine. Pair Seagate's Savvio up to Fujitsu's extended-duty MHZ2120BS

SATA drives to maximize both cost and availability, for instance. The bottom line is that when you need lots of density in a transactional environment, 2.5-inch SAS drives are your best bet, and Seagate's Savvio delivers the performance of 3.5-inch storage in a denser form factor.

### Seagate Cheetah 15K.6

The fastest 10,000rpm and 15,000rpm drives have always suffered an inherent disadvantage to traditional desktop drives: capacity. A consequence of those blazing spindle speeds is that enterprise disks simply don't hold as much. But now that Seagate is shipping its Cheetah 15K.6 family at up to 450GB, running out of space shouldn't be as big of an issue. The disk's other specs are equally impressive: a 3Gbps SAS interface, a 15,000rpm spindle, 16MB cache, and average latencies in the 2ms range.

Make no mistake, Seagate's Cheetah 15K.6 is one of the fastest drives we've ever tested. Claims of 110 to 171MBps sustained throughput seem farfetched, but our test mule delivered 145.9MBps in HD Tach. Pay no mind to those near-800MBps bursts: They're likely attributable to cache reads (yet still consistently



**WD6400AAKS 640 GB 3.5" Desktop HDD**  
\$89  
Western Digital  
www.wdc.com

**Specs:** 640 GB; 7,200rpm; 3Gbps SATA  
interface; 16MB cache; three-year warranty;  
2.8 bels @ idle; 4.2 ms average latency



**Spinpoint F1**  
\$175  
Samsung  
www.samsung.com

**Specs:** 1TB; 7,200rpm; 3Gbps SATA inter-  
face; 32MB cache; three-year warranty; 2.7  
bels @ idle; 4.17ms average latency

## Platter Races

Although making apples-to-apples comparisons between our drives is a fruitless endeavor, these internal HDDs provide an excellent

sampling what type of performance you can expect from each class of product. ▲

	Hitachi 7K320	Seagate Savvio 15K.1	Seagate Cheetah 15K.6	WD WD5002ABYS	WD WD6400AAKS	Samsung Spinpoint F1
<b>HD Tach 3.0.4.0</b>						
Burst Rate (MBps)	185.7	749.5	769.1	223.7	225.8	231.6
Average Read (MBps)	67.5	97.3	145.9	87.9	91.3	94.1
Random Access Time (ms)	16.4	5.6	5.6	11.9	12.2	14.2
CPU Utilization (%)	0	1	3	1	2	3
<b>IOMeter</b>						
<i>Default Access Spec, Four Workers</i>						
Total MBps	0.13	0.41	0.24	0.2	0.18	0.15
Total I/Ops	68.93	210.12	123.17	101.59	91.15	75.63
Average I/O Response (ms)	14.51	4.75	8.11	9.84	10.97	13.22
Max I/O Response in (ms)	161.54	37.54	67.27	39.66	50.13	84.23
Price	\$189	\$419	\$630	\$129	\$89	\$175
<b>CPU</b> s	● ● ●	● ● ● ● ●	● ● ● ●	● ● ●	● ● ● ●	● ● ● ●

repeatable). The IOMeter runs weren't quite as impressive, despite multiple re-runs. However, only the 2.5-inch Savvio turned out to be faster.

Speed isn't the Cheetah's only eye-catching attribute. The drive is also significantly more reliable than the SATA drives in this roundup. Error correction code, a background media scan feature, and even tighter manufacturing help extend the drive's MTBF to 1.6 million hours. Seagate has also reportedly thrown itself at the issue of power consumption, though the 3.5-inch, 15,000rpm drive is still going to chew through a little more than 12W at idle. And the Cheetah does get too hot to touch if you don't keep air moving over it. In a rackmounted server you shouldn't have a problem, but pay close attention to cooling in a pedestal workstation.

Like its 2.5-inch cousin, the Savvio, Seagate's Cheetah is a purpose-built piece of hardware for a very specific type of customer. The drive is decidedly enterprise-oriented, with a hefty price tag to hammer the point home. In return, however, you get the ultimate in speed, availability, and capacity. That's not a bad tradeoff if you're used to Extreme Edition processors and dual-GPU setups.

### Western Digital WD5002ABYS

Enterprise storage used to mean SCSI or SAS hard drives—expensive technology

that not only delivered the best performance but was also manufactured to withstand the harshest server room environments. But where SCSI and SAS drives always came up short—capacity and prohibitively high cost—the SATA interface excelled. Or course, most SATA drives are manufactured to less stringent tolerances, making them unsuitable for the storage needs of big businesses. But Western Digital's RE family, now in its third generation, cranks the dial up on reliability to make SATA feasible in rack-mounted storage servers.

According to WD, the RE3 is 20% faster than its predecessor, thanks to a handful of new features, such as a more powerful onboard processor and fourth-generation vibration compensation technology. A 3Gbps interface, 16MB cache, and 7,200rpm spindle speed also help keep data flowing quickly. The drive's real-world performance numbers are just as impressive as its paper specs. A 223MBps burst rate, 87MBps average read, and ultra-low 11.9ms random access time in HD Tach easily showed up the other SATA drives we tested.

Of course, performance means nothing at the enterprise level without an equal dose of reliability. Most telling is Western Digital's five-year warranty. In order to make sure each RE3 drive is able to meet that five-year mark, WD puts the drives

through an extended burn-in with thermal cycling. Moreover, a multi-axis shock sensor, real-time fly-height adjustment, and NoTouch ramp load technology help minimize wear on the RE3 during its lifetime, measured by WD as a 1.2 million hour MTBF.

Priced just north of \$100, the RE3 is a fantastic value for enterprise storage, especially when used in conjunction with a SAS controller. In a mixed SAS/SATA environment, you're able to attach either serial interface to the storage card. So, the most performance-sensitive data can live on high-availability 10,000 or 15,000rpm drives, while the nearline information (or nightly backups) resides on much larger and cheaper SATA drives, such as Western Digital's RE3.

### Western Digital WD6400AAKS

Western Digital recently revamped the branding on its desktop drives, introducing Black, Blue, and Green models. The Caviar Blacks constitute the company's performance offering, with capacities up to 1TB, more powerful onboard processors, a massive 32MB cache, and a 7,200rpm motor. The Caviar Greens are also available in sizes as high as 1TB, but they employ a technology called IntelliPower to dynamically change spin speed, transfer rate, and caching to cut back on power consumption. Western Digital's Caviar



## Seagate: The Current King of Capacity

It's amazing to watch the nearly exponential growth of hard drive capacity, knowing that no matter how large the disks get, we'll still be able to fill them with music, movies, and pictures. Early in 2007, Hitachi broke the terabyte barrier with its Deskstar 7K1000, enabled by a massive increase in areal density at the hands of PMR (perpendicular magnetic recording). Continued development of the technology is leading to even more exciting milestones.

For instance, Seagate recently unveiled the first 1.5TB drive, a massive 500GB jump over its former flagship. Remember that when Seagate's first terabyte disk hit the scene, it crammed all of that storage space into a 3.5-inch form factor with four platters spinning at 7,200rpm. This new offering, also a member of the Barracuda 7200.11 family, does the exact same thing, sacrificing nothing as it adds copious capacity.

Extra space isn't the only virtue of higher areal densities. Because a more densely-packed magnetic platter accommodates more information, a greater number of bits move under each head per rotation. The result is higher transfer speeds. Seagate says its 1TB drive can sustain 105MBps. In comparison, the 1.5TB model should be able to sustain 120MBps. Of course, performance will be further helped along by a 32MB data cache, a feature available on the other drives in the Barracuda 7200.11 family.

The move from 250GB platters to 375GB platters is interesting, because it opens the door to even larger capacities, should Seagate desire them. A 3.5-inch chassis holds as many as five platters, so it'd be technically feasible to hit close to 1.9TB with today's technology. However, the decision to maintain a four-platter architecture likely had to do with heat and noise concerns, which are two less-than-savory side effects of adding more magnetic media to an already complex mechanical device. ▲



Blue drives strike a balance between the Black and Green families, delivering both solid performance and ample reliability for everyday use on mainstream desktops.

We got our hands on a 640GB model available online for less than \$90. That's 14 cents per gigabyte. Despite its value-oriented price, the disk's specs still convey all of the latest storage technologies. It spins at 7,200rpm, includes 16MB of data cache and offers a reasonable 4.2ms average latency. WD's WhisperDrive feature cuts the acoustics to 2.8 bels at idle, though that's actually a bit higher than Seagate's competing Barracuda.

Western Digital's real advantage is power consumption. Because the Caviar Blue trades a bit of performance in favor of quieter operation and optimized efficiency, the WD6400AAKS is rated for the lowest power in its class under load. It's no doubt aided by IntelliSeek, a WD feature that

adjusts seek speeds for the best combination of power draw, noise, and vibration.

All of the technology included to help keep the drive quiet and earth-friendly doesn't hammer the Caviar Blue's real-world performance. Using HD Tach, we measured burst rate and average read speed at 225.8MBps and 91.3MBps—faster even than WD's enterprise-ready WD5002ABYS. It didn't do as well in IOMeter, exhibiting slightly lower transfer performance and higher response times. Nevertheless, at its decidedly entry-level price point (\$30 under the 500GB WD RE3) you won't find a better value.

### Samsung Spinpoint F1

When it comes to pushing the envelope in desktop performance, Hitachi, Seagate, and Western Digital have all made their respective marks. But Samsung snuck up on all three enthusiast favorites with its

Spinpoint F1, a 1TB drive that relies on industry-leading areal density to cram 334GB onto each of three platters. Compare that to Hitachi's first 1TB drive (five platters) and Seagate's 1TB Barracuda 7200.11 (four platters). The Spinpoint should deliver more throughput, better thermals, lower acoustic power, and better power consumption as a result of Samsung's aggressive R&D.

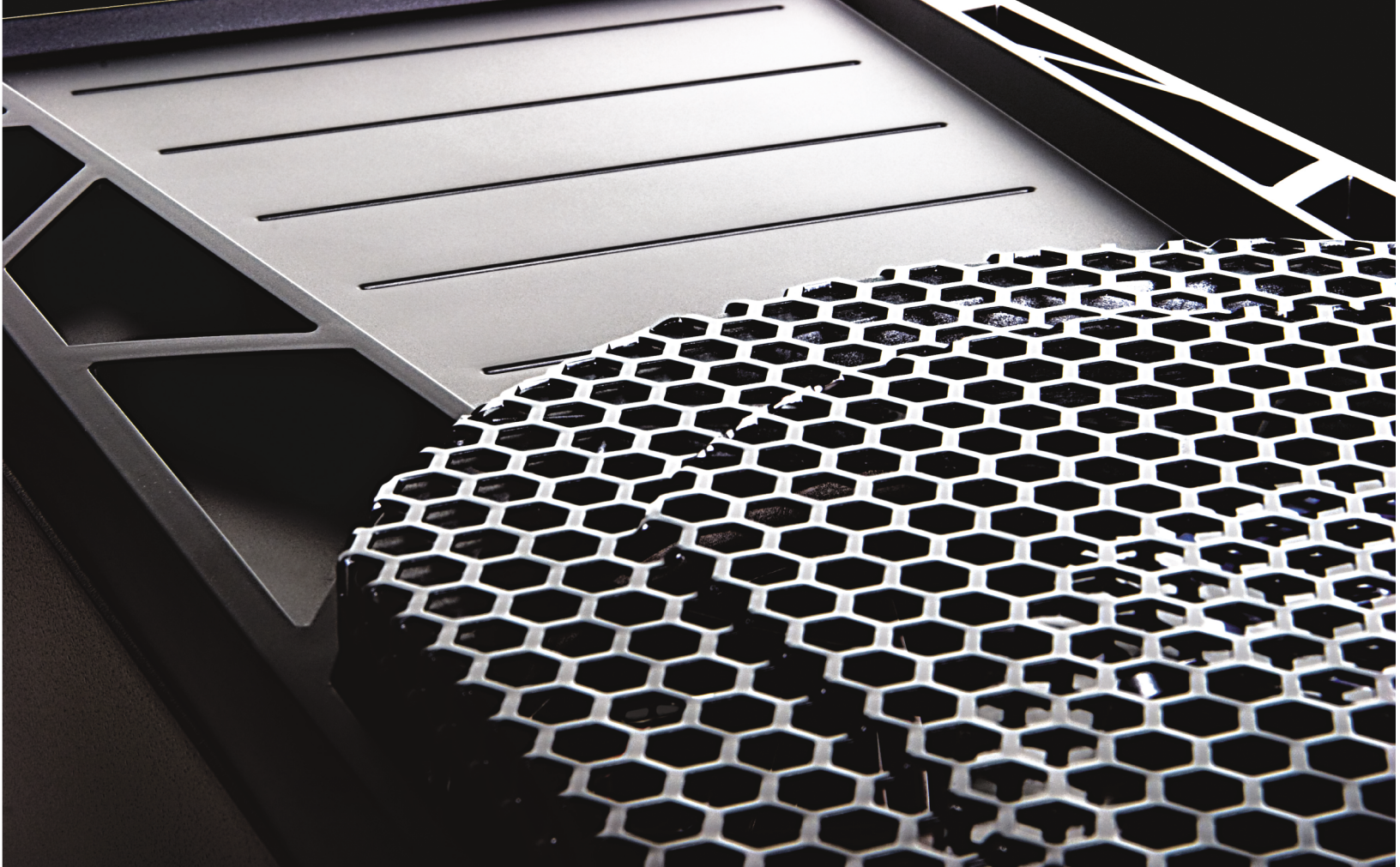
Indeed, it's armed for spirited performance. A 7,200rpm motor and 32MB data cache nicely complement Samsung's dense platters, pushing average latency down to 4.17ms and media-to-buffer speeds up to 175MBps. HD Tach demonstrates screaming burst speeds and average reads of 231.6MBps and 94.1MBps respectively, while the IOMeter numbers don't look nearly as good. Nevertheless, this is undoubtedly a performance-oriented disk.

At the same time, Samsung's NoiseGuard and SilentSeek features keep the speed demon idling at 2.7 bels. And because the drive only employs three platters, spinning them around doesn't chew up as much energy. Consumption hits 8.4W during read/write operations and drops to 6.7W at idle. When the disk goes to sleep, power draw falls under 1W.

Perhaps the biggest obstacle the Spinpoint F1 faces is its relative obscurity. We couldn't find Samsung drives at any of the local hardware shops, forcing us to buy our test mule online. And despite its relatively high-end pedigree, Samsung protects the 1TB disk for three years, whereas Seagate and Western Digital cover their enthusiast models for five years. Samsung's Spinpoint F1 is a tremendous performer and massive step up from a lesser-known storage vendor. We hesitate to dub this the ultimate enthusiast drive, though. Seagate's 1.5TB Barracuda 7200.11 will be available by the time you read this, delivering higher areal density, a substantial bump to capacity, and an extra two years of warranty coverage. That's the disk we'd want to be dropping into our workstations through the end of 2008. ▲

by Paul Cross





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# WHATEVER YOU WANT, YOU WILL GET

## YOU'LL WANT ONE OF THESE PORTABLES AS YOUR WINGMAN

Hard drives have never been a glamorous peripheral, or a glamorous computer technology in general, and external hard drives have been languishing even further in the computing scene. Sure, USB 2.0 connections, diminutive sizes, and increased capacities have made them terribly useful (and in some ways, the *de facto* standard in data backup devices for power users), but no one really gets excited over external hard drives, do they?

Prior to 2008, we'd have to count ourselves among the "not excited" camp, but our sampling of the latest external hard drives has changed our minds.

### How We Tested

We connected each of our test drives to several machines to verify compatibility, but our benchmarks are taken with a 3GHz Intel Core 2 Duo, an Intel G35-based motherboard with an ICH9R SATA controller, and onboard FireWire 400 ports. Because Windows Vista is still slower at file manipulation than Windows XP, we tested with WinXP, meaning we also used PCMark05's hard drive tests (PCMark Vantage is Vista-only) along with IOMeter and HD Tach. For our File Copy test, we copied 1.25GB of a mix of about 2800 files, ranging from 100MB video files to 1K text files. Our source drive was an internal Seagate 7200.11, and we timed the results with a stopwatch. For comparison, we've also included the 7200.11's benchmarks, though we didn't assign it a *CPU* score. We also tested the speed of all the interfaces available with a given external



**Mercury-On-The-Go  
(FireWire 800/  
400 + USB 2.0)**  
\$249.99  
OWC  
eshop.macsales.com  
●●●●●

drive, which is why some drives have multiple benchmarking columns.

### OWC Mercury-On-The-Go (FireWire 800/400 + USB 2.0)

Very rarely does a 2.5-inch notebook hard drive-based external drive brag about its speed, but OWC (Other World Computing—traditionally a Macintosh peripheral company that's now branching out) is rightly proud of its portable drive's performance. OWC isn't a drive manufacturer *per se*, and this MOTG employs a 320GB Hitachi 7,200rpm SATA notebook drive. We know this because the MOTG's case is constructed of clear plastic, which reveals the unit's internals, save for a ribbed aluminum heatsink on one side that gets pretty toasty.

The rear of the unit is crowded with jacks—one mini USB, two FireWire 800 jacks, and a DC power plug—and a power switch. The unit doesn't ship with an AC adapter, but it isn't needed. The power switch is superfluous if you connect via USB, because the drive powers itself on and off automatically, which is a nice touch. Frustratingly short USB and FireWire 400-to-800 cables (each is about 12 inches long) are included with the drive, as is a longer FireWire 800 cable. This collection of cables all of fits inside the included vinyl case along with the drive for enhanced portability.



**Mercury Elite-AL Pro  
'Quad Interface'**  
\$295.99  
OWC  
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Speed-wise, the MOTG was faster than our other portable drive in USB mode, significantly so in FireWire mode. In both cases, we think the drive's speed is still limited by these interfaces. OWC offers a similar portable unit with USB 2.0 and eSATA connections (though the eSATA mode requires the use of power adapter) that's worth considering if you need the fastest portable drive available and have access to an electrical socket.

The software bundle for PCs is meager, consisting of just an older version of NovaStor's NovaBackup that isn't completely compatible with Windows Vista but works well under WinXP for your backup, copying, and disk imaging needs.

### OWC Mercury Elite-AL 'Quad Interface'

OWC's second offering distinguishes itself from the pack in several ways: It offers four interfaces (USB 2.0, FireWire 400, FireWire 800, and eSATA; cables are also included), comes in an attractive aluminum case that looks like a high-end Mac Pro, is blazingly fast, and is significantly less expensive on a per-GB basis than almost everything else here. Like its little brother, the Mercury Elite-AL suffers from a meager software bundle (just NovaBACKUP 8 for Windows, although the CD includes a lot more for Macs), and it comes pre-formatted with HFS+, which Windows can't read. In both cases, we used Window's Disk



Management console (right-click My Computer and choose Manage) to format the drive to NTFS, although the included documentation punts you to a Web page to document this critical step.

Performance is the Mercury Elite-AL's strong suit. In USB and FireWire modes, it essentially all competitors; in eSATA mode, it blew them away. Because it was essentially as fast as the internal SATA drive, the Mercury Elite-AL Quad proved that the USB and FireWire buses really are the limiting factors for high-performance external drives. Naturally, the included eSATA cable won't work if your computer lacks an eSATA port, but SATA-to-eSATA cables (which can be had under \$10) work just fine. Another eSATA bonus (that also applies to the Fantom drive): It had no problems booting a Windows installation.

Unlike the OWC's Mercury-On-The-Go, the power switch is required to turn the drive on and off regardless of your connection method, and the power supply is a "brick on a rope" type with an annoying multi-pin connector. The aluminum case gets warm during operation, effectively acting as a heatsink, which should improve the drive's lifespan.

### Fantom Drives GreenDrive (GD500EU)

Fantom is another vendor that doesn't manufacture its own drive mechanisms but has been selling external drives for many years, and its experience shows. The GreenDrive looks like a smaller version of the Mercury Elite, which is to say, like a Macintosh Pro's "Mini-Me" clone, complete with satin aluminum sides and a drilled, vented front case.

The GreenDrive is billed as being "eco-friendly," which, when you get past the flowery superlatives in its literature, boils down to consuming 4 to 5 fewer watts than typical full-size external drives while "maintaining solid performance." Fantom accomplishes this by using a Western Digital Caviar Green desktop SATA drive, which varies its spindle speed between 5,400 and 7,200rpm as necessary, and employs other electronic tricks to save you about \$15 a year in electricity (assuming 24/7 operation). It also runs cooler than



### GreenDrive (GD500EU)

\$119.95

Fantom Drives

[www.fantomdrives.com](http://www.fantomdrives.com)



### OneTouch 4 Plus

\$299.99

Maxtor

[www.seagate.com](http://www.seagate.com)



most desktop drives, so a fan isn't needed for cooling. Indeed, the GreenDrive's aluminum case is cooler than the ME-AL's.

For "maximum compatibility," the GreenDrive comes formatted with FAT32, but the voluminous and well-written documentation recommends reformatting the drive to NTFS for various reasons. (It also provides how-to instructions.) USB benchmarks barely changed, but eSATA performance improved enough overall that we list those benchmarks here, though they reveal that the GreenDrive gives up some speed for the sake of energy efficiency. And don't forget your own eSATA cable, as Fantom doesn't provide one.

The GreenDrive comes with no software, but given its good eSATA speed and astonishingly low price, users who already have backup software will enjoy the savings.

### Maxtor OneTouch 4 Plus

In a field filled with razzle-dazzle, the Maxtor OneTouch 4 Plus comes off looking a little unusual, if not pedestrian. In fact, the steel and plastic trapezoidal case blends in with nothing and looks a little cheap in comparison. Still, Maxtor includes a very complete package that includes FireWire and USB ports and cables; a conveniently small power supply with a 1-pin power jack; a friendly and programmable push-button on the front of the case; and a solid five-year warranty. Also included is a comprehensive software package that integrates with the push-button, which Maxtor considers the main selling point of this drive. But we have our reservations.

We have no complaints with the hardware. The drive itself remains cool and quiet when in use, and its front power/activity LED is easy to see from all angles, thanks to its extreme brightness. There's no power switch to forget to turn on and off, because the drive turns itself on and off when it senses power from the USB or

FireWire connections, which is handy. Its benchmarks are superior to the Fantom drive, but there's no eSATA connection to really take advantage of the drive's full speed.

The OneTouch software is perfectly adequate for basic tasks, but can get dicey during emergency system restoration, which unfortunately is one of its main selling points. You can designate files and folders that copy over to the OneTouch, either on a schedule or when the button is pressed, plus you can perform two-way synchronizations with the drive and any computer with the OneTouch software installed. The SafetyDrill feature creates whole partition/disk images of your boot disk to the OneTouch (though it missed a non-NTFS partition—oops), and you use the included Linux-based restoration CD to restore your images, but the disc failed to boot on our main test machine, offering an error message often repeated and rarely resolved on Maxtor's support forums. Clearly, test it before relying on it.

### Western Digital My Book Mirror Edition

External drives are great for backups, but what happens when the backup drive fails? If you're using the My Book Mirror Edition, then the answer is nothing worse than "a minor inconvenience." Western Digital squeezes a pair of 1TB hard drives into a glossy black case and links them in a mirrored array, so when you copy data to the device, it automatically writes to each drive. Should one drive fail, a taskbar icon notifies you and identifies which drive is the bad one, and the tool-less case makes replacing the bad drive a two-minute job. Upon the next boot, WD's RAID utility rebuilds the redundant drive array automatically.

Furthering the "fully automatic backup" theme, the My Book Mirror Edition comes with WD's own Anywhere Backup



# Data On The Loose

We took our four contenders and left no interface untested. You'll notice that any given drive offered considerably different performance,

based on the interface. This was especially the case with drives that offered an eSATA interface. ▲

	Seagate 7200.11 500GB	OWC Mercury-On-The-Go	OWC Mercury Elite-AL QUAD	Fantom GreenDrive GD500EU	Maxtor OneTouch 4 Pus	FreeAgentGo	Western Digital My Book Mirror Edition
<b>Price</b>	N/A	\$249.99	\$295.99	\$125.00	\$299.99	\$84.99	\$549.99
<b>Capacity</b>	500 GB	320GB	1TB	500GB	1TB	160GB	2TB (1TB in RAID 1)
<b>Cost (in cents) Per GB</b>	N/A	78 cents/GB	28 cents/GB	25 cents/GB	30 cents/GB	53 cents/GB	55 cents/GB
<b>Warranty</b>	N/A	2 Years	2 Years	1 Year	5 Years	5 Years	3 Years
<b>CPU rating</b>	N/A	●●●●	●●●●●	●●●●	●●●●	●●●●	●●●●●

	Internal SATA	USB	FireWire	USB	FireWire	eSATA	USB	eSATA	eSATA (NTFS)	USB	FireWire	USB	USB
<b>PCMark05 HD Tests</b>													
HDD Overall Score	6868	3516	3926	3931	4425	6776	3400	5455	5739	3598	3779	2863	3207
XP Startup (MBps)	9.046	7.907	8.533	8.823	9.707	10.265	7.473	8.043	8.21	7.84	8.493	5.998	7.408
App Loading (MBps)	7.512	6.422	7.107	7.918	8.762	9.064	6.277	6.919	6.949	6.762	7.05	4.778	6.033
General Usage (MBps)	6.584	5.42	6.14	6.719	7.66	8.113	5.232	5.959	5.954	5.999	6.321	3.819	4.795
Virus Scan (MBps)	138.441	31.066	35.282	31.209	35.734	95.876	29.738	85.621	103.19	30.627	32.898	29.018	24.816
File Write (MBps)	101.341	25.851	29.237	26.381	30	81.226	25.629	69.993	73.127	25.497	25.487	24.868	26.244
<b>HD TachRW 3.0.4.0</b>													
Burst Speed (MBps)	253	35.1	41.3	37.7	41.3	129.1	37.7	227.2	246.5	37.6	40.2	35.1	37.5
Random Access (ms)	12.5	16.5	16	12.9	12.6	12.6	14.8	14.3	14.2	12.9	12.8	16.2	16.5
Average Read (MBps)	93.2	35	40.1	35	40.2	72.7	35.7	63.9	92.8	35.5	39.2	31.5	35.1
<b>IOmeter 2006.07.27</b>													
File Server (Ios)	309.82	569.84	606.33	535.96	579.3	605.6	437.47	419.63	407.29	321.81	342.26	405.96	421.22
File Copy (min:sec)	N/A	1:00	:53	:59	:53	:34	2:24	:38	:34	:54	1:00	1:08	1:03



**My Book Mirror Edition**  
\$549.99  
Western Digital  
[www.wdc.com](http://www.wdc.com)  
●●●●●



**FreeAgent Go**  
\$84.99  
Seagate  
[www.seagate.com](http://www.seagate.com)  
●●●●●

software, and it's quite clever. Once you tell it what folders to monitor, Anywhere Backup copies entire folders from your internal drives to the external drive during idle periods. Then, it copies new and updated files as you add them or make changes. It can store multiple versions of files and even encrypt them for safety. We never noticed a slowdown after the initial copy process, and simplicity was impressive.

Western Digital employs its own "green" line of hard drives, so both the power consumption and heat levels weren't as high as cramming two drives into a single, fan-less case would suggest. These drives were slightly slower than competing drives, but the USB 2.0

interface is the real bottleneck, so there's no real issue. Physically, the glossy black plastic case and Knight Rider-esque scanning LED look impressive during activity, but the lights also display a fuel-gauge style indicator indicating remaining capacity during idle times, which is very handy.

## Seagate FreeAgent Go

The FreeAgent Go is the smallest, lightest, and least expensive drive we looked at, yet it comes with the most innovative software bundle. It was the slowest drive in our benchmarks, but Seagate doesn't really market it for speed.

The case is an attractive plastic wedge, with nothing but a mini USB connector on

one end, while the other end glows and pulses during drive activity. The USB cable has a third USB connector to draw extra power from a second USB port should your PC's USB ports be electrically deficient (we never needed it), and the drive powers itself on and off automatically. You'll find yourself tossing it in your computer bag all the time, despite its lack of a carrying case.

The drive comes with Ceedo, which is a software package that lets you run dozens of programs directly from your external drive without touching the main system drive, and optionally automatically syncs your folders and files. The system works amazingly well, but it should considering it's also a standalone commercial product (it costs about \$30) rather than some in-house programming job. It practically makes for a portable office as well as a data backup. ▲

by Warren Ernst

CPU RANKING ○ 0 = ABSOLUTELY WORTHLESS | ●●● 2.5 = ABSOLUTELY AVERAGE | ●●●●● 5 = ABSOLUTELY PERFECT

# TOTALLY SOLID

## SSDs CRANK UP THE PRESSURE

**W**e spoke of SSDs' present and future in general terms earlier in this Spotlight section (see "Storage Unleashed" on page 54); now let's get down to some specific contenders.

Performance enthusiasts, mainstream desktop users, and notebook users alike are all interested in the way these wicked little critters stack up next to typical hard drives for their applications. To this end, we benchmarked Western Digital's fastest drives for all three of these markets and added them to the end of the chart. All drives used the SATA interface.

Synthetic tests aren't the last word in performance, but the only category the HDDs swept concerned burst read rates. In case you were wondering why hard drive manufacturers are packing 32MB of fast DRAM cache into their flagship drives (although the smaller VelociRaptor gets by with 16MB), it's because cheap DRAM has become a counter against the SSD menace, albeit one that's less effective than HDD's cost-capacity ratio. Of course, SSD manufacturers, such as Memoright, can and do buffer their drives with volatile RAM, too.

### Imation PRO 7000 3.5" 64GB

This Mtron-manufactured SLC (single-level cell) drive is the server cousin of the Mobi 3000. (See page 35 of the July 2008 issue.) It's a little faster than the Mobi, and it has a longer warranty. Regular readers of these pages are no strangers to Mtron's



#### PRO 7000 3.5" 64GB

\$1,299

Imation

[www.imation.com](http://www.imation.com)

**Specs:** 7-bit ECC; 1 million hour MTBF; dynamic/static wear-leveling; 10-year data retention at 25 C; 0.5 to 2.7W power consumption; Five-year warranty

#### GT 2.5" 32GB

\$845

Memoright

[www.memoright.cn/en](http://www.memoright.cn/en)

**Specs:** 200G operating (2ms)/800G non-operating (1ms) shock tolerance; ECC; wear-leveling; >10-year data retention; 1 million hour MTBF; Five-year warranty



lineup, so we'll save our breath. Models range from 16GB to 128GB and from 2.5- to 3.5-inch form factors.

Imation was kind enough to send us a pair of PRO 7000s for RAID 0 testing; the results are in brackets ([ ]). This big SLC drive held the middle ground, performance-wise.

By the time you read this, Imation says the price may have dropped to "at least \$1,199." Still, that's four times more than the MLC (multilevel cell) brawlers from OCZ and SuperTalent. (Just before press time, the newer PRO 7500 superseded the SATA 7000.)

### Memoright GT 2.5" 32GB

Our returning champ faces some tough competition from the NAND-master Samsung, but thanks to an aggressive controller design and a fast 32MB cache, the GT Series SSD still logs the best write rates around. Witness the top score in our custom File Server profile in Iometer. (The Samsung 32GB wrecks its revenge in RAID.) If you work with music or video, take note that this drive won't leave you waiting long.

### OCZ Core 2.5" 64GB

OCZ means performance, but with its long-awaited Core line of SSDs, it seemed to add the tagline, "for the money." Everyone knows that SSDs are taking off, but the cost per GB of common SLC NAND drives is still through the roof. Thus, OCZ, like SuperTalent, decided to go for the underserved entry-level SSD market using less expensive MLC NAND technology.

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**Core 2.5" 64GB**

\$259

OCZ

www.ocztechnology.com



**Specs:** 3Gbps SATA; 10-bit ECC; 1,500G operating (0.5ms) shock tolerance; 1.5 million hour MTBF; Two-year warranty

MLC can store 2 bits per cell. Its density is the reason that Bitmicro ([www.bitmicro.com](http://www.bitmicro.com)) can pack 1.6TB of NAND into a 3.5-inch form factor. MLC is slower at writing than SLC, and a MLC controller must do much more error correction to ensure data integrity. You'll see a clear difference in an MLC drive's random access time, which in our HD Tach tests manifested itself as 0.4ms for MLC and 0.1ms for SLC.

Remarkably, OCZ's Core posted very impressive scores in light of the fact that it costs roughly a quarter as much as its SLC

competitors. Like SuperTalent's MLC drive below, its IOMeter File Server (single user, 16 outstanding I/O requests) results appear dismal at best, especially compared with the hard drives. However, the OCZ and SuperTalent SSDs get their own back in the read-only Web Server (four users, 16 outstanding I/Os each) test.

On the other hand, sequential reads and writes of moderate to large file sizes make these value drives look pretty decent. In other words, if you buy an MLC drive for its bang for the buck, be prepared for a more mixed bag of performance than you would get with most SLC models.

**Samsung MCBQE32G5MPP-0VA 2.5" 32GB**

It's a rare benchmark in which a VelociRaptor hard drive is faster than this SSD. If Samsung could boost its write rates somewhat, it would have a home run on its hands.

Certainly, this Samsung's read rates are nothing short of incredible. In our read-heavy tests such as IOMeter's Web Server, as well as in PCMark Vantage, this SSD swept the field. And it's dirt-cheap for an SLC drive.

Speaking of incredible, Samsung has promised by year's end a 200MBps read/160MBps

**Benchmark Results**

Vista Home Premium SP1 (32-bit), Core 2 Extreme Q6850 (3GHz), 2GB DDR3 (1,333MHz), Intel DX48BT2, ICH9R controller. All drives use SATA.

	<b>SSDs</b>				
	<b>Imation PRO 7000 3.5" 64GB [RAID 0]</b>	<b>Memoright GT 2.5" 32GB [RAID 0]</b>	<b>OCZ Core 2.5" 64GB</b>	<b>Samsung 2.5" 32GB [RAID 0]</b>	<b>SuperTalent MasterDrive MX 2.5" 60GB</b>
<b>Media type</b>	SLC NAND	SLC NAND	MLC NAND	SLC NAND	MLC NAND
<b>PCMark Vantage 1.0.0 (Nov 07 patch)</b>					
HDD Score (points)	11814 [15982]	12921 [17817]	9343	19709 [26043]	9062
Defender (MBps)	82.1 [101.8]	85.3 [102.5]	62.8	121.2 [140.3]	59.8
Gaming (MBps)	86.7 [93.4]	90.8 [94.9]	74.3	119.7 [124.9]	68.3
Photo Gallery import (MBps)	96.5 [124.5]	104.5 [127.5]	97.9	149.1 [203.2]	98.9
Vista startup (MBps)	59.5 [92.2]	62.7 [100.2]	49.2	106.7 [152.4]	47.3
Movie Maker edit (MBps)	50.5 [59.2]	66.2 [78.5]	30.7	65.2 [83.5]	30.9
Win Media Ctr (MBps)	55.7 [106.9]	88.3 [163.6]	48	92 [149.6]	47
WMP music add (MBps)	24.3 [39.5]	26.5 [40.1]	18.8	59.3 [74.8]	18.4
Application Loading (MBps)	30.1 [34.6]	21.9 [35.2]	20.7	61.6 [92.6]	19.7
<b>HD Tach RW 3.0.4.0, Long Bench</b>					
Read rates, average/maximum (MBps)	98.4/99 [108.1/120.5]	117.2/118 [121.4/143]	116.2/129	147/166 [182.6/216]	110.6/122
Write rates, average/maximum (MBps)	75.9/81 [82.2/100]	119.4/120 [130.1/146]	74.1/83	62.7/91 [91.6/110]	72.4/83
Random access time** (ms)	0.1 [0.1]	0.1 [0.1]	0.4	0.1 [0.1]	0.4
Burst read rate (MBps)	106.2 [186.9]	126.9 [219.7]	143.2	106.3 [166.3]	134.1
CPU Utilization** (% +/- 2%)	0 [3]	2 [0]	3	2 [3]	2
<b>Iometer 2006.07.27</b>					
File Server (I/Ops)	688 [1274]	1363 [2455]	20	746 [2872]	21
File Server (MBps)	7.5 [13.8]	14.7 [26.7]	0.2	8 [31]	0.2
File Server avg/max response** (ms)	23/130 [13/123]	12/185 [7/218]	794/3239	21/244 [6/130]	774/3248
Web Server (I/Ops)	4353 [8253]	1363 [7150]	2002	4589 [9795]	1947
Web Server (MBps)	66.7 [126.4]	58.8 [109]	30.3	69.8 [149.3]	30
Web Server avg/max response** (ms)	15/59 [8/54]	17/60 [9/46]	32/325	14/57 [33/17]	33/95
<b>Price</b>	\$1,299 [\$2,598]	\$845 [\$1,690]*	\$259	\$397 [\$794]*	\$319
<b>CPU</b>	● ● ● ●	● ● ● ●	● ● ●	● ● ● ● ●	● ● ●

\* Prices from DVNation.com. \*\* Lower is better. \*\*\* 3.5" in factory heatsink.

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## Performance Tips

OCZ and other manufacturers offer a number of suggestions for best performance with an SSD. Besides updating your motherboard's SATA drivers, install the latest BIOS version. Disable your SATA controller's AHCI (Advanced Host Controller Interface) mode, as some SSD controllers conflict with it. The native command queuing AHCI makes possible only affects (certain) hard drives, which have to combat rotational latency with every trick at their disposal. In fact, OCZ and others recommend setting a SATA controller to IDE mode, although we have used Intel controllers' RAID mode without mishap with most SSDs we've tested.

Next, check for firmware updates. A firmware-upgradable hard drive is a rare bird, but some SSD manufacturers, such as Mtron, occasionally post new versions for their SSDs.

Speaking of RAID, our test results demonstrate that SSDs scale very well in most striping setups, although performance varies on different SATA controllers. Keep your stripe size large, such as 128KB or bigger, OCZ says.

For longevity reasons, don't let defragmentation software touch your SSD. If you run Vista, install SP1 and disable SuperFetch. And if you use Linux on a system with an SSD but no hard drives, use the noop I/O scheduler. ▲

### MCBQE32G5MPP-0VA 2.5" 32GB

\$397

Samsung

www.samsungssd.com



**Specs:** 0.2 to 0.4W power consumption; 1,500G operating (0.5ms) shock tolerance; >2 million hour MTBF; wear-leveling

### MasterDrive MX 2.5" 60GB

\$319

SuperTalent

www.supertalent.com



**Specs:** 1,500G operating shock tolerance; ECC; wear-leveling; Five-year data retention; 1 million hour MTBF; One-year warranty

write SSD—using MLC, no less. It's worth noting that the firm makes the NAND inside many popular SSDs from other manufacturers. Its partners/competitors may design their own controllers, but the flash memory chips are all Samsung, baby.

### SuperTalent MasterDrive MX 2.5" 60GB

We like the "truth in advertising" approach to this drive's labeling. It has the same capacity as any "64GB" SSD around, but it (along with the rest of the 15 to 120GB family) is sold according to the rough amount of storage space you'll actually get from it once you format it with a file system. The drive comes with an Ubuntu Desktop Edition installation CD, too, which is a nice gesture that should sit well with open-source fans.

You'd never be able to tell this drive from the OCZ during everyday use, although the latter MLC drive has a slight edge in benchmark results. SuperTalent may sneak past, however, as shortly before press time it announced a speed boost for several new SSDs, including this one. The company is just a price drop away from giving OCZ something to worry about.

### Solid Contestants

OCZ and SuperTalent deserve kudos for their efforts in bringing SSDs to the masses, using MLC memory to hit lower price points. Of course, those lower prices come at the cost of lower performance levels. This being *CPU*, we'll have to overlook these fine values and choose a winner from among the more traditional SLC crowd.

The Samsung's blistering read capabilities and amazingly low price (for SLC) propel it to the top of our short list, even though Memoright seems to be on the right track with its stellar efforts in write performance. Our experience with storage media of all kinds reminds us that so-so write rates can gnaw at you during your day-to-day user experience, so you could be forgiven for wanting a more balanced approach to reads and writes.

(Special thanks to distributor DVNation.com for the Samsung and Memoright drives.) ▲

by Marty Sems

Enthusiast HDD WD VelociRaptor 2.5" *** 300GB [RAID 0]	Mainstream HDD WD Caviar Black 3.5" 1TB [RAID 0]	Notebook HDD WD Scorpio Black 2.5" 320GB
10,000rpm disks	7,200rpm disks	7,200rpm disks
6479 [6982]	5796 [6428]	3768
27.3 [29.6]	26.3 [27.7]	18.4
20.6 [19]	16.2 [15.1]	12.2
60.1 [53.2]	56.7 [53.2]	24.6
23.4 [27.6]	20.6 [24.2]	16
59.5 [62.1]	56.6 [58.3]	42.4
115.9 [150.2]	121.9 [178.1]	67.4
16.1 [13.6]	13.3 [11.6]	8.7
7.8 [11.9]	6.2 [10]	4.1
108.7/130 [177.6/206]	88.1/110 [156.7/196]	64.2/85
107.2/130 [162.6/204]	87.7/112 [157.6/180]	63.2/82.5
7.1 [7.2]	12.5 [12.2]	14.9
241.1 [395.3]	221.7 [326.3]	228.4
2 [4]	2 [4]	2
280 [425]	137 [221]	126
3 [4.6]	1.5 [2.6]	1.4
57/1047 [38/622]	116/1602 [72/1692]	127/1676
320 [545]	150 [262]	142
5 [8.3]	2.3 [4]	2.2
200/1655 [117/1578]	425/2361 [244/2272]	451/2334
\$299 [\$598]	\$249.99 [\$499.98]	\$229.99
● ● ●	● ● ●	● ●

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# RED vs. BLU

## EXCEPTIONAL OPTICAL DRIVES, REGARDLESS OF FORMAT

**D**o you remember a time when you could generically call a writable optical drive a “CD burner”? A lot of folks still do, of course, but technically, drives these days should really be called “CD/DVD burners,” or in the case of the most format-friendly drive in our roundup, a “CD/DVD/DVD DL/BD Writer,” which doesn’t exactly roll off the tongue. So for the purposes of this article, “optical burner” it is, even though it

sounds like something an evil ophthalmologist should use.

We wanted to see what was new in the world of optical burners, which typically doesn’t introduce a lot of new technologies within a short time span, but things are different now. Given the demise of the HD-DVD format, the wide availability of BDs (Blu-ray discs), the broad acceptance of LightScribe labeling, and the introduction of SecurDisc to protect your data, there’s a lot to look at. And of course, drive speeds ramp up while prices march down.

### How We Tested

We connected each of our optical drives to two machines to verify compatibility. We performed all of our benchmarking on a PC equipped with a 3GHz Intel Core 2 Duo, an Asus motherboard using Intel’s G35 chipset, ICH9R SATA controller, JMB368 PATA controller, and Windows XP. Specific benchmarks included Nero DiscSpeed 4.11.2.0 (a free download from Nero), Windows Media Player 11 (for audio ripping), and DVD Decrypter 3.5.4.0 (for DVD ripping). We

### Optical Drives, Clocked & Compared

	LG GH20LS10	LG GBW-H20L	Pioneer DVR-2910	Pioneer DVR-116DBK	Lite-On DH-20A6L	Lite-On DH-401S*
<b>Features/Specs</b>						
Supported formats and speeds	DVD+R 20X, DVD+R DL 12X, DVD+RW 8X, DVD-R 20X, DVD-R DL 12X, DVD-RW 6X, DVD-RAM 12X, DVD-ROM 16X, CD-R 48X, CD-RW 32X, CD-ROM 40X	DVD+R 16X, DVD+R DL 4X, DVD+RW 8X, DVD-R 16X, DVD-R DL 4X, DVD-RW 6X, DVD-RAM 5X, DVD-ROM 16X, CD-R 40X, CD-RW 24X, CD-ROM 40X, BD-R 6X, BD-R DL 4X, BD-RE 2X	DVD+R 20X, DVD+R DL 10X, DVD+RW 8X, DVD-R 20X, DVD-R DL 10X, DVD-RW 6X, DVD-RAM 12X, DVD-ROM 16X, CD-R 40X, CD-RW 32X, CD-ROM 40X	DVD+R 20X, DVD+R DL 12X, DVD+RW 8X, DVD-R 20X, DVD-R DL 12X, DVD-RW 6X, DVD-RAM 12X, DVD-ROM 16X, CD-R 40X, CD-RW 32X, CD-ROM 40X	DVD+R 20X, DVD+R DL 8X, DVD+RW 8X, DVD-R 20X, DVD-R DL 8X, DVD-RW 6X, DVD-RAM 12X, DVD-ROM 16X, CD-R 48X, CD-RW 32X, CD-ROM 48X	CD-ROM 32X, DVD-ROM 12X, BD-ROM 4X
Cache size	2MB	4MB	2MB	2MB	2MB	2MB
Drive length	170mm	190mm	180mm	180mm	170mm	185mm
Included bezel cover colors	Black, ivory	Black	Black	Black	Black, white	Black, silver
Interface	SATA	SATA	SATA	PATA	SATA	SATA
Firmware Ver.	FL01	YG01	1.13	1.03	8L04	CP56
Warranty	1 Year	1 Year	1 Year	1 Year	1 year	1 Year
LightScribe	Yes	Yes	Yes	No	Yes	No
Bitsetting + Media	Yes	Yes	No	No	Yes	N/A
Software bundle	PowerDVD 8, PowerProducer, Nero 7 Essentials, SecurDisc Viewer	PowerDVD 8, PowerProducer, PowerBackup, Power2Go, LabelPrint, InstantBurn	Nero 8 Essentials, PhotoShot Express, SecurDisc Viewer	Nothing	Nero 7 Essentials	PowerDVD BD Edition
Other included accessories	SATA cable, screws, Molex-to-SATA power adapter, installation poster	SATA cable, screws, Molex-to-SATA power adapter, installation and use booklet	Screws, 3-language installation poster	3-language installation poster	SATA cable, screws, ejector pin	Sata cables, screws, ejector pin

\*Previously reviewed

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included additional tests based on the particular software bundled with each drive (except where noted) and a stopwatch. Speaking of bundled software, we installed and used it all, making sure it did what it claimed, and judged its real-world usefulness. We used Verbatim blank media, which came recommended from many of the vendors, for our tests.

Finally, we've included a few previously reviewed drives for comparison purposes. Sony's BDU-X10S, Pioneer's BDC-2202, and Lite-On's DH-401S are all back for another spin, so to speak, so check out how they compared to some of the new competition. (One quick spoiler: After assessing all of the drives, we knocked the BDU-X10S down from its initial 3.5 rating to a 3.) We'll close with a few comments on all of the drives' performance and value.

#### Lite-On DH-20A6L

The DH-20A6L sports the lowest retail MSRP of any of the drives here, but its

#### DH-20A6L

\$49.99

Lite-On

us.liteonit.com/us



#### DVR-116DBK

\$55.99

Pioneer

www.pioneerelectronics.com



good performance, techie-welcoming features, and software bundle make it a worthy choice for the cost-conscious buyer.

Sporting enough silkscreened logos to look like a NASCAR racer, the DH-20A6L comes with both black and white faceplates. This, combined with a regularly sized and positioned eject button, make it ideal for "stealthed" drive bays with spring-loaded doors. The relatively short length of the drive should help with tight-fitting SFF and media computer cases.

The Lite-On drive stands alone with its ability to both alter the drive's Bitsetting for DVD+R media to "DVD-ROM" (which increases burned-disc compatibility with many DVD consoles) and to perform detailed media testing on its burned discs without resorting to our having to hack the drive's firmware. It's the fastest audio ripper of all the drives and just a tick slower than the fastest at other tasks.

Like many of the drives here, this one ships with Nero 7 Essentials, a thoroughly complete, but sometimes thoroughly confusing, disc burning software suite. The individual programs that perform these tasks are easy enough, but the SmartStart program selector that picks the right program for your tasks is anything but intuitive. You're on your own for DVD playback software.

#### Pioneer DVR-116DBK

The DVR-116 is targeted at older machines that are rolling along with nothing but a PATA interface. After checking that our test machine still sported such an interface, we were pleased to confirm what Pioneer had told us: The PATA-equipped drives are just as fast as SATA drives, even at 20X speeds. Although our SATA-equipped Pioneer drive used a slightly different mechanism, the benchmarks for both are practically identical to each other.

The DVR-116 is marketed as a "bare drive," and that's exactly how ours arrived. There was no software and no

interface cables—not even any screws. Its faceplate had no printed labels, instead making do with embossed logos.

Performance is excellent, beating the Lite-On in most benchmarks, but what the figures don't show is the relative silence of this drive. Pioneer took pains to improve the drive's internal airflow and ensured that vents and holes were either silenced or removed. The result was a drive that was noticeably quieter than the rest.

#### Pioneer DVR-2910

We initially tested the DVR-2910 just to confirm that SATA and PATA drives can be just as fast, but found the DVR-2910 to have charms all its own. Like its cousin, the DVR-2910 has a faceplate bereft of printed logos. Unlike its cousin, ours came in a full retail package, which included cables, screws, and a software bundle (which, in this case, was Nero 8 Essentials, Nero PhotoShow 5, and a SecurDisc Viewer).

Although just about as fast, the DVR-2910 wasn't as quiet as the DVR-116, so consider LightScribe and the software bundle a tradeoff for near-silence.

#### LG GH20LS10

LG's conventional DVD burner has a lot going for it, including a great software bundle, detachable faceplates, a small 170mm depth, Bitsetting options, and generally great benchmarks across all categories except one. The only real problem was DVD ripping, where repeated tests with different discs and software never changed the slowest tested scores of all our tested drives. It works, of course, but takes more than twice as long as other burners.

We hope it's just a firmware problem, which would make for an (eventually) easy solution. LG is the only vendor whose software bundle includes a firmware updater, and it automatically goes online to download and install the latest firmware when run. Also included is

Pioneer BDC-2202*	Sony BDU-X10S*
DVD+R 12X, DVD+R DL 4X, DVD+RW 6X, DVD-R 12X, DVD-R DL 4X, DVD-RW 6X, DVD-RAM 5X, DVD-ROM 12X, CD-R 24X, CD-RW 24X, CD-ROM 32X	DVD-ROM 8X, BD-ROM 2X, CD-ROM 24X
2MB	4MB
185mm	190mm
Ivory	Black
SATA	SATA
1.04	1.0a
1 Year	1 Year
No	N/A
No	N/A
Corel Video Studio 11 SE, WinDVD 8 LE, Burn.Now SE	PowerDVD 7.3
screws, disc, installation manual	Thinner tray cover, screws, Molex-to-SATA power adapter, user guide, installation guide



**DVR-2910**

\$59.99

Pioneer

www.pioneerelectronics.com

**GH20LS10**

\$79.95

LG Electronics

us.lge.com

**GBW-H20L**

\$279.95

LG Electronics

us.lge.com



PowerDVD for movie playback (which other vendors seem to have ignored for this market segment), and Nero 7 Essentials with SecurDisc technology.

In a nutshell, discs burned with SecurDisc features enabled can have files encrypted through AES-128 with a private key/public key arrangement, which also utilizes firmware routines (so you need SecurDisc compatible drives to read the encoded disc). PDFs stored on such discs can't be copied, and the system utilizes unused space on the disc to write redundant copies of files, in case the disc gets scratched or damaged. We didn't spend a lot of time trying to hack the system, but it does seem to ensure basic file protection.

LG drives tend to have lower street prices than competing drives, which should make an attractive drive a good deal.

**LG GBW-H20L**

Why should it be surprising that the most expensive drive in our roundup is also the best all-around burner? Although it's not the fastest DVD burner in our pack (in fact, its DVD DL burning speeds are quite poor), it supports BD writing

and reading, includes a great software bundle, and is (dare we say it?) attractive to boot. It's not cheap, but considering what you get, it represents a good value.

The faceplate is finished with pinstriped black lacquer with a silver ribbon along the bottom that blends into the eject button, which blends in nicely with a glossy black HTPC case. If your case has stealthed drive bays, you'll want to rip them off.

CyberLink's Hi-Def Suite comes bundled with the drive, and it handles movie playback with PowerDVD, while Power2Go and its ancillary programs handle ripping, burning, and LightScribe label creation. Unlike Nero's, CyberLink's program launcher is attractively and logically laid out, and its subprograms launch quickly.

DVD ripping isn't as slow as the other LG burner, but it could still stand to be faster. Perhaps a firmware update will eventually take care of it. Amazingly, burning a 20GB BD-R is significantly faster than burning an 8GB DVD DL, though at \$8 to \$12 a BD-R, you might not be burning many for a while.

Because the drive isn't that much pricier than BD-ROM combo drives, it may be worth getting one now and wait for media prices to drop.

**Recommendations**

Each of the "basic" DVD burners had good overall performance, but none led every benchmark. Each had some minor weakness, be it the software bundle, a relatively higher price, noise, or DVD ripping speeds. We suggest choosing the model with the disadvantage that least affects you.

Each is significantly faster than the Pioneer combo drive, as is the Lite-On BD-ROM at reading, so if you have two drive bays and SATA ports, consider two drives for best overall performance. Otherwise, the Pioneer BDC-2202 is a fine drive that does a lot for a good price, although it excelled at nothing.

For just a little more money, the LG GBW-H20L combines good looks, good performance, great software, and maximum media flexibility in a single drive. If its price isn't too high, then it's the drive to get. ▲

by Warren Ernst

**Benchmarks**

	<b>LG GH20LS10</b>	<b>LG GBW-H20L</b>	<b>Pioneer DVR-2910</b>	<b>Pioneer DVR-116DBK</b>	<b>Lite-On DH-20A6L</b>	<b>Lite-On DH-401S*</b>	<b>Pioneer BDC-2202*</b>	<b>Sony BDU-X10S*</b>
Nero Discspeed DVD Read AVG	11.67X	8.81X	11.39X	11.32X	9.07X	8.66X	8.9X	5.78X
Nero DiscSpeed DVD Read Max	15.45X	11.66X	15.11X	14.71X	12.12X	11.41X	11.81X	7.64X
Nero DiscSpeed BD Read AVG	N/A	3.61X	N/A	N/A	N/A	3.16x	1.89x	1.98X
Nero Discspeed BD Read MAX	N/A	4.80X	N/A	N/A	N/A	4.40X	2.00x	2.0X
DVD Decrypter rip (minutes:seconds)	29:18	17:33	11:31	11:32	11:50	17:26	27:24	17:14
WMP 11 audio rip (minutes: seconds)	2:01	2:05	2:15	2:14	1:56	2:44	2:36	3:21
Burning Audio CD 2:15 (52X disc, minutes:seconds)	2:20	2:55	3:00	2:47	N/A	4:00	N/A	
Write 4.0GB +R (16X disc, minutes:seconds)	5:06	5:23	5:15	5:35	6:02	N/A	12:42	N/A
Write 20.6GB to BD (minutes:seconds)	N/A	19:58	N/A	N/A	N/A	N/A	N/A	N/A
Write 8.0GB to DL (8X disc, minutes:seconds)	15:17	27:36	21:32	18:57	18:55	N/A	27:10	N/A
MSRP	\$79.95	\$279.95	\$59.99	\$55.99	\$49.99	\$139.99	\$199	\$199
Street price (approx. avg.)	\$30	\$260	\$45	\$30	\$32	\$140	\$175	\$150
CPU's	●●●●	●●●●●	●●●●●	●●●●●	●●●●●	●●●●●	●●●●	●●●

\*Previously reviewed

CPU RANKING ○ 0 = ABSOLUTELY WORTHLESS | ●●● 2.5 = ABSOLUTELY AVERAGE | ●●●●● 5 = ABSOLUTELY PERFECT





"We at 80 PLUS® are delighted to applaud Cooler Master as the first power supply manufacturer to meet Silver certification status for a multi-output power supply in production." **80 Plus**



# LAST POWER STANDING

Cooler Master's UCP (Ultimate Circuit Protection) sets the bar even higher for efficiency and durability for computer power supplies. The UCP 900W has received the world's first 80 Plus Silver Certification. This certification validates that the power supply has the capacity to power systems up to 88% efficiency.

The UCP has an innovative circuitry layout designed to prolong its life expectancy for hardcore gamers and over-clockers who push their components to the max.

UCP is truly the last power standing.

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[amazon.com](http://amazon.com)

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[COMPUSA](http://COMPUSA.com)  
We got it. We get it.

[DELL](http://DELL.com)

[Fry's](http://Fry's.com)

[J&R](http://J&R.com)

[MICRO CENTER](http://MICRO CENTER.com)  
The Computer Connection

[newegg.com](http://newegg.com)

[TigerDirect.com](http://TigerDirect.com)

[Zip2omfy](http://Zip2omfy.com)  
.com





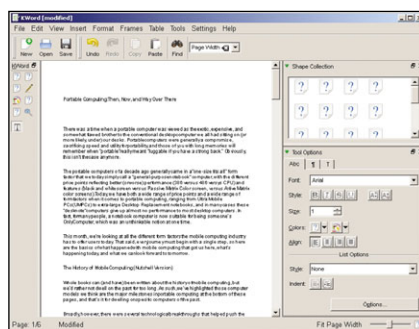
# The Bleeding Edge Of Software

## Inside The World Of Betas

### KOffice 2.0 Alpha 8

Why settle for a highly evolved and debugged free replacement to Microsoft Office when you can use a free office suite that crashes (but still runs) no more than once a minute? Of course we jest, since KOffice for Windows is clearly in the Alpha stages of development, but . . . “What’s that?” you say? “KOffice for Windows?” Yes, you read right, the next generation of KOffice is available for Linux, Windows, and even Macintosh, and though we clearly can’t recommend it for any reason over Microsoft Office or OpenOffice, it is an interesting look at what to anticipate.

The installer is basically automatic for Windows, downloading dozens and dozens of modules (hope you have broadband) that not only give you KOffice (which includes KWord, KSpread, KChart, Kexi, Kivio, Krita,



**Product Name:** KOffice 2.0

**Version # Previewed:** Alpha 8

**Publisher and URL:** KDE e.V.,

<http://ev.kde.org>

**Developer and URL:** KDE e.V.,

<http://ev.kde.org>

**Product URL:** [www.koffice.org/releases/2.0alpha9-release.php](http://www.koffice.org/releases/2.0alpha9-release.php)

**ETA:** Q1 2009

**Why You Should Care:** An Office alternative from a group that knows what it’s doing.

Karbon14, KPresent, KPlato, and more), but most of the utilities and

small desktop games that come with the KDE Desktop Environment. Many of them even work!

But seriously, KOffice is impressive for what it is. Though slow, it manages to open a surprisingly large number of office file formats (though not Office 2007). Its interface, though missing certain icons and widgets, is attractively laid out for wide-screen monitors, with sets of tools arranged on the right side and content placed on the left. It offers a variety of tools to get office work done that OpenOffice has no equivalent of. KOffice 2.0 works much better in Linux, where it’s relatively stable and actually faster than OpenOffice when starting and for most tasks.

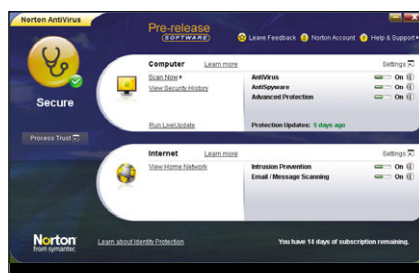
The Windows and Mac versions are impressive achievements for what they are, and if its speed can be brought up to is Linux cousin, KOffice will be a worthy alternative. Just don’t use it yet for anything you value. ▲

by Warren Ernst

### Norton AntiVirus 2009 Pre-Release

Since 2007, Symantec has been listening to power-users complaints about Norton AntiVirus’ slowness and bloat, and successive versions of NAV have been leaner and meaner. Last year, we judged NAV-2008 to have the speed of NAV2003, which is a vast improvement. NAV2009 supposedly ups the ante with a new interface and boosts in speed, and so we checked out the latest public beta.

The beta booted our test machine in exactly the same time as NAV2008 and ran our disk benchmarks within 5%, as well, but we’re more impressed with what it did not do. It didn’t run a background scan while we were working, nor did it decide to download large updates while doing other things, and it shut down a background scan within a few seconds of our starting another program. By right-clicking the Tray icon,



**Product Name:** Norton AntiVirus 2009

**Version # Previewed:** Public Release/Beta 1

**Publisher and URL:** Symantec,

[www.symantec.com](http://www.symantec.com)

**Developer and URL:** Symantec,

[www.symantec.com](http://www.symantec.com)

**Product URL:** [www.symantec.com/norton-beta](http://www.symantec.com/norton-beta)

**ETA:** Q4 2008

**Why You Should Care:** The giant in anti-malware gets leaner and meaner.

you can send NAV into Quiet Mode for between 10 minutes and three hours, meaning NAV won’t download updates or pop up warnings for that length of time.

The interface is revamped, reducing the level of on-screen clutter. Pop-up screens present obvious tasks when links and buttons are clicked. Users with multiple computers running NAV can manage all of them via the Home Network control panel. It’s intuitive and attractive and sure beats running up and down the stairs all the time. We only spot-checked the beta’s anti-malware abilities, but it blocked drive-by downloads and a relatively small 12-item test-zoo without trouble or any undue fuss.

Based on the beta’s good performance and interface, as well as a blazingly fast installer and uninstaller, we consider NAV2009 to be worth a hard look when your current AV subscription runs out. ▲

by Warren Ernst

# UP TO SPEED

Upgrades That'll Keep You Humming Along

Adobe releases multiple program updates for both its free and professional software. Flock test drives the Firefox 3 engine, while Mozilla plugs FF2. And Sony's PS3 firmware upgrade misfires at first.

## Software Updates

### Adobe Acrobat 9

The PDF creator gets a major release that incorporates Flash. Now, authors can place videos and applications directly into documents. A new PDF Portfolio feature gathers multiple file types into a compressed PDF, as well.

[www.adobe.com](http://www.adobe.com)

### Adobe AIR 1.1 Update for Flash CS3 Professional

For Flash programmers, this latest AIR release lets your code access desktop resources and data.

[www.adobe.com](http://www.adobe.com)

### Adobe Reader 9

The latest iteration of the ubiquitous PDF viewer makes it easier to sign PDFs and create a PDF on the free Acrobat.com site. Collaboration has been streamlined with the Comment and Markup toolbar and an online Adobe ConnectNow service.

[www.adobe.com](http://www.adobe.com)

### AIM 6.8

AOL's instant messenger now has plugins for customizing a Buddy window with videos, stock trackers, Web radio, etc. You can send text messages directly to your friends or have incoming messages sent to your phone.

[www.aim.com](http://www.aim.com)

### AIM Express 7.0 Beta

The Web-based version of AIM improves connections and performance, adds shortcut keys for starting new sessions, and has

easier history clearing. Each IM window now gets its own drop-down menu.

[www.aim.com](http://www.aim.com)

### Azureus 3.1.1.0

The torrent client gets an Auto Starting rule that seeds large swarms first. Clicking a Friend can open a chat window, and dragging content from your PC to the friend's icon shares content with that user. Downloads now can be renamed and moved while running.

[Azureus.sourceforge.net](http://Azureus.sourceforge.net)

### Firefox 2.0.0.15

For those who have not made the big switch to Firefox 3, Mozilla continues to maintain the earlier version by plugging some security holes and fixing crashes related to memory corruption.

[www.mozilla.org](http://www.mozilla.org)

### Flock 1.2.3

The increasingly popular "social browser" fixes issues with sharing media over Digg and Yahoo! Mail and for the Media Magic bar and YouTube videos. A public beta of Flock 2.0 is now live, which incorporates the Firefox 3 engine.

[www.flock.com](http://www.flock.com)

### Google Media Server

This Google Gadget installs in Google Desktop to stream PC-based multimedia into UPnP-enabled devices across your home network. Early users report varying degrees of success, but it purports to run images and videos from the PC into devices such as the PS3.

[www.google.com](http://www.google.com)

### Microsoft Remote Desktop Connection 2

For connecting Macs to Windows PCs, the remote access tool now has a revamped UI, code that runs on PowerPC and Intel Macs, and improved compatibility and performance with Vista machines. It also supports connections to multiple machines.

[www.microsoft.com](http://www.microsoft.com)

### Winamp 5 Full 5.54 Build 2124 Beta Preview

It's a mouthful, but this latest preview build of the venerable media player offers Adobe Shockwave Flash playback support, background reading option for playlists, and better Vista support.

[www.winamp.com](http://www.winamp.com)

### Xfire 1.94

The in-game communications console now enables video capture by default. Fixes include in-game drawing errors, display problems in chat rooms, and some performance problems in Vista 64-bit. GRID, Lego Indiana Jones, and MTV's Virtual World are among the new titles supported.

[www.xfire.com](http://www.xfire.com)

## Driver Bay

### Apple Time Capsule & AirPort Base Station 7.3.2

The new wireless network/backup combo from Apple gets a firmware refresh that includes bug fixes. The update requires AirPort Utility 5.3.2 for proper Leopard, Tiger, or Windows installations.

[www.apple.com](http://www.apple.com)

### Nvidia GeForce 177

For GeForce video cards, the latest drivers are WHQL certified and add support for GTX 280/260 GPUs, Folding@home, and CUDA Technology.

[www.nvidia.com](http://www.nvidia.com)

### Playstation 3 2.40

Sony recalled this latest firmware update for the game console after it locked systems. A fixed version should be available by the time you read this. In-game XMB menu access and an online trophy system are the key features . . . when it finally works.

[www.us.playstation.com](http://www.us.playstation.com)



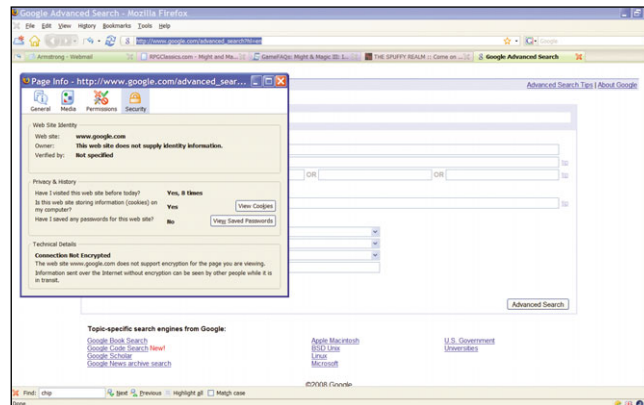
# Firefox 3

## The One Browser To Beat?

There are several pretenders to the browser throne currently occupied by Internet Explorer: Opera, Safari, and Netscape come to mind. But with more than 20% market share, only one candidate's ratings reveal a decent chance at deposing the reigning monarch: the latest entry from Mozilla, Firefox 3. We're going to take a look here at both its best new features and issues that affect them, then offer tentative conclusions about whether it handles matters well enough to stage a coup d'état.

### The Best Of The New

Ease-of-use accounts for many of the things we like best in Firefox 3, and there are several standouts among a host of minor improvements. One example is the Bookmarks Manager. It's a Windows Explorer-like tree directory of all your bookmark folders in the left margin, with their contents (files, subfolders) on the main portion of the screen. Moving a bookmark is as simple as dragging one on the right to a folder on the left. We also like its ability to edit bookmark Web locations and to sort folder contents by name, location, visit date, visit count, keyword, last modified, etc. You can use it to search your bookmarks for a word or phrase, and save the results of that search. If you bookmark a new site whose URL or name matches your search, it will be added to those results, too. There is one thing missing



You can view and access cookies quickly with Firefox, which makes it easy to manage them.



It won't take long before you'll need to edit your massive collection of bookmarks, and Firefox offers one-click bookmark creation/editing/removal.

from Bookmarks Manager we still would like to see: an Auto Sort-All-By-Name feature to alphabetize the contents of every folder you have. As it currently stands, you have to use Sort By Name separately for every folder. Otherwise this is an extremely handy bookmark organizer utility.

Editing bookmarks has become noticeably easier, too. Clicking the star on the right side of the location bar lets you quickly add a new bookmark to a folder and edit or remove an existing bookmark.

Equally good are the add-ons that improve ease-of-use—not by the Mozilla Foundation, but certainly owing a lot to their free, open-source code. Opera's widgets are designed to operate along similar lines but are peripheral to the product: buttons that launch weather reports, to-do lists, new services, mail senders, etc. Firefox's add-ons go further, providing extra browser configuration controls, auto-correction for the location bar, an undo close button, and keyboard reassignments. (See the "Firefox 3 Add-Ons" sidebar for our own recommendations.)

We also appreciated the ability to remember zoom level changes you've made using your trackball wheel or mouse on a per Web page basis. Return later, and the browser adjusts the view to your previous setting. One minor problem is that roughly a quarter of the time, when we later surfed back to these sites, there was a one second delay upon arrival with the image appearing in its unaltered state, before an abrupt shift. However, auto-resizing is such a nice feature that we wouldn't have minded even a lengthier delay, as long as it got the job done.

Without meaning to slight Firefox 3's interactive security changes, most are informational rather than substantive—though no less welcome, for that. If you visit a site listed by the Google Safe Browsing Service as possessing malware or employing phishing tactics, you'll get a large screen message to that effect, asking if you wish to continue. If you click the icon to the left side of the location bar, you'll supposedly get an identity pop-up on the site owner. But as most sites don't typically

provide this information, in practice the pop-up is more useful for its site-specific cookie controls. However, we did like the fact that the browser's download manager now automatically requests a virus scan from your antivirus program of active downloads before they're finalized.

## Room For Improvement

In roughly 200 hours clocked with Firefox 3, we've had half-a-dozen crashes. Your mileage may vary, but there's this to be noted: In every crash we experienced, we were able to restart the browser directly afterwards with all previous tabs open. That's a decent record for a major browser release.

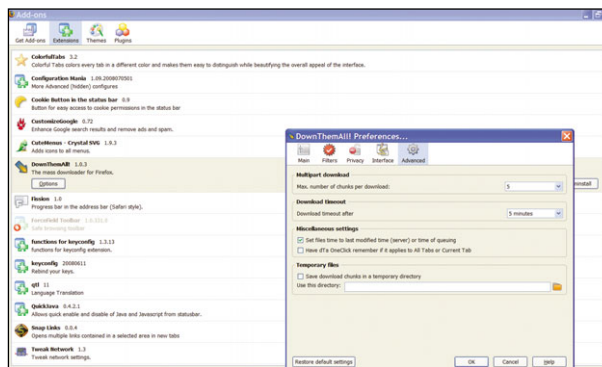
Significant memory issues exist, however. Firefox consumes less than 40MB of RAM when loaded, but its memory usage grows over time. Clicking Browse All Add-Ons from the Add-Ons popup box launches Firefox's customization Web site under a new tab, and adds another 20MB of RAM. Closing both pop-up and tab-only regains 10MB. Even with the default cache setting of just 50MB, we still somehow manage to regularly hit 80 to 130MB within roughly eight hours of work, and with no add-ons installed. Options/Advanced allows you to clear both Firefox's memory and disk caches (you can see this happen by bringing up a new tab and typing **about: cache** in the location bar) as well as your browsing history, but all this didn't affect memory usage.

Firefox 3 is slightly faster in our experience than that hare among browsers, Opera 9. We experienced a significant slowdown in Web navigation when memory increased this dramatically, however. We further found that closing Firefox didn't always remove the browser immediately from memory. The delay was sometimes 10 to 15 seconds, most usually after a long session, and went as

high as 30 seconds. Once Firefox 3 simply hung in memory for more than a minute, and we had to bring up the Windows Task Manager to manually terminate it. After you remove Firefox 3 from memory, you can reload it with all its wonted speed, but we'd rather not have to go to that trouble.

## Conclusions

In sum, we think Firefox 3 is very fast, and easy to configure and use. It keeps



If you use Firefox, you'll almost certainly use add-ons, as well. Open the add-on popup screen to tweak their settings.

you informed about dangerous sites, while add-ons significantly up the value of the base product. Memory issues and occasional crashes are its main drawbacks, but the former can at least be resolved at this time by closing and reopening the browser, while the latter doesn't affect tab settings. Does all this make Firefox 3 good enough to supplant Internet Explorer in the hearts and minds of Internet users? It's certainly possible, especially when you factor in Mozilla's proven record of quickly quashing newly discovered security exploits in Firefox 2. (By contrast, Microsoft's record in that respect isn't too good.) As the browser is free, consider downloading it from [www.mozilla.com/en-US/firefox](http://www.mozilla.com/en-US/firefox) and trying it out yourself. ▲

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**by Barry Brenesal**

**Firefox 3**  
Mozilla Foundation  
[www.mozilla.com](http://www.mozilla.com)



Firefox 3 has some very awkward key configuration choices: CTRL+SHIFT+W closes a window, for instance. The bad news is that these can't be changed within the default browser. The good is that there's Keyconfig, an add-on that lets you do just that. (Our favorite change is moving around tabs just by pressing keyboard numbers.) A more extensive utility is Configuration Mania. It's the Firefox 3 equivalent of a Windows tweaker, a program that lets you quickly go under the hood and make a raft of self-explanatory changes. One very good example is Enable Internet Keywords, that tries to find an appropriate site as you type words into the location bar. Another auto-completes your location bar entry for the best match, as you type.

Tweak Networks further improves the speed of Firefox site loads and downloads, while the oddly named DownThemAll! manages multiple downloads easily. It's one of the most popular Firefox add-ons, allowing you to pause and resume downloads and establish filters that, when applied to a large number of potential downloads on a site, gets just those that match your criteria. But if you need a good, secure, cross platform FTP, FireFTP is the way to go. This add-on features searches and filtering, file compression, integrity checks, and tutorials.

Undo Closed Tab Button is just what it says, and a godsend, since few of us would really relish having to press CTRL+SHIFT+Z each time we wanted to reopen a closed tab. While on the subject of small things to appreciate, Cookie Button in the Status Bar makes it much easier to control cookies on a site-by-site basis than going through the identity pop-up box. You just click the cookie, and select to accept, reject, accept a session cookie, go for the site default, or clear all cookies relating to that site.

Note that once you've installed an add-on, another new feature of Firefox 3 comes into effect: It informs you if an upgrade to that add-on becomes available. It will also auto-remove older versions from the browser when newer ones are installed. Yet another new feature well worth having. ▲



# GMX (Global Mail Exchange)

Webmail providers are nothing new, and if you're reading this magazine, it's likely you have at least one Webmail account with one of the Big Three Webmail providers (that is, Gmail, Hotmail, and Yahoo! Mail) and possibly one with the dozens of minor (and sometimes paid, commercial) players, too. Into this crowded marketplace comes the GMX (Global Mail Exchange), which has been around in Europe for a few years but is now being targeted at U.S. users. Its attractive interface is top-notch, looking and feeling rather like Outlook with elements of other clients tossed in. Combined with a good set of features and mail collection routines, there's a lot to like, but is it enough to pull you from your existing Webmail provider? That depends.

GMX supplies you with a gmx.com, gmx.us, or gmx.co.uk address, and checking for address availability from all three is a cinch when registering. You can also create



## GMX (Global Mail Exchange)

United Internet  
Free

www.gmx.com



up to 10 alternative addresses (think "secondary" or "temporary and disposable") on the fly, and messages sent there arrive in your main Inbox. Additionally, GMX can collect your emails from other POP3-enabled email services and dump them either into your inbox or another folder you create and even lets you send outgoing

emails that look as if they're coming from those other services. Antivirus duties are handled by a Symantec module on the GMX server, and seven antispam filters handle junk mail. There's room for 5GB of mail (with an extra 1GB available as an "online file locker"), and attachments of up to 50MB are allowed.

GMX automatically pops up a new browser window when you use it, which is very annoying until you realize that, with its client-like interface, it's trying very hard to act like a standalone application. It does this credibly thanks to full drag-and-drop keyboard shortcuts, pop-up menus, and in-browser tabs to handle child-windows.

It seems doubtful someone with gigabytes of emails would switch to GMX just because of its excellent interface, but if you're starting from scratch and need a new Webmail account, or are introducing a newbie to Webmail, GMX warrants serious consideration. ▲

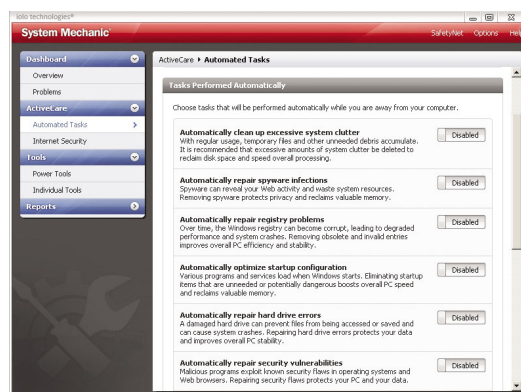
by Warren Ernst

# System Mechanic 8

System Mechanic 8 is probably the first version that achieves its original promise: the true integration of dozens of Windows utilities and tweaks under a common and attractive interface. In fact, this updated GUI and integrated background monitor finally present a compelling reason to spend your hard-earned \$49.99 on SM instead of cobbling together your own collection of dozens of freeware and shareware utilities and applications. We also like how the basic version of SM, which can be legally installed on three computers, happily coexists with other security programs like firewalls, antivirus, and antispyware, permitting a "best of the best" setup for your computer should you be so inclined.

SM8's main purpose in life is to keep your system running fast and to solve potential problems before they become real problems, and it performs this task well. After performing either a Quick Analysis (about one minute) or

Deep Analysis (about five minutes), SM8 presents you with a list of the problems it finds and offers either to just fix them all, run you through a Wizard to deal with each problem step-by-step, or ignore the problem for however long you designate. You can also tell SM8 to fix the problems during its next automated fix-it routine (called ActiveCare), which only gets to work when it senses long periods of idle time and quickly stops when it senses activity again.



There are more than 40 tools, ranging from a Registry optimizer, disk defragmenter, startup program monitor, junk file remover, S.M.A.R.T. hard drive parameter monitor, file shredder, TCP/IP networking tweaker, file and memory optimizer, and so forth. There's also a Windows "Hidden Settings Tweaker," a MBR-fixing boot-disk maker, and a basic antispyware blocker that prevents changes to key browser and registry settings. A "master-undo" utility, aptly called SafetyNet, lets you undo any and all of the changes any of the utilities make.

Power users may not need a utility suite with such automation, but we're guessing you know someone whose computer would benefit from the constant vigilance SM8 ably provides, and even power users can enjoy the consistent interface SM8 provides across so many useful tools. ▲

by Warren Ernst

## System Mechanic 8

iolo technologies

\$49.99

www.iolo.com/system-mechanic/standard

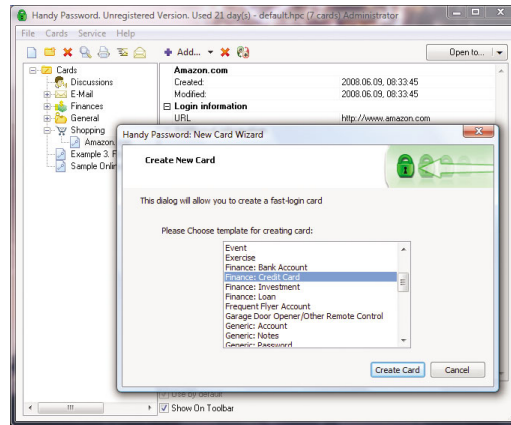


CPU RANKING ○ 0 = ABSOLUTELY WORTHLESS | ●●● 2.5 = ABSOLUTELY AVERAGE | ●●●●● 5 = ABSOLUTELY PERFECT

# Handy Password

Handy Password is an all-in-one password manager, bookmark manager, and form filler that does a pretty good job of clearing a path for you on the Internet without compromising your security. It lets you set a master password to access the software, and then uses entries called cards to store information for all the sites you visit. A toolbar is included for Internet Explorer and Firefox that makes it easy to log in to password-protected sites using a single click. Once everything was set up, we found it worked relatively seamlessly. It can even generate random passwords and assign them to sites to improve security without getting in the way of your browsing.

The form filler is nice because instead of relying on generic information, it remembers forms you've filled out at various sites and then inserts that information in the



future. This is great for online shopping sites or other places where you only want to check out using guest accounts instead of signing up permanently.

A simple bookmark manger rounds out the package and is worthy of attention if you plan to use Handy Password on a USB drive, which is supported if you opt for the USB Edition. This license lets you use all of

## Handy Password

Novosoft LLC

\$29.92 (PC license or USB license),  
\$39.92 (PC and USB licenses)

[www.handypassword.com](http://www.handypassword.com)



the program's features on any USB-equipped PC and is a terrific way to work on the road without worrying about leaving a bunch of personal information on a public computer. Although Handy Password doesn't do much to distinguish itself from the dozens of other products in this category, it performs its duties well, and the only real downside is that you must choose whether you want the PC license or the portable license unless you want to pay extra for both options. ▲

by Tracy Baker

# Antics 3.1 Base Pack

So you want to make a movie? Maybe whip up a machinima to post on YouTube or an animated storyboard to give a client an idea of what to expect from your multimedia services? If so, you can throw down thousands of dollars and spend countless hours learning an obtuse 3D animation package, or you can fire up Antics 3.1 Base Pack for free and jump right in.

The graphics Antics generates aren't cutting-edge, but the amount of control it allows is unprecedented for a product of this type. It basically transforms your PC into a movie studio, providing all the props, characters, and sets you need to create your own movies. Extensive camera options also provide complete control when directing your piece, making it easy to show others how every single shot will look should you decide to commit to a more sophisticated 3D or live production. Scenes can be mocked up using wireframes for speed or full 3D models with textures for better accuracy, and it

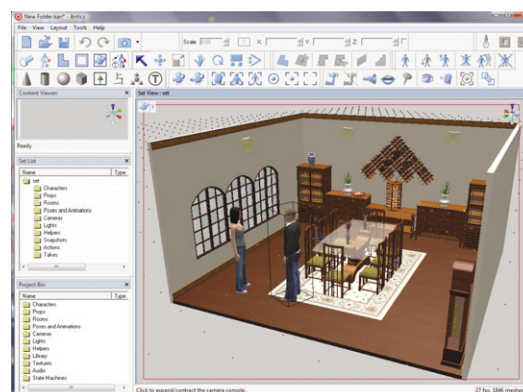
doesn't take a lot of practice to get the hang of positioning and animating simple elements. Advanced camera controls to achieve dramatic shots when the video is generated are trickier, but the interface makes it easy to experiment and correct errors.

Antic's relative ease-of-use is its main selling point, but recent support for Google 3D Warehouse makes this free-ware incredible. The biggest problem with a package like this is building all of the props and finding all of the textures necessary to keep a scene from looking

generic. Now Antics users can browse Google 3D Warehouse directly from the application and import any object they find directly into their scene (or save it for later use). This, along with the free content you can download at the Antics Web site, provides limitless options without forcing you to create a single element by hand, although objects we tested from Google 3D Warehouse cannot be interacted with as extensively as those supplied by or created with Antics.

Antics is like a doodle pad for directors. It provides a big sandbox and a ton of tools to let you and others visualize nearly anything you can imagine. You certainly won't master it in minutes, but compared to other pre-viz products Antics provides a simple way to show off your talents. ▲

by Tracy Baker



## Antics 3.1 Base Pack

Antics Technologies

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[www.antics3d.com](http://www.antics3d.com)





## App Store Applause

**D**espite your feelings (you have *feelings* for technology?!) for Apple or its products, you simply should not underestimate the power of what Apple has created in its App Store. Is it perfect? No. Is it perfect enough today? Abso-friggin-lutely. As a self-proclaimed software junkie, I've been like a kid in a candy store since its inception. Can't say I've installed every single app, but you bet that I've given a fair amount of the free ones a shake—in some cases literally, since some of them take advantage of the iPhone's accelerometer.

It's amazing to see powerful programs selling for \$5 a pop, along with complaints that they're "too expensive" and "not worth the money." Dude, it's five bucks. You likely spend more on your fast food or daily beverage than you would on something that would last *ad infinitum*. That said, Apple needs to change its App Store policies stat.

**Refunds!** Currently, if you buy it, you can't get your money back, even if the software is a lemon. That discourages people from impulse shopping, but it potentially dissuades developers from offering a stellar customer service experience after the purchase. Some users have reported that they've contacted the developer directly to initiate a refund, but Apple should really be managing this process directly.

**Video reviews!** For some odd reason, I'm made to stare at screenshots of an app, which don't always tell the full story. Many times, I'll download something, only to discover its usability is a nightmare. In many cases, had I seen a video review, I would have avoided downloading (or possibly purchasing) the app in the first place. This is iTunes, for goodness sake. Where the heck is a video preview? I'd also care to see more than just a single "X out of 5 stars" metric for the app. Break it down for me on dozens of levels.

**Review vetting!** I can't even look at reviews or ratings in the App Store anymore. Since Apple lets anybody post their thoughts, you wind up with a cacophony of voices that offers little insight on the

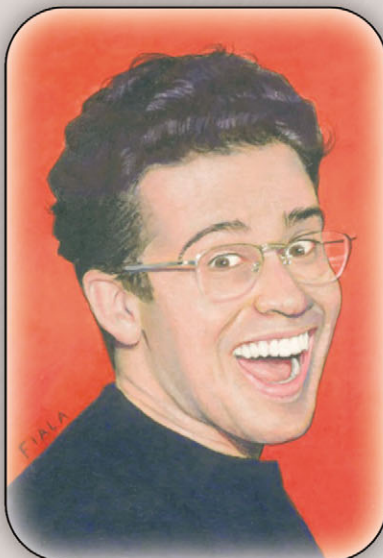
app experience. In some cases, reviews are placed by people who openly claim not to have downloaded or purchased the software before posting their thoughts! I find it extremely difficult to believe that Apple can't tie a download directly to a user's iTunes account and thus limit reviews to users who've actually downloaded the software.

**Better changelogs!** Updates have been posted for a few apps, though it's somewhat difficult to discover changes from earlier versions. Yes, information is usually posted in the information pane, but it's difficult to track dates and revision points. Moreover, the comments (positive or negative) may not be reflective of the current version, so there should also be a way to hide notes made before the date of the most recent upload. Apps are not media, and they require different data fields that don't yet exist.

**Trials!** I've been sent a few iTunes gift certificates by email (love 'em!) so that I could review apps without incurring charges. While I do appreciate having a full working version of an app, I also know that I can't rely on review copies for every one I'd want to try. If I was given a small window of time to see if a full-featured app was worth purchasing, the amount of software I buy would surge. As it stands, I have to buy retail software before I can see if I like it. Not a smart way to run a digital software store.

So, the App Store is both perfect and imperfect (more the former than the latter, I believe). If the community continues to berate Apple (forcefully, yet kindly), perhaps they'll listen and improve the experience accordingly. One thing's for sure: I can't picture myself using another mobile communications device that doesn't offer the same level of ease, comfort, and completeness.

It's never been more fun and exciting to install software . . . on a PC. ▲



*Chris Pirillo once thought he didn't want an iPhone. Then, one magically landed on his desk, and he was compelled to play with it. Months later, surgeons from Norway were flown into Seattle to remove it from his right hand. (He still has the scars.) He's taken to reviewing new App Store applications on his blog at [chris.pirillo.com](http://chris.pirillo.com). There's more iPhone information scattered about [Locker gnome.com](http://Locker gnome.com), as well. Chris isn't addicted to the iPhone as much as he's. . . okay, so he's addicted to the iPhone. He even wrote this entire article in its yellow-coated Notes app. If that's not a power user, we don't know what is. Actually, that's, well, we're just glad he didn't do it on a Newton.*

You can dialogue with Chris at  
[chris@cpumag.com](mailto:chris@cpumag.com)

## Fun With File Systems

Microsoft surprised me again: Vista still requires that you regularly run a disk defragmentation program. Surprised, because the answer to one of the most frequently asked of all FAQs by new Linux users—"How do I defrag my Linux drives?"—is "You don't have to." But, according to Microsoft:

Infrequent disk defragmentation leads to an inefficient layout of files on the hard disk, which can slow PC performance. Windows Vista includes a new disk defragmenter that runs in the background and automatically defragments the hard disk as need arises.

Why? Because NTFS (New Technology File System, originally shipped with Windows NT) still depends on the same basic file system principles used in the original MS-DOS, designed for a single-user, single-tasking OS.

Sure, NTFS for Vista is up-to-date, with features like longer file names, bigger files, support for multiple data streams, and even journaling (tracking all changes as transactions, so changes can be reversed if need be). But Windows users defrag, Linux users don't. Why?

The simple answer is that NTFS still relies on a Master File Table, similar to the original FAT (File Allocation Table) approach that Bill Gates co-created back in 1976. FAT file systems write files onto disk sequentially: The first file uses the first available disk sector(s) and the next file starts at the very next sector. Add data to the first file, and the result is a fragmented file because the extra data is written to disk right after the second file. Even a handful of active, growing files (think log files, for instance) quickly create chaos.

Today's NTFS is smarter than the original FAT, so you don't immediately get bogged down with fragmentation. But you still have to deal with it eventually.

The simple answer is that Linux (and \*Nix) file systems allocate space for files smarter: Instead of storing files contiguously, files are initialized with plenty of room between them to allow for expansion without fragmentation. Less fragmentation, so less need to defrag Linux systems. But there's more to it than that.

The FAT allocates each file an entry linking the file name with a "cluster" on the disk; files with more than one cluster get separate FAT table entries for every cluster. The OS follows this "chain" to get the entire file; if any one of the links in the chain is missing or damaged, the file can be lost. Even if the links are all solid the file can still be fragmented and result in disk thrashing.

It's not that files can't (or don't) become fragmented under Linux (they do), but rather it doesn't matter as much. Because in addition to not storing data strictly sequentially on the drive, Linux file systems usually use a construct called an inode to keep track of files. Directory entries consist of just a file name and an inode number. The inode number points to an entry in a table with the file's metadata, including where to find all the contents of that file—not just the next cluster.

This makes a big difference when it's time to start doing disk I/O, especially for Linux, which schedules I/O requests from different processes to optimize performance for all processes, rather than a strict first-come, first-served basis. Linux needn't trace cluster chains to figure out where it needs to go next; it just has to check the inode table. Even if a file is fragmented, the Linux kernel can work around it.

Can Microsoft end defragmentation miseries for their users, perhaps in Windows 7? As usual, Microsoft's "coming attractions" for WinFS (Windows Future Storage) seem rosy. But we first saw WinFS in 2003, and it won't be "for reals" until 2010. Early reports that WinFS was to be another layer on top of NTFS rather than an entirely new file system model give me even less reason for hope. Since the NTFS specification is a trade secret, Microsoft must consider it a competitive advantage; with so much history behind NTFS there must also be massive, and understandable, organizational inertia holding back any major changes.

How much time do you spend on disk defragmentation? Let me know! ▲



*Peter Loshin publishes  
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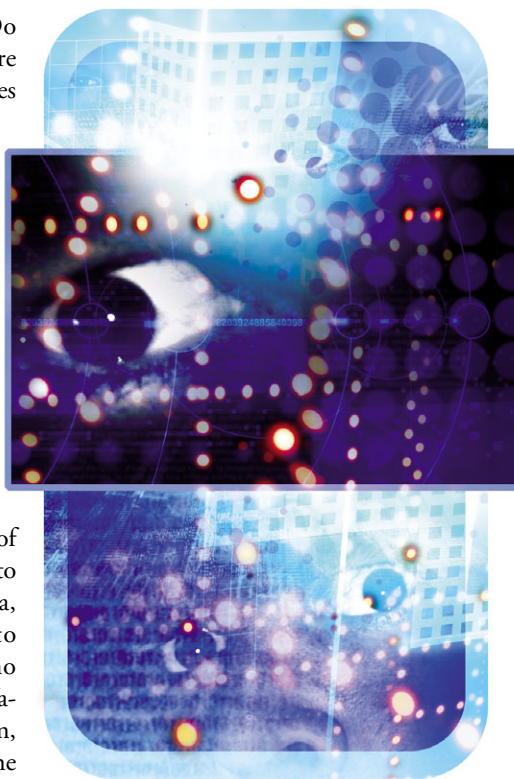


# Who's Watching You?

## Behavioral Targeting Comes Out From The Shadows

To paraphrase Bugs Bunny, “Do you ever get the feeling you are being watched?” When it comes to online browsing, it’s very likely that someone is watching where you travel, which content you view, and how recently you viewed it. Hundreds of millions of browser cookies perform some kind of tracking of our online behaviors in order to deliver what marketers call “behaviorally targeted ads.”

Behavioral targeting (often called “BT” in the industry) serves ads to your browser across the Internet based on the places and the content you have already browsed. The names of the providers probably are unfamiliar to most users: Revenue Science, Tacoda, AlmondNet, and SpecificMedia, to name but a few. The publishers who deploy these technologies are not unfamiliar, however: They include WSJ.com, About.com, AOL, eBay, and most of the major media brands. And in coming months, BT may become a more common household term as privacy advocates and the government start to target the targeters for greater scrutiny. Many are asking, even if these companies track users without knowing their specific identities, is it fair to follow someone’s



content consumption within a site and across sites without their knowledge?

“While behavioral advertising provides benefits to consumers in the form of free Web content and personalized ads that many consumers value, the practice itself is largely invisible and

unknown to consumers,” said the Federal Trade Commission in December. The FTC, some state legislatures, and even the U.S. House Subcommittee on Telecommunications and the Internet have all raised questions about BT and brought the practice out of the shadows of online advertising in the past year. The FTC held a series of “town meetings” in Washington to investigate the standard practice of dropping tracking cookies into browsers, and it issued suggested industry guidelines for self-regulation and improved consumer privacy protection in February. But this year, newer models for tracking user behavior at the ISP level raised many eyebrows and sparked House hearings. Internet providers such as Charter and Embarq planned to test the tracking of their customers’ online behavior for marketing purposes. At the July hearing, Texas Democrat Gene Green called the practice “contemptible.” Both Charter and Embarq announced they were suspending plans to test BT.

Nevertheless, behavioral targeting is here to stay in some form because it represents an integral part of digital publishing and the ad models that support it. David Hallerman, senior analyst for research firm eMarketer, estimates that by 2012, advertisers will be spending \$4.4 billion purchasing behaviorally targeted ads. “The largest growth still lies ahead,” says Hallerman. More to the point, online behavioral targeting is just the first foray into ad targeting approaches that digital TV and mobile media companies are already exploring.

### Attractive Behavior

Behavioral targeting is so powerful to publishers and marketers because the technology leverages the unique powers

## Want To Opt Out?

While behavioral marketers continue to insist their technology and tactics are honorable and never involve PII (personally identifiable information), many people simply dislike being tracked. Most of the major players in the BT space such as Yahoo!, DoubleClick, and 24/7 Real Media are members of the NAI (Network Advertising Initiative; [www.networkadvertising.org](http://www.networkadvertising.org)). A tool at the NAI site detects which of its members has a cookie planted on your browser and gives you the option of opting-out of their tracking. In fact, the service adds an opt-out cookie that specifically tells the browser not to pick up a cookie from that network in the future. Many privacy experts argue this kind of “opt-out” is not good enough. Privacy advocates often say that any kind of online tracking should occur only after a user gives explicit permission up front (“opt-in”). ▲

## Cookies, Cookies, Everywhere: Q&A With Alan Chapell

**A**pioneer in Internet advertising research, Alan Chapell, principal, Chapell & Associates, advises most of the major ad networks and publishers on their behavioral targeting practices and privacy issues. While the practice of behavioral ad targeting is only now attracting the notice of legislators, he tells us that its practice is fairly pervasive and standard.

**CPU:** Is it fair to say that most people's browsers already have a tracking cookie from a behavioral targeting company like Revenue Science, SpecificMedia, or AOL's Tacoda?

**Chapell:** Unless someone is blocking cookies on their browser, there's a pretty good chance that you are going to have a cookie drop from one or more of those companies.

**CPU:** What is the reach of some of these major targeting companies and the major search engines?

**Chapell:** Collectively, there is a chance they are touching a very high percentage of the U.S. population. Any kind of ad server has the capacity to ensure you aren't seeing the exact same ad too many times, and that is in theory tracking. The search engines don't talk a ton about this. But I think it is safe to say that many searches that are conducted for things that are commercially viable like "Corvette" or "pretty flowers," that information is often converted into commercial categories and then downstream utilized to serve more relevant ads.

**CPU:** The industry likes to say it tracks users "anonymously." What does that mean really? How anonymous are we in these systems?

**Chapell:** The folks that I see are collecting information and instantaneously converting that information in to what they call commercial categories. So if someone knows a search term being entered, they are not necessarily capturing the search term, but what commercial category the search term translates into. So on your cookie, it may say "travel," "finance," "probably male over 40," and none of that information can really be used to identify someone individually. It starts to get dicey, as AOL found out a couple of years ago, when you start capturing enough non-personal information. There are isolated incidents when it can become personally identifiable. But even in that scenario, one struggles to find where the harm is.

**CPU:** Is online BT just the beginning? Are there targeting technologies migrating to all-digital platforms such as digital television and radio, mobile? Is this just the beginning of how we do advertising everywhere?

**Chapell:** Absolutely, positively. Look back to the first Sears catalog where they realized that if you tailored the catalog based on what you knew about the catalog recipient you got a better response. That goes back 100 years. This is no different. The ability to collect information certainly has increased exponentially, however. ▲

of digital media to make more money for them in more places on the Internet. Traditionally, advertising both online and off is sold "contextually," where ads for technology show up on tech sites like ComputerPowerUser.com and car ads

show up in auto sections of news Web sites or on Edmunds.com. Because advertisers know that audiences coming to these sites are very interested in these products already, the advertisers consider this audience well-targeted and worth a higher price. But users spend only a fraction of their time on these valuable sites.

Behavioral targeting uses browser cookies to follow a user with relevant advertising even as he moves onto other kinds of content. When a user visits a shopping engine and searches for a Dell laptop, for instance, an ad network that partners with the site will drop a cookie in that person's browser that indicates an interest in laptops and/or Dell. "That cookie is something connected only to that particular ad network," says Michael Benedek, vice president of business development, AlmondNet,

which supplies behavioral tracking services to ad networks. Because ad networks often serve thousands of publishers across millions of pages, the odds are good that you will travel to another site allied with a company like AlmondNet. When you arrive at this other site, the ad network sees that cookie in your browser, understands that you may be shopping for a Dell laptop, and then will serve you an ad for Dell, or perhaps a competitor, even if you're on a page that has nothing to do with technology, laptops, or Dell.

"Unlike adware, the cookie does not track the consumer wherever they go," Benedek insists. "It is not connected to any personally identifiable information [also known as PII]." Echoing many in the behavioral industry, he says that "anonymous cookies" on our browsers simply identify the browser by a code number that is recognized only when the user goes to another site that partners with that ad network. Benedek calls the cookie a "passive file" unattached to any person's name or email address, let alone



As ISPs initiated trial of behavioral targeting technology this year, House Representative Ed Markey (D-NY) convened Subcommittee hearings on how ISPs use information about their subscribers.



<b>Atlas</b> <a href="#">More Information</a>	<b>Active Cookie</b> You have not opted out and you have an active cookie from this network.	Opt-Out <input type="checkbox"/>
<b>BlueLithium</b> <a href="#">More Information</a>	<b>Active Cookie</b> You have not opted out and you have an active cookie from this network.	Opt-Out <input type="checkbox"/>
<b>DoubleClick</b> <a href="#">More Information</a>	<b>No Cookie</b> You have not opted out and you have no cookie from this network.	Opt-Out <input type="checkbox"/>
<b>MediaGoggles</b> <a href="#">More Information</a>	<b>Active Cookie</b> You have not opted out and you have an active cookie from this network.	Opt-Out <input type="checkbox"/>
<b>Mindset Media</b> <a href="#">More Information</a>	<b>Active Cookie</b> You have not opted out and you have an active cookie from this network.	Opt-Out <input type="checkbox"/>
<b>Revenue Science</b> <a href="#">More Information</a>	<b>Active Cookie</b> You have not opted out and you have an active cookie from this network.	Opt-Out <input type="checkbox"/>
<b>Safecount</b> <a href="#">More Information</a>	<b>Active Cookie</b> You have not opted out and you have an active cookie from this network.	Opt-Out <input type="checkbox"/>
<b>SpecificMEDIA</b> <a href="#">More Information</a>	<b>Active Cookie</b> You have not opted out and you have an active cookie from this network.	Opt-Out <input type="checkbox"/>
<b>24/7 Real Media</b> <a href="#">More Information</a>	<b>Active Cookie</b> You have not opted out and you have an active cookie from this network.	Opt-Out <input type="checkbox"/>
<b>Undertone Networks</b> <a href="#">More Information</a>	<b>Opt-Out Cookie</b> You have opted out of this network.	Opt-Out <input type="checkbox"/>

**The Network Advertising Initiative opt-out page detects which networks are tracking you actively and give users the option to opt-out.**

president of strategic partnerships, TRUSTe.

### Deep User Inspection

That discomfort may have ratcheted up a notch last summer, when some Internet service providers began testing BT technologies that are even more pervasive than tradition-

al, cookie-based approaches. So-called "ISP-based" behavioral tracking inserts technology at a customer's service provider so it can view virtually all online behavior: all sites visited, all applications used, all searches performed. Companies such as NebuAd, Phorm, and Front-Porch started luring ISPs with the prospect of additional revenue from customers. This new class of BT firms would monitor usage patterns, pay the ISPs for the data, and use it to target ads.

The announcement that several ISPs planned trials with the technology prompted the House Subcommittee to convene. House Representative Edward J. Markey opened hearings arguing that ISP-level tracking raises new kinds of privacy concerns. "There is a distinction in the detail, type, and amount of data collected," he said. "As opposed to individual Web sites that know certain information about visitors to its Web sites and affiliates, deep packet inspection technologies can indicate every Web site a user visits and much more about a person's Web use."

DPI (Deep Packet Inspection) is a newer technology that ISPs can use to read deeper than packet headers to see what applications a user is employing and even the content of data packets. DPI can be used for security or it can be used to track usage patterns for ad targeting. Some legislators feel that kind of monitoring may violate federal wiretapping laws.

The CEO of NebuAd, Bob Dykes, was at the center of the hearings, and a

day after testifying reflected that critics simply misunderstand the methods and technology of ISP-based targeting. "For example, we say that we don't take any PII. And we even include IP addresses in that category," he insists.

But the debate is only beginning. Being able to serve ads targeted to individual interests is the holy grail of the marketing world. Likewise, the same digital technologies that make such targeting possible online will also make BT possible on set-top boxes, mobile phones, and even game consoles. That "Minority Report" world where billboards address you by name is not that far away, said David Martin, director of interactive media for marketing firm Ignited at a recent behavioral trade conference. "Today's behavioral marketing is just a taste of what's to come. It's only going to get creepier." ▲

by Steve Smith

## Infinite Loop Invisibility Cloak Becoming A Reality

It's normally the stuff of science fiction, but researchers at the University of California, Berkeley, have taken another step in developing a cloak that can make objects invisible. Now, we're not talking about making people or 747s invisible, not yet. But the scientists were able to cloak a 3D object for the first time using "metamaterials" made from ceramics, Teflon, and other weird things. We're anxiously awaiting a consumer version. ▲



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ION=HOME&TEMPLATE=DEFAULT&CTIME=2008-08-11-07-36-38

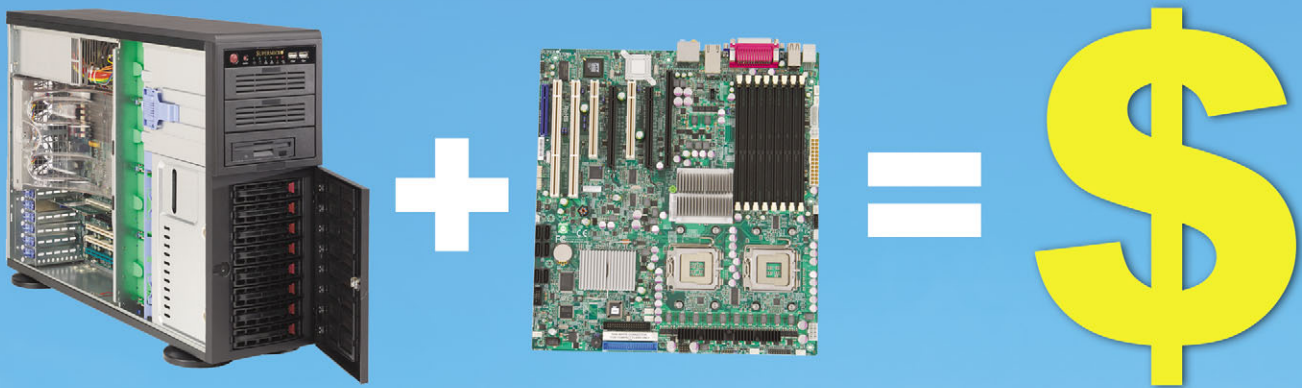
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# The Department Of Stuff

by Rob "CmdrTaco" Malda

## appstore.txt

**S**ure, the new iPhone 3G is sexy: it's curvy and fits nicely in your hand. And if you happen to live in a major metropolitan area, the 3G speeds will make your mobile surfing much faster. But the most important part of the new phone is actually the App Store and the new applications available to the phone. But with this power comes something far scarier: total control.

The new API creates a powerful illusion of freedom and flexibility. Developers can create many exciting and interesting applications using tools that are familiar to them. Although things like proper backgrounding of tasks aren't available (Apple plans to provide a sort of push kludge around this in a future revision), you can still create some amazingly useful applications.

Some of these new functions directly compete with the telco's bottom line. SMS text messaging has long been a cash cow for the phone companies, even though the actual amount of bandwidth being used is insignificant. In fact, SMS text messaging for most people is the single most expensive way to send bytes. But there is already a free AIM client from AOL, and another free client that includes Jabber support. It's already possible to route SMS for free through either of these tools, provided you don't need real-time reception.

But there are rules cell phone networks have to follow. AT&T has recently announced that it will start banning cell phone users who run P2P clients. Apple's rules strictly prohibit the creation of a turn-by-turn-based navigation system because it sure wouldn't want to make Garmin mad.

The App Store itself is simply designed and incredibly easy to use. My mom could use this system, and that's saying something. But this only creates the illusion of flexibility.

"Jailbreak" iPhones have been available since almost the moment the original

iPhone was launched. Although they were primarily used to give iPhones to users unwilling to use the AT&T network, they were also used to create a plethora of interesting custom applications. These apps didn't use the Apple API, but most importantly, they weren't "approved" by any Apple employee for use on the phone.

This is critical and powerful usability. We don't want a single

corporation to be able to decide what we use on our network. The power of the Internet is the simple fact that anybody can run anything on it. We all agree on standards in the form of RFC documents, but even that is optional. Anyone can create anything.

If they can't control it, they can't take it away. And believe me, they will take it away. Within the first few weeks of launch, Apple pulled a program called NetShare which made it possible to violate AT&T's terms of service. This example demonstrates Apple policing your use of their device. What if your wireless provider allows you to use NetShare's functionality?

The incredible ease of use makes the iPhone a Trojan horse. It's a closed, locked down platform where we have sacrificed control of our machines to a single corporate entity with a strong motivation to maintain that control.

The solution is simple. Allow third parties to upload applications to the iPhone.

The App Store itself will always be the standard. It is integrated. It is easy. And grandma can navigate it and install her Sudoku. But we need that freedom to guarantee that the cell networks aren't controlled in ways that we disapprove of.

Until then, people will continue to jailbreak their iPhones, and since Apple will be powerless to stop the escalating arms race between developers and the infinite hours of the determined hackers who want to play with their toys, the real battle will once again take place in Washington, D.C. Pay attention. ▲



*Rob "CmdrTaco" Malda is the creator and director of the popular News for Nerds Web site Slashdot.org. He spends his time fiddling with electronic gizmos, wandering the 'Net, watching anime, and trying to think of clever lies to put in his bio so that he seems cooler than he actually is.*

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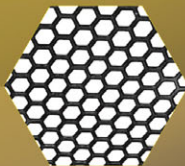
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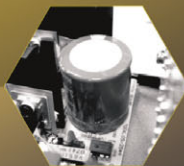
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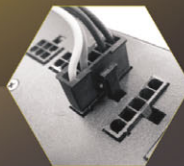
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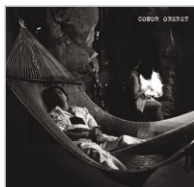


# At Your Leisure

The entertainment world, at least where it pertains to technology, morphs, twists, turns, and fires so fast it's hard to keep up. But that's exactly why we love it. For the lowdown on the latest and most interesting releases in PC entertainment, consoles, DVDs, CDs, and just leisure and lifestyle stuff we (for the most part) love and recommend, read on.

## Audio Video Corner

by Blaine A. Flamig



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### Conor Oberst and The Mystic Valley Band—"Conor Oberst"

Ditching long-time band Bright Eyes and producer Mike Mogis in favor of the new Mystic Valley Band and self-producing the record's 12 tracks reportedly over a month's time in Tepoztlan, Mexico, Conor Oberst is still too serious for his own good here and there ("Lenders In The Temple," "Eagle On A Pole"), but his trademark lyrical phrasing and songwriting is looser than on anything in recent memory. From the CD's hopping first single "Souled Out!!" to the country boogie of "I Don't Want To Die (In The Hospital)," Oberst and company are in a wandering frame of mind, and the scenery is oh so pleasing.



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[www.concordmusicgroup.com](http://www.concordmusicgroup.com)

### Little Richard—"The Very Best of Little Richard"

Along with the recently deceased Bo Diddley, Jerry Lee Lewis, Chuck Berry, and of course, Elvis Presley, few if any musicians have influenced rock music since its inception as much as Little Richard. Although the man dubbed Richard Penniman at birth has done his damndest to tarnish his pioneering reputation over the years with his inability to turn down his grating, over-the-top persona, Little Richard nonetheless was a master of furious piano-driven rock and roll, as witnessed on the 25 tracks on this compilation. With classics such as "Tutti Frutti," "Long Tall Sally," "Slippin' and Slidin'," and "Ready Teddy," along with live medleys of "Kansas City/Hey Hey Hey" and "Ain't That A Shame/I Got A Woman/Tutti Frutti," "The Very Best" is as toe-tappin' good as it gets.



\$28.96  
Sony Pictures  
[www.sonyclassics.com/thecounterfeiters](http://www.sonyclassics.com/thecounterfeiters)

### The Counterfeiters

What lengths would you go to in order to survive? That's the question Stefan Ruzowitzky's "The Counterfeiters" poses. The 2007 Academy Award for Best Foreign Language Film, "The Counterfeiters" depicts the true story of habitual criminal Saloman "Sally" Sorowitsch (Karl Markovics), "The King of Forgers." After he's imprisoned and subsequently transferred to a concentration camp, the Nazis ask Sally to head up Operation Bernhard, a plot to weaken the British and American economies with fake currency in exchange for various luxuries. Fellow group member Adolf Burger (August Diehl) voices the ethical consequences of their actions, pulling Sally's conscience in opposing directions. Brutal, unflinching, and morally challenging, "The Counterfeiters" is masterful filmmaking.



\$19.99  
Shout Factory  
[www.g4tv.com/codemonkeys/index.html](http://www.g4tv.com/codemonkeys/index.html)

### Code Monkeys: Season One

If you witnessed Adam De La Pena's fantastic, short-lived "I'm With Busey," you know the shock and awe waiting in his "Code Monkeys." De La Pena also gave us "Minoriteam" and contributions on "Jimmy Kimmel Live" and "The Man Show," which should indicate the random, gross-out humor contained in "Code Monkeys." Set in the early 1980s, the animated episodes feature Dave and Jerry, game developers at GameaVision, which Texas billionaire Mr. Larrity buys from previous owner Woz (yes, that Woz) in the opening episode. Pioneers Nolan Bushnell, John Romero, Gary Gygax, and The Woz himself supply guest-voice spots, but the show's real genius resides in Dave, a foul-mouthed prankster who could give Cartman a run for his money.

## DVD Byte

10/7

The Happening  
You Don't Mess With The Zohan  
The Simpsons—The Complete Eleventh Season  
Sleeping Beauty  
Paranoid Park

10/14

War, Inc.  
The Ultimate Matrix Collection (Blu-ray)  
Icons of Horror: Hammer Films



10/21

The Strangers  
Expelled: No Intelligence Allowed

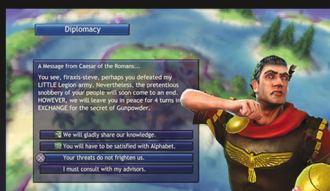
10/28

Houdini's Death Defying Acts  
The Deal  
Little Rascals: The Complete Collection

See the full reviews from A/V Corner at [www.cpubmag.com/cpuboct08/AYL](http://www.cpubmag.com/cpuboct08/AYL)

# SID MEIER'S CIVILIZATION<sup>®</sup> REVOLUTION<sup>™</sup>

**CPU**  
Game Of The Month



## Making Sleep Obsolete—by Dr. Malaprop

\$59.99 (360; PS3); \$29.99 (Nintendo DS) • ESRB: (E)veryone

Take-Two Interactive Software • [www.civilizationrevolution.com](http://www.civilizationrevolution.com)

The Civilization franchise that started with MicroProse for DOS and Amiga computers is going strong under the watchful eyes of current developer Firaxis. Development for Civilization Revolution is all new but stays with the turn-based strategy elements and world domination themes.

Players can choose from one of 16 civilizations, with each represented by a historical leader (Gandhi, Abraham Lincoln, Queen Isabella, etc.), to grow a civilization over land and sea through technology, culture, diplomacy, war, and other variables. Civilization Revolution has been designed for consoles from the ground up. The result is a buttery smooth interface on the Xbox 360, PS3, and DS. Mouse and keyboard controls are understandably nonexistent and are never missed. The game has excellent in-game help, bolstered by the broad Civlopedia that features real-world pictures of the various historical details found within the game. The visual presentation

and representation of the world is attractive, clear, and easy to navigate. There's plenty of graphical flair and a variety of single-player difficulty levels to suit the gaming gamut. Pitting yourself against up to four online players in team or free-for-all matches works as expected and gives the game some very long legs.

There are four ways to achieve victory in Civilization Revolution. Domination victories come by conquering other civilizations' primary cities. It's a reasonable way to push for a victory earlier in the game, but it becomes more difficult later in the game. Economic victories can be had by accumulating 20,000 in gold in your coffers and completing the World Bank wonder. Cultural victories occur by accruing 20 Culture points. Points come by having famous historical figures move to your cities, building Wonders, and influencing cities from other civilizations to convert to your cause. Once you have gained a full allotment of points, it's time to

build the United Nations Wonder to win. Last but not least is the Technological victory, which comes through researching technologies to build and send a ship into space. The first spaceship to reach Alpha Centauri dominates. The victory conditions are varied but simple, but the journey to victory (or loss) is devilishly addictive.

For PC gamers unfamiliar with the franchise, we highly recommend picking up a copy of Sid Meier's Civilization Chronicles to catch up on the PC back-catalog (we've seen online prices for less than \$30), which includes the more recent Civilization IV. The modern-day PC-to-console transition for the franchise is an unqualified success: Civilization Revolution can be considered a must-buy for anyone with a passion for strategy games. It's a great title regardless of the fact that it's console-only. We do feel the game would benefit from having a way for Xbox 360 and PC gamers to play against each other. What better way for two platforms to compete in turn-based megalomania? Firaxis, are you listening? ▲

## Civilization Revolution To-Go, Please

The Nintendo DS version sacrifices the Civlopedia, 3D graphics, and map size for portability. Though not pretty, the graphics are fully functional (reminiscent of the classic PC versions) and work smoothly with the DS's touchscreen interface. The turn-based nature of Civilization Revolution makes it a shoo-in when you're on the move or taking a break at work—as long as you remember to get back to work.

There's been talk about having games that you start playing on the console, continue on a mobile device, and finish back on the PC/console. That's a paradigm that would fit nicely here and make a great feature for an update or sequel. ▲







## Best Battlefield For Consoles—by Dr. Malaprop

\$59.99 (360; PS3) • ESRB: (T)een • Electronic Arts • [badcompany.ea.com](http://badcompany.ea.com)

Dice, the developer behind the multiplayer-centric Battlefield series, introduces its first full-featured single-player campaign with Battlefield: Bad Company. You may already be shying away with the thought of playing through yet another World War II game—worse, by a developer new to creating single-player campaigns.

Bad Company's primary focus is its multiplayer mode, but the strong single-player game gets you in the mood while dishing out a good old time. Your single-player team in Bad Company consists of bottom-of-the-barrel soldiers that have been thrown together for unsavory assignments. You enter the squad as Private Preston Marlow, joining three other squad mates. As the game progresses, your squad opts to get rich on mercenary gold and follows a path not unlike the

movie "Three Kings." You play through seven lengthy missions with the ability to destroy nearly anything you see: vehicles, buildings, bridges, and the lot. That means your (or an enemy's) cover can be blown (up) with ease. That simple mechanic boosts the pacing of game and is entertaining both visually and tactically. The characters' heavy chatter is often humorous and sets up the simple story in-game. We also liked being riff-raff and not part of some elite unit we've played in so many other games.

By the end, you've had the opportunity to try out all the game has to offer, so you're familiar with the game's physics, weapons, and vehicles. Oddly, that leaves you well prepared for the multiplayer games where you'll likely spend the remainder of your Bad Company time. This is the first Battlefield game not on the PC that's truly worthy of your valuable play time. ▲



## LEGO INDIANA JONES THE ORIGINAL ADVENTURES

### Heartwarming & Formulaic Family Fun—by Dr. Malaprop

\$49.99 (360; PS3; Wii) / \$39.99 (PS2) • ESRB: (E)veryone • LucasArts • [www.lucasarts.com/games/legoindianajones](http://www.lucasarts.com/games/legoindianajones)

Traveller's Tales has extended its reach to the Indiana Jones movies. The gameplay concepts that worked so well with the Star Wars games have been fine-tuned and tweaked for Lego Indiana Jones, which makes this release imminently more playable than even the excellent Lego Star Wars titles.

To the game's credit, there's not a peep about the new Indy movie, which is a good thing. Instead, the focus is on the original trilogy and breaks each film into six levels that will take no more than 10 hours to complete. Some of the most memorable scenes are replicated in the inimitable Lego animation, with numerous laugh-out-loud moments for fans of the films as you swing, jump, fight, and puzzle your way through the levels. Each character

has special abilities, and having another human player jump in for local co-op play is a welcome alternative to playing solo with co-op AI. Finish the game, and you'll find ample replayability in the Free Play mode, where you can pick from 60 characters (most unlockable) to discover the game's many hidden items, which are unavailable to the standard characters on your first time through.

Gameplay between the PC and consoles is identical except in two areas: Keyboard-mouse controls have been added to the PC version, and the game can be natively played at resolutions up to 1920 x 1280. This looks superb. However,



just because you can use a keyboard doesn't mean you should, so we recommend an Xbox 360 controller for the PC. The 360 and PS3 versions look graphically similar, as do the Wii and PS2 versions to each other. It ultimately doesn't matter which version you pick, because you'll have the same high quality entertainment experience across all four platforms. Lego Indiana Jones is a treat to play and watch. ▲







## I Don't Want To Miss A Thing—by Dr. Malaprop

\$59.99 (360; PS3); \$49.99 (Wii, PS2) • ESRB: (T)een • Activision • [www.guitarhero.com/ghaerosmith](http://www.guitarhero.com/ghaerosmith)

On the heels of this winter's enjoyable but difficult *Guitar Hero III: Legends Of Rock* comes *Guitar Hero: Aerosmith*. The first two songs of each of the first five tiers are by bands that have supported Aerosmith over the years, and the latter three by the Aerosmith. The sixth tier follows the same format but has an additional song as a boss battle (which can be skipped) with lead guitarist Joe Perry. An additional 10 Aerosmith or solo Joe Perry songs are available for purchase from The Vault with your in-game earned money. One immediate noticeable change to the gameplay is a more balanced feel to the songs and a more natural escalation of the difficulty levels. The Aerosmith caricatures have been motion-captured from the actual band members and look pretty sweet.

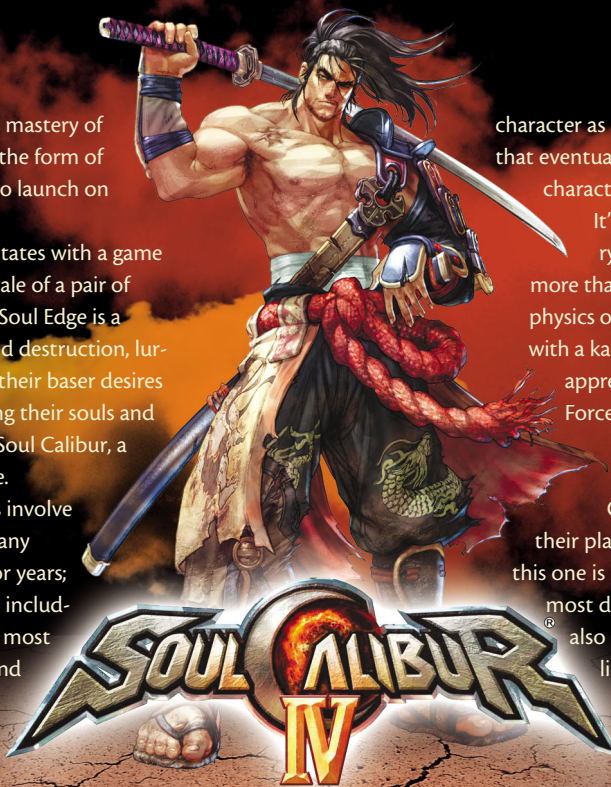
This is a skinned version of *Guitar Hero III* in which you pay full price for 41 songs vs. more than 70 in the previous game. Newer fans of the band will miss more recent hits, such as "I Don't Want To Miss A Thing." In any case, all borderline Aerosmith fans should rent the game before purchase. However, buying the game is a no-brainer for any self-respecting, long-term Aerosmith groupie. The band's video trivia vignettes between each song tier are icing on the cake.

There's never been a better time to rock. All this just whets our appetites for more *Guitar Hero*. First, expect *Guitar Hero World Tour* (essentially GH4—the first in the series to bundle a drums and microphone with the obligatory guitar) for the 2008 holiday season followed by *Guitar Hero: Metallica* in the first half of 2009. With or without Aerosmith, we still don't want to miss a thing. ▲

The latest reminder of Namco Bandai's mastery of the 3D fighting game genre comes in the form of *Soulcalibur IV*, the first *Soulcalibur* game to launch on the Xbox 360 and PlayStation 3.

The series, which began in the United States with a game called *Soul Blade* (1997), follows the epic tale of a pair of swords imbued with supernatural power. *Soul Edge* is a demonic entity that hungers for power and destruction, luring the warriors who wield it to give in to their baser desires for violence and power, eventually trapping their souls and becoming their master. Its counterpart is *Soul Calibur*, a weapon for good forged to fight *Soul Edge*.

The events surrounding these weapons involve an impressively large cast of characters, many who have been showing up in the series for years; there are 34 characters altogether in SCIV, including the guest and unlockable fighters. The most visible new contestants are Darth Vader and Yoda, licensed from LucasArts and featured prominently on the covers of the PS3 and Xbox 360 versions, respectively. Although initially each version only offers its cover-adorning guest



character as a playable toon, the word on the street is that eventually both versions will offer their *Star Wars* character's counterpart as DLC.

It's a bit weird seeing Jedi fighting 16th-century warriors, and our geek brains have spent more than a few minutes trying to reconcile the physics of defending oneself against a light saber with a katana. Also, the inclusion of Vader's Sith apprentice from the upcoming *Star Wars: The Force Unleashed* game feels a bit forced, but at the end of the day this game is so amazingly good at what it does we don't care.

Games in this series have always pushed their platforms' graphics abilities pretty hard, and this one is no exception: SCIV looks great and has the most detailed, interesting backgrounds to date. It also offers scads of play modes (including online versus play) and some nice gameplay improvements/additions, and the core experience of delivering a beatdown to someone on the same couch just never gets old. ▲

## En Freakin' Garde!—by Chris Trumble

\$59.99 (X360; PS3) • ESRB: (T)een • Namco Bandai Games

[soulcalibur4.namcobandai.com](http://soulcalibur4.namcobandai.com)



# The Cutting Edge

by Barry Brenesal

## Lost, Off A Greek Island: One Computer

Way back when I first started this column, we took a look at Charles Babbage's early- and mid-19th century computer designs, which included a programmable model. But what about non-programmable, machine-driven computers? How far back must we go to before we reach the earliest documented instance of a successful one? Let's turn to an astonishing find made just before the turn of the 20th century off the coast of the Greek island Antikythera, near Crete. It involves the shipwreck of a 300-ton, cargo-laden Roman merchant ship on the always capricious Aegean Sea, slightly less than 2,100 years ago.

At first, the discovery by six local sponge divers in then state-of-the-art diving suits yielded many coins and important bronze sculptures. It wasn't until 1902 that the noted archeologist Valerios Stais realized one rock recovered at the site had, of all things, a portion of a gear wheel extruding from it. Upon further study, it was realized that the thing wasn't a rock, at all, but a badly decayed device in three larger parts, coated in solid sediment. The bronze mechanism was so fragile—a little over a foot tall, nearly seven inches wide and 3½ inches deep—that it was a wonder it survived at all. Ironically, had the device made it to land, it would have likely ended up recycled for its valuable bronze, a fate that we can now surmise befell others like it.

The Antikythera Mechanism, as it is now called, was inscribed with over 3,000 characters of generally indecipherable text. With much work, dozens of tiny rock-embedded fragments of more than 30 gears and three main dials were gathered. These were revealed to have been made using steel tools, not uncommon in the sophisticated urban centers of the Mediterranean basin, such as Alexandria. But the lack of a functional model left both the construction and purpose of the Antikythera Mechanism open to debate for some time. Attempts were made to explain both, but they foundered upon assumptions that couldn't be proved.

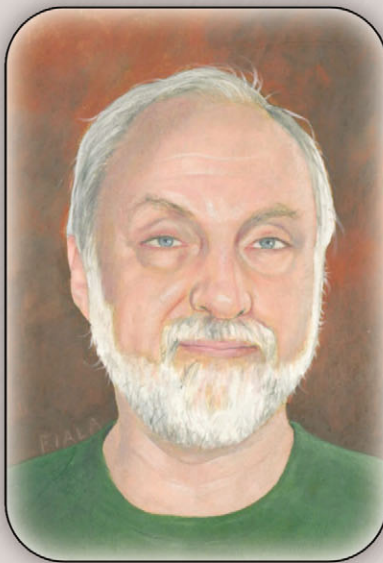
A breakthrough came as recently as 2006. Hewlett-Packard brought a 3D surface-imaging, light control device known as a PTM Dome to capture advanced texture maps of the Mechanism, while X-Tek Systems developed a

12-ton, 450kV microfocus computerized tomographer to painstakingly examine it, layer by layer. In this fashion, roughly 95% of the surviving inscribed text was finally available for translation by scholars. This allowed the Antikythera Mechanism to be established, once and for all, as an elegant representation-in-miniature of a series of accurate and sophisticated astronomical scales to determine the relative positions of the sun, moon, and possibly planetary motions. No child's orrery, the

Antikythera Mechanism has been rightly described as an analog computer operated through gears. We still don't know exactly how it all went together, or its purpose: for astronomical measurements, as a navigational aid, a teaching device, as an eclipse predictor—or any or all of the above. A working model of it, however, incorporating the latest research, has been presented to the National Hellenic Research Foundation in Athens by Michael Wright, former curator of mechanical engineering at the London Science Museum.

Comes finally the inevitable question: Who made the thing? That's not something archaeology can establish. Quite a few scholars, however, point an accusing finger at Hipparchus, a brilliant Greek astronomer and mathematician of the second century BCE. He discovered precession (the shift in direction of the axis of any rotating object); drew up the earliest extant catalog of stars, including position and brightness; and built upon earlier Babylonian mathematical techniques to create spherical trigonometry. Hipparchus developed a quantitative geometrical model for the first anomaly of the moon's motion, due to the eccentricity of its orbit, and the Mechanism is among other things a practical demonstration of that.

The engineering feats of so-called ancient cultures are neither unknown nor unappreciated. However, the Antikythera Mechanism shines a very brief but brilliant light on an aspect of early technology that we would otherwise never have thought existed at anywhere near that time. Whoever made it, how can we doubt that it was, for its period and for many centuries to come, truly the cutting edge? ▲



*Barry Brenesal has written more than 1,000 published articles and reviews on electronic technology since 1987. His first personal computer was a Radio Shack TRS-80 model 100. It was last seen functioning as a boat anchor.*

Wax nostalgic with Barry at  
[barry@cpumag.com](mailto:barry@cpumag.com)



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Source: PcPerspective.com

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# Software

## Tips & Projects

### Where Were We? Geotagging Your Images

As GPS and other geo-location technology becomes common in cell phones and digital cameras, “geotagging” is sure to be the next big thing in digital media. When created with a location-aware device, image files can carry latitude and longitude coordinates so they can be indexed by the place they were recorded and then mapped in a number of creative ways. In this first part of a series on geotagging, we look at some of the latest hardware-to-software services that let you tag photos geographically. As we found in our walking photo tour of San Francisco recently, even the iPhone 3G and a DSLR armed with a location-aware memory card requires some hoop-jumping to get your pictures properly located. Next month we will look at software and online uses of geotagged images.

#### iPhoning It In

As of now, the most common GPS-enabled imaging device is the mobile

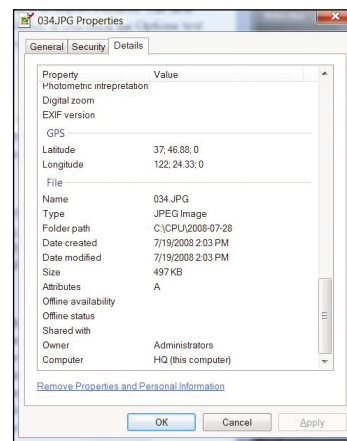
phone. A number of recent models from RIM/BlackBerry, Nokia, and Sony Ericsson boast embedded GPS chips and tools for geotagging images. For illustration purposes we will use the high-profile Apple iPhone 3G, since it's very PC-friendly. The new iPhone 2.0 software allows geotagging of photos in both original iPhones and the new 3G model. Older models rely on a rough geo-location scheme that uses cell towers and nearby Wi-Fi signal strengths to approximate your placement. The 3G model released this summer has GPS built in for much more precise tagging. We must say that in our initial use of the iPhone, its

GPS capabilities are slower and less reliable than dedicated GPS devices or even some other GPS phones. Nevertheless, the two location methods together delivered strong geotagging.

In the iPhone, you first must ensure that Location Services is set to On. Go into the General sub-menu of the Settings tool to toggle the service on or off. The first few times you use the iPhone Camera in a geo-locating state, the OS will notify you that “Camera” would like to use your current location.” Answering OK will cue the OS to tag subsequent photos by location until you turn the Location Service off in the Setting tool.

The trick with geotagged iPhone images is not taking them so much as getting them off the iPhone with the GPS info intact. iTunes itself only has one-way synchronization of images; it will push Desktop images to your device but not pull the ones you take with the iPhone onto your PC. In our experience, sending the images to an online library or to yourself via email strips the GPS information from the image file's tag.

Apple's own iPhoto program for Macs and several shareware tools can pull images from the iPhone, but we found



A properly geotagged image will have a separate section added to the image properties that includes the GPS coordinates.

#### Windows Tip Of The Month

Over the years in Software Tips & Tricks we have covered the art of “slipstreaming” Windows installations. As each version of the Windows operating system ages and accumulates service pack updates and security patches, a fresh install from your original disc requires lengthy post-install online updates and catch-ups to bring the OS up to date. Slipstreaming creates a new install disc with the most recent updates already integrated, but it can be an involved, lengthy process when done manually. Some new tools help users streamline the slipstreaming process. The custom installer nLite ([www.nliteos.com](http://www.nliteos.com)) is donation-ware that builds the installation disc and even lets you remove and adjust some Windows components. nLite works with Windows 2000 and all flavors of Windows XP. For Vista users, the same programmer has issued vLite at [www.vlite.net](http://www.vlite.net) in beta form. ▲

#### Registry Tweak Of The Month

Did your OEM bake its own brand name into the installation of your WinXP or Vista machine? You can find this in any About Windows screen (try the Help menu of the Control Panel), and it often shows up as the “licensed owner” in some other programs you install into Windows. To customize this item, open Regedit to find the RegisteredOwner Value in the HKEY\_LOCAL\_MACHINE\SOFTWARE\Microsoft\Windows NT\CurrentVersion key. Double-click the Value and change the name in the Value Data box. Right above RegisteredOwner in this same key, RegisteredOrganization is responsible for a second line in the “licensed to” listing. You can leave this blank or add a company name, etc. The changes are immediate. ▲

that Windows itself is good enough. In most cases, Windows XP/Vista will recognize a connected iPhone as a camera. If this doesn't happen, go to the Control Panel and open the Scanners and Cameras app. Use the Refresh button or Add Device function to re-run the device detection wizard to try to find your iPhone. Once it is listed in My Computer, right-click Apple iPhone and simply choose Import Pictures. The next box (in Vista) will prompt you to apply a tag to all the photos. If you click the Options text button, however, you get much more flexibility in targeting a specific folder and modifying its name.

Once the images have been imported, right-click one to bring up its Properties box. Under the Details tab, scroll down to find a section labeled GPS. If a Latitude and Longitude number is present here, then your image has been geotagged.

Another option for iPhoners is the downloadable SmugMug application for the Web-based photo sharing service of the same name ([www.smugmug.com](http://www.smugmug.com)). This app works through the iPhone camera and sends its geotagged snapshots directly to the SmugMug site. The company offers a 14-day trial, after which it gives you ad-free service for \$39.95 a year.

Until someone comes up with an iPhone app for one of the other photo-sharing services, SmugMu is the most seamless way to get geotagged images from the phone to an online repository. There are a couple of oddities at work, however. First, the geotagging only passes through to SmugMug on the images you take within the app itself. The application does let you upload other images from your iPhone Camera Roll, but for some reason the GPS info doesn't survive the journey. The developers tell us this is a glitch in the iPhone's APIs that

may be corrected by the time you read this. One workaround for this is to offload the iPhone images to your PC and then go to your SmugMug account. Use the Add Photos button to upload these offloaded iPhone images from your

Desktop to the online folder. If the geotags have been preserved properly, then the folder should offer a new button labeled Map This. Next month we will drill into this and other opportunities for using geotagged images.

### Eye-Fi In The Sky

Sooner than you think, new digital cameras will come with embedded GPS for automatic geotagging. Otherwise, you will need a dedicated GPS tagging device for cameras (which is bulky) or you can try the new Eye-Fi Explorer

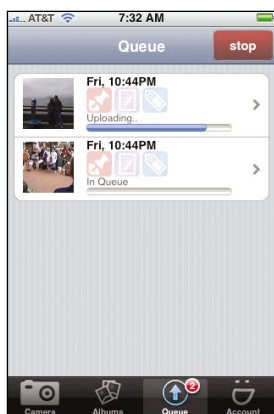
Wi-Fi-enabled SD memory card. The first-generation Eye-Fi card connected wirelessly to your network to transfer images directly from your camera. The Explorer variant (\$129 for a 2GB version), adds geo-location capability. Eye-Fi's is not a full-bore GPS device. It uses a third party Wi-Fi geo-location service that maps the public and private wireless routers around the U.S. to locate your snapshots and tag the image file with latitude and longitude. In our experience, in urban locations the positioning can be almost as accurate as GPS.

But there are some caveats, as we had uneven results with the Eye-Fi Explorer until we had all hardware and software settings properly configured. Our best results came after several key steps. First, before popping the memory card into your camera, put the Eye-Fi in a card reader connected to your PC. Install the Eye-Fi Manager software, and establish the card's connection with your home network. Next, click the Settings item in Manager. Click the Geotagging item and ensure this feature is enabled. In the next installment of this series we will

drill into the details of transferring images to Web services such as SmugMug and Picasa where the tagged images can be mapped. For now, however, go to your Desktop tray's Eye-Fi Manager icon and click the Check For Updates command to ensure the latest firmware is on the card.

Finally, and perhaps most importantly, make sure that the power settings on your digital camera are set properly. We can't stress this enough. Until we made this change to our Nikon D80, geotagging of captured images was hit or miss. Go to <http://support.eye.fi/compatibility/optimize> to find your camera and a walkthrough for making the adjustments. When properly configured, the Eye-Fi Explorer card should automatically geotag most file formats (excluding RAW) and transfer them wirelessly to your Eye-Fi Manager and then to individual Web photo sites. Next month, we will play with these geotagged images. ▲

by Steve Smith



In the Apple iPhone, the SmugMug application can upload geotagged images directly to the Web service for later mapping.

## Infinite Loop

### How Much Is That Clone In The Window?

We know there are a lot of serious pet lovers out there, but we think few miss their pets as much as Bernann McKinney missed her pitbull "Booger", who died in 2006. McKinney paid Korean company RNL Bio \$50,000 for a litter of pups cloned from her pitbull. She now has five new pitbull pups, all named some variant of "Booger". ▲



[www.siliconvalley.com/news/ci\\_10112596](http://www.siliconvalley.com/news/ci_10112596)





# Warm Up To Penguins

## Idle Speculation

For one reason or another, many people choose to leave their computers on all the time. Rather than let those computational cycles go to waste, there are a number of initiatives that will make your idle computer part of a giant, distributed supercomputer. Using the vast power unleashed by such an arrangement, these massively parallel computers are working to solve some of the most important scientific and mathematical problems of the day, as well as a few frivolous ones. And unlike many software categories where Linux lags behind the commercial operating systems, these projects have gone out of their way to make Linux part of the equation.

Before we look at the specific projects, we'll discuss in general terms how they work and issue some caveats. These programs implement what we computer jocks call massively parallel, coarse-grained computation. Coarse-grained is a way of saying that each processor in the overall system works on a relatively large piece of data for a prolonged period of time, rather than doing a few simple operations on a small piece of data. There are

only certain types of problems that work well on a coarse-grained system, usually those that require trying a lot of permutations of a possible solution or performing the same detection algorithm over a large set of data. These projects work by taking the overall problem set and dividing it up over a large number of computers. For

A, 11 through 20 to machine B, and so on. Each machine would chew over its respective piece of the puzzle and return its findings, which would be gathered together into a final result.

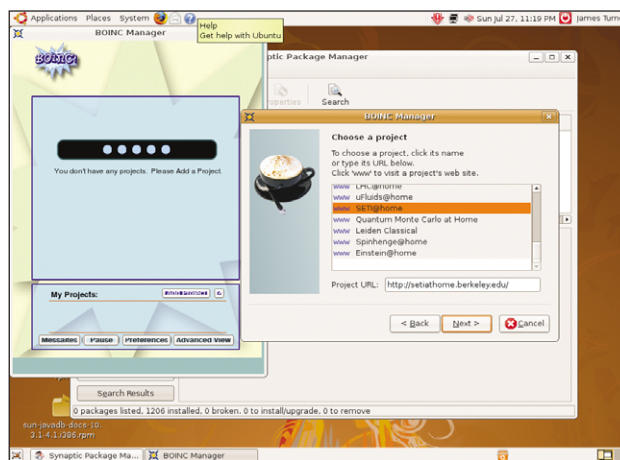
Because distributed computing projects need to send new jobs, retrieve work units, and return results, all of them require network connectivity. Typically, the bandwidth required is not high, because it isn't the volume of data that's the issue. It's the complex computations each chunk requires that consumes the bulk of your resources. Each work unit is usually given to more than one computer to double-check results. This also prevents a malicious user from corrupting the data by running a bogus version of the client that returns bad results.

The client programs try to only consume idle process time, staying out of the way of running programs. Most can be configured to only start running after the system has been idle for a certain amount of time. They shut down

when you resume normal activity, although some are less adept at reducing their resource consumption, which can lead to sluggish performance immediately after resuming from an idle state.

The other caution is that when this idea was first developed, chip makers weren't as conscientious about power savings as they are today. Modern processors can drastically cut down their power usage when idle, but running one of these programs can have the side effect of raising your power consumption by keeping your CPU actively working.

Originally, all of the projects had their own client programs, but many of them have now consolidated under one common platform called BOINC (Berkeley



When you initially start BOINC, it will prompt you to choose from a variety of distributed computing projects.

example, if the (admittedly simple) problem was to determine out what the square of every number between one and 100 was, the system might assign the numbers one through 10 to machine



The World Community Grid is a collection of projects that are all available at your fingertips.

information and join a team. Teams pool the points they've earned by completing work, but just like individual scores, it's merely a fun way to compete to see who can do the most jobs.

Once you've added your first project, BOINC will start grabbing spare CPU resources and using it to run computations for the project. If you add more than one project, BOINC will queue up work for each project you're involved with, starting the next job in the queue after your system completes its current work unit.

There are a few significant differences between BOINC under Linux and Windows. BOINC runs as a screen saver in Windows; it only starts up after the system has been idle. Under Linux, it starts running if there hasn't been keyboard activity for a certain amount of time, which you can set with the manager. BOINC won't run as a screen saver in Linux, so the only way to see the nice visualizations that some of the projects display as they chug along is to click the Advanced View button, then select the running project, and click the Show Graphics button. This will launch a separate window with the visualization you'd normally see as a screen saver under Linux. This is probably the biggest advantage that the Windows version has over the Linux one.

Open Infrastructure for Network Computing), which can be downloaded at [boinc.berkeley.edu](http://boinc.berkeley.edu). The nice thing about BOINC is that distributed computing junkies can easily switch between projects without loading different software. If you suddenly decide to try curing cancer rather than searching for little green men, it's a snap.

If you're running some distributions, you may find BOINC already available in your distro's package manager. For example, under Ubuntu you can find the boinc-client and boinc-manager packages. If you select them for install, you'll get a new item in your System Tools menu called "BOINC Manager." You use this tool to configure BOINC and control it when it runs.

When you first start the manager, you'll have nothing running, so the first step is to click the Add Project button. This opens a window that presents a list of projects that are currently available. Once you've selected a project, you'll need to register. Each project maintains its own user registry, which is mainly used to keep track of how much each user has contributed (primarily for bragging rights). As a final step, most projects will launch a browser window that gives you the opportunity to provide some additional user

We'd like to see the BOINC folks step up and get a screen-saver mode working under Linux.

One project, the World Community Grid ([www.worldcommunitygrid.org](http://www.worldcommunitygrid.org)), actually encompasses a lot of smaller projects. The World Community Grid project has about a half dozen sub-projects underneath it, including the FightAIDS@Home project. To participate in WGC projects, first create a WGC account, then select on the Web site the WGC projects in which you want to participate. Add WGC as a project under BOINC, and when WGC runs, it downloads work from one of the WGC projects you designated.

There are even some BOINC clients designed to run on the graphical GPUs of game consoles, such as the PS3. But whether you run BOINC on one system or a dozen, you'll be doing your part to solve some of today's most important scientific and mathematical problems. ▲

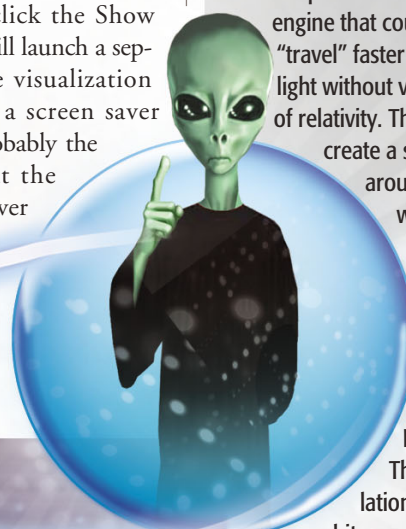
by James Turner

## Infinite Loop

### Warp Drives Nanometers Closer To Reality

Two Baylor University physicists believe it's possible to create a warp

engine that could make a vessel "travel" faster than the speed of light without violating the theory of relativity. The engine would create a space-time "bubble" around the ship, which would remain stationary as space-time shrinks in front of it. But before you place a want ad for a Scottish Chief Engineer, know this: The physicists' calculations depend on "some arbitrary advance in technology or some alien technology." ▲



dsc.discovery.com/news/2008/07/28/warp-speed-engine-02.html



# Shavings From The Rumour Mill

by Mike Magee

## Graphics Wars Break Out With A Vengeance

There's blood on the carpet as Nvidia and AMD-ATI are slog-ging it out against each other, but there's one big player they're both terrified of, and it's not graphics minnow S3.

As I write this, Intel is about to announce more details of its Larrabee confection—a contact admitted to me earlier this year that the company would launch against both Nvidia and ATI-AMD with a series of discrete graphics cards. I pointed out then that Intel faced several obstacles to world domination, one of them being that it had to persuade the add-in board partners to dance the fandango with a different kettle of fish. It has succeeded in doing so.

So much so that several of the add-in partners, according to reports, have realised the formerly very lucrative graphics market is slipping away from them and have started prospecting the not very lucrative entry-level motherboard market.

There are several very complex twists to this already convoluted tale. One is that Nvidia suffered a blow to its dignity when it announced it would take a charge in its financial results because of problems with chip packaging. The other is that the ATI wing of AMD must really have had rather a sound roadmap in place because several of its designs outperform Nvidia, and at a price that undercuts its rival, too. It can only be a matter of wonder how the ATI division of AMD, bought at quite a high cost of \$5 billion, has managed to proceed in an orderly direction with its product roadmap while the CPU arm has faltered in its goals to topple Intel.

Ah yes, Intel. No one underestimates Intel's reserves and its ability to deploy technology. It has a history of announcing products and initiatives which haven't always received the warmest reception in the market, but like the cobbler, it always sticks to its last, and it is so profitable it can afford the odd hiccup or four. It is struggling to produce the right kind of die for its Larrabee family as I write this, but in addition to having a lake of liquidity, it is also rightly renowned for its process technology

and its skilled engineers, so it can be only a matter of time before it gets Larrabee right.

And then the gates of hell will open, because Intel is already big in the integrated graphics market and is never content with a slice of cake if it can have the whole thing. I haven't seen the Larrabee product roadmap, but you can bet your bottom dollar that it's going to go for the lot. Modesty is a pleasant virtue, but

in 25 years of covering the semiconductor market, I have never heard this epithet applied to Intel.

There's another element in this graphics stew; the demand for faster and very high-end graphics cards appears to be faltering in the gaming market. Nvidia and ATI have done a great job producing great products over the last several years, but no one seems to get very excited these days about new graphics cards, partly because the software is satisfied by previous generations. The demand for better and brighter isn't sated in the high-end workstations market, but both ATI and Nvidia sold their products by capitalizing on the gaming dream, and no one seems that interested anymore.

So will Intel mop up and achieve its aims? As I've noted before, the firm doesn't get things right all of the time, but when it makes a determined effort to grab a market, as it did with network interface cards in the early 1990s, few can resist it. The fanboys may disrespect Intel's integrated graphics chipsets, but they are enormously popular, dominate the market, and have given the firm a lot of design experience.

It was always a matter of wonder to me that two chip firms like ATI and Nvidia catapulted themselves into public vision and made themselves seem ultracool essentially through the power of branding. No one could ever accuse Intel of being ultracool, but Nvidia and AMD must really be very worried about Larrabee. ▲



*Mike Magee is an industry veteran. He cut his teeth on ancient products like the Dragon and the Japanese PC platforms long before the IBM-PC won. He worked for a corporate reseller in the mid-'80s and saw the Compaq 386 sandwich box and every GUI known to humankind. Mike decided that the way to go was the Interweb around 1994 after editing PC mags in the late '80s and '90s. A co-founder of The Register, Mike started the chip-driven INQUIRER ([www.theinquirer.net](http://www.theinquirer.net)) in 2001. He has contacts from top to bottom in the business, spanning the entire chain, who help him root out interesting rumours and speculation.*

Send rumours to "Mad Mike" Magee at [mike@cpumag.com](mailto:mike@cpumag.com)

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# Wagging The Dog

by Rahul Sood

## Intel's Kung Fu Is Unstoppable

Nvidia dropped a bombshell recently when it all but erased the line it drew in the sand a little over a year ago. In early 2007, it was pretty clear that Nvidia was no longer going to support Intel in its hybrid graphics for notebooks strategy, nor was it going to support SLI on anything other than its own nForce chipsets. I weighed in on these developments on my blog (Google “Nvidia gives Intel the finger” and “Nvidia’s quest to become a platform company”). At the time, as I mentioned then, Nvidia saw a huge opportunity to compete against Intel’s lucrative chipset business. So, rather than keeping its enemy close as Sun Tzu recommends, Nvidia tried to fight the giant head to head.

What’s transpiring now is a direct result of that decision. What makes this especially interesting is that Jen-Hsun Huang is easily one of the smartest strategic thinkers in the industry, yet this time he got caught in an almost predictable situation. Perhaps sometimes our successes cloud our judgment—but then again, without risk there can be no reward. Either way, these weren’t “flip of the coin” decisions.

Intel’s kung fu seems to be unstoppable. It seems that any time someone challenges the chipmaker, Intel slowly tears the challenger apart bit by bit until there’s little left but hope. Rumor has it that Intel has been secretly hiring top engineers from the graphics industry, and, combined with other bits of evidence, this leads me to suspect that Intel’s Larrabee initiative is more than just another ho-hum Intel Extreme Graphics core; it’s a serious play to make third-party discrete graphics on a notebook redundant.

AMD’s Puma doesn’t help the situation, either. If AMD can scale it, the company will have created a very competitive platform for the entry-level notebook arena. In the meantime, if it’s everything I think it might be, Intel’s Larrabee will make Centrino king of the world. So what’s next for Nvidia?

I imagine that Nvidia will do whatever it can to make high-performance graphics

chips more relevant in the general computing space. If Apple or Microsoft, for example, continue to use the GPU to increase computing performance in their operating systems, this would likely bode well for Nvidia.

I love the concept of visual computing, and the performance that Nvidia has demonstrated by using the graphics processor to accelerate applications that are typically CPU-dependent is astounding.

That said, if Intel continues on the path that I think it’s on, the GPU space will have a third major graphics competitor, and of course more competition is great for consumers.

When I was 15, I built an RC helicopter from the ground up. Two months and \$2,000 later, I went outside for my maiden flight. I sent my model into the air and wrote it off in less than 45 seconds. I was devastated and swore I would never do it again.

Two weeks ago, I came home with a ready-to-fly RC helicopter under my arm. I spent some time with my kids setting it up, and we took it outside: I crashed it in 30 seconds. This time, however, I rebuilt it, and took it up again. I crashed again, went back to the store and bought a bunch of parts, rebuilt it again, and left it in my garage. I then picked up an RC Flight Simulator for my Blackbird; I’ve been practicing ever since and have become an accomplished flyer.

The moral of the story is you can give up, but don’t ever give up in front of your kids. Well, I guess that’s one of two morals. The other is that you probably shouldn’t give up on Intel as a discrete graphics company based on its previous attempts to get into the market. I believe Larrabee could really shake things up in the graphics market this time around; it seems likely that they will at least offer a compelling alternative to current offerings.

So what was I talking about again? Oh yeah, Intel’s kung fu is tight! ▲



*Rahul Sood's love for computers started at the young age of 11. Much to the shock and dismay of his parents, he ripped apart his brand-new Apple IIc and painted it red before turning it on. His parents' dreams of having a doctor for a son were shattered when college drop-out Rahul founded what is now one of the most respected high-end computer companies in the world, Voodoo Computers.*

Send your opinions to this opinionated guy at [rahul@cpumag.com](mailto:rahul@cpumag.com)





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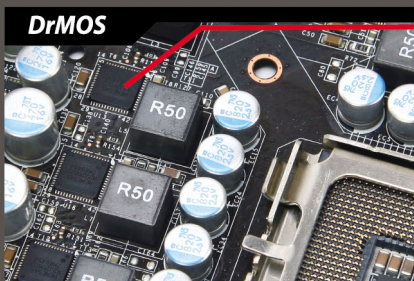
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# Technically Speaking

An Interview With Raymond Soneira,  
CEO Of DisplayMate Technologies

**D**r. Raymond Soneira is the founder, president, and CEO of DisplayMate Technologies. He has a Ph.D. in Physics from Princeton University, where he spent five years as a long-term member of the Institute for Advanced Study. He has authored over 35 research articles in scientific journals on physics and computer science.

by Barry Brenesal



**CPU:** When I first reviewed your original product, DisplayMate for DOS, in 1991, there was just one type of screen available: the cathode ray tube, CRT. Now we're seemingly inundated with new video technologies. Let's focus, if you will, on a rundown of each of the main contenders for the home and office markets, and how they're doing. Quite a few have had meteoric careers, haven't they?

**Soneira:** A lot of these technologies we're going to be talking about really do deserve to survive. CRT is a prime example. I think everybody knows it was used in the first television displays in the 1920s and was in its prime until about 10 years ago. Now, you can only get it in \$50,000 reference monitors and in el-cheapo displays, if you can't afford a flat panel. In many cases, what people replace a CRT with will actually cause a decrease in image quality.

The CRT doesn't have a native resolution, so it can do any resolution and aspect ratio that you want and has a great viewing angle, 180 degrees. Infinite color depth, too, and no motion artifacts. It's unfortunate that if you don't have \$50,000, you can't get a good one

anymore. But for that kind of money, you get a display that is close to theoretically perfect.

**CPU:** Yet if CRT is so good, why has it slipped so heavily from favor?

**Soneira:** It's big, and it's heavy. A 36-inch CRT weighs 300 pounds. In the consumer marketplace, I certainly understand why it just doesn't work anymore. But it remains an important force in television and movie production facilities. Medical imaging monitors are still CRTs, thanks to their incredibly high resolutions. In terms of color and grayscale accuracy, my lab and other labs that I advise in their testing and analysis recommend that medical professionals have a CRT reference monitor because it really produces the best picture and reproduces the very subtle grayscale and color shadows in a picture that are important for early diagnosis.

**CPU:** Let's look next at plasma display technology.

**Soneira:** Plasma rose into prominence and general distribution before LCD. It has phosphors driven by individual cells

rather than a scanning beam, so essentially it's a very short and flat CRT. It delivers very rich colors, and has almost no motion artifacts. Like a CRT, you can view it at an almost 180 degree angle. But people should be aware: the CRT is a pure analog technology. Plasma is true digital, in that it has individually addressed pixels, each of which is either on or off. The way you generate intensity on a plasma display is that you rapidly switch each pixel.

**CPU:** So its main advantage to people who bought it was that it was digital as opposed to analog, with most of the inherent qualities of a CRT. Was it also lighter than a CRT?

**Soneira:** It's still pretty heavy. Its major disadvantages a couple of years ago—and these affected its public perception—were that it had a much lower resolution, along with aging issues, incorrectly called burn-in.

It's worth considering, here, how high the test bar has been raised. Years ago, when many of the newer display technologies launched, they were competing against CRT. They came in with

absolutely awful picture quality. They struggled and, over the years, improved. But now, you can't launch a product that isn't as good or better than anything else that's around and survive. That partly accounts for the lower number of new video technologies, many of the most deserving of which have not made it out of the lab.

**CPU:** But if plasma looks so good, what's been responsible for the downturn in the market?

**Soneira:** Plasma is faced with LCD, and there are two different markets that we need to consider. There's the computer marketplace and the video entertainment marketplace. Computers are personal display devices generally used by a single person sitting dead center in front of the screen. The background is generally peak white, because there is a paper analogy. Colors are fairly saturated. LCDs are primarily used in the computer arena, because plasma displays can't handle peak white well.

Video images, on the other hand, have a wide variation of color and intensity and require a good black level. LCDs have true native contrast ratios of 1,000

**Soneira:** In terms of picture quality, absolutely. For color and grayscale, plasma is unmatched. In my lab, we did this experiment where we wanted to see what the best of the best could do against one another. We got the flagship displays and did our tests with a lot of people that came through the lab, and there's no question that the plasma display, in a controlled ambient light viewing environment, wins big over the LCD. Where LCDs win is if you have a bright ambient light environment, like a sunroom, but in a bright ambient light environment, you can't get good picture quality—color and grayscale—anyway.

**CPU:** What about DLP, Digital Light Processing?

**Soneira:** When it was launched in the mid-1990s it was awful, but TI [Texas Instruments] did a marvelous job with it. By 2000, it was excellent. DLP is a projection technology—truly amazing, because it was based on micro-mirrors on a RAM chip. You would address a mirror in much the same way as you addressed a memory location, affecting its tilt. Once again, it's digital, so intensity of light is managed by either tilting that mirror to

**Soneira:** Yes, but if you now walk into a Best Buy, you'll find most of the televisions to be LCD, some plasma—and only in some corner, maybe, a few rear projection DLPs. I think consumers partly fell for the concept that you could hang an LCD over your fireplace and look at it as though it were a picture, which is of course nonsense. Realistically, if you think about how most televisions are presented in a living room, they're not usually hung on a wall, but standing on a piece of furniture—and the difference between a screen that's 3 inches deep and 20 inches deep is not a significant space factor.

But DLP has reinvented itself. TI has moved to the digital cinema marketplace, so you can find DLP projectors in your local theaters. It's not as large a market as putting a TV in everybody's living room, but it's one where LCD doesn't play at all, since it can't manage high resolutions.

**CPU:** What about LCOS, Liquid Crystal on Silicon?

**Soneira:** LCOS is a technology that was in development for roughly 15 years. LCD is a transmissive technology, but LCOS is reflective. One of the interesting things about it is that it can do much

The difference between a screen that's 3 inches deep and 20 inches deep is not a significant space factor.

—Raymond Soneira

to 2,000, whereas plasmas are 4,000. You also have an audience that requires a wide viewing angle for sitting all around the room. LCDs do very poorly in that regard. While all the dozen LCD HDTVs I currently have in my lab claim a 176 degree or greater viewing angle, I've done tests in my lab showing that it's actually no more than 15 degrees before there is a noticeable color shift in the image. The sweet spot for viewing an LCD is only one person wide.

**CPU:** Do you think that the HDTV market should logically belong to plasma displays?

show light, or into a black backstop. Something so small it could sit on your thumb could have up to 2,000,000 individually addressable mirrors.

One of the successes of DLP was that TI produced an entire light engine that manufacturers could plug into their own devices. It's a marvelous technology. If I had to put two things into a time capsule to show what earth technology was all about at the turn of the 21st century, I'd probably put in an Intel processor chip, and a DLP chip.

**CPU:** It sounds like a technology with a remarkably fine degree of control.

higher contrast ratios and resolutions than LCD. It's very comfortable doing eight megapixels. Back in 2005, we did a display shootout where we got prototypes of all of the LCOS displays to evaluate. It was exciting then, and I was very impressed by the technology.

JVC, Sony, and other smaller companies launched the LCOS television. But the minute the LCD and plasma prices fell into an area people were willing to consider, the rear projection market that included technologies such as LCOS simply died. Like DLP, LCOS thrives best nowadays in the front projection and digital cinema market. **CPU**





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[www.lanified.com](http://www.lanified.com)

Lannage - Peoria, AZ  
[www.lannage.com](http://www.lannage.com)

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[support.resnet.eku.edu/lanmain.php](http://support.resnet.eku.edu/lanmain.php)

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[www.lanmaniac.com](http://www.lanmaniac.com)

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The[CARE]Cian and 313 Gaming - Ferndale, MI  
[www.fop130.org/index.html](http://www.fop130.org/index.html)

DragonFire LAN - Erie, PA  
[www.dragonfirelan.com](http://www.dragonfirelan.com)

Muncie Gamers - Muncie, IN  
[www.munciegamers.com](http://www.munciegamers.com)

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Nemesis Gaming - Big Lake MN  
[www.nemesislans.com/index.htm](http://www.nemesislans.com/index.htm)

09.20.08

Carolina Armageddon - North Carolina  
[www.carolinagaming.com](http://www.carolinagaming.com)

E-Town LAN - Emporia, KS  
[www.etownlan.com](http://www.etownlan.com)

North Bay LAN's - ON, Canada  
[pc-solutionz.ca/lanparty/index.html](http://pc-solutionz.ca/lanparty/index.html)

Warfactory LAN - Missouri  
[www.warfactory.net](http://www.warfactory.net)

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GVCCLAN - Placerville, CA  
[www.gvccclan.com](http://www.gvccclan.com)

LanAddict Fall Frag Fest - Orangevale, CA  
[www.lanaddict.com](http://www.lanaddict.com)

Overkill LAN Party - Tampa, FL  
[www.overkill-lan.com](http://www.overkill-lan.com)

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ATD Arena - Charlotte, NC  
[www.atd-arena.com](http://www.atd-arena.com)

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WCU LAN 2008 - Cullowhee, NC  
[wcugaming.org](http://wcugaming.org)

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Necronomicon - Florida  
[www.seads.org/LANParty/necrolan.htm](http://www.seads.org/LANParty/necrolan.htm)

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Big Shot Gaming - Mount Pleasant, MI  
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CapLAN - North Vancouver, BC Canada  
[caplan-bc.com](http://caplan-bc.com)

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MAGFest 7 - Alexandria, VA  
[magfest.org/index.php](http://magfest.org/index.php)

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North Bay LAN's - ON, Canada  
[pc-solutionz.ca/lanparty/index.html](http://pc-solutionz.ca/lanparty/index.html)

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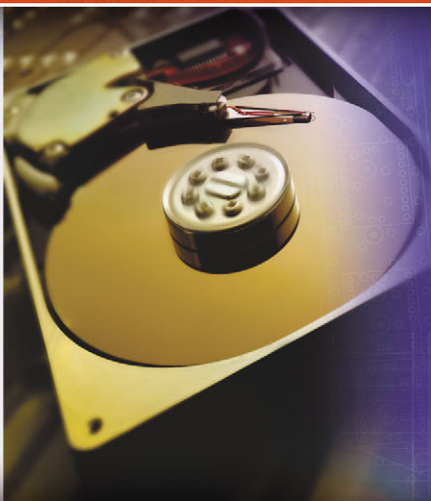
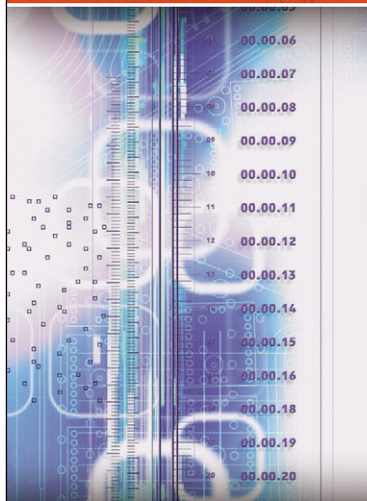
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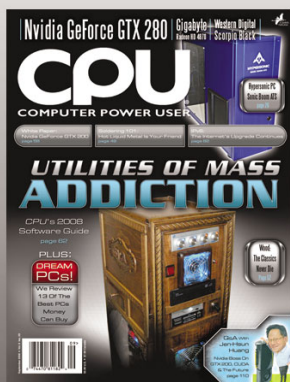
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# Under Development

A Peek At What's Brewing In The Laboratory

## Mobility Research Center Rings In A New Academic Era

The call's just come in, and mobile phone developers had best get the message: There's a new kid in town. Carnegie Mellon has recently launched the Mobility Research Center to coalesce current research, education, and entrepreneurship programs for mobile devices. Based in Silicon Valley, the Center is an extension of

people around the world are exclusively wired through their cell phones, and that in the future, our PDAs "will know who you are, where you are, and what you are doing." Narasimhan also notes that industry giants have not been introducing new technology to the market quickly enough to keep up with the demand. It only made sense to create the Center to offer students the opportunity to work on the cutting edge of the industry and to holistically tackle the inevitable diversity of issues that arise—"policy, usability, context-aware applications, security, and privacy" to name a few.

Students will be able to take courses such as "The Mobile Ecosystem," "Mobile Hardware for Software Engineers," "Designing the Mobile User Experience," and others involving context-aware computing, software agents, machine learning, and security and networking,

reveals Griss.

And the projects students will be working on are stuff of Neal Stephenson's novels. Imagine, for example, your PDA making appointments, calling for your favorite takeout, and ordering flowers for a romantic dinner party—all based on a database of intimate knowledge of your life.

As for how the Mobility Research Center might impact the mobile industry, Griss hopes that "novel applications, conceptual prototypes, and research will encourage our industrial partners to collaborate more to [create] new devices and device capabilities, applications and services, as well as gain a deeper understanding of the potential of 'anywhere, anytime' computing." ▲

## Hybrid Computer Materials: Making Your Toys Faster, Cheaper, Smaller

If memory and logic functions were compressed into one computer component built of a theoretical hybrid material capable of both magnetism and semiconduction, your PDA certainly would get a boost in operational speed and power, not to mention a drop in cost. And that's just the outcome that a multi-university consortium, led by University of Iowa professor Michael Flatté, hopes to achieve with its research.

Although the actual, tangible inventions lie considerably in the future, the target devices will be based on the researchers' exploration of manipulating magnetism. The team expects that the hybrid materials they create will be made possible by modifying magnetic fields or the flow of electron 'spin'—the property of electrons that generates magnetism. Of course, Flatté himself says the project is still highly theoretical.

Backed by a \$6.25 million grant from the Department of Defense, the UI-led researchers are working to meld a computer's magnetic materials (memory functions) with new-to-market organic semiconductors (logic functions) in order to create devices such as laptops, cell phones, and unmanned sensors that would last considerably longer between battery charges and would be inexpensive for manufacturers to produce. ▲



CyLab, a university-wide, multidisciplinary project aimed at creating public-private partnerships for new technology, and is working in collaboration with Carnegie Mellon's Pittsburgh campus.

The goal is creating new discipline of study for Master's and Ph.D. students who are interested in pursuing an advanced degree in Electrical and Computer Engineering or Software Engineering and Information Networking. Leading the charge are professors Martin Griss and Priya Narasimhan, bicoastal colleagues who were inspired by "the growing use of wireless devices (phones, in-vehicle, etc.) of increasing power," says Griss.

In proposing the Center, Griss and Narasimhan and their teams asserted that



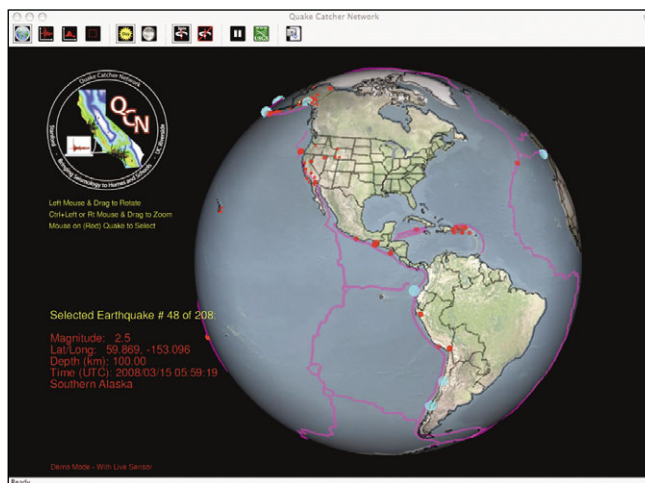
## Quaker Catcher Network Shakes Up Laptops

If you live anywhere near a fault line, knowing more about the whys, hows, and especially whens of earthquakes sounds like a great idea. Researchers Elizabeth Cochran (assistant professor of seismology at the University of California, Riverside) and Jesse Lawrence (earthquake seismologist at Stanford) certainly thought so when conceptualizing the Quake Catcher Network. Although the name conjures up camera-wielding thrill-seekers chasing down natural disasters for a National Geographic Channel program, QCN serves to record “moderate-to-large” earthquakes (4.5+ magnitude) via accelerometers and special software loaded on laptops.

Cochran was inspired to create QCN after seeing “SeisMac,” an OS X widget that turns a MacBook into a seismograph by utilizing its

internal Sudden Motion Sensor. Knowing that seismologists are challenged by research-grade seismometers’ inability to get a good read of larger quakes because of oversensitivity, Cochran reasoned that a distributed computer network with less-sensitive recordings could fill in the data gap.

Currently running on Apple laptops (2005 or later) and IBM ThinkPads but expected to be available on all Windows-based machines by end of the year, QCN works on the same premise as projects such as SETI @home. “We access the data from accelerometers internal to most laptops using a distributed computing infrastructure,” explains Cochran. “This infrastructure is provided by BOINC (Berkeley Open Infrastructure for Networked Computing) freeware allowing us to



communicate with users who download the software and attach our project to it.”

The software itself runs in screen-saver mode, and the inactive computer sends signals to a server at Stanford. Each fresh signal is compared to a minute of previous baseline signal to check for an unusual “trigger.” “Once we determine that the trigger is related to an earthquake, we

can download the waveform data from the users’ computers,” says Cochran.

Currently with a network of 400+ users worldwide, the QCN team hopes to expand to at least 1,000 sensors in earthquake-prone cities such as San Francisco and Los Angeles. They are also developing software to work on desktops via external USB-based accelerometers. ▲

## Project:Possibility Makes Assistive Technology Accessible

In the midst of graduation and starting a new life, many college graduates are too slammed to ask themselves how they’re going to improve the world. Not so for Christopher Leung, computer engineering Master’s candidate at USC. Instead, he pondered this question: “Given my experience, skills, and passion in the field of software development, how can I make the biggest impact?” The answer for him, upon finding the dearth of open-source software to assist and empower disabled people, was to create Project:Possibility.

Leung’s brainchild, which is a nonprofit with a mission to encourage developers and disabled persons to work together to create open-source assistive technology, focuses on inventing new ways for the disabled to experience the world.

Also a software engineer at NASA JPL (Jet Propulsion Laboratory), Leung coaxed some influential sponsors (Mozilla Foundation, USC, Microsoft, and Knowbility) to help jumpstart his first project, SS12: Code for a Cause ([ss12.info](http://ss12.info)), a 24-hour code-a-thon. “We thought the 24-hour development challenge would be a great

opportunity for students to not only get exposed to ‘accessibility’ in a short period of time, but to actually team up and create software that did not previously exist,” explains Leung.

Nearly 40 student developers participated, and with project mentors (Google, Orbital Sciences, NASA JPL, AMGEN, and USC’s Engineering Graduate Student Association and Association of Computing Machinery) to guide the students over the weekend, SS12 was a rousing success. Several of the projects were publicly released within three weeks of the event.

Leung, encouraged by these achievements, then inceptioned a new opportunity for students to build on what they began in SS12. Project:Possibility’s Semester Project pairs students and professionals to create open-source software for the disabled over the course of a semester. The following are the top three projects to watch for from the initial Semester Project: Word Prediction software service; SunSPOT’s “Gesture recognition framework” for Sun Microsystems’ handheld device; and Web Community Closed Captioning for YouTube. ▲

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## Q&A With Gabe Zichermann

**V**ideo game concepts are spreading beyond video games to non-video game applications, making those applications a lot more fun.

At the same time, the definition of a video game is changing, and it isn't clear that the video game industry realizes it. It's easy to see the game-like parts of social media. Call it Funware. That's the name that Gabe Zichermann, CEO of New York-based startup rnbr, has given to applications with game-like mechanics and behavior, but really aren't traditional video games. While the term may be new to you, you can readily guess what Zichermann means, particularly if you've heard the phrase, "Facebook is a game."

**Q** What are you trying to do with games?

**GZ** I feel really passionate about the industry and its potential. In spite of all of its success so far, I think we're still not at its full potential as a media category beside the printed word, moving images, or music. I arrived at a point where I said the biggest point of pain I have now is that I encounter a lot of applications that are interesting but are fundamentally not fun. I realized there were a handful of applications that were fun, and they were taking a lot of time. Social networking was fun. eBay was fun. I wasn't spending my time doing stuff like tagging photos. Digital photography, social networking, and games were the three things that bubbled up for us. We thought about approaches. We had an "Aha" moment. Almost all problems can be fixed through the application of a game mechanic. Like, how can you get someone to tag 10,000 photos? How can you create a connection with someone in real time? You can make those things fun with game mechanics.

**Q** What is funware?

**GZ** We coined the term "funware" to describe the use of game mechanics in non-game contexts. You can see funware applications that are intentional and unintentional all around you. I mentioned eBay. A few years ago, they hired the game designer Amy Jo Kim to work on balancing aspects of the reputation system. It dawned on them that people are "playing" eBay rather than using it.

**Q** What are some examples of funware?

**GZ** There are intentional funware companies, like our company rnbr, "iminlikewithyou," Pmog, Lupo (German shopping game), and Bunch Ball. They are explicitly designing things that marry games to things that aren't thought of as games. They do that to manipulate user behavior. Yamaha has a musical instrument built by a game designer. It's a 16 x 16 grid of buttons that flash lights. You respond by pressing the buttons. It's like a keyboard designed by a game designer. My world view is that as the millennial generation continues to grow, people will come to realize that their primary form of discourse is influenced by the games they play. They expect everything to be fun.

**Q** Are serious games, like educational games, the same as funware?

**GZ** Here's the distinction. If your first objective is fun, then it's funware. If it's something else, like education, then it is not funware. That's been a failure of educational games. First, you have to make a fun experience. That will teach people something interesting.

**Q** So it seems that a lot of game companies are adding social networking to their products because they realize that Facebook is sucking a



lot of time away from games. Is that what you see is happening?

**GZ** I will say this unequivocally. Most of my game industry friends hate when I say it. For the first time, games have direct competition for user time. Until now, we've been the Pac-Man eating the cherry of television and movies and the printed word. Now, a new type of application has emerged that is stickier in the long term than games. In a 15-minute spurt, Facebook is not more fun than Guitar Hero. But 15 minutes a day, seven days a week, for eight months, Facebook is more engaging than Guitar Hero. This is a reality that is still not dawning on most of the game industry.

**Q** Why isn't the game industry moving faster?

**GZ** I had a conversation with a game industry person. I said it was frustrating to see them moving so slowly. He said they had a profitable business, and they were not sure how social networks can be used to grow business and not cannibalize. They were trying to figure it out. I said that was exactly what the music industry said to Napster in 1998. ▲

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