GPU-SPORTING ZENBOOK!
Is it the best back-to-school PC? PG. 79

MINI-ITX GAMING PC
How to build this small-but-mighty rig. PG. 68

GOOGLE'S NEXUS 7 TABLET
It extinguishes the Kindle Fire! PG. 80

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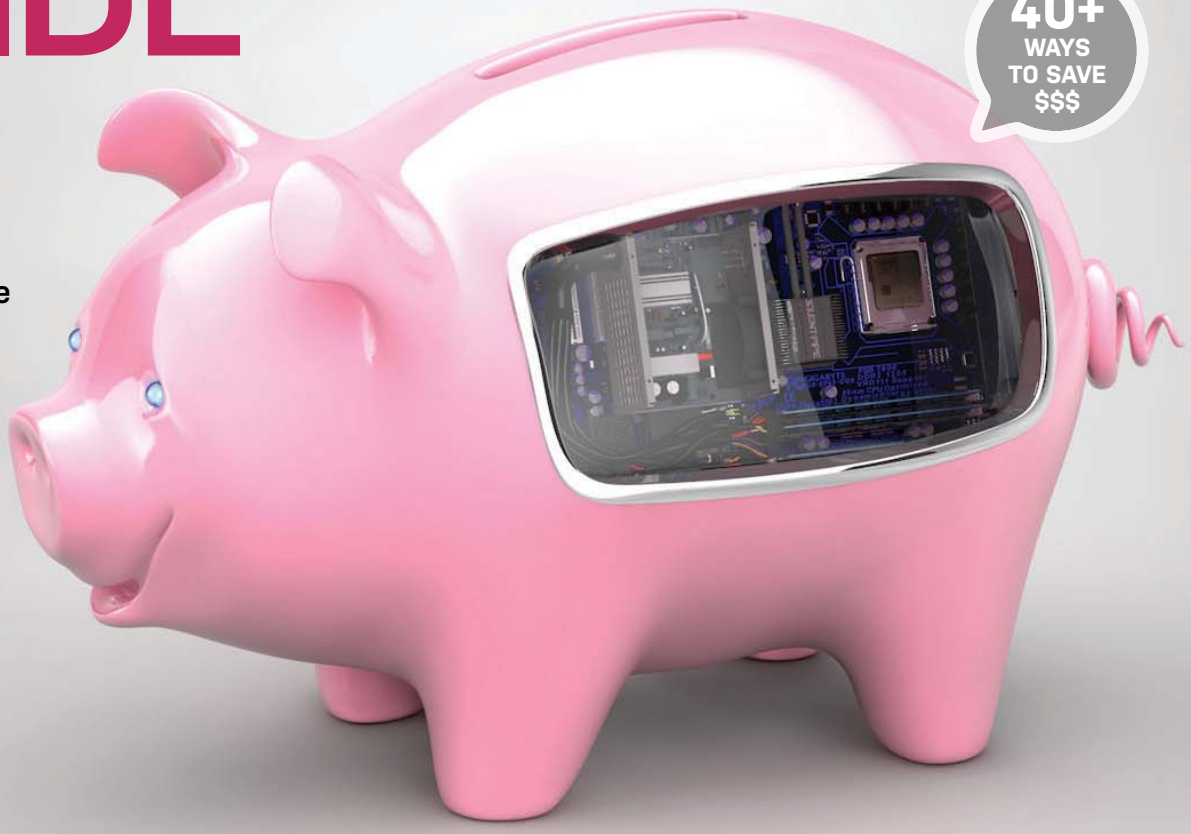

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inside
OCTOBER 2012

On the Cover
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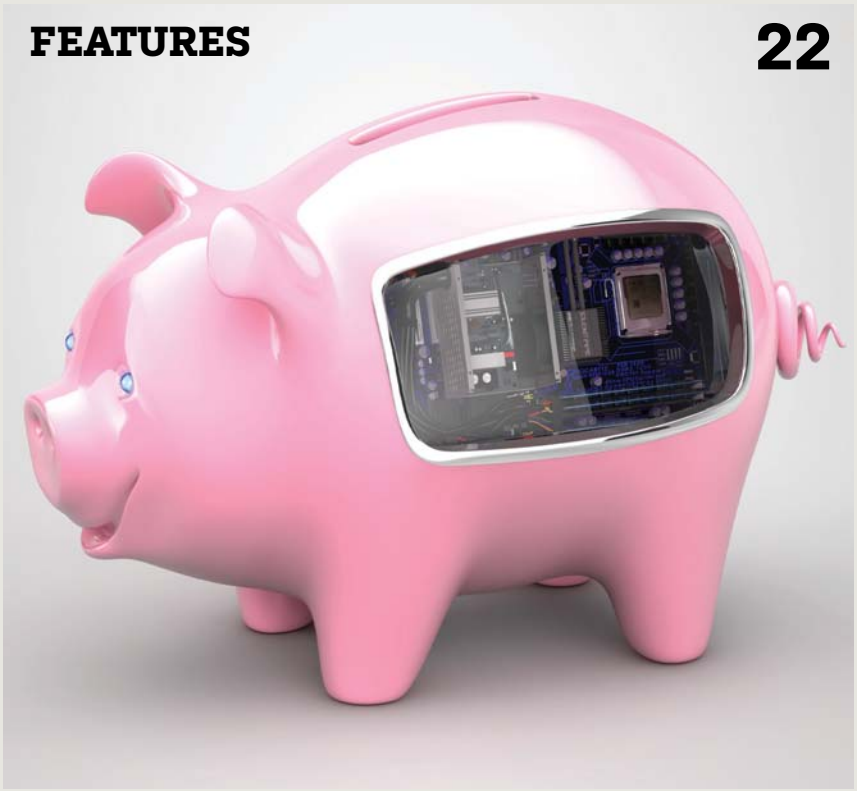
FEATURES 22



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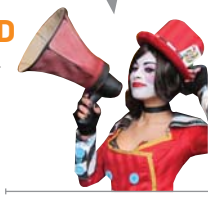
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Gordon
Mah Ung

HATE THE GAME, NOT THE PLAYER

I'M PRETTY sure that when I go to the 2012 Ball of the Playa Haters, of which I am a distinguished member, Microsoft's Windows 8 and Intel's Thunderbolt will be at the top of the agenda.

My considerable tech experience has taught me that both are technologies people are primed to hate on. Why? It doesn't take a genius to figure it out for Thunderbolt: The cables cost $50, it's been overhyped, and it was named by Apple, which got exclusive access to the tech for a year. For haters, that's all we need.

But let me give you some startling advice: Don't hate on Thunderbolt.

I finally got some hands-on time with it on a proper PC platform this month, using a Promise Pegasus R4 cabinet, a stack of OCZ SSDs, and an Asus P8Z77-V Premium board (which is the most expensive Z77 board I've ever seen, so let the hate begin). The result? I saw performance approaching 1,000MB/s using the R4. As much as I'm a hater, I can't hate on that.

Yes, there's about a $60 price premium for a Thunderbolt motherboard, but it'll give you an interface capable of writing 17GB of files in 23 seconds (provided you have a fast enough RAID enclosure, of course.) And that's just today's iteration—it's only going to get faster. For any enthusiast who needs fast external file I/O, Thunderbolt should be on your list of products to consider.

Playa haters are already lined up around the block to throw down insults on Windows 8 when it comes out in October. Why? The OS takes a well-known interface and tosses it in the recycle bin. It's like Microsoft killing the most popular character in a movie franchise and expecting fans to come back for the sequel. Ready to let the hate spew? Not this hater.

Before I put on my top hat and mink coat, and grabbed my cane, I decided to run the Windows 8 Release Preview with a ViewSonic VX2258wm multitouch panel. The result? I can't hate on it.

The Metro UI with a touchscreen is a surprising joy to use. When is the last time someone said that about a personal computer UI? Yeah, I can't remember that, either. In fact, going from the Metro UI to the traditional mouse and keyboard desktop interface is about as abrupt as dropping from a GUI to a command-line interface. Some will say that's something to be hated on too, but I say that one day we won't want to leave that Metro UI when we're surrounded by 30-inch, multitouch panels.

So as much as it pains this hater to say it, "Don't hate the player, hate the game."

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

↘ submit your questions to: comments@maximumpc.com

THE NEWS

SSD Prices in Steep Decline

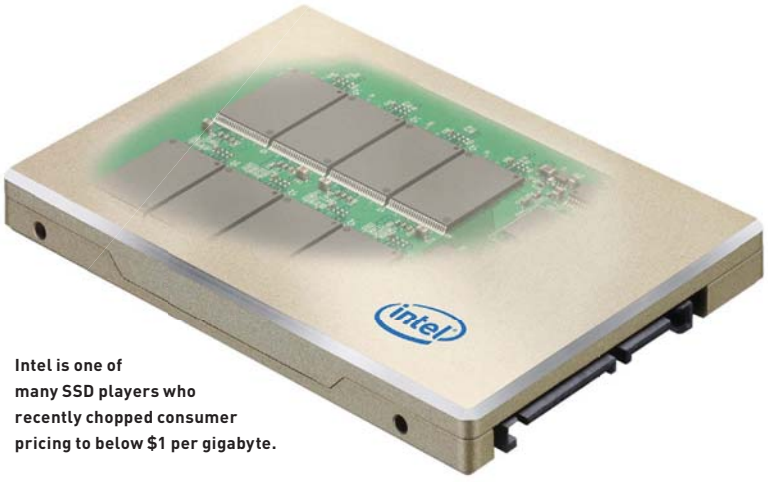
Owning a solid-state drive has never been more affordable, but why the sudden drop in price?

HOLD ON TO your hats, folks, solid-state drive (SSD) prices are in free-fall mode, pelting system builders smack dab on the head when they least expect it. After holding steady at "obscene" and "holy moly, it costs *how much*?" prices, many high-end SSDs abruptly dipped below the $1-per-gigabyte mark in recent times, triggering a conscious switch in consumers' brains to view flash-based storage as affordable. That's not an adjective system builders are accustomed to using when it comes to SSDs, but with all the recent price cuts, they've become just that. At the risk of looking a gift horse in the mouth, we donned our detective cap in search of answers to the curious case of rapidly declining SSD prices.

The web is a breeding ground for rumors and speculation, and one of them opines that the real reason SSD prices have fallen so sharply is because the major players are trying to squeeze out the little guys by sparking a price war that only the big boys can participate in. Since OCZ is one of the biggest SSD pushers around, we went right to the source and asked the company straight up if there's any truth to the rumor, but we might as well have been trying to pull teeth from a jellyfish. OCZ did explain that it's the largest independent manufacturer of SSDs and therefore has the advantage of working with multiple flash vendors to deliver lower prices, but flashed the "cannot comment" card when pressed for further information.

Micron was a little more forthcoming. According to Justin Sykes, general manager of Micron's client SSD division, NAND component prices have been in a steady decline for the past few months. He also said there's a "slight oversupply in the larger NAND market" and what we're witnessing with the summer price drops is a "battle among SSD suppliers to try to gain the most market share."

Fair enough, but is that all there is to it? It certainly appears that way. Jeff Janukowicz, a research director at International Data Corporation (IDC), echoed Micron's comments, noting that a "slight oversupply situation in the overall NAND market" has contributed to a 35 percent decline in SSD prices compared to this time last year. As Janukowicz explains it, some OEMs overestimated the demand from mobile phones, tablets, and Ultrabook PCs, which in turn led to an abundance of NAND flash chips.



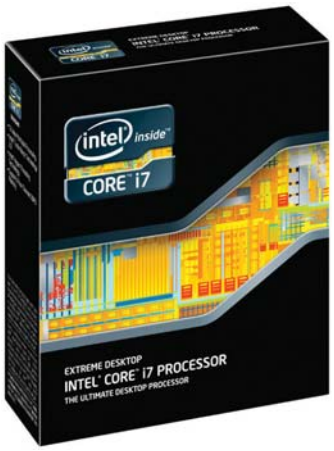
Intel is one of many SSD players who recently chopped consumer pricing to below $1 per gigabyte.

> "THE GENERAL CONSENSUS AMONG INDUSTRY EXPERTS IS THAT NOTHING SINISTER IS AT PLAY

Despite the rumors, the general consensus among industry experts is that nothing sinister is at play. Michael Yang, senior principal analyst of Memory & Storage at HIS iSuppli, tells us the rumor mill is essentially "dramatizing" the results of a changing market. "It's really a cycle of a market becoming more mature," Yang says, adding that companies with a logistical advantage are able to scale their operations and rise above the rest.

If you've been holding off on upgrading to an SSD, now could be the time to act. Prices on today's drives might continue to trickle downward, but they're unlikely to plummet following the latest round of deep cuts. These are still premium storage solutions, after all. Rather than continued price cuts, we suspect we'll start to see higher-capacity SSDs emerge at price points cost-conscious enthusiasts can more easily talk themselves into spending. **–Paul Lilly**

Sandy Bridge-E Gets Love



With the new Ivy Bridge baby in the house, Intel's other child, Sandy Bridge-E, has gotten no love for months. That's about to change later this year when Intel is expected to roll out a clock bump with the Core i7-3970X, according to web reports.

The Core i7-3970X will reportedly clock in at 3.5GHz and will Turbo up to 4GHz. The current Core i7-3960X has a base clock of 3.3GHz and will Turbo to 3.9GHz. The new Core i7-3970X is expected to pack the same six cores and cache as its predecessor, but one site is predicting an increase in rated thermals from 130 watts to 150 watts.

Our take? If such a chip did come out at 150 TDP, it's possible it would not be sporting six cores, but possibly eight cores. And what of Ivy Bridge-E? Previously expected by the end of this year, the LGA2011 version of Ivy Bridge is now expected early next year. **–GU**

Windows 8 Watch

Release Date, Pricing Known

In the last few weeks, we not only learned that Windows 8 will officially debut on October 26, but we also learned that an upgrade to Windows 8 Pro, via digital download, will cost current users of Windows XP, Windows Vista, and Windows 7 $40. In good news for early adopters, the upgrade will support the Release Preview of Windows 8, provided WinXP or newer was present on the machine at installation.

Contrary to earlier rumors, a full version of the OS *will* be available on a retail disc, for $70. Prices of both the online and retail versions are part of a promotion that ends January 31, 2013. It's not known what the prices will be thereafter. **–KS**

100W USB Power on the Way

One day you might very well have one power brick to handle all your charging needs. The specification for USB Power Delivery has been ratified, meaning that within a year, you might be able to charge your laptop, external hard drive, and any device needing up to 100 watts, over a standard USB cable.

USB Power Delivery will deliver up to 7.5 watts over existing cables and up to 100 watts with newer cables that are Power Delivery aware. The aim with USB Power Delivery is to eliminate piles of power bricks that are thrown out every year, by giving consumers a universal means of charging their devices. **–GU**

Tom Halfhill
Fast Forward

BEYOND MOORE'S LAW

WHAT HAPPENS when Moore's Law hits the wall? It must happen eventually. And the effects will be as earthshaking as the advent of integrated circuits in the early 1960s.

First, let's be clear that Moore's Law will not expire anytime soon. Although we already trail the curve that Gordon Moore described in 1965 and revised in 1975, the component density of integrated circuits continues to double approximately every 24 months. Ignore the dire predictions that Moore's Law will soon become a relic, like the Code of Hammurabi. True, the future looks fuzzy beyond eight years or so. But then, it always has.

In any case, Moore's Law will not die suddenly. It may even experience a renaissance if a radical new technology (such as carbon nanotubes or quantum computing) becomes practical. But when progress inevitably levels off, what then?

Watch out, programmers! When hardware stops delivering the wonderful gifts of performance we've enjoyed for 50 years, the pressure will shift to software. We've already seen the early effects of clock speeds hitting the power wall. As microprocessors compensate by adding more cores, programmers are tackling the complexities of parallel processing. When Moore's Law hits the circuit-density wall, programmers will have to find more performance by optimizing their code.

Of course, programmers tune their code today, but usually not much. Hardware stasis will bring a new urgency to code optimization that we haven't seen since the olden days, when skilled coders scrounged to conserve every byte and clock cycle. Better tools will help.

So don't worry. The flatlining of Moore's Law will not kill the computer industry, but it will enforce more discipline on programmers and reduce our expectations.

Someday, we will celebrate a 1 percent performance boost as we do an Olympic athlete who breaks a world record by 1/10 of a second.

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

Thomas McDonald
Game Theory

A $5,000 'FREE LUNCH'

EPIC'S TIM SWEENEY says it's the next big thing. After Crysis 3, Crytek is focusing on it exclusively. John Riccitiello and Peter Moore (EA), Yves Guillemot (Ubisoft), and American McGee are saying it has a bright future. The verdict is in, and "free-to-play" is the new black.

When Peter Moore gets excited about something, it's time to make sure you have a good hold on your wallet, because it's about to get picked. You want to know what has John Riccitiello pumped? The realization that some gamers are paying $5,000 a month to pay the "free" FIFA Ultimate Team.

What the money men are looking at is something called ARPU, which is "average revenue per users," and it's much, much higher for freemium games. You ever look in the App Store for the most *profitable* iOS games? Ever notice something? They're all "free."

Gamers are paying more, on average, to play for free than they do for $60 SKUs. This is because the costs tend to be hidden and the expenses creep up on you. A buck here, five bucks there; a little horse armor here, a new character set there: Each microtransaction feels fairly small, and thus lowers the consumer's natural psychological resistance to spending large amounts of money. But each of those transactions adds up very quickly. People pay more per user on freemium than they do on premium because they're being manipulated.

Gamers get committed, and then rather than reaching a single tipping point and investing once in a game, they make repeated, impulsive choices to repeatedly invest smaller amounts, often losing track of just how much they've spent. As Riccitiello observed to shareholders, "When you are six hours into playing Battlefield and you run out of ammo in your clip and we ask you for a dollar to reload, you're really not that price sensitive at that point in time."

Just stand back and soak in the crass manipulation of that statement, and then tell me with a straight face that F2P is good for gamers.

You can follow Thomas McDonald on Twitter: @StateOfPlayBlog.

Valve Hedges with Linux

Valve is hard at work porting its Steam client to the Linux platform. Not because the company has developed a sudden affinity for the open-source space, but because Valve sees the upcoming Windows 8 release as disastrous for the PC industry at large. At least that's the viewpoint held by Gabe Newell, cofounder and managing director at Valve. Newell expressed his sentiments at Casual Connect, an annual videogame conference in Seattle: "We want to make it as easy as possible for the 2,500 games on Steam to run on Linux as well.... I think Windows 8 is a catastrophe for everyone in the PC space.... If that's true, then it will be good to have alternatives to hedge against that eventuality." **–PL**

Amazon Phone Rumors Swirl

First came word that Amazon was collecting patents as part of its upcoming smartphone strategy, followed by chatter that Amazon is currently testing what it hopes to be a game-changing device. Then a *Wall Street Journal* report citing "people familiar with the situation" pegged mass production of the smartphone for later this year, or possibly early 2012.

Unfortunately, most details are still nonexistent. Nobody seems to know exactly how large the screen will be (one of *WSJ*'s sources says between 4 and 5 inches), what kind of processor Amazon plans to use, or other hardware specifics. We do know Amazon will face fierce competition, not only from the upcoming iPhone 5, but also from a bunch of low-cost Android devices. **–PL**

OCZ on the Auction Block?

Folks wondering why the two biggest players in mechanical hard drives have yet to seriously tackle SSDs might be interested to know about rumors alleging that Seagate and Micron are considering buying OCZ.

Seagate is said to be the most likely buyer. Fudzilla was the first to report that OCZ may be on the market; Reuters ran with the story and got FBN Securities analyst Shebly Seyrafi to pony up support: "I'm hearing the same rumors.... I can only say that after the last quarter, when OCZ's cash situation became more challenging, they would be more willing to enter into a deal."

Bloomberg reports that OCZ's quarterly results were disappointing, partly because of cash flow woes and issues stemming from the supply chain. At times, OCZ was rumored to be simply unable to afford to build SSDs at pace with demand. Seagate's massive pull and mountains of cash could help prevent those types of problems going forward, while the benefits OCZ would bring to Seagate (or anyone else, for that matter) are fairly obvious.

The current stock market price tag for OCZ is hovering around $375 million after a rumor-fueled spike in share prices. Fudzilla expects Seagate to offer much more than that for the company. It also says OCZ will continue to operate as a separate brand or company if purchased. **–BC**

Quinn Norton
Byte Rights

LONDON 2012 GAMES YOUR RIGHTS

IF YOU WANT to see what a 1980s cyberpunk dystopian novel looks like in real life, you can't do much better than this summer's Olympic games in London.

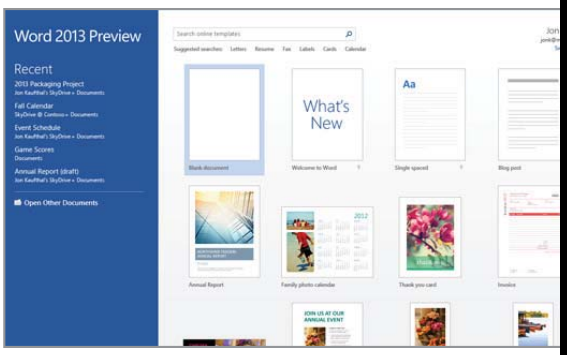
The International Olympics Committee requires host countries to pass special laws that put draconian intellectual property barriers around the organization and its customers, its corporate sponsors. These barriers are both legal, and in the case of huge swaths of London for the five weeks of the summer games, physical. It's hard to match the brilliant insanity of Gibson or Stephenson, but even they never came up with anything quite as perverse as the London Brand Exclusion Zone: an area where no brands that hadn't paid the IOC could appear, under pain of criminal prosecution.

These measures are all about preventing what's called ambush marketing—when companies that haven't paid steep sponsorship fees essentially photobomb the games for publicity. There's been a lot of sneaky sports marketing in the last 15 years, but to discard the fundamental freedoms of the people seems outrageous, excessive, and a terrifying precedent.

These rules not only trumped speech, they turned wandering around in the zone with a nonapproved clothing brand or even snack food into a crime—should the IOC's special patrols of branding police choose to prosecute. They also applied to words and phrases the IOC laid claim to this season, which included "London" and "2012". IOC also worked with Twitter to make sure no ads looked Olympic-branded, and made posting your Olympic games pictures to Facebook a crime. I don't like to trot out Orwell, because it's the Godwin's Law of digital-rights conversations, but when you censor the web, threaten to criminally prosecute people for using the name of the city and year, and hire specialized police to bust people for drinking Pepsi in Coke-sponsored territory, you're asking for it: Orwellian.

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

Microsoft's Modern Office



Microsoft has made a "customer preview" of Office 2013 available for download (office.com/preview), giving anyone who's interested a glimpse into the changes the suite has in store. One of the most notable differences is Microsoft's approach to Office as a service as opposed to a software package, something Steve Ballmer emphasized in his announcement of "the new, modern Office." Office 2013 will still be available on disc for installation on a local client, but expect to hear even more about the Office 365 subscription plan, which will come in home, small business, and enterprise flavors. A Home subscription includes multiple installs across multiple devices and tosses in 20GB of SkyDrive storage and 60 minutes of Skype world service a month.

The subscription Office suite caters to a mobile lifestyle, with SkyDrive being central to making documents and programs accessible from any Internet-connected device. Touch will also figure prominently when Windows 8 comes out. Microsoft is demonstrating a new approach to compatibility, as well, with Office 2013 and Office 365 only available to Windows 7 and Windows 8 users. **–KS**

Group Forms to Defend Internet Freedom

Critics say the collective interwebz can never again generate as much political pressure as it did in the days leading up to the SOPA/PIPA votes. A new organization called the Internet Defense League hopes to prove them wrong. Many of the major forces behind the SOPA Blackout have already signed on.

The idea is simple: Websites that sign up to join the IDL will be sent a snippet of code to publish whenever a new threat endangers the Internet. If the website owner decides to publish the code, the warning message is broadcast on his or her website. Done!

"Think of it like the Internet's Emergency Broadcast System," the IDL's website proudly proclaims. The EFF, Wordpress, Mozilla, Reddit, the Cheezburger Network, AccessNow, TechDirt, Grooveshark, Fark, Tor, Free Press, TorrentFreak, Public Knowledge, Open Congress, BoingBoing, and plenty more are already on board. **–BC**

LG, Others Settle LCD Price-Fixing Suit

LG Display, AU Optronics Corp., and Toshiba Corp. have agreed to pay a combined $571 million in damages to settle a class-action lawsuit alleging the three were involved in a scheme to artificially drive up the price of liquid crystal display (LCD) panels. That's on top of over $550 million collected from seven other manufacturers earlier in the year, which tallies up to over $1.1 billion in class-action penalties.

Of the three defendants in this latest settlement, LG will pay the most, forking over $380 million in damages. Joseph Alioto, a leading attorney in the case, calls this "the largest consumer class-action price-fixing settlement ever." The case dates back several years to when nearly a dozen companies allegedly held secret meetings in hotel conference rooms, tea rooms, and karaoke bars in Taiwan to inflate LCD panel prices. **–PL**

THE LIST

8 CRAZY THINGS WE SAW AT COMIC-CON THIS YEAR

8 EARTHWORM JIM

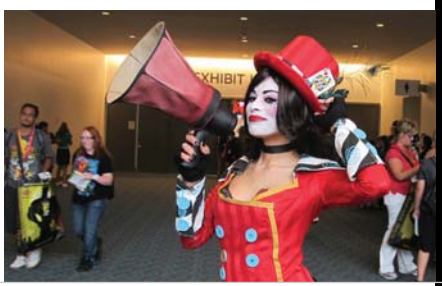
We found this fellow on his way to rescue Princess What's-Her-Name.

7 A BLINGED-OUT STORMTROOPER

Don't be fooled by the rocks that he got; he's still (he's still) a chip off Jango's block.

6 AN ARENA RINGLEADER

Borderlands' Mad Moxxi wants to see you fight. Preferably to the death.



5 A WORLD TRAVELER

This guy was surprisingly easy to spot.

4 THE HEAD OF APERTURE SCIENCE

Cave Johnson here, reminding you that roughly 40 percent of these cosplayers are actual aliens.

3 A WINDOWS-POWERED BOOTH

Hey, look, something PC related!

2 A SCIENTIFIC LEGEND

Astrophysicist Neil deGrasse Tyson, looking thrilled to meet Senior Editor Nathan Edwards.

1 THE COSPLAY COMBO DEAL

This Steampunk Female Joker wins the Inevitable Fandom Convergence Award, and thus all of Comic-Con.

HEAD TO

BY GORDON MAH UNG

Thunderbolt vs. USB 3.0

Intel's long-awaited Thunderbolt has finally arrived on the PC after being exclusive to the Macintosh platform for more than a year. With its promise of 10Gb/s-per-channel throughput, what self-respecting power user wouldn't opt for a Thunderbolt-based external backup solution? Well, before you get too excited, let's compare T-bolt point-by-point with its natural competitor, USB 3.0. After all, there's more to a technology than pure performance, as we found out.

Round 1: Specsmanship

Intel created USB in the 1990s, and it has been an amazingly revolutionary technology. USB has scaled from 12Mb/s at its inception to 5Gb/s today with relatively minor road bumps, and is now basically "free," as it's included on Intel's and AMD's chipsets. Still, when you play the specsmanship game, it's hard not to fall in love with Intel's newest child: Thunderbolt. SuperSpeed USB 3.0's theoretical 5Gb/s, or 640MB/s, looks impressive until you notice that Thunderbolt can move 10Gb/s over its copper interface. Oddly, the 10Gb/s speed is actually a misrepresentation. Thunderbolt can move 10Gb/s per channel. Since it has two channels, it can actually hit 20Gb/s. That means Thunderbolt theoretically moves 2.5GB/s if you don't account for overhead. Why not call it 20Gb/s? Intel doesn't want to brag, apparently.

Winner: Thunderbolt

Round 2: Price

You know what's incredible about USB 3.0 today? It's practically free. It comes baked into chipsets from both AMD and Intel, and even when it's not native, host controllers cost just two bucks. Thunderbolt's pricing, on the other hand, is crazy expensive. At least we think so; we don't know how much the controllers—all made by Intel—even cost. Early on, one vendor told us $200, which is insane. Other board makers have since told us that T-bolt chips cost about $30. Whatever the cost, the fact is that basic boards with Thunderbolt cost about $60 more than similar boards without it. Let's not even get into the cables, which today cost $50 for a basic 2-meter span. By a country mile, USB 3.0 wins this category, and we can't see that changing for the foreseeable future. Did we mention that Thunderbolt cables cost *$50*?

Winner: USB 3.0

Round 3: Ubiquity

USB ports are so common, they're in cars and wall plugs and are as ubiquitous as an AC outlet these days. Have to bring a boatload of data to your friend's house? Just unplug your USB 3.0 cabinet and bring it with you. Even if he doesn't have USB 3.0, you can still access your data via USB 2.0. That's not the case with Thunderbolt, which is extremely rare even on the Macintosh platform, where it's been supported for more than a year. If you want to lug your project on your Thunderbolt drive to your friend's house, you'd better bring your computer too, because he or she likely doesn't have Thunderbolt. Hell, by the end of 2012, Intel is hoping that we'll have 100 devices that support Thunderbolt. There are likely 100 USB 3.0 devices made in just burnt umber alone.

Winner: USB 3.0

Round 4: Implementation

Why is Intel wielding iron-fisted control over Thunderbolt instead of releasing it to the world? We believe the company is trying to fast-track the technology by using a unilateral approach to bypass the usual rule-by-chaos that's so common to committee-driven standards. Look at Bluetooth, Wi-Fi, and even early USB adoption as examples: Incompatibility raged for years. Even so, Thunderbolt isn't perfect. We could not hot-plug our Thunderbolt device without hardlocking the system. So, epic fail? Not really. USB 3.0 really hasn't been smooth-as-silk, either. Coaxing the highest performance out of USB 3.0 is not easy. And with more than a half-dozen USB 3.0 host-controller makers, the performance and reliability can be irregular. Even the board we used for our performance tests, Asus's P8Z77-V Premium, gave us two USB 3.0 controllers, each with its own modes to enhance speed.

Winner: Tie

The Promise Pegasus R4 RAID cabinet offers blistering speed—if you have a Thunderbolt port and $1,000.

If equipped with the same four 1TB drives, the Startech USB 3.0 RAID Tower would cost about $780 but would let you run the ubiquitous USB 3.0.

Round 5: Performance

Let's be frank: It's hard to make a definitive judgment about the performance of either the Thunderbolt or USB 3.0 interface based on our speed tests alone because of all the variables inherent to the hardware. Even so, it's obvious to us that Thunderbolt is wickedly fast. The ATTO benchmark clocked the Promise Pegasus R4 reading files in the 936MB/s range. We could literally copy 16.9GB of files to the R4 configured with SSDs in 23 seconds. Our gut says there's likely a lot more headroom left in Thunderbolt, too. USB 3.0 didn't impress us as much. The Startech cabinet was allergic to our OCZ SSDs. Performance wasn't stellar, but it wasn't horrible either. USB 3.0's speed is actually very respectable, but Thunderbolt clearly has the edge in pure performance.

Winner: Thunderbolt

And the Winner Is...

Yeah, we know, no one likes a **tie**, but to recommend one technology over the other at this point would be wrong. If you need performance external storage for video editing, photo editing, or other storage-intensive needs, Thunderbolt rules. It's over, right? Hands down, performance wins? Not quite. Ubiquity really matters in this world. As we said earlier, the inability to just grab your data and go to work at a friend's or colleague's without wondering if Thunderbolt is available is a major ding. Thunderbolt pricing is also at a premium, but really not quite as over-the-top as we expected. We acknowledge that T-bolt has other interesting configurations, but we think its primary purpose today will be for storage.

One thing is clear: The showdown between USB 3.0 and Thunderbolt isn't over. And as much as their respective proponents deny that the two interfaces even compete, we think both are headed for a major clash down the road.

SPECIFICATIONS

	Promise R4 w/4 SSDs in RAID 0 on Thunderbolt	Promise R4 w/4 HDDs in RAID 0 on Thunderbolt	Startech w/4 HDDs in RAID 0 on USB 3.0
CrystalDiskMark 3.01 Read / Write (MB/s)	**402 / 540**	357 / 500	267 / 247
AJA Video Systems Benchmark Read / Write (MB/s)	**622 / 732**	508 / 685	255 / 227
ATTO Disk Benchmark Read / Write 8MB file (MB/s)	**939 / 831**	936 / 417	265 / 254
Time to write 16.9GB of data (sec)	**23**	55	110

Best scores are bolded. Our test system used an Asus P8Z77-V Premium board with a Core i7-3770K, 32GB of DDR3/1600, Windows 7 Professional SP1, on a WD 150GB Raptor. Four 1TB Hitachi HDS72101 HDDs were used to test the Promise R4 and Startech USB 3.0 RAID enclosures. The Promise R4 was also tested with four OCZ 240GB SATA 6Gbs SSDs in RAID 0. File-write performance copied 16.9GB of Steam games from a 26GB RAM Disk with 5GB/s read speeds.

DOCTOR

THIS MONTH THE DOCTOR TACKLES...

> Trash Collection in RAID
> Upgrading Old Cases
> When to Upgrade

Did AOE3 Kill My PC?

My brother bought an MSI Radeon HD 6670 GPU. He was playing Age of Empires III one day and decided to turn on antialiasing. His screen went black and the picture never came back. We have tried rebooting, but it still won't come back. Could AOE3 have messed up his GPU somehow?

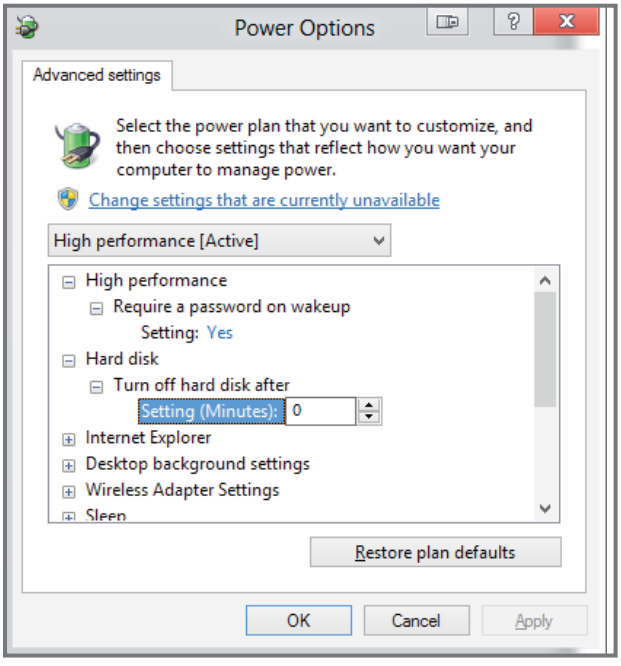
—Bryon D. Jones

THE DOCTOR RESPONDS: There's really no reason that switching on AA in a game should kill a card. There are AA image-quality issues reported with AOE3 and certain AMD drivers, but nothing that should keep the display from coming back at all. Occam's Principle of Limited Imagination tells us it's likely that some unrelated part of your machine blew up. You should try to first clear your CMOS. With the machine powered down and unplugged, look for the CLR CMOS switch or jumper on your motherboard and use something metallic to bridge the connection. If you can't find the jumper or switch, just remove the coin-cell battery on the motherboard for 10 seconds, replace it, and boot your machine. If that doesn't work, start looking for a power connector that slipped loose—or perhaps the GPU itself worked loose. If it wasn't properly seated in the first place, it could have jostled loose at that moment. Check the 24-pin main power connector, as well as the ATX12V connector and the RAM. This may sound dumb, but also check the video connection to the monitor and the power connection to the monitor. You should also rule out that the monitor itself hasn't gone kaput.

Taking Out the Trash

In my last rig, which was built in 2009, I went with two 128GB SSDs in RAID 0. This was purely for economic reasons—the price of a 256GB SSD was out of my range. I would like to see a discussion as to the pros and cons of a 512GB SSD versus two 256GB SSDs in RAID 0. I know you give up the Trim command if you build a RAID. Are the current trash collection routines sufficient to overcome the stutter issues?

—James Stachowski



Prevent your hard drives from shutting off when your computer is idle to allow garbage collection to take place.

THE DOCTOR RESPONDS: A RAID 0 of two 256GB SSDs will be roughly twice as fast as a single 512GB SSD from the same line, but you're also doubling your chances of a drive failure wiping out your system. Of course, SSDs are less likely to have a mechanical failure than HDDs, but they can and do fail. So if you're running a RAID, be sure to back up regularly.

Although some RAID controllers can now pass Trim commands to member drives, you'll probably have to rely on your drives' native garbage collection. Most drives do their garbage collection routines while the computer's idle, so make sure your computer isn't set to sleep too quickly and your drives aren't set to turn off too quickly when idle, either. Go to Power Options and select High Performance, then "Change plan settings." Go to "Change advanced power settings," and under Hard Disks set the "Turn off hard disk setting" to 0 (never). This will allow your drives to perform garbage collection when the computer is idling.

↘ submit your questions to: doctor@maximumpc.com

Modern Amenities in an Old Case

I recently upgraded my old Core 2 Duo-based PC to a brand-new Ivy Bridge CPU using Gigabyte's GA-Z77X-UD5H motherboard. The case is a Gigabyte 3D Aurora 570 (which got a 10 Kick Ass, April 2007). The build was a snap, but I'm having trouble getting some modern accessories to work in a 5-year-old case. First, the motherboard shipped with a 3.5-inch front-panel USB 3.0 kit. The kit has two plastic arms for the sides, with screw holes for mounting in the drive bay. The case uses clamps to hold the drives in place, and when I tried to mount the panel, the plastic arms simply squeezed in and wouldn't hold in place.

I added a Kingston HyperX SSD during the upgrade. It came with a mounting plate to fit in a 3.5-inch drive bay, but the plate is too short to use with the case's rails and is just hanging loose in the drive cage. What are the best ways to adapt these parts to the case's nonstandard mounting method?

—Steve Latta

THE DOCTOR RESPONDS: Your best bet for the 3.5-inch USB 3.0 kit might be to use a 3.5-inch-to-5.25-inch bay adapter that uses actual screws rather than the screwless clamps, unless those clamps are removable. We tend to like the Silverstone FP55, which also happens to have mounting holes for two 2.5-inch drives, neatly solving your other problem, as well. It'll run you about $15.

Stay or Raise?

I am running an Intel Core 2 Duo E8400, 4GB of DDR2/800, a GeForce 550 Ti, and a 300GB VelociRaptor, all on an Asus P5N-T Deluxe motherboard. I am short on cash right now, but I plan on doing a complete overhaul next year. What can I do now to upgrade my current system for better gaming performance without going overboard? I have about $200 I could use to upgrade now, or I could just save it for a later upgrade.

—William Carver

THE DOCTOR RESPONDS: It's a little tough for the Doc to make recommendations without knowing what games you play and at what resolutions. Your Core 2 Duo Wolfdale, with its 3GHz base clock, is actually still a good processor for many games. The Wolfdale is also a good overclocker, and you can squeeze an extra 500MHz out of it fairly easily. That will help a bit if the games you play are CPU-bottlenecked. Most games are still optimized for two cores, but more and more games are starting to support quad-cores and up, as well as newer microarchitectures.

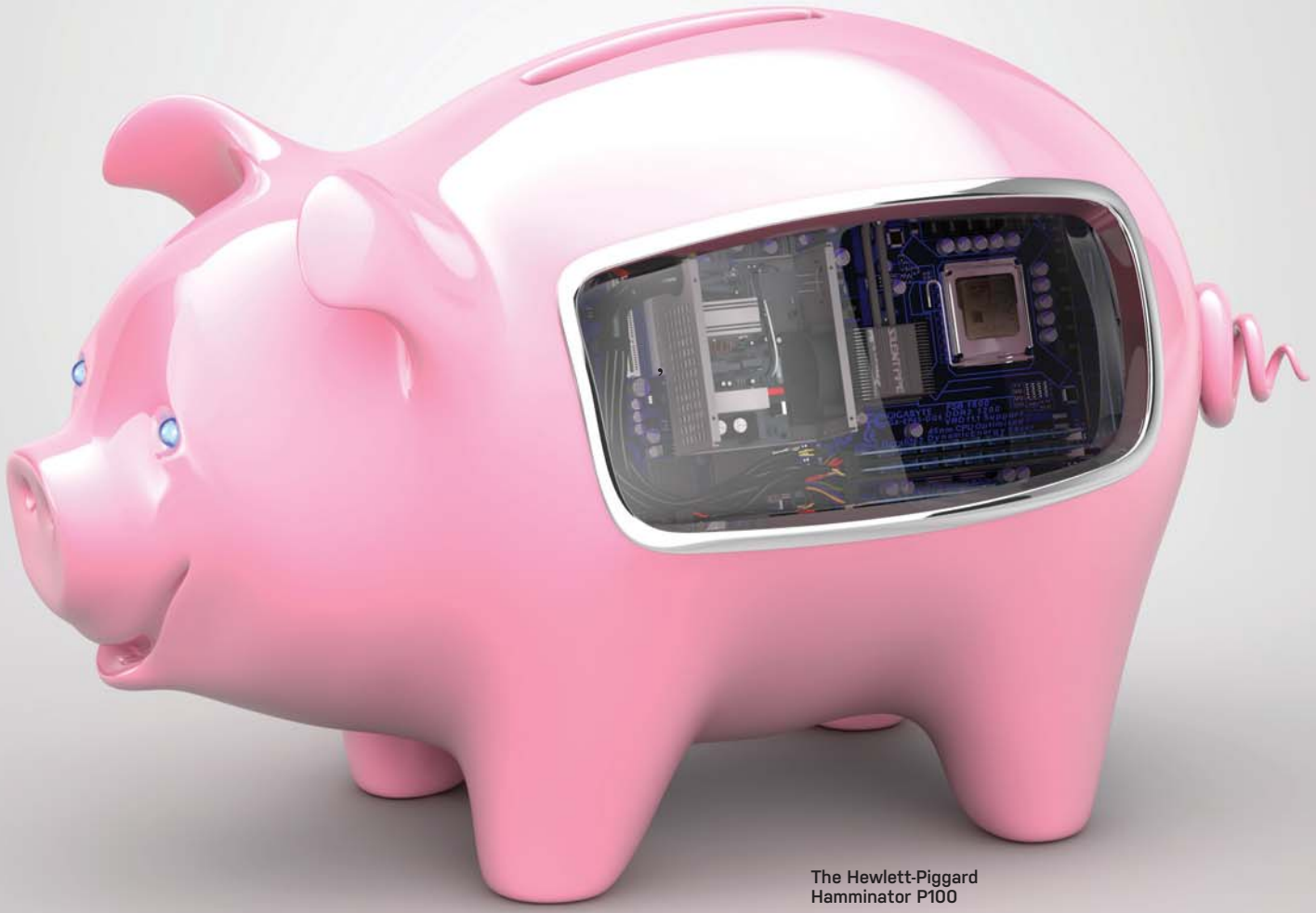
The vast majority of new games are bottlenecked by graphics these days, especially at higher resolutions with visual-quality settings turned up. In your case, adding a second GeForce 550 Ti should get you the best bang for the buck. You can get a second GeForce 550 Ti for as little as $120. This will help if your gaming is limited by your GPU and you must have more now. The only issue with this route is that you're throwing money at something that may not cut the mustard for you next year when you do a full upgrade, so choose wisely.

[SECOND OPINION]

SSD Kludge-Around

I had a situation virtually identical to Mr. Schafer's ("Room for an SSD?", August 2012). I wanted to add SSDs to my Dell XPS 8300, in which all of the SATA ports were occupied. I tried your solution of an add-in SATA card (a HighPoint Rocket 620), but found that when it was in place it was not possible to access either the BIOS or the boot menu on my computer, even without any hard drives connected to the add-in card. No matter how often or how fast I pressed the appropriate keys during boot, they were ignored and I would invariably go to the OS (I'm guessing that the card's BIOS was somehow intercepting or blocking the keystrokes). My eventual solution was to run an eSATA cable from its external connection back into the innards of the computer, connecting it to one of my HDDs. This freed up a 6Gb/s port on the motherboard for the SSD. A major kludge, but it works fine, and the computer is much faster. It was definitely worth the hassle.

—Robin Lake



The Hewlett-Piggard
Hamminator P100

COMPUTING ON THE CHEAP

BY THE MAXIMUM PC STAFF, ALEX CASTLE, BRAD CHACOS, AND PAUL LILLY

IT (LITERALLY) PAYS TO KNOW ALL THE CRAFTY WAYS YOU CAN SAVE MONEY WITHOUT SACRIFICING YOUR POWER USER CRED

AS MUCH AS WE LOVE ogling top-of-the-line PC hardware and fantasizing about price-be-damned rigs, we also love, love, love to stretch a dollar. Does that make us cheapskates? You betcha, if that's what you want to call someone who doesn't pay a premium when he or she doesn't have to. Sign us up! In fact, where computing is concerned, knowing all the various angles to save a buck—a buck that can then be put toward new and better gear, mind you—is as much a part of being a power user as knowing how to flash a BIOS or overclock RAM. If you're currently spending top dollar on your PC activities, it's time you got schooled in the fine art of penny-pinching. From free software alternatives, to the best deals on all forms of digital entertainment, to hardware-buying tips, to our blueprint for a $600 PC, this year's Cheapskate's Guide can save you thousands of dollars and make you a more savvy consumer in the process.

SAVE ON SOFTWARE

WHY PLUNK DOWN CASH WHEN YOU CAN HAVE THESE OUTSTANDING FREE ALTERNATIVES?

The sad truth about building a PC is that you never end up sticking to your budget. Even if you manage to resist the temptation to splurge on an extra SSD, you're going to hit the point where your brand-new system is assembled and ready for action—just as soon as you buy some software. First you shell out for the operating system, then some office software, then a security suite. Before you know it, your budget is ancient history and you're taking out a second mortgage to pay for Photoshop.

Well, it doesn't have to be that way. Here are some excellent free software options that can take the place of pricey commercial applications.

AV: MICROSOFT SECURITY ESSENTIALS

It's getting harder and harder to justify paying for an antivirus suite, now that Microsoft offers its own capable AV solution. Microsoft Security Essentials provides real-time system scanning, Windows Firewall integration, and rootkit protection, all for the unbeatable price of zero dollars. We say slap it on any new system, and leave paying for AV to the idle rich. http://windows.microsoft.com/MSE

FILE BACKUP: SYNCBACK FREEWARE

You know all those photos you have on your hard drive? Priceless reminders of family vacations and childhood memories? Well, it would be a real shame if something happened to them.

No, we're not trying to shake you down—this is just a reminder that you should be using software to automatically back up any file you're not prepared to lose. SyncBack Freeware is a great choice for backing up and synchronizing your valuable files, automatically. If you want to go a step further and clone your whole drive, our standing recommendation is Macrium Reflect (www.macrium.com/reflectfree.aspx). www.2brightsparks.com/syncback/index.html

OFFICE SUITE: GOOGLE DOCS

In the past we've recommended Open Office (or its descendant, LibreOffice) as the best free replacement for Microsoft Office, but we think it's time for a change. Let's all admit to ourselves that much of what we currently do using software on our hard drives will, in the next few years, move over to the cloud. Office software has been some of the first to make the transition, and nowadays there's no reason you can't use Google Docs as your everyday productivity software.

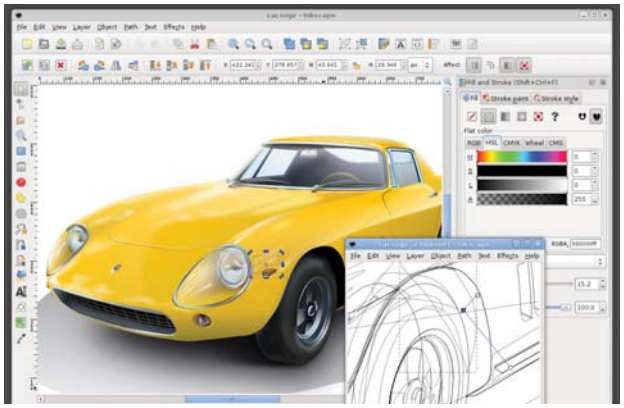
Google Docs can create and edit documents, spreadsheets, presentations, and forms. It's also a great way to collaborate remotely, as multiple people can log in and work on shared documents simultaneously. http://docs.google.com

PHOTO EDITOR: GIMP

There's still only one truly good replacement for Adobe's versatile-yet-oh-so-expensive Photoshop, and that's GIMP. The Gnu Image Processor (for long) is open source, free, and has all the tools you need to spruce up your photos, do a little image manipulation, or add some LOLtext to a picture of a cat. If the built-in features aren't enough for you, there's an extensive library of scripts and add-ons available online that should provide what you need. www.gimp.org

VECTOR EDITOR: INKSCAPE

GIMP can help you with any raster (that is, pixel-based) editing you do, but it's no good for creating vector-based images. Vector images, which can be smoothly scaled to any size, are the perfect format for company logos or any other illustration that you want to be able to use over and over again. Adobe Illustrator is the standard application for



vector editing, but like all professional Adobe software, it's very expensive. Instead, take a look at Inkscape. Inkscape is yet another product of the open-source scene, and it has all the tools you need to create great-looking, high-quality vector graphics. http://inkscape.org

DESKTOP PUBLISHING: SCRIBUS

Finishing off the trifecta of open-source design apps is Scribus, which lets you take all those graphics you've created in GIMP and Inkscape (along with any text you've written in Google Docs), and lay them out on a page for publishing. Whether you're putting together an e-book, a magazine, or just the family newsletter, a desktop publishing app like Scribus is the best way to create a professional layout that you can reuse whenever you want. www.scribus.net

ADOBE SOFTWARE FOR $30

If you're a creative professional, you know that Adobe programs like Photoshop, Illustrator, and Premiere are the industry standard for a reason. They are streamlined, well documented, and incredibly powerful. They are also, unfortunately, incredibly expensive. There's an inexpensive Elements version of Photoshop and Premiere available, but if you need access to the professional-level Creative Suite for personal projects or freelance work, you could be out $1,000 or more in startup costs. Or, you could spend $30.

Starting this year, Adobe is offering full versions of all its Creative Suite software on a rental basis, so if you need Photoshop for a certain project, you can simply rent it for $30 a month with a one-year subscription. If you're sad that you don't get to keep it when you're done, just pop a bottle of champagne and console yourself by rolling around in all the money you saved.

VIDEO EDITING: LIGHTWORKS

For a long time, nonlinear video editing software was something you just couldn't really get for free. Microsoft's Windows Live Movie Maker is free, and can be a good option for very basic video editing tasks, but if you're looking to put together anything more complicated than a simple home video, it just doesn't have the feature set you'll need. Other than that, you're pretty much out of luck. There's Blender, which is free and actually has a fairly powerful sequencer, but something just feels off about doing our video editing in a 3D-modeling application. There have also been a number of high-quality open-source video editors in Linux, but those haven't been of any help in Windows. Until now, that is.

Earlier this year, professional video editing software Lightworks

went open source, and released a free version for Windows. The software was formerly a professional film-editing suite (*The King's Speech, The Departed,* and *Braveheart* are just a few films that were edited in Lightworks), and therefore has a pretty steep learning curve. Additionally, only a handful of codecs are supported for importing footage, unless you upgrade to the Pro version, which is offered for only $60. Even with those caveats, Lightworks is hands-down the most powerful video editing suite you can get for free. www.lwks.com

DVD PLAYBACK: VLC

If you bought an optical drive to play movies, but don't have a copy of playback software like Cyberlink PowerDVD, you might think you're out of luck. But don't take out your wallet just yet—if all you need is bare-bones video playback, VLC might be just right for you. The free, open-source player can handle pretty much any digital video file, as well as video DVDs. Blu-ray playback is also possible in VLC, although you'll need to do a little Googling if you want to watch copy-protected discs. www.videolan.org/vlc/index.html

OPERATING SYSTEM: UBUNTU

If you've gotten this far in your hunt for free software, it might be time to think about going all the way. That's right—the ultimate in free computing: Linux. Nearly every program mentioned so far started as a Linux application before being ported to Windows, and there are still more free software packages that aren't available on Microsoft's OS.

If you're ready to get started with Linux, you'll want to create an Ubuntu Live CD from the website. Ubuntu's the most user-friendly Linux distro, and the easiest to get started with. Once you've downloaded the installer, just burn it to a CD, put the disc in your drive, and restart. When your computer boots from the live CD, you'll be able to try out Ubuntu and see how you like it. If you want to go all the way, you can install the full operating system to your hard disc.

Linux is great for productivity applications, but it doesn't always have an equivalent for your favorite Windows applications. You can use WINE (www.winehq.org) in Linux to run most Windows applications natively. www.ubuntu.com/download/desktop

FREE CLOUD STORAGE

Cloud storage solutions are cheaper and more numerous than ever before, with several contenders just begging to give you something for nothing. But what if one service and 5GB isn't enough for your vast collection of J-Pop and Klingon poetry? Pay attention, young Padawan: We'll show you how to get the biggest bang from your lack of bucks when choosing a free cloud service.

Microsoft SkyDrive - Old-skool SkyDrivers are sitting pretty on 25GB of free cloud storage, but new users are "limited" to 7GB. Even so, that's more than the competition offers, and SkyDrive hooks deeply into the native apps found in both Windows Phones and Windows 8. SkyDrive lacks Android support, but it's the only cloud-storage service here with a Windows Phone app.

Google Drive - Google Drive offers 5GB of free storage and the same basic functionality as SkyDrive, including the ability to edit documents with others in real time through your web browser. We prefer Google Docs to Microsoft's Office Web Apps, though, which makes Google Drive a great place to stash documents, spreadsheets, and slide shows.

SugarSync - SugarSync adds another 5GB of free cloud storage to your total, but more importantly, it syncs any folders of your choosing on your PC. The desktop clients of the other services mentioned here force you to stash your files in a predetermined location. That makes SugarSync a terrific option for a hands-off, constantly updated backup of critical folders, such as your Documents folder.

Dropbox - At first blush, Dropbox's free 2GB offer pales in comparison to the others, but a little legwork opens up a bountiful cornucopia of free storage. Using the Camera Upload feature and linking social media accounts earn you more space, but the big payoff comes in referring friends: Each referral gets you another 500MB, capped at a whopping 16GB of free additional space. Don't want to bug your pals? We've already explained how to game the system (bit.ly/exLt1r).

Add it all up and that's 22GB of free cloud storage. Plus, Dropbox doesn't impose size restrictions on files uploaded via the desktop client. It's ideal for large file dumps.

Box - Box is just a 5GB storage locker; it doesn't sync files, search text, or offer version histories. What it does do is frequently hold promotions for 50GB of free space. Through the end of 2012, if you sign into Box's app on a PlayBook, TouchPad, LG phone or tablet, or a Sony tablet or Xperia phone, you'll nab an additional 50GB for life. Files are still limited to 100MB in size, though. ADrive offers 50GB free without all the hoop-jumping, but its craptastic web-only interface and lack of mobile support make it more hassle than hurrah.

Grand Total: 44GB, or 119GB if you're a veteran SkyDrive user who hops on Box's 50GB offer. Not too shabby for nothing! Protip: With the exception of SugarSync, disable the services' desktop clients from running at startup to avoid needlessly tying up system resources.

F2P IS FTW

A GROWING NUMBER OF TRULY GOOD FREE-TO-PLAY GAMES HAS US GIDDY

The biggest story in gaming over the last few years has been the rise of the "free-to-play" business model, where publishers let gamers access the core game for free, then turn a profit off of optional microtransactions. There are just about a million F2P games available today, but only some of them are worth your time. Here are eight games that can be really, truly fun even if you don't pay a single penny.

TEAM FORTRESS 2

Valve's flagship team-based shooter went free-to-play just over a year ago, and it has become the perfect example of how to implement the business model. For the low, low price of absolutely nothing, you get the full game, with all characters and all maps. Any server, any game mode. Extra weapons allow for different play styles, but don't give an advantage, and can be unlocked without paying anything, if you're patient. If you've gone this long without playing Team Fortress 2, you're missing out—download it today. www.tf2.com

LEAGUE OF LEGENDS

You've probably heard of League of Legends. It's the biggest name in the new MOBA (multiplayer online battle arena) genre, and its growth has been nothing short of phenomenal. Recent usage figures

from XFire show League of Legends as the most-played online PC game. Period. *By a wide margin*. So what's the secret to LoL's success? Our money is on the extreme ease with which you can get into the game. At any given time, a balanced subset of the game's roster of 100-plus champions is available for free, and more champions can be unlocked by winning games. The competition's fierce, but you can go all the way to the top without spending any money. http://na.leagueoflegends.com

EVERQUEST 2

These days, if you look at the total number of MMORPGs, you'll find that at least 80 percent offer some sort of free-to-play option. Of these, there are two very distinct varieties. On one hand, you've got a vast expanse of same-ish Korean and Chinese MMOs with pretty graphics, grindy gameplay, and extortionist microtransactions. On the other, there's the Western MMO-in-decline—games that once used a traditional subscription business model, but have switched to free-to-play after subscriber numbers dwindled. Everquest 2 is a great example of the latter, with a generous free option (including the original game and six expansion packs), plus a monthly subscription model for those who want full access. www.everquest2.com

VINDICTUS

Nexon is the Korean publisher behind a slew of free-to-play games, including eight currently running MMOs in America and tons more overseas. Of all these, we

recommend Vindictus as the best Asian-style MMO for a Western audience. It's still a bit of a grind, but the combat is fun and fast-paced, and the dark, gritty graphics are absolutely gorgeous. http://vindictus.nexon.net/

COMBAT ARMS

If you're dying for a team-based modern military shooter, but don't want to shell out for the latest Call of Duty game, give Combat Arms a try. With CounterStrike-style action gameplay and a host of character and weapon customization options, this game should hold you over at least until Crytek's Warface is released in the states. One downside: Combat Arms uses the stingy microtransaction model favored by some Asian F2P games, where most items not purchased with real money disappear from your inventory after a set period of time. Our philosophy: If you work to buy something, you should get to keep it. http://combatarms.nexon.net/

TRIBES: ASCEND

Who wasn't a little surprised when the classic Tribes franchise was relaunched with the free-to-play Ascend? The game's multiplayer-centric nature makes it a good fit, and the free version has every bit as much running, flying, and exploding-disc-launching as any game in the series. Some important gear and classes have

to be unlocked, and gaining experience is slow going without paying money, but it is perfectly possible to enjoy the game for a long time without paying anything. https://account.hirezstudios.com/tribesascend/

AGE OF EMPIRES ONLINE

Age of Empires Online continues the trend of nearly forgotten, revered gaming franchises coming back as F2P games. The cartoony graphics might make you think that this is a watered-down casual, but the truth is that AoE Online is a full-featured, robust online RTS with great gameplay and a ton of customization options. You can play the full game with two of the four available civilizations for free, though you'll have to pay for extra civs and some advanced gameplay features. www.ageofempiresonline.com

WORLD OF TANKS

If you're looking for a more tactical take on the action genre, check out World of Tanks. By participating in team-based tank battles, you level up your crew and unlock and customize ever-stronger WWII fighting machines. It's hard to get to the very highest level of tank without purchasing an XP booster, but the gameplay is polished enough that even the low- and mid-level battles are a ton of fun. http://worldoftanks.com/

BEST OF ONLINE MUSIC

Buying songs through iTunes or Google's Play Store won't break the bank, but true cheapskates spin their songs using streaming music services. Anyone with an Internet connection and the willingness to endure a few ads can listen to millions of tracks for the low, low price of $0. Streaming music services are a dime a dozen these days; here are four that let you listen to the tunes you want, when you want them—in unlimited quantities—for even less than that.

SPOTIFY

Wait, isn't Spotify a premium streaming music service? Yep, but free subscribers can tap into all of Spotify's offerings in the desktop client, including the ability to make and share playlists or listen to any of the 16 million-plus songs in Spotify's catalog on-demand. The software even integrates songs stored on your local drives.

Recommended

STRONG SUITS

- Massive catalog of on-demand music
- Making playlists is easy
- Optional apps add a lot of features and functionality

WEAK POINTS

- Facebook login is required
- Lackluster radio stations
- Mobile listening is iOS-only and limited to lamesauce radio

GROOVESHARK

Grooveshark's user-uploaded tunes give it a gargantuan catalog with hit-or-miss audio quality and a dubious, lawsuit-luring legal footing that has already caused Grooveshark's apps to be yanked from all the major app stores. There are ton of different ways to find and listen to music, though. Unfortunately, the interface is fairly horrible.

STRONG SUITS

- Huge music catalog
- Includes unlimited on-demand, radio, playlist, and social listening options
- Upload your music collection to Grooveshark's servers, then stream it anywhere

WEAK POINTS

- Legal issues could close the service
- Variable audio quality
- No sanctioned mobile apps for major brands; must sideload apps from the Grooveshark website
- Free listeners limited to radio functionality on mobile devices
- Fugly, clunky interface

SLACKER RADIO

Slacker doesn't offer on-demand listening to freeloaders, only radio-style listening, but its library is 10 million-plus songs strong and the 200-plus stations are all curated by actual DJs for maximum awesomeness. Plus, freebie listeners get the same device support as paid subscribers, including mobile apps and home audio devices like Sonos, Sony electronics, and the Logitech Squeezebox. Yay!

STRONG SUITS

- Large song catalog
- DJ-curated radio stations
- Full device support for free listeners
- Polished, attractive interface

WEAK POINTS

- Smaller library than Spotify or Grooveshark
- Playlists and on-demand listening for premium subscribers only
- No rewinding and limited song skipping

TURNTABLE.FM

Turntable.fm shines by tickling your social bone. Up to five DJs take turns spinning songs for a "room," either using Turntable.fm's licensed music or uploading tracks of their own. Other users can hop into the room and listen to what all the fuss is about, up- or down-voting songs all the while. Oh, and did we mention the chat function and awesome customizable cartoon avatars?

STRONG SUITS

- Outstanding social aspects and visual style
- Great for discovering new music
- DJing and customizing avatars is just plain fun
- Dozens of rooms with varying musical themes...

WEAK POINTS

- ...but geez, there are a lot of electro/dubstep rooms
- U.S. only
- Limited licensed song selection
- Users have little say in what music plays

HOW TO GET FREE READS

It's great that e-readers make it possible to tote around a veritable library of books wherever we go. What's not so great is having to pay for all those tomes. Well, guess what? You don't have to. There are several ways you can satisfy your reading jones for free. Project Gutenberg (www.gutenberg.org) offers over 40,000 books in the public domain, giving you a great excuse to brush up on the classics. Free-eBooks.net showcases books by independent writers of both fiction and nonfiction, with Top 10 lists and member voting providing useful guidance. If you're an Amazon Prime member, you're eligible to borrow one e-book a month (with no due dates) from the Kindle Owners' Lending Library, which comprises more than 145,000 titles . And any Kindle owner, regardless of Prime membership, can borrow e-books from their local public library, if it uses the OverDrive system for online checkout. (For more info on this, see our February 2012 How To on the subject or visit www.overdrive.com.)

SAYONARA, CABLE OR SATELLITE

A SURFEIT OF FREE/CHEAP STREAMING OPTIONS HELPS YOU STICK IT TO THE MAN

A true cheapskate realizes that in today's age of low-cost broadband and high-quality video streams, paying $100-plus a month for cable isn't the entertainment necessity it used to be. But before you cut the cord, you need to know where to go to find what you want to watch. Let us be your guide!

First, a word of warning: Some streaming websites walk a gray, unlicensed legal line, offering a ton of very current content, but constantly playing whack-a-mole with copyright enforcement agencies. Malware can be a concern, too. We'll mention a few of the top options; if you choose to surf these gray areas, you do so at your own risk. The same goes for torrents.

Got it? Good! Let's get streaming.

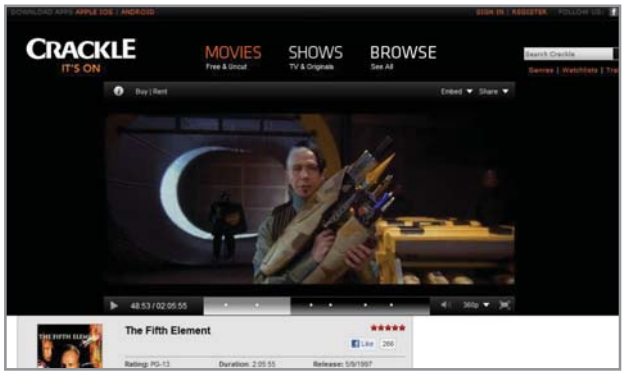
MOVIES

Cinema fans have the most options when it comes to cutting the cord, starting first and foremost with the 800-pound gorilla in the streaming video world: Netflix Watch Instantly. For just $7.99 a month—that's around a quarter a day, if you're counting—you can stream anything from the service's library as often as you want. Finding newer releases is a bit hit-or-miss, but Netflix nevertheless has a tremendously deep movie catalog full of interesting titles, along with robust device support, 720p HD video, and 5.1 surround sound, to boot.

Crackle has also been rocking our socks in recent months. The Sony-owned venture is completely free and jam-packed with over 300 kick-ass movies, with a focus on sci-fi, action, comedy, and horror flicks. Plus, Crackle is available on a ton of devices, including iOS and Android, Sony electronics, Roku, and the Xbox 360. New titles are nonexistent, though, and the SD streams are a bummer during full-screen viewing.

If you're a fan of classic movies, Entertainment Magazine Online (EMOL.org) streams a cornucopia of films made prior to 1970.

CinemaNow, iTunes, and Amazon Instant Video are pricier à la carte options for movie rentals or digital purchases. Spending a fiver on a movie rental doesn't seem too bad, but it can add up quickly over the course of a month. On the plus side, these services carry virtually every title you can think of, with most available in HD.



Crackle's catalog is packed with awesome action, comedy, and genre movies, and it's free.

TV SHOWS

The services discussed in the movie section apply here, too. The à la carte options also sell TV episodes; Crackle is a good source for older sitcoms, original content, and anime; and Netflix Watch Instantly has a ton of television offerings, most notably its wide collection of children's cartoons and documentaries.

Speaking of documentaries, check out DocumentaryStorm.com, a killer site that adds a new documentary every day. Many come embedded from high-quality sources like National Geographic, PBS, TED, and VICE.

Of course, there's always Hulu. Hulu carries several recent television shows, with new episodes often appearing the day after they air on cable. The coverage has gaps, however, and ABC, NBC, Fox, and Comedy Central supply a lot of the content. Numerous older shows are also available. The base version is free, but it forces you to watch shows only on your PC and only in standard definition. Upping to Hulu Plus for $7.99 a month unlocks device support and HD streams. Every flavor contains ads.

TV-Links.eu is one of those questionable "gray area" websites, but it's been around forever and streams a huge selection of shows. We prefer its legal counterpart: Installing an HD TV tuner in your HDTV or HTPC. Add Windows Media Center (or an equivalent) and you've got a free, full-blown DVR solution for your local TV stations.

Hulu has a lot of free TV shows, but the SD video quality and numerous ads suck.

SPORTS

Wannabe cord cutters often cite the lack of sports options as part of their reluctance to commit to a cable-free lifestyle. That's not quite true these days: TNT live-streamed more than 40 NBA playoff games last season, while the NFL streams both its Sunday Night Football games and its playoff games.

The big games may be covered, but everyday game coverage is severely lacking, making it difficult for cheapskates to root, root, root for the home team unless you purchase a streaming subscription from your league of choice—and those aren't cheap. Season-long passes for streaming the NBA, MLB, and NHL fall in the $100 to $200 price range depending on the sport and the particular package. The NFL's Game Rewind only costs $40 for the season, but it doesn't stream live games, only full replays that go live the day after the real action takes place.

Once again, an HD TV tuner slapped in an HTPC can nab any signals your local stations broadcast; that's probably the best bet for cord-cutting sports fanatics.

In the ever-present gray area, FirstRow Sports live-streams ESPN and pretty much every live sporting event from around the world. It's also proven remarkably resilient to takedown efforts. In a pinch, you can head to Justin.TV, where people often put up low-quality live streams of their TVs whenever a large sporting event takes place. Just don't act surprised when the MPAA sends you a nasty letter.

HOW TO SAVE ON YOUR CELL PHONE AND BROADBAND BILL

Death, taxes, and bill shock. The first two are unavoidable, but luckily, there are a number of ways to avoid unnecessarily high mobile phone and broadband bills. Starting with the former, it's important to figure out how and when you use your phone. Unlimited talk and texting plans are great for chatterbugs, but if you only whip out your phone for emergencies, don't overpay for headroom you'll never use. Along those same lines, you can reduce your reliance on cell phone minutes by using your landline to make calls, or by using VoIP services like Skype.

Another way to sidestep cell phone charges is by integrating Google Voice into your daily usage habits. Google Voice supports free SMS text messaging to the U.S. and Canada, and you can also make and receive calls without tapping into your cell phone minutes.

Don't let your wireless carrier nickel-and-dime you to death with supplementary add-ons, like premium voice mail, roadside assistance, and other optional features. If you absolutely need the peace of mind that comes from an extended warranty (or were born clumsy), shop around for the best rates and service. SquareTrade is one of the most popular third-party providers of warranties, and you can typically find online coupon codes good for 20 to 30 percent off.

Finally, decide if it's really in your best interest to commit to a long-term contract, especially if you plan on getting a feature phone. Prepaid and pay-as-you go plans can be obtained for as little as $10/month. On the flip side, if a long-term contract is in the cards, utilize strength in numbers by splitting a family plan not just with immediate kin, but with a close friend, co-worker, roommate, or a family member who doesn't live with you. Wireless carriers typically charge $10 to $15 to add a line to a family plan, and if you and a friend split the entire bill, you both can come out ahead.

Saving money on your broadband bill starts the same way: by analyzing your usage habits. The most obvious way to save some coin is to make sure you're not paying for an ultra-fast service tier if all you're doing is roaming the web in search of lolcats and updating your Facebook status. Don't be afraid to downgrade your service to see if a lower speed suits your surfing style.

Bundling your TV, phone, and Internet service can reduce your bill, and it also gives you increased bargaining power. Times are tough all around, and if you call your ISP to cancel your service, they'll usually try to sweeten the deal in some way so that you'll stick around. If not, ask to speak with a supervisor to let them know you're leaving for a cheaper competitor. Of course, you don't have to bluff. Services like Sonic.net offer relatively low-cost broadband-plus-phone service, albeit it's limited to California residents.

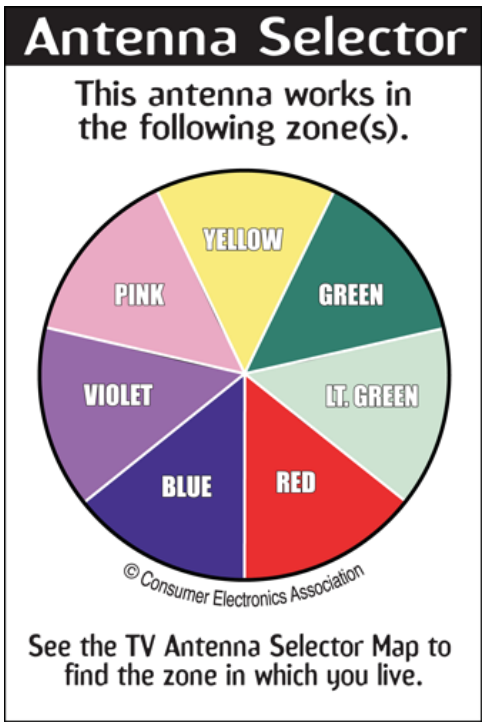
Need more help? BillShrink.com is a great resource to find out if you're overpaying on everyday expenses, including wireless service.

HOW TO GET HDTV FOR FREE

Ever notice how cable and satellite companies only call some channels "pay per view"? Well, the truth is, they're all pay-per-view, aren't they? Not once you cut that satellite or cable in favor of a hybrid streaming/ATSC strategy. ATSC is the fancy way to say free broadcast TV. This usually gets you your local network affiliates with national and local news, as well big event sports such as the World Series or Super Bowl.

To see if you can go this route, first visit AntennaWeb.org and click on the "maximize your television reception" button under the home tab. Punch in your zip code and the web app will present a list of stations, how far away they are, their direction, and more importantly, what level of antenna you need. Since the most difficult part of picking an antenna is knowing what your needs are, many antenna makers now follow the CEA's color-coding. So if the stations you need to hit are nearby, an indoor antenna may suffice. If you're trying to pinch a signal from a station 50 miles away, you may need a directional antenna that can be moved.

The color coding is confusing, but yellow and green are for areas with strong signals, while red and blue are the weakest signals, requiring directional antennas with amplifiers. Decoding the signal is easy if you intend to plug it into any modern HDTV, as each includes ATSC decoders. If you're looking for a PVR-like experience, TiVo boxes will function with ATSC signals, but you will have to pay a monthly service fee or pay up front for the lifetime service. An HTPC with an ATSC tuner will also replicate much of the PVR's ability to record playback.



SAVE MONEY ON PC HARDWARE

GREAT DEALS CAN BE HAD, IF YOU KNOW WHERE TO LOOK

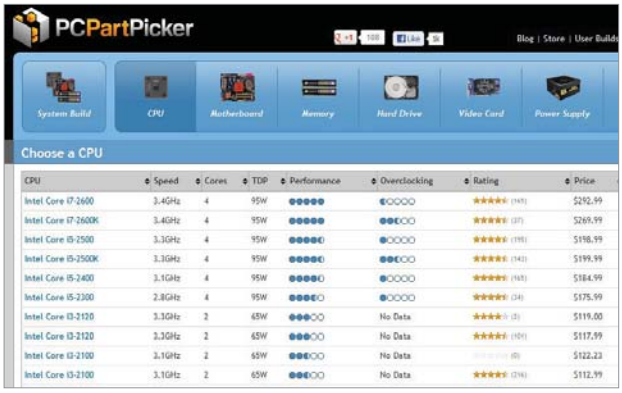
Having a fixed hardware budget doesn't mean you have to sacrifice system specs. By following our handy guide here, you can literally stretch your hardware dollar to get that faster CPU, larger hard drive, or bigger GPU.

DIY MEET BIY: BUY IT YOURSELF

If you haven't already guessed, we love building our own computers—it's as therapeutic as whittling or gardening—but quite often, it's not the best course of action for a penny-pinching cheapskate. That's because you'll never get the break the big boys do. Sure, you might occasionally get a killer deal on a CPU or motherboard that brings the cost down, but since OEMs buy CPUs and motherboards by the boxcar, you can bet they get a far better price on everything, from the CPU to the RAM to the OS. We don't think you should give up, though. One great advantage a do-it-yourselfer has over most OEMs is flexibility. You want X GPU with Y CPU and Z case? Building it yourself gets you that. It just won't be cheaper. If you're doing an ultra-cheap box for your brother-in-law, however, and he doesn't have particular hardware needs, you should first peruse the websites of the OEMs to see if a prebuilt rig with support and warranty is the cheapest route.

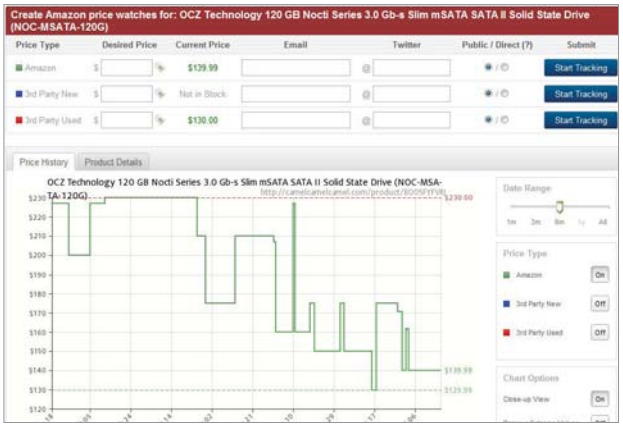
USE PCPARTPICKER.COM

PCPartPicker.com does much of the heavy lifting for any cheapskate looking to build a good system. If we actually had the initiative, and we weren't working as roadies on the Speed of Sound Tour six years ago, man, we would have created the cool building tool known as PCPartPicker.com. PCPartPicker.com lets you easily build your new DIY masterpiece by selecting each major component from a list of parts based on the best available price. What we especially like about the site is that it lets you game up configurations on the fly to share with friends for input. Often, PCPartPicker even accounts for shipping and rebates. Want to see how much your build would cost if you bought all the parts from each store? PCPartPicker does that, too. There's even a chart showing the historical fluctuation of the price of a particular part. If you're putting together a new PC, we recommend that you start here.



LOOK AT THE RAW INTELLIGENCE

When you're as intimately familiar with a product category's prices as you are with the sandwich toppings at Subway (right?), you instinctively know when you're getting a good deal. But what if you don't follow a category religiously? In those cases, we turn to Camelcamelcamel.com. This site data-mines leading e-tailers such as Amazon.com, BestBuy.com, and Newegg.com and displays the info in a nice, tidy chart. It also gives you the historical high, low, average, and current price and allows you to set alerts for individual items that hit a price before you make your move.



A BUNDLE OF SAVINGS?

Part of the joy in building your own PC is the granularity you get in selecting parts. Sometimes you want the motherboard with the green heatsinks instead of the blue ones. When you're in skinflint mode, though, don't overlook the advantage of doing a bundle deal. Many sites—Newegg and Fry's, in particular—offer bundle deals that can save you a good amount of cash. Some bundles combine motherboard with CPU, and others combine all the parts you need to build a PC.

MONITOR THE DEAL SITES

You know what's wrong with deal sites like Slickdeals.net, Fatwallet.com, and Woot.com? They don't save you any money if you have poor self-control. If, however, you have some ability to restrain your impulses, deal sites can yield incredible savings on PC parts.

You'll need to cruise the sites on a regular basis while waiting for the deal you want to come up, but the savings can be significant. Again, the key is that you exercise self-restraint. For instance, we recently bought a five-pack of AV software that we didn't really need simply because it was too cheap to pass up.

CAN WE INTEREST YOU IN A USED PC PART?

An easy way to stretch your dollar is to buy "pre-owned" equipment. There are several tiers of pre-owned. At the top are refurbished parts. Technically, hardware that has been refurbished has been "certified" by the manufacturer before being sold. While refurbs can be defective items that have been repaired, don't assume that's always the case. Sometimes the original buyer may return it out of dissatisfaction, the inability to use it, or a cosmetic flaw, such as a scratch. Legally, manufacturers cannot sell them as new, so the item is "checked out" and then sold as refurbished. These refurbed items can be sold from the manufacturer of the item as well as through retailers. Many refurbished items carry

the same warranty as a new item, but in some cases, the warranties may be far shorter—it's up to the buyer to verify that information with the store first. We recommend doing stress testing and putting any refurbed hardware through its paces before the warranty period expires. You don't want to, for example, buy a used videocard and wait 60 days before you power it on. Test it immediately.

The next tier down is "open box" which is usually sold only by the retailer. Why was it returned? Who knows. Reasons could run the gamut, from it not matching the original purchaser's carpet color, to it being defective out of the box—or it could have been the store demo unit. Open-box items are very much a crapshoot, as the manufacturer hasn't tested it or made sure the power brick was in the box. Because it's so risky, check the store's return policy on the item before you buy, and be crystal clear as to whether it carries a warranty from the manufacturer.

The last category is "used," which means what you think it does. We honestly think that used PC parts have a lot of upsides. Used items are normally marked down the most when sold by stores. If it's a person-to-person sale, the fact that someone was using it means it worked. And unlike a mechanical item with a limited life cycle, a used CPU's life span is typically indistinguishable from a new one, if it hasn't been abused. The greatest risk with buying used is the lack of a warranty and the fact that you don't truly know the history of the part if you're buying it on eBay. Face-to-face transactions through Craigslist.com can be more comforting, until you realize you're meeting a complete stranger with $900 in your pocket. In these situations, we recommend that you meet the person in a café or, if you're really paranoid, the lobby of the police department.

One final tip: Remember to be aware of restocking fees (which some stores charge even for defective items) and who's responsible for shipping if you have to send it back because it's bad: you.

LOOK FOR LOSS LEADERS

A "loss leader" in retail terms is something sold at a slight loss to stimulate some other sale that helps the retailer. This can be deeply discounted hardware on a weekly basis to get people into the stores in the hope they will buy other items. One long-running loss leader few know about is Micro Center's deep cuts on certain CPUs. Intel's Core i7-3770K, for example, will fetch from $330 to $350 elsewhere. But walk into a Micro Center and you can buy a Core i7-3770K for $290. That Core i7-3820 going for $300 outside? Walk into a Micro Center and get it for $229. Sweet, right? The bad news

is that you'll have to literally walk into the store, which means you'll have to pay taxes (damn, those roads and freeways that don't build themselves!). And since we don't have any self-control, we usually end up walking out with a bulk spindle of blank DVDs, a new mouse, ink for the printer, and a Diet Coke. D'oh! There go our savings!

1440P UNDER $400

The DIY sphere has been a-buzzin' over previously unknown monitors like the Yamasaki Catleap and the Achieva Shimian, which use the same 27-inch 2560x1440 S-IPS panel from LG that's in the 27-inch iMac's Cinema Display. They ship straight from Korea for as little as $350. Why so cheap? They're no-frills, and the panels could contain a few dead pixels. We ordered a Catleap from an eBay seller to check it out. No frills is right: The model we chose has only one input (dual-link DVI), no onscreen display, and a wobbly stand, but the picture is great and there are no discernible dead pixels. Even with the added cost of a sturdy (and reusable) VESA monitor stand, we're still getting a hell of a deal on this panel—though attaching the VESA mount means partially disassembling the monitor.

What it lacks in extras it makes up for in price: the 2560x1440 Yamakasi Catleap is less than $400 new on eBay.

COMMON SAVING STRATEGIES PUT TO THE TEST

Over the years, we've observed PC builders employing all kinds of interesting methods intended to save money or stretch a buck. Let's ponder for a moment whether these strategies actually make sense.

IS ADDING A SECOND CARD LATER EVER WORTH IT?

There's a famous cheapskate maneuver that we'll call the "Multi-Card Gambit," where a consumer buys a midrange $250 GPU with the intention of doubling the performance a year later when the prices of the same card have been cut in half. The problem is the gambit rarely works.

The key to the gambit is timing. Do it too soon, and you really haven't gained anything at all except suffering lower frame rates for six months. Wait too long, and it will make more sense to buy the next-generation card instead. An example of this is the GeForce 560 Ti dilemma. Originally $270, GeForce 560 Ti cards are now as low as $180. For a cheapskate, that's cheaper than having to shell out the $400 for a GeForce GTX 670, and you will get a decent frame rate increase you can feel. Six months from now, however, the 670 will have dropped in price or a new card will replace it, making the Multi-Card Gambit a foolish move.

THE RELEVANT CONUNDRUM

Cheapskates know the best time to buy a 2012 car is after the 2013 models have been introduced. But does that same wait-and-see approach hold up for CPUs? We looked at several popular models of CPUs and found that while buying the last-generation model can yield some savings, the tight controls the chip makers exert over their inventories can make this strategy unreliable. For example, the Core i7-2600K debut price in 2011 was $330. Today? It's $290. Its replacement, the Core i7-3770 is $330. The even more popular Core i5-2500K came out at $225 in early 2011. Today it costs $220, and its replacement, the Core i5-3570K, is $229. Intel's former top chip, the six-core Core i7-990X, made its debut at $999 last year. Today? It sells for $999. Its replacement, the Core i7-3960X, fetches $999. Even Intel's ancient Core i7-870 hasn't gotten cheaper over time after you factor in Intel's price cuts to it two years ago. We simply can't recommend paying $330 for a Core i7-870 today. Even eBay prices put the chip at $250 or more—and it's two generations old at this point.

But what about in AMD land, where the controls aren't as iron-fisted? There the prices are what you would probably expect when buying older hardware. Since its introduction, the AMD Phenom II X4 965 has made a stair-step drop from its initial price of $245 to $104 today. Even AMD's FX-8150 has steadily dropped from its $280 introduction to $199 today.

THE REAL HARDWARE HOARDERS OF ORANGE COUNTY

Cheapskates, invariably, want to "stock up" on a good deal when they see one. Frankly, we think that's a poor strategy to follow if not done wisely. Yes, such a move might look prescient in light of the Thailand floods of 2011 that caused hard drive prices to triple and quadruple overnight, but stocking up for future builds is often fraught with risks.

Take RAM, for example, which climbed in price late last year and seemed bound to climb higher following the bankruptcy of DRAM maker Elpida. The reality is, RAM prices are insanely low today. You can get four 8GB DIMMs of DDR3/1600 for $200. If you had stocked up on RAM last summer because prices were "headed back up," you would have paid $150 for four 4GB DIMMs of DDR3/1600. If you stocked up on DDR3 DIMMs now for a build next year, they would introduce DDR4 just to spite you.

It's far safer to bet on one constant in technology: It always gets cheaper, and it always gets better. So unless you're sure it's a killer deal you're getting, it's generally safer to wait until you need to buy it.

FOUR CLEVER USES FOR OLD HARDWARE

A true cheapskate never upgrades until his or her hardware is not only inoperable but irreparable. Take Gordon's trusty ThinkPad. It's so old it was made by IBM but has soldiered on with a new hard drive, RAM, and even CPU, and he still uses it every day.

Even the most reluctant upgrader, though, will occasionally find him- or herself with old hardware that still works to some degree—an ancient laptop, an old desktop, an aged MP3 player. If it ain't dead, put some new life into it. Here are five ways to stretch the value and the life span of your hardware.

MAKE IT A MEDIA CENTER

If your old desktop or laptop has at least a dual-core CPU and a couple gigs of RAM (so it can stream HD video), turn it into a media center! If you already have Windows installed, so much the better! You can use web-based video (like Netflix, Hulu, and HBO Go), plus if you install XBMC you can play all sorts of local video and audio files from the PC or the network. Use a remote-desktop program on your phone or tablet to control it, and you won't even need a keyboard and mouse!

TURN IT INTO A NAS

If you just want plenty of network-attached storage for backup and media streaming, turn your old PC into a NAS by using FreeNAS (www.freenas.org). It's easy to install and configure, and the latest beta of Version 8 contains support for plugins that will let you stream audio and video to the rest of your network via DLNA, UPnP, and iTunes.

TURN AN OLD SMARTPHONE INTO A MEDIA PLAYER

Have an old smartphone you're not using? Put it in airplane or Wi-Fi mode and use it as an app-enhanced media player! Plug it into your TV or stereo to access streaming music from the cloud, use it to read e-books and watch movies, and more! Fill it with games and give it to your kids! Many smartphone OSes include parental controls so you can disable Wi-Fi.

RECYCLE IT

If you have old electronics that still work but you don't need and don't want to repurpose, consider donating them to a charity or nonprofit. There's probably one in your area that could use the extra gear. If your stuff is nonfunctional or really obsolete (think Pentium 4 or earlier), take it to an e-cycler who can dispose of it safely. It's what Captain Planet would have wanted.

BUILD A $600 PC

AN ALL-AROUND-CAPABLE, KICK-ASS RIG DOESN'T NEED TO COST A FORTUNE

There's no such thing as a no-compromises $600 build. There just isn't. But by balancing things where you can and making judicious cuts where necessary, you can at least build a modern gaming PC—with an upgrade path to the future. That means a full quad-core CPU, DirectX 11 GPU, and a fast hard drive. To paraphrase Han Solo, she may not look like much, but she's got it where it counts.

CPU
AMD PHENOM II X4 965 BLACK EDITION

The Phenom II ain't the newest or fastest CPU on the block, not by a long shot. But it's a cheap, overclockable quad-core with plenty of bang for the buck. We got it for $100. www.amd.com

MOTHERBOARD
GIGABYTE GA-970A-UD3 ATX

It's not the fanciest or the flashiest, but it has USB 3.0 and 6Gb/s SATA and supports not just our Phenom II but also FX CPUs, if we want to upgrade later. It only has one x16 PCIe 2.0 slot, but that's what you get for $99. www.gigabyte.us

MEMORY
PATRIOT GAMER 2 SERIES 4 (2X 2GB) DDR3/1600

4GB is really the minimum, and we wish we could have gone for more, but every penny counts. Two 2GB sticks allow us to run in dual-channel mode at DDR3/1600 for just $32. www.patriotmemory.com

CASE AND POWER SUPPLY
ROSEWILL R218 W/450W PSU

OK, this is definitely a compromise. If we had our druthers, we'd go for a separate case and PSU, but we don't have our druthers. We have about $43. At least it comes with a warranty. We've used this case/PSU combo before, and nothing bad happened. www.rosewill.com

GRAPHICS
GIGABYTE RADEON HD 6850 1GB

It's slightly more expensive and draws more power than the modern-gen Radeon HD 7770, but it's also faster. Last generation's where the deals are. It's still DX11, and it's only $138. www.gigabyte.us

HARD DRIVE
SEAGATE BARRACUDA 1TB 7,200RPM

In a $600 budget build, you only get one hard drive and no SSD. It needs to be fast and capacious. This Barracuda is both, and it's only $85. www.seagate.com

OPTICAL DRIVE
LITE-ON IHAS124-04 DVD/CD WRITER

It's a DVD burner. It's $18. If you're on a budget, you can't go without an optical drive. www.lite-on.com

OS
MICROSOFT WINDOWS 7 HOME PREMIUM (64-BIT)

We could have cheaped out and recommended Windows 8 Consumer Preview for free, but that's a bit like cheating. $100, www.microsoft.com

TOTAL PRICE: $615

At this price point, we're going without many of the things we love best about custom PCs—no SSD, no aftermarket cooler, no cool case—but what we have is a desktop PC that will handle modern games and programs, will accept upgrades with ease, and doesn't break the bank. It's far slower than our zero-point, but that machine is built on a six-core Sandy Bridge-E CPU with a $1,000 GPU and is designed to compete with $3,000 rigs. Even with a Radeon HD 6850, our Cheapskate PC puts out nearly playable frame rates in Arkham City at 2560x1600 with all settings maxed. It's more than enough to run on high settings on a smaller screen. As for the CPU-bound encoding tests, the Cheapskate's Phenom II doesn't keep up, but for a gaming machine it's fine.

There's plenty of room to upgrade, too. The AM3+ motherboard will take a Bulldozer CPU like the FX-8150 and the upcoming "Vishera" FX chips, when they appear. You can easily put another 8GB (or more) of RAM alongside the existing 4GB. The motherboard's second physical x16 PCIe slot runs at 4x, so CrossFire builds will be compromised, but you could update to a newer single-GPU setup down the line. An SSD would speed up boot and load times, and a more powerful PSU will allow more drives and a more power-hungry CPU and GPU.

BENCHMARKS

	ZERO-POINT	
Premiere Pro CS6 (sec)	2,000	10,433 (-81%)
Stitch.Efx 2.0 (sec)	831	1,566 (-47%)
ProShow Producer 5.0 (sec)	1,446	2,658 (-46%)
x264 HD 5.0 (fps)	21.1	9.1 (-57%)
Batman: Arkham City (fps)	76	27 (-64%)
3DMark 11	5,847	1,164 (-80%)

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

Our current desktop test bed consists of a hexa-core 3.2GHz Core i7-3930K 3.8GHz, 8GB of Corsair DDR3/1600, on an Asus Sabertooth X79 motherboard. We are running a GeForce GTX 690, an OCZ Vertex 3 SSD, and 64-bit Windows 7 Professional.

BY MARCO CHIAPPETTA

THE BEST OF BOTH WORLDS

LUCIDLOGIX VIRTU MAKES HYBRID GRAPHICS ON THE DESKTOP POSSIBLE

Historically, integrated graphics, with their notoriously lackluster performance, have been of little interest to power users. But perceptions began to change with Intel's Sandy Bridge, and later its Ivy Bridge, microarchitecture. While Sandy Bridge's DX10-class, Intel HD 2000/3000 graphics engines aren't cutting-edge by any means, they offer enough performance for many mainstream PC users, and consequently, helped Intel gain market share in the graphics race. Ivy Bridge further improves the situation with a more powerful graphics core outfitted with additional execution units and DX11 support. Whereas Intel's HD 3000 offers 12 EUs, Ivy Bridge's HD 4000 engine has 16.

But perhaps the most sought-after feature of Sandy Bridge and Ivy Bridge is Quick Sync. Quick Sync is a dedicated encoding/decoding engine that can burn through video-encoding tasks lightning-fast. Problem is, Quick Sync is part of the GPU block on Sandy Bridge and Ivy Bridge processors, and when a discrete GPU is installed and no monitor is connected to the integrated GPU, Quick Sync is unavailable.

Not being able to use Quick Sync and discrete graphics simultaneously didn't sit well with enthusiasts, but a workable solution was made available when LucidLogix introduced Virtu, a product that can virtualize the GPUs in systems and enabled hybrid graphics configurations. With Virtu, users can enjoy the benefits of a discrete GPU when gaming and still leverage an integrated GPU for power savings or Quick Sync. The best part is that Virtu is supported by a variety of motherboards. On the following pages we're going to explain how Virtu works and how you can set it up on your own system, and then we'll show you how a hybrid graphics configuration affected benchmark performance on our test systems.

LUCIDLOGIX VIRTU EXPLAINED

Although the underlying technology is relatively complex, it's somewhat easy to explain and understand how Virtu works. First and foremost, note that Virtu is a software solution from top to bottom—save for programming some BIOS code, no modifications are necessary at the hardware level. Virtu requires special hooks in the BIOS and the presence of both discrete (dGPU) and processor/integrated (iGPU) graphics in a system, but that's it.

When Virtu is installed on a system, it essentially virtualizes the available GPUs. The name Virtu is actually an abbreviation of GPU Virtualization. With Virtu, Lucid's Multi-GPU Abstraction Layer is installed between the OS and drivers, and that abstraction layer intercepts DirectX API calls from games or applications. At this point in time, OpenGL and WebGL are not supported. Once a call is intercepted, Virtu's Rendering Assignment Manager then analyzes it and decides to shuttle the subsequent task to either the iGPU or dGPU, based on a set of predetermined application profiles, which includes hundreds of games and multimedia tools.

Virtu can be configured in two modes: i-Mode or d-Mode. I-Mode refers to a configuration in which a monitor is connected to the integrated graphics engine's display output, while d-Mode means the monitor is connected to the discrete GPU. We mention the modes available because the final step Virtu performs is dependent on the mode being used. Once a task is complete, the output (typically a rendered frame) is copied to the appropriate GPU's frame buffer, where it is finally output to the screen. When operating in i-Mode, the dGPU's output is copied to the iGPU's frame buffer memory; vice versa for d-Mode.


Discrete Graphics
Integrated Graphics
BOTH

Currently there are three different versions of LucidLogix Virtu available to end users: Virtu Green, Virtu Universal, and Virtu MVP. All the different versions function in a similar manner, but each has a different feature set. Virtu Green is the most basic version and works only on Intel platforms. Next up the chain is Virtu Universal, which works with both Intel and AMD platforms and also adds support for Lucid's Virtual V-Sync technology. Finally, there is Virtu MVP, which has all the features and compatibility of Universal, but adds support for Lucid's HyperFormance technology, as well.

While they're independently configurable, Virtual V-Sync and HyperFormance are interconnected. These two features have been mistakenly characterized as game performance enhancers, when in fact they'll only affect image quality and input responsiveness. Virtual V-Sync leverages the iGPU's resources when the discrete GPU is being used to probe the dGPU's frame buffer and ensure that only the last fully rendered frame is shown on the screen. By doing so, Virtual V-Sync prevents tearing artifacts and always ensures the latest frame data is displayed on screen. It's only useful, however, when a game's frame rate exceeds the refresh rate of the attached monitor, which is usually 60Hz (or 60fps) for mainstream LCDs. HyperFormance uses a predictive algorithm to ascertain which frames will never be displayed, and removes any unnecessary rendering tasks for those frames from the pipeline, freeing up the dGPU to process only the items which will ultimately be displayed. This results in a decreased workload for the dGPU and an increase in responsiveness, but like Virtual V-Sync, HyperFormance is only useful when frame rates exceed the monitor's refresh rate.

VIRTU'S HARDWARE CONSIDERATIONS

Short of having a compatible motherboard, as well as discrete and integrated processor GPUs, there are no specific hardware considerations for Virtu. As we've mentioned, it's a software-only solution. LucidLogix has been working with motherboard manufacturers to have Virtu included with strategic motherboards—typically those supporting Intel's Sandy Bridge and Ivy Bridge-based processors—but Virtu is also compatible with AMD's A-Series APU chipsets. Due to Virtu's requirement for both discrete and integrated graphics processors, however, it does not support any high-end, enthusiast-class chipsets, like those designed for Intel's Sandy Bridge-E or AMD's Bulldozer, for example, as those processors lack on-die graphics.

At this point in time, Virtu is qualified to work with single discrete-GPU configurations and is also compatible with any display output—DVI, DisplayPort, HDMI, etc. are all supported. Virtu also supports multimonitor configurations, but multi-GPU support is iffy. We asked Lucid about Virtu's support for CrossFire or SLI multi-GPU configs and were told, "The reason for limited support today is our flexibility to plug the display in i-Mode (to motherboard) or d-Mode (discrete GPU). In i-Mode, which is the most popular one, we enable additional power savings and noise reduction, but the vendor control panels for SLI or CrossFire are not available. Also, the Virtu product line is shipped in mass volumes (expecting to pass 10 million units by end of year). Virtu is for the mass market. SLI/CF are relatively smaller markets and require a great deal of work with special workarounds." Indeed, when in i-Mode, Nvidia's and AMD's driver control panels will not load. In fact, if you try to access it when Virtu is enabled in i-Mode, an error message will pop up saying a supported GPU is not available, although the drivers for the GPU do load with Windows. The nonfunctioning control panels prevent users from switching on SLI or CrossFire, though, and prevent their application profiles from properly detecting games. With that said, you can start up a system in d-Mode, turn on SLI or CrossFire, then switch back to i-Mode, but success isn't guaranteed. We did get CrossFire working in i-Mode, but SLI never scaled properly.

THE COMPETING STANDARDS

Hybrid graphics are hardly new, and certainly not unique to Virtu. Nvidia and AMD both offer switchable graphics solutions to achieve many of the same goals as Virtu. Nvidia's Optimus technology seamlessly switches between discrete and integrated GPUs depending on an application's needs or available power. AMD's switchable graphics, while not quite as seamless as Nvidia's, essentially does the same thing. But both Nvidia's and AMD's technologies are typically relegated to the mobile space, save for a single Alienware system (the X51) that leverages Optimus.

We reached out to both companies to see if either had switchable graphics solutions in the works for desktop systems and got the typical answer that neither company could comment on unreleased products. Nvidia said there is nothing preventing OEMs from using Optimus on desktop systems, but that it hasn't been done because power is much less of a concern on desktop system, especially since recently released graphics cards consume little power while idling or sitting at the desktop. A rep for AMD said something similar: "On desktop platforms, AMD leads in power efficiency with ZeroCore Power. This vastly reduces power without having to rely on solutions such as switchable graphics."

The closest Nvidia has come to offering a hybrid graphics solution for desktops is with this wee Alienware X51 PC.

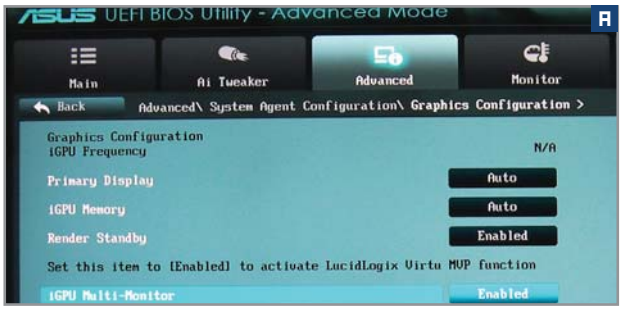
HOW TO SET UP VIRTU ON A DESKTOP PC

Installing Virtu on a system could not be any easier. Assuming you've got a compatible platform with the necessary motherboard and iGPU and dGPU installed, there are only a few steps necessary to get Virtu up and running.

1 CHOOSE YOUR MODE As we've mentioned, Virtu can be set up in i-Mode, in which a monitor is connected to the processor's integrated graphics output, or d-Mode, in which a monitor is connected to the discrete graphics card. Although our tests didn't show much difference in either mode, you'll want to use i-Mode if power consumption is your main concern and d-Mode if game performance is your priority. To choose your mode, simply connect your monitor to the desired display output on your graphics card (d-Mode) or motherboard (i-Mode).

2 ENABLE VIRTU IN THE SYSTEM BIOS/UEFI For Virtu to function, you must be using a compatible motherboard with the necessary hooks incorporated into its system BIOS/UEFI. If you're unsure about your motherboard's support for Virtu, reference its specification on the manufacturer's website (if Virtu was included on your motherboard's driver disc, chances are it's supported).

» If you're certain you've got a Virtu-compatible motherboard, the next step is to enter the system BIOS and enable Virtu **(image A)**. On the Asus motherboard we used for testing, the setting was located in the Advanced > System Agent Configuration > Graphics Configuration section of the BIOS. The name and location of the setting will vary from manufacturer to manufacturer, however.

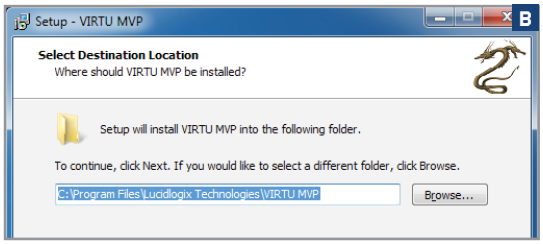


A

3 INSTALL YOUR GPU DRIVERS Virtu requires that your GPU drivers be installed before Virtu. Once you've got your monitor(s) connected and the necessary feature enabled in the BIOS, boot into Windows and install the latest drivers for your iGPU and dGPU.

4 INSTALL VIRTU Installing Virtu requires no special knowledge or configuration information. The tool installs the necessary drivers and abstraction layers and automatically detects the hardware in the system. Although a Virtu installer was likely included on your motherboard's driver disc, we recommend grabbing the most recent version from the LucidLogix website to ensure the broadest compatibility.

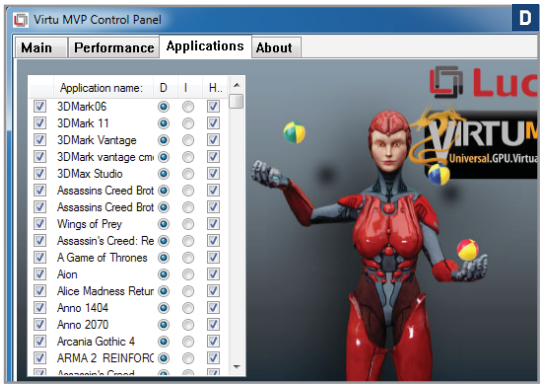
» If you don't need to change the default installation options, simply start the installer, accept the license agreement, and click through the onscreen prompts to complete the process **(image B)**. If all went to plan, once rebooted, Virtu will be installed and enabled.



B

5 USING VIRTU When the Virtu installation is complete, GPU virtualization will be enabled by default. To access Virtu's control panel, right-click the Virtu icon in the system tray and simply choose the option to open the control panel. There are only four tabs available in the Virtu tool—Main **(image C)**, Performance **(image D)**, Applications, and About—and they're all simple to navigate.

C



D

PUTTING VIRTU TO THE TEST

To get a feel for how Virtu functioned and to test whether or not it affects performance, we built up an Intel Ivy Bridge Core i7-3770-based system with integrated Intel HD 4000-series graphics, using a Z77 Express motherboard from Asus, 8GB of RAM, and a few high-end graphics cards from Nvidia and AMD, namely a pair of GeForce GTX 680s and a pair of Radeon HD 7970s. We tested every supported configuration, in both i-Mode and d-Mode, checking performance and power consumption along the way.

What we found was that Virtu had little impact on power consumption with our hardware. In fact, power consumption was typically a bit higher using Virtu, presumably because the iGPU is used for some of Virtu's proprietary functions when the dGPU in under load. We should point out, however, that this will not always be the case. Some older graphics cards behave differently under Virtu and may exhibit much lower idle power consumption. With the GeForce GTX 680 and Radeon HD 7970, though, idle power was mostly flat.

In terms of game performance, we found that Virtu had little impact. We saw some slight performance variations from configuration to configuration, but the deltas were relatively small and of no consequence. There is some overhead associated with shuttling frame buffer data between GPUs, but Lucid seems to have done a good job minimizing its impact on frame rates.

For the most part, Virtu just worked. When we wanted to use Quick Sync we could, regardless of the graphics configuration, and the applications and games we tested didn't exhibit any image-quality or performance issues. Quick Sync's output quality was also unchanged in each configuration. We did, however, experience an issue with Metro 2033 when in i-Mode. The game simply wouldn't launch when GPU Virtualization was enabled. We'd get to the loading screen and the game would just hang.

SPECIFICATIONS

POWER CONSUMPTION	Intel HD 4000	GeForce GTX 680	GeForce GTX 680 (d-Mode)	GeForce GTX 680 (i-Mode)	Radeon HD 7970	Radeon HD 7970 (d-Mode)	Radeon HD 7970 (i-Mode)
Idle (W)	89	112	114	115	115	111	113
Load (W)	116	308	312	316	319	322	323
GAME PERFORMANCE							
3DMark 11 (Extreme Preset)							
Overall Score	224	3,349	3,352	3,311	2,825	2,823	3,609
Graphics Score	197	3,062	3,064	3,029	2,565	2,564	3,310
Metro 2033 (High Quality, AAA, 16X Aniso)							
1920x1200 (fps)	10.67	89.33	88	Fail	81.33	82	Fail
2560x1600 (fps)	6.67	57	56.67	Fail	54.33	55.67	Fail
Alien vs. Predator (SSAO=On, 4x AA, 16x Aniso)							
1920x1200 (fps)	5.2	52.8	52.7	50.7	62.3	62.4	60.1
2560x1600 (fps)	5	32	32	30.8	38.2	38.3	34.7

MEDIA ENCODING PERFORMANCE	CPU Only	AMD Stream	Nvidia CUDA	Quick Sync	Quick Sync w/ Virtu & 7970	Quick Sync w/ Virtu & GTX 680
Cyberlink MediaEspresso 6.5 (sec)	0:31	0:40	0:25	0:07	0:07	0:07

ONE FOR ALL AND ALL IN ONE

JOIN THE ALL-IN-ONE REVOLUTION, ALREADY IN PROGRESS

By Michael Brown

We know what you're thinking. Why is *Maximum PC* dedicating precious pages to another roundup of all-in-one PCs? You'd never buy one of these machines as your primary computer, right? Right. We'd never be satisfied with just an all-in-one, either.

But we can't think of a better second computer. Sure, you could retire an older PC to the kitchen or family room. Or you could carry a notebook or tablet from room to room. But it's hard to overstate the convenience of an all-in-one: There's only one device taking up space on your desk; it has the same footprint as a monitor; you need just a single power outlet; it's always there when you need it; and unlike a notebook or tablet, you'll never need to hunt it down only to discover that it has a dead battery.

We're not ignoring the drawbacks of nearly all consumer all-in-ones. They're difficult, if not impossible to upgrade; and they generally suck for hardcore gaming, because most depend on mobile GPUs at best, and integrated graphics at worst. But this class of machine is definitely on an upswing. In fact, the market research firm IHS recently forecast that AiO sales will grow by a blistering 20 percent this year, while sales of conventional desktops will post an anemic gain of just .2 percent.

With that kind of growth, we weren't surprised that Asus, Dell, Gateway, HP, and Sony all sent us machines for this story. We reviewed each one with three criteria in mind: First, is it sufficiently powerful and feature-rich to tempt us into trading in a conventional desktop PC? If it didn't rise to that level, would it a make a good second PC for a *Maximum PC* reader? And finally, did it exhibit a price/performance ratio that renders it worthy of a recommendation to friends and relatives looking for an all-around family PC?

ASUS ET2701INKI-B046C

DELL XPS ONE 27

GATEWAY ZX6971-UR10P

HP OMNI 27-1015T

SONY VAIO L SERIES

ASUS ET2701INKI-B046C

JUST THE RIGHT BALANCE

The IPS display inside the Asus ET2701 is so beautiful you'll quickly forget that its maximum resolution is just 1920x1080 pixels.

SPECIFICATIONS

CPU	3.1GHz Intel Core i7-3770S
GPU	Nvidia GeForce GT 640M
RAM	8GB DDR3/1600
HDD	2TB (7,200rpm)
Optical	Blu-ray player/DVD burner
Display	27-inch LED-backlit IPS LCD 1920x1080 (non-touch)

ASUS TAKES the price/performance crown in this roundup. The company's ET2701 all-in-one can't match the audacious display built into Dell's XPS One 27, and it doesn't have a fast SSD to supplement its 2TB hard drive, like the Dell; but many of the other components inside the ET2701 are exactly the same as what you'll get with the XPS One. And the ET2701 costs $500 less.

Both machines have the same CPU and GPU—Intel's Core i7-3770S and Nvidia's GeForce GT 640M, respectively—but Asus outfits its machine with a 27-inch display that's limited to 1920x1080 resolution, while Dell goes the extra mile with a 27-inch display that's capable of 2560x1440 resolution.

The ET2701 scored first place in our ProShow Producer and Adobe Premiere tests, although the Dell was faster in the three others. But if you think you'll be watching movies on its tray-mount Blu-ray player/DVD burner and surfing the web more than performing precision edits on digital photos, the ET2701 will make you very happy. The LED-backlit IPS display isn't a touchscreen (none of the large all-in-ones we tested are), but it is absolutely gorgeous, with bright, vibrant colors and generous off-axis viewing angles.

A door on the left side of the machine flips open to reveal a memory card reader, two USB 3.0 ports, one combo USB 2.0/eSATA port (a unique feature in this roundup), a mic input, a headphone out, and a subwoofer out. We appreciate doors that hide ugly elements like I/O ports, but Asus didn't think to include a cable cutout so you could close the door while a cable is plugged in—the door just hangs open and the cables spill out like spaghetti.

Asus provides a miniature, powered subwoofer with the PC. It's the only one that will work with the system, because it draws power over the same cable that carries the audio signal from the PC. The speakers built into the ET2701 are good, but not great, so the sub is a welcome addition. But the combo doesn't put out enough sound to fill even a small room—especially one with a lot of background noise, such as a kitchen.

Each of the all-in-ones in this roundup is equipped with an HDMI input, which is great when you want to connect a cable or satellite set-top box or a videogame console to the display. You can set up the ET2701 so that its display and HDMI input remain active even when the PC is shut down. Asus doesn't offer a TV tuner with the ET2701 in the North American market, which isn't a big loss, and it doesn't provide a remote control, either.

Bottom line: The Asus ET2701 is a great all-in-one computer that offers exceptional value.

We were surprised to find a VGA *input* on the Asus ET2701's back panel.

VERDICT **9**

Asus ET2701INKI-B046C

$1,500, www.asus.com

DELL XPS ONE 27

MY GOD! IT'S FULL OF STARS!

Dell's XPS One 27 is a gorgeous computer. You'll have to decide if it's $2,000 worth of gorgeous.

SPECIFICATIONS

CPU	3.1GHz Intel Core i7-3770S
GPU	Nvidia GeForce GT 640M
RAM	8GB DDR3/1600
Storage	2TB (7,200rpm); 32GB SSD
Optical	Blu-ray player/DVD burner
Display	27-inch LED-backlit PLS LCD 2560x1440 (non-touch)

OK, OUR FIRST look at the Dell XPS One's stunning display didn't leave us quite as flabbergasted as astronaut David Bowman staring into the monolith at the end of *2001: A Space Odyssey*. But the absolutely gorgeous Samsung PLS panel—with its 2560x1440 native resolution—did leave us a bit slack-jawed. The XPS One's $2,000 price tag might have contributed to that reaction, too; then again, a 27-inch Samsung Series 9 display built using the same panel costs $1,200 all by itself.

The display and a host of other features account for the $500 price difference between the XPS One and the Asus ET2701, but the CPU, GPU, and memory aren't among them. Both machines ship with a Core i7-3770S, an Nvidia GeForce GT 640M, and 8GB of DDR3/1600. Dell and Asus split the benchmark wins, with the Asus taking first place in two of the five benchmarks and the Dell winning in the three others.

The XPS One's other features include an integrated TV tuner, a remote control, and a vastly superior wireless keyboard. Dell also bundles facial-recognition software from Sensible Vision that you can use in place of typed passwords to log on to the computer and into websites. Once you've established your credentials—and your face—with the software, the computer will automatically log you out when you move away from the PC, and automatically log you back in when you return. We've seen facial-recognition technology like this before, but it's never worked this fast. The system routinely logged us in within five seconds of sitting in front of the camera—and it took even less time to log us out when we moved out of the camera's field of view.

The HDMI and S/PDIF outputs on the XPS One are much more useful than the VGA input on the Asus.

The XPS One is the only machine in our roundup to provide USB 3.0 ports, exclusively: two on the left side and four in the back. The rear I/O panel also features both an HDMI input and an HDMI output, so you can run a second monitor. The speakers get plenty loud to compete with environmental background noise, but there's a S/PDIF digital audio output if you want to connect powered speakers that have a DAC.

A media card reader, mic input, and headphone output are also on the left-hand side. There's a slot-feed Blu-ray player/DVD burner on the right-hand side, but it lacks an eject button. That's aesthetically pleasing, but it's silly to make the user rely on software to eject a disc. The power button is also on the right side, which is the next best place to put it. Asus was the only manufacturer that put the power button in front, where you can see it easily and not accidentally press it while you're repositioning the computer.

Dell hits all the right notes with this design: In our book, the XPS One 27 fully justifies its lofty price tag.

VERDICT 9 KICK ASS!

Dell XPS One 27

$2,000, www.dell.com

GATEWAY ZX6971-UR10P

A MODEST PC WITH A MODEST PRICE TAG

Gateway's ZX6971-UR10P is a very basic touchscreen PC with a price tag that won't induce sticker shock.

SPECIFICATIONS

CPU	3.3GHz Intel Core i3-2120
GPU	Integrated
RAM	6GB DDR/1333
HDD	1TB (7,200rpm)
Optical	DVD player/burner
Display	23-inch LED-backlit TN LCD 1920x1080 (touchscreen)

GATEWAY LISTS no fewer than 13 all-in-one models on its website, and this model with a dual-core CPU, integrated graphics, and twisted-nematic LCD is its top offering. If the PCs in this roundup were playing football, the Gateway would be the water boy. But if all you need in a family PC is a machine for web browsing, email, productivity, and watching DVDs, this model might serve you well.

The ZX6971-UR10P is outfitted with a Core i3-2120, a dual-core Sandy Bridge chip that runs at a respectable clip of 3.3GHz. This is the only contender in the roundup to rely on integrated graphics, but Gateway does provide abundant memory: 6GB of DDR3/1333. As you've probably guessed, the Gateway trailed the field by a wide margin in benchmark results, while 3DMark 11 and Metro 2033 wouldn't run at all.

The Gateway and the Sony have the smallest screens in this roundup (23 and 24 inches, respectively), but they're also the only touchscreen models. The Gateway is an easel-style form factor, with a broad rear foot that slides backward to adjust the angle of the display as you push down on the top of its bezel. There's a media card reader, a mic input, a headphone output, and two USB 3.0 ports on the left side of the machine. One of these ports can charge a USB device, such as a phone or music player, even when the computer is powered off.

There's a tray-mount DVD player/burner (no Blu-ray) on the right side, and there's a good ol'-fashioned eject button right next to it. You'll find the switch for toggling between PC and HDMI display modes right below this, and a second button that toggles an LED that illuminates the Gateway "cow box" logo.

You can use Gateway as an HDMI display even while the PC remains powered off.

What you won't find anywhere on the chassis is a freakin' volume control! You can use the keyboard or the mouse to adjust the volume in PC mode, but you get a fixed level when you're using the HDMI input and the display alone. Compounding the problem is an onboard amplifier that's so anemic we had to connect a pair of self-powered speakers to the computer when we plugged our satellite TV set-top box into its rear-panel HDMI input. On the bright side, you don't need to fire up the entire PC just to use the monitor.

Gateway's Touch Portal is a suite of apps optimized for a touchscreen, including a web browser, a music player, a video player, a slide-show program, a web camera utility, and a copy of Cooliris. Gateway also provides a very cool remote control. There's a basic Media Center remote on one side; flip it over, and you get a miniature QWERTY keyboard very much like the one that D-Link ships with its Boxee Box. Unfortunately, the remote has no control over the volume when you're using only the HDMI input.

The Gateway ZX6971-UR10P isn't the most exciting all-in-one we've laid hands on, but it's priced right.

VERDICT **7**

Gateway ZX6971-UR10P

$800, www.gateway.com

HP OMNI 27-1015T

HAS HP LOST ITS TOUCH?

HP needs to move the power button off the top of its all-in-one PCs; it's too easy to accidentally turn the machine off while adjusting the angle of the display.

SPECIFICATIONS

CPU	3.0GHz Intel Core i5-3550S
GPU	AMD Radeon HD 6550A
RAM	8GB DDR3/1600
HDD	2TB (7,200rpm)
Optical	DVD player/burner
Display	27-inch LED-backlit IPS LCD 1920x1080 (non-touch)

WE USED TO get excited when HP would send us its latest all-in-one. Each new model seemed to add some cool innovation or new feature that no other manufacturer had. The Omni 27-1015t has us wondering if the all-in-one pioneer has grown tired of pushing the envelope.

Sure, this new model has a slightly faster CPU, a better GPU, a bigger hard drive, and faster memory than the last HP all-in-one we tested (HP's Omni 27 Quad, reviewed in July), but simply reaching into a new parts bin isn't innovating. Visit HP's website, and you'll see the Omni 27-1015t selling for $1,250. You can customize the machine you buy, however, and the computer that HP sent for review was pumped up with a faster CPU (an Intel Core i5-3550S), more memory (8GB of DDR3/1600), a faster videocard (an AMD Radeon HD 7650A), and a higher-capacity hard drive.

This bumped the price tag to $1,470, which puts it just $30 below the price tag of the Core i7-3770S-powered Asus ET2701. In addition to a superior CPU, Asus puts a Blu-ray drive in its machine, whereas HP cheaps out with a simple DVD burner. Both machines include an LED-backlit IPS LCD panel (neither are touchscreens).

In terms of benchmark performance, the Omni 27-1015t proved to be considerably faster than the relatively weak Gateway and roughly on par with the Sony L Series, but it trailed the Asus and Dell machines by considerable margins.

In most other respects, the Omni 27-1015t is a carbon copy of the Omni 27 Quad. On the machine's left-hand side, you'll find two USB 3.0 ports, a mic input, a headphone output, and a media card reader. There's a slot-feed DVD player/burner on the right-hand side (with an eject button), along with buttons for volume control and for switching between PC and HDMI modes.

The HDMI input is also located on the right-hand side, but HP would be wise to follow the rest of the industry in moving this port to the back of the machine so the cable can be hidden. And for the love of Pete, when your engineers design the next model, force them to provide an easier means of controlling the volume when the machine is in HDMI mode. As we noted in our review of the Omni Quad, it takes 14 button presses to bring the volume from 100 percent to zero.

The Omni 27-1015t's back panel hosts four USB 2.0 ports, line-level RCA outputs for powered speakers, and a subwoofer output. HP sells a pretty good powered subwoofer—the $130 HP Pulse—but you can plug any powered sub into this jack.

If you don't need an all-in-one as powerful as what Asus is offering, we recommend stepping down to the Gateway. The price/performance ratio of HP's Omni 27-1015t is just too out of whack for us to recommend it as an in-between compromise.

We dig HDMI inputs on all-in-one computers, but the port should be back here with the rest of the I/O ports.

VERDICT **6**

HP Omni 27-1015t

$1,470, www.hp.com

SONY VAIO L SERIES (MODEL SVL24116FXB)

OH ME-OH, OH MY-OH, LOOK AT THE PRICE OF THIS VAIO!

Sony declined to say if its 24-inch touchscreen panel is based on TN or IPS technology, but we can tell you it isn't nearly as bright and vibrant as either the Asus or the Dell.

SPECIFICATIONS

CPU	2.3GHz Core i7-3610QM
GPU	Nvidia GeForce GT 620M
RAM	8GB DDR3/1600
HDD	1TB (5,400rpm)
Optical	Blu-ray player/DVD burner
Display	24-inch LED-backlit LCD 1920x1080 touchscreen

SONY INTRODUCES a number of cool innovations with its latest generation of Vaio L Series all-in-ones, but the company exacts a hefty premium from those who want the best the company has to offer. This model SVL24116FXB costs $200 more than the Asus, but is outfitted with a slower CPU, a smaller display, a lesser videocard, and a smaller hard drive.

Sony's most important innovation is its capacitive touchscreen that recognizes not just two, but 10 touch points. As such, this will be one of the few current-generation computers that will meet the Windows 8 requirement for touchscreens to recognize a minimum of five touch points. What's more, the computer can use its built-in webcam to respond to physical gestures even without the touchscreen.

While listening to music, for instance, you can adjust the volume by pointing your index finger at the computer's camera and drawing a circle in the air: A clockwise spin turns the volume up, and a counterclockwise movement turns it down. If you're watching a slide show, waving your hand from left to right advances to the next photo, while moving it from right to left moves back to the previous slide. It's a bit of a gimmick now, but we predict it's a feature we'll come to expect over time.

Other unique features we'd like to see every all-in-one manufacturer copy include a picture-in-picture mode that lets you use the full Windows 7 desktop while video from the HDMI input streams to a small window in a corner. This allows you to watch TV and use the web at the same time. There's also a picture-and-picture mode that splits the screen vertically and places a window for the HDMI input alongside a Windows 7 window. These features would be even better if you could swap either to full-screen mode without losing sound from the HDMI input (so you could focus on the web during commercial breaks and switch back to the windowed view when they're finished).

Unlike the Asus, the Sony has an integrated TV tuner, and you don't need to fire up the PC to use it, to use the display with an HDMI source, or even to use a web browser. There's a Core i7 CPU under the hood, but it's a Core i7-3610QM that doesn't include Intel's more advanced virtualization technologies (vPro and VT-d) or Intel's demand-based switching technology. The Vaio's Nvidia GeForce GT 620M videocard is also a step behind what Asus, Dell, and HP have to offer.

Sony's Vaio L Series model SVL24116FXB brings some impressive innovations to the all-in-one market, but we don't think they're worth a $200 premium over the much more powerful Asus ET2701 with its larger, better-looking display.

Sony is one of the few all-in-one manufacturers still providing a TV tuner by default. The Vaio L Series also provides both an HDMI input and an output.

VERDICT **6**

Sony Vaio L Series

$1,700, www.sony.com

WHO'S THE FAIREST OF THEM ALL?

Can any of the latest all-in-one machines lure us away from a conventional desktop?

THE ALL-IN-ONE MARKET has grown and changed for the better this year, thanks in large measure to efforts by Asus and Dell to push the envelope. Sony also deserves a measure of credit for introducing picture-in-picture, picture-and-picture, and gesture-recognition innovations (even if its Vaio L Series trails the pack in terms of price/performance ratio). But can any of these contestants tempt a hard-bitten PC enthusiast into giving up separate boxes?

Dell comes close with its new XPS One, especially the configuration reviewed here. We can't overstate the beauty of that gorgeous Samsung PLS panel. The display might not satisfy a professional photographer or illustrator, but games, movies, and websites look fantastic, and it delivers higher resolution than most of us are using today (this review was written using a Dell U2410, with native resolution of 1920x1200). Plus, it's the only machine in the roundup to include an SSD, albeit a small one.

> THE ET2701 COSTS $500 LESS THAN THE DELL, AND ITS MOST CRITICAL INFRASTRUCTURE IS EXACTLY THE SAME

The Asus ET2701, on the other hand, delivers the best bang for the buck. Yes, its IPS panel has native resolution of only 1920x1080, but it costs a full $500 less than the Dell, and the rest of its most critical infrastructure—CPU, GPU, memory, and mechanical hard drive—is exactly the same. (But if you decide to buy one, don't bother unpacking the keyboard—it well and truly sucks.) If you—or your friends and family, if they're looking for your recommendation—have the budget, this is the machine to buy.

But not everyone has that much cash to throw down for a new PC, so what do we recommend for smaller budgets? Certainly not the HP Omni 27—it's nearly as expensive as the Asus, but it's not nearly as good a value. The same goes for the Sony Vaio L Series, although we applaud the company for introducing new features into the market. That leaves Gateway's little engine that could. The ZX6971-UR10P is nothing to brag about, but for those who need a simple productivity machine that can double as a display for a set-top box or a gaming console, it's the machine we'd recommend.

BENCHMARKS COMPARED

	HP Omni 27 Quad (Zero-Point)	Asus ET2701INKI-B046C	Dell XPS One 27	Gateway ZX6971-UR10P	HP Omni 27-1015t	Sony Vaio L Series Model SVL24116FXB
3DMark 11	DNT	P1,937	**P1,967**	WNR	P,1145	P,1103
Metro 2033 (fps)	9.3	29	**34**	WNR	17.3	19.0
Adobe Premiere (sec)	574	**404**	413	740	428	451
MainConcept (sec)	1,341	919	**906**	1,602	1,011	1,026
ProShow Producer (sec)	652	**486**	487	920	534	531

Best scores are bolded. DNT = Did not test; WNR = Would not run.

SPECIFICATIONS COMPARED

	HP Omni 27 Quad (Zero-Point) *	Asus ET2701INKI-B046C	Dell XPS One 27	Gateway ZX6971-UR10P	HP Omni 27-1015t	Sony VAIO L Series Model SVL24116FXB
Price	$1,250	$1,500	$2,000	$800	$1,470	$1,700
CPU	2.5GHz Intel Core i5-2400S	3.1GHz Intel Core i7-3770S	3.1GHz Intel Core i7-3770S	3.3GHz Intel Core i3-2120	3.0GHz Intel Core i5-3550S	2.3GHz Core i7-3610QM
GPU	Integrated	Nvidia GeForce GT 640M	Nvidia GeForce GT 640M	Integrated	AMD Radeon HD 6550A	Nvidia GeForce GT 620M
RAM	8GB DDR3/1333	8GB DDR3/1600	8GB DDR3/1600	6GB DDR/1333	8GB DDR3/1600	8GB DDR3/1600
HDD	1TB (7,200rpm)	2TB (7,200rpm)	2TB (7,200rpm)	1TB (7,200rpm)	2TB (7,200rpm)	1TB (5,400rpm)
Optical	Blu-ray player/DVD burner	Blu-ray player/DVD burner	Blu-ray player/DVD burner	DVD player/burner	DVD player/burner	Blu-ray player/DVD burner
Display	27-inch LED-backlit IPS LCD 1920x1080 (non touch)	27-inch LED-backlit IPS LCD 1920x1080 (non-touch)	27-inch LED-backlit PLS LCD 2560x1440 (non-touch)	23-inch LED-backlit TN LCD 1920x1080 (touchscreen)	27-inch LED-backlit IPS LCD 1920x1080 (non-touch)	24-inch LED-backlit LCD 1920x1080 touchscreen

* No longer available

iFixit presents:

AUTOPSY

THIS MONTH WE DISSECT...

Google Nexus 7

About iFixit

iFixit is a global community of tinkerers dedicated to helping people fix things through free online repair manuals and teardowns. iFixit believes that everyone has the right to maintain and repair their products. To learn more, visit www.ifixit.com.

MAJOR TECH SPECS:

The Nexus 7 is the latest challenger in the ever-expanding 7-inch tablet arena. Let's see what the folks at Google and Asus packed into this little package.

- 8GB or 16GB storage
- 1GB DDR3 RAM
- Quad-core Tegra 3 processor
- 7-inch 1280x800 (216 ppi) backlit IPS display
- 1.2 megapixel front-facing camera
- Android 4.1 Jelly Bean

KEY FINDINGS:

• The Nexus 7 is just one millimeter thicker than the latest iPad (10.4mm vs. 9.4mm). And yet that tiny millimeter could save users hours of time and hundreds of dollars, should the device ever need to be serviced. Why? Because Asus used retaining clips to hold the case together, not glue. Opening up the Nexus 7 requires a couple of minutes and some plastic opening tools.

• The Nexus 7 earned a repairability score of 7 out of 10, just slightly lower than the Kindle Fire's 8 out of 10. The Nexus 7 display glass and LCD are fused together, meaning you'll have to replace both components should one of the two break (which is not the case with the Fire). But the rear case is very easy to open, the battery can be replaced without ever reaching for a screwdriver, and all fasteners inside are Phillips #00 screws. All in all, it's light-years more repairable than its Apple counterpart, and not too far off its Amazonian cousin.

• Though the back cover's dark and light layers remind us of something a Stormtrooper would have in his arsenal, it houses the GPS, NFC, and Wi-Fi antennas—all manufactured between April 20 and May 25 of this year.

• The Nexus 7 has a 4,326mAh, 16Wh battery that can last 9:49 hours. The Kindle Fire, by comparison, has a 4,400mAh, 16.28Wh battery—but only lasts 7:42 hours. Go figure.

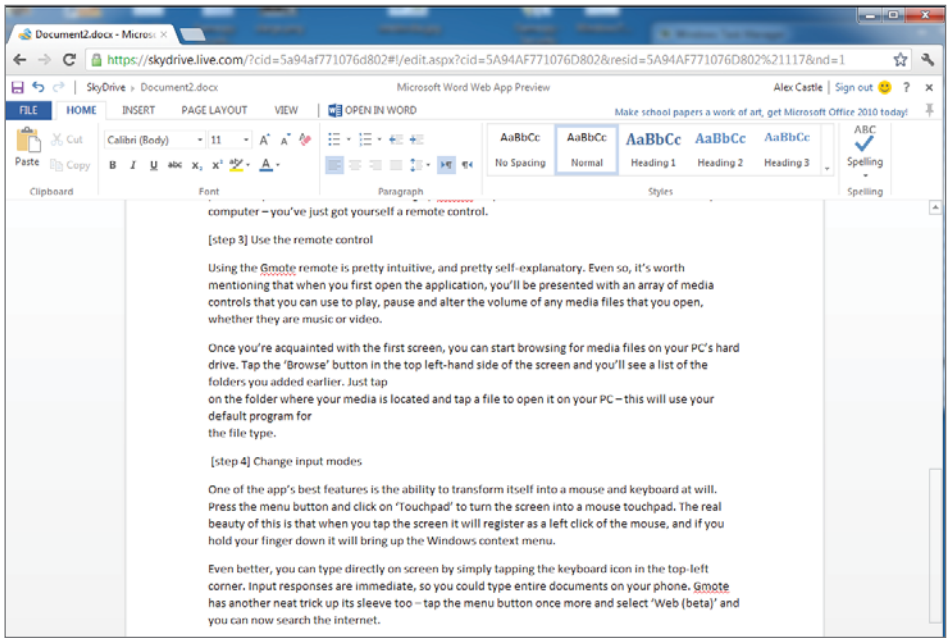
• Although the official Nexus page just indicates there's a "speaker" in the back (singular reference), we clearly see a pair of drivers. No word whether it's stereo or not, as the unit was already apart when we made this discovery.

• We tested iFixit's new Android app on the Nexus 7 right before we took it apart. Good news, folks—it works! Users can now natively browse our repair manuals on their Android devices. bit.ly/iFixit_Android_App

HOW TO

STEP-BY-STEP GUIDES TO IMPROVING YOUR PC

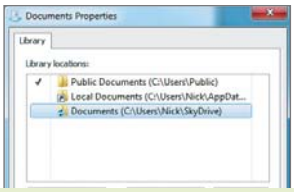
WINDOWS TIP OF THE MONTH



CREATE OFFICE DOCUMENTS IN SKYDRIVE

You might know that SkyDrive is integrated into Microsoft Office, but did you know you can create and edit documents, spreadsheets, and presentations on the SkyDrive website? Just log in to your SkyDrive account and click one of the document buttons. Edit them in the web interface, and they'll appear on your synched PCs.

MAKE - USE - CREATE



ALEX CASTLE
CONTRIBUTING EDITOR

WHAT DO YOU REALLY NEED?

I BELIEVE in having as few programs running on your computer as possible. I love to look at the task manager and see just a handful of active processes—it lets me know my computer's not getting bogged down and that my RAM's free for my own personal use. Unfortunately, just about every program these days thinks it needs to run at startup and keep on going in the background. I propose taking a principled stand: If you don't need it running in the background, don't let it run in the background.

So Microsoft Security Essentials? That can stay. Sync and backup? Those are fine, too. Hardware configuration suites? I'll run those when I need to configure something. But Steam, Spotify, and Evernote? These are some of my favorite programs, but there's no reason not to just start them when I need them and close them when I'm done. Keep it clean, people!

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

Control Your PC Remotely with an Android Phone

YOU'LL NEED THIS

GMOTE
This app turns your phone into a remote control for your PC.
www.gmote.org

AN ANDROID HANDSET
Sadly, the Gmote app is only available for Android.

THERE'S SOMETHING deeply liberating about being able to get one over on those huge, faceless, and cold-hearted corporations, and nothing does that better than building your own recordable TV powerhouse in your living room.

You can achieve this snub by installing a media center PC next to your big screen. Unfortunately, no matter how good you make your media PC—and modern systems are good, allowing you to watch, record, and play back TV in perfect silence—there's often one weak point in DIY home-media networking that will bring the rest of the house toppling down.

The weak link in question is the remote control. Many of us use the standard keyboard and mouse, or some kind of cobbled-together version of the two to control a media PC from a distance. Neither option is particularly good. You can purchase a third, more expensive option in the form of a media center remote, but we don't think this is the best method available, either.

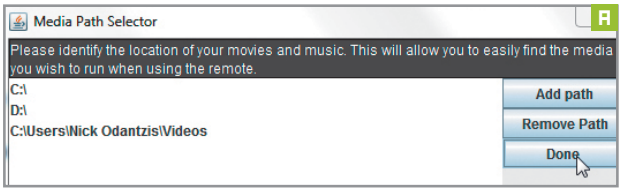
So what are you left with? Well, there's a solution, and you probably already own it: a smartphone. Not just any smartphone, though—it must be an Android device, which, when paired with a little application called Gmote, gives you complete control of your media PC.

In addition to being a great way to control the media on your PC for playback on a big screen TV, Gmote also enables you to stream media from your PC to your phone or tablet. Here's how to install the app on your device, as well as the software needed on your computer to communicate with it.

1 INSTALL GMOTE ON YOUR PC AND PHONE Gmote 2.0 is available from Google Play, so go there to download and install it. The first time you open the app, it will inform you that you need to install the Gmote server on your PC by downloading it from the website. You can get Gmote to email you the link, or alternatively just go to www.gmote.org/server and select the right installer for your computer.

» Once you've installed Gmote on your Android phone and PC, allow the program access to the Internet. Create a password for connecting to the Gmote server through your Android phone, then select the location of the media files on your hard drive. Click "Add path", then simply choose the folder (or folders) that you want to share with the phone **(image A)**.

» If, at a later date, you change your mind and decide to create a more secure password for your smartphone's access, or you wish to add more folders to share or even remove those folders that you've linked to previously, it's easy. All you need to do is right-click the Gmote icon in your Taskbar tray and select the appropriate link from the Settings menu **(image B)**.

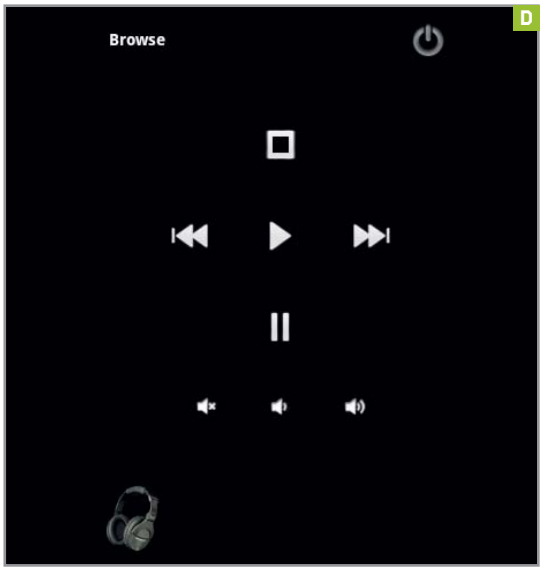


2 LINK UP Once your PC is ready for action, it's time to get your Android device into gear. Go back to Gmote and tap the button on the screen to let the application know that you have Gmote installed on your machine now. The name of your PC should show up on the screen, so just tap it. If not, press the option below it to enter your computer's IP address manually.

» You'll now see the remote control layout on your Android device's screen, complete with media playback controls and more. Tap any of the buttons on the screen and then enter the password you used earlier when setting up Gmote on your PC **(image C)**. Once that's done it'll connect to your computer—you just got yourself a remote control.

3 USE THE REMOTE CONTROL Using the Gmote remote is pretty intuitive, and pretty self-explanatory. Even so, it's worth mentioning that when you first open the application, you'll be presented with an array of media controls that you can use to play, pause, and alter the volume of any media files you open, whether they are music or video **(image D)**.

» Once you're acquainted with the first screen, you can start browsing for media files on your PC's hard drive. Tap the Browse button in the top left-hand side of the screen, and you'll see a list of the folders you added earlier **(image E)**. Just tap on the folder where your media is located and tap a file to open it on your PC—this will use your default program for the file type.



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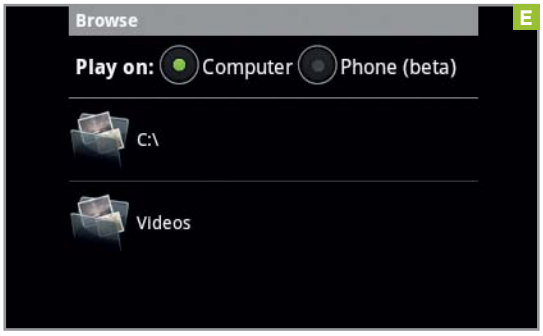
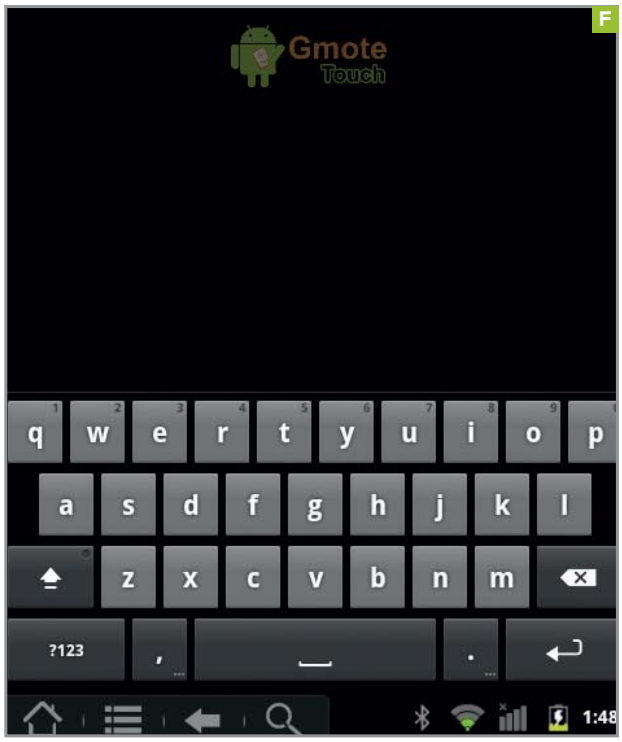


E

4 CHANGE INPUT MODES One of the app's best features is the ability to transform itself into a mouse and keyboard at will. Press the menu button and click Touchpad to turn the screen into a mouse touchpad. The real beauty of this is that when you tap the screen it will register as a left-click of the mouse, and if you hold your finger down it will bring up the Windows context menu.

» Even better, you can type directly on screen by simply tapping the keyboard icon in the top-left corner **(image F)**. Input responses are immediate, so you could type entire documents on your phone. Gmote has another neat trick up its sleeve, too: Tap the menu button once more, select Web (beta), and you can now search the Internet.



F

5 STREAM TO A TABLET You can also beam media stored on your PC to your Android tablet or smartphone. Streaming this way is easy—just go back to the file browser on your Android device, and at the top where it says "Play on", tap Phone (beta). You can now search for media files as you did before. It's worth noting, however, that because this feature is still in beta, not all file types are supported.

Back Up Your Files with the SkyDrive App

YOU'LL NEED THIS

A LIVE ACCOUNT
If you've used Hotmail, Games for Windows Live, or Xbox Live, you've already got one. If you don't, you can make one for free at http://live.com.

THE SKYDRIVE APP
Available for free at https://apps.live.com/skydrive.

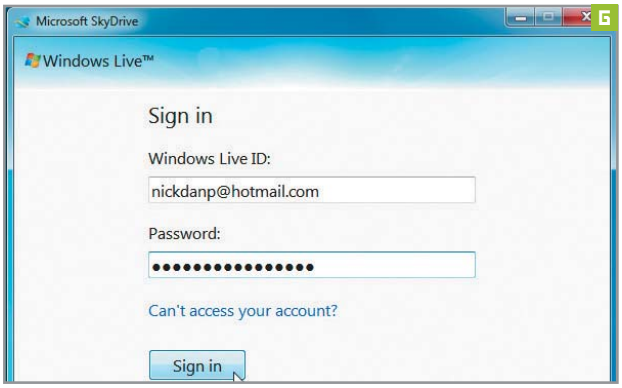
IF, LIKE US, you regularly work on two or more computers, the biggest issue you face is ensuring that you have the very latest version of your files wherever you happen to be working. Microsoft's new SkyDrive app now extends its simple and elegant backup solution to offer people file-synching capabilities, too.

Install the SkyDrive app on all the computers you own, and it won't be long before you can fire up your desktop PC and be assured that the latest version of that document you edited on your laptop earlier in the day will be ready and waiting for you to work on.

Why use SkyDrive over other options like Dropbox and SugarSync? For one, SkyDrive integrates better with Microsoft Office. Also, SkyDrive comes with a generous 7GB of free online storage space, and you can add a lot more for as little as $10 per year. It's not only the best value backup-and sync-solution around, but it's fast and smart, too. **–NICK PEERS**

1 INSTALL AND LOG IN Install Microsoft SkyDrive from https://apps.live.com/skydrive. Once the download completes, click Get Started. If you already have a Windows Live account, enter your Windows Live ID—typically your Windows Live or Hotmail email address—and your password, then click the "Sign in" button **(image G)**. If you don't have an account, click the "Sign up" link to get your free Windows Live ID through your web browser.

» By default, your SkyDrive folder will be stored inside your personal User folder (typically C:\Users\[username]). If this is OK, click Next. If not, click Change to choose another location—for example, your My Documents folder or another drive or partition. Use the browser to select your chosen destination, then click OK. Review your choice and click Next to continue.



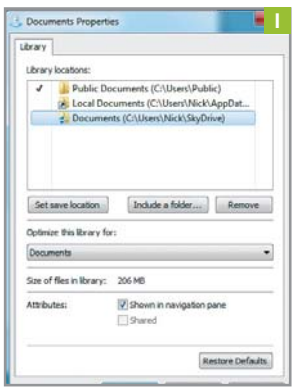
2 START SYNCHING By default, files you copy into your SkyDrive folder on this PC will be synched to other computers you install SkyDrive on, plus any mobile apps you later install. To keep your files private, uncheck "Make files on this PC available to me on my other devices" before clicking Done.

» SkyDrive now opens your personal SkyDrive folder, which may be empty or contain folders you created if you've been using SkyDrive previously through your web browser. Simply copy—or save—files to this folder in the usual way, and they'll be backed up to your SkyDrive account.

» Files copied to the SkyDrive folder start to upload to your SkyDrive account immediately; this can take some time, depending on the size of the files and the speed of your Internet connection. Blue arrows on a folder indicate the folder is being synchronized. A green checkmark indicates it's up to date.

» Install SkyDrive on your second PC, then log in with the same Windows Live ID. Once set up, you'll see the files from your first PC automatically start to download to this one. Now when you add new files or edit existing files on one PC, the changes will be updated on the other computer, too, ensuring you have access to the latest version of your files on both.

3 INTEGRATE WITH LIBRARIES Organize your SkyDrive content into similar folders as your personal User folder: Documents for documents, Pictures for photos, and so on **(image H)**. Windows 7 users can then add these folders to their Libraries to make them more accessible. For example, right-click the Documents Library, choose Properties, then click "Include a folder... " and select your SkyDrive\Documents folder to add it to the Library **(image I)**. Once done, you'll be able to save directly to your SkyDrive folder from the Documents Library.



BUILD IT

NATHAN EDWARDS **SENIOR EDITOR**

A Small but Mighty Gaming Rig

It's not as wee as our Wee Ass-Kicking Machine, but it kicks more ass

LENGTH OF TIME: **2 HOURS** | LEVEL OF DIFFICULTY: **INTERMEDIATE**

WAY BACK IN DECEMBER 2010, we built an awesome Mini-ITX gaming rig dubbed the Wee Ass-Kicking Machine. It featured a Core i7-870 CPU, a GeForce GTX 460 GPU, 4GB of DDR3, a 1TB hard drive, and a 120GB SSD—all crammed into a Silverstone SG07 chassis not much larger than a shoebox. The total cost? Around $1,600 (at the time).

It's, uh, been a while since then, though, and I thought it was high time we built another Mini-ITX gaming rig. This one's not quite as small, but it's got a lot more oomph. We're using the BitFenix Prodigy, which has room for a full-size ATX PSU, scads of hard drives, and even a 240mm radiator (if you swing that way), while still being small enough to be lugged around by its convenient carrying handles.

LET'S SEE WHAT FITS

JUST BECAUSE this is a Mini-ITX build doesn't mean we're messing around with integrated graphics. Pah. Pshaw. And other expressions of contempt. Nope, when we build a gaming rig, we use a real discrete graphics card. This time we're going with an MSI GTX 670 Power Edition, which is factory overclocked but still sips power like the rest of the Kepler lineup. We'll use our sweet-spot Ivy Bridge CPU, the 3.4GHz Core i7-3570K, on a Zotac Z77 WiFi Mini-ITX board. The board has one full-size x16 PCIe 3.0 slot, two DIMM slots, USB 3.0, and 6Gb/s SATA. We'll fill those DIMM slots with two 4GB Corsair Vengeance DDR3/1600 DIMMs, and use a 240GB Corsair Force GS SSD and a 3TB HGST Deskstar for mass storage.

The most important part of the build is the case. The BitFenix Prodigy is large for a Mini-ITX chassis, but that just means there's room for more stuff. It can accommodate a full-size PSU (although 140mm is really the maximum depth), up to six hard drives and six SSDs, a long videocard, and, thanks to its big main compartment, a full-size air cooler or even a liquid cooler.

Because most of our favorite air coolers would interfere with the PCIe slot, and we didn't want to give up the lone 5.25-inch bay just so we could install a 240mm radiator, we opted for an all-in-one liquid-cooling loop: Thermaltake's Water 2.0 Performer. This will give us plenty of headroom for overclocking the 3570K to a steady 4.4GHz.

INGREDIENTS

	PART	URL	PRICE
Case	BitFenix Prodigy	www.bitfenix.com	$80
PSU	Thermaltake Smart Series 730W	www.thermaltakeusa.com	$99
Mobo	Zotac Z77-ITX WiFi	www.zotacusa.com	$178
CPU	Intel Core i7-3570K	www.intel.com	$220
Cooler	Thermaltake Water 2.0 Performer	www.thermaltakeusa.com	$60
GPU	MSI GTX 670 Power Edition 2GB	ww.msi.com	$430
RAM	8GB Corsair DDR3/1600 Vengeance	www.corsair.com	$49
Optical Drive	Samsung SH-222AB CD/DVD burner	www.samsung.com	$20
SSD	240GB Corsair Force GS	www.corsair.com	$220
Hard Drive	3TB HGST Deskstar	www.hgst.com	$160
OS	Windows 7 Professional 64-bit (OEM)	www.microsoft.com	$139
Misc	3-pin-to-Molex adapter	www.amazon.com	$4
Total			$1,659

BUILDING IT

The Prodigy is roomy for a Mini-ITX case, but that still means it's a bit of a complicated build. Here's what I had to do.

1 PREP THE CASE

REMOVE THE four thumbscrews holding the side panels in place and remove the panels. Pop the four clips holding the front panel in place, and remove that too. Grip the top hard drive cage by its top and bottom clips and slide it out of the case. Turn the case on its side and remove the six screws holding the lower cage to the chassis and remove that cage **(image A)**.

2 ADD THE SSD

ATTACH THE SSD to one of the case's six mounting points—either at the bottom of the case, the inside of the left side panel, or the side of the PSU compartment **(image B)**. It doesn't really matter which of the many SSD mount points you use. You could just mount the SSD into one of the hard drive trays, but it'd be nice to leave those free for additional hard drives later on. Replace the hard drive cage. Stand the case upright.

3 OPENING THE CASE

FLIP OVER the front panel and remove the two screws holding the optical drive bezel in place **(image C)**. On the front of the chassis, pry off the metal bezel in front of the optical drive tray. Replace the front panel and slide the optical drive into the bay, stopping when it's flush. Secure with the same M3 screws you used for the SSD.

4 ADD THE PSU

UNSCREW the four thumbscrews securing the PSU backplate. You'll want as short a PSU as you can get for this: anything longer than 140mm and you'll have a hard time routing the cables. As tempting as it is to go modular, a nonmodular PSU will be easier to deal with here. Attach the backplate to the PSU and install it into the chassis, but don't put all four thumbscrews back in, as you may want to be able to slide the PSU out later for ease of wiring **(image D)**.

5 CPU AND COOLING

REMOVE THE CPU socket protector and install the CPU. Lower the gate arm to secure it **(image E)**. Add the RAM. Although the Prodigy has room for the large skyscraper-style air coolers we like in our builds, those coolers don't play nice with our solitary PCIe slot, so we're going with a water cooler.

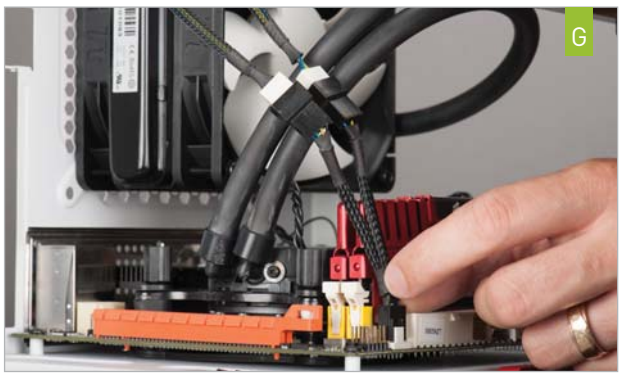
Thermaltake's Water 2.0 Performer (catchy!) is an Asetek-built dual-fan 120mm all-in-one cooler that should keep our CPU nice and chilly. But first we have to install the backplate. Find the Intel backplate and assemble it for Socket 1155 per Thermaltake's instructions. Attach it to the rear of the motherboard. Assemble the retaining clips and screws in the socket ring.

Take the motherboard I/O shield, pop off the tabs covering the Wi-Fi antenna ports, and install it into the case back. Unscrew the case's 12cm exhaust fan and set it aside. Install the motherboard into the case using four screws **(image F)**.

6 ADD THE COOLER

TAKE THE all-in-one cooler and one of the 12cm fans, as well as four of the mounting screws and four washers. Run the screws through the washers, through the mounting holes at the back of the case, through the fan (making sure it's oriented to exhaust out of the case), and into the mounting holes on the radiator. Attach the pump unit to the CPU with the socket ring. Turn to tighten, alternating in an X pattern.

Take the other fan, positioned to blow air through the radiator out of the case just like the first, and install it on the side of the radiator. Plug the fans into the included Y cable and into the CPU_FAN header, and plug the pump unit into the SYS_FAN header near the SATA ports **(image G)**.



7 ROUTE THE POWER

NOW IS a good time to route some power-supply cables. Bring the 8-pin and 24-pin ATX power cables and one PCIe cable around the front of the PSU to the right side of the case. Route a SATA power cable along the left side to the hard drive bays, connect one port to the hard drive, then terminate it at the SSD, leaving the middle port for a future second drive **(image H)**. Route the other SATA power cable along the bottom of the case, up the front panel, and into the routing hole just above the optical drive. Pop the top fan filter off and route the cable above the optical drive and plug it in **(image I)**. Route SATA data cables from the blue 6Gb/s SATA ports to the SSD and HDD, and route one from a red 3Gb/s port to the optical drive.

8 MORE ROUTING

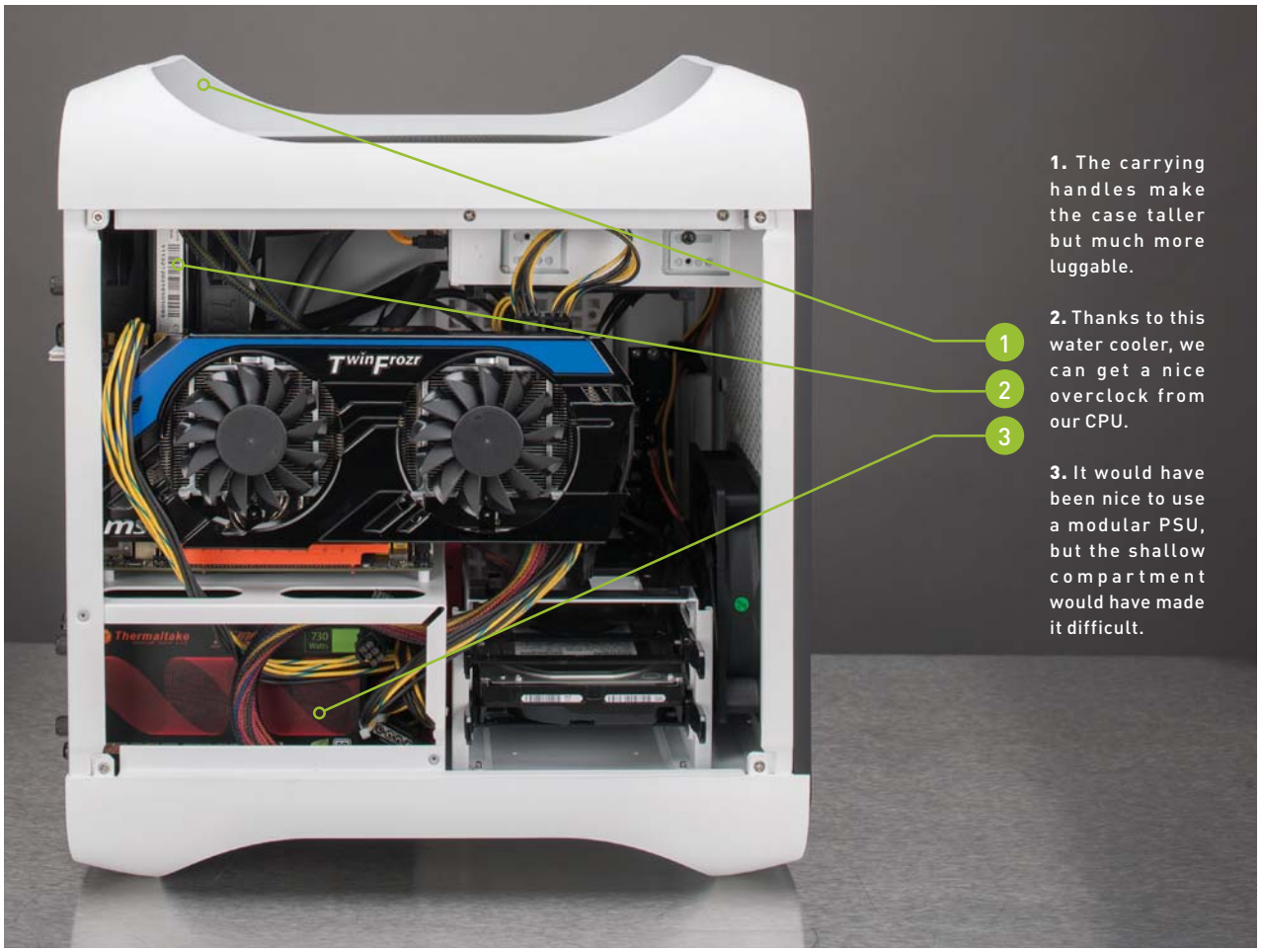
DISCONNECT the HD_Audio cable from the side panel and connect the motherboard end to the mobo, as the port will be impossible to access once the GPU is in place. Run the 24-pin motherboard power cable through the front of the PSU casing and into the port on the motherboard. Run the 8-pin through the cutout toward the rear of the casing **(image J)** and plug it in. At this point you can reattach the top hard drive cage if you want; I've left it out to improve airflow.

9 ATTACH FRONT-PANEL CONNECTORS

PLUG THE USB 3.0 header into its place below the radiator **(image K)**. Connect the front 12cm fan to a 3-pin-to-Molex adapter and connect that to one of the Molex adapters. Re-attach the other end of the HD_audio cable to the left side cover **(image L)** and put the cover back on the side, pulling the front-panel headers through toward the GPU slot and plugging them in.

10 INSTALL THE GPU

UNSCREW the expansion-slot cover plate and the expansion-slot covers, and remove them. Install the GPU, making sure the 8-pin ATX power cable can still reach its plug. Replace the cover plate and secure both it and the GPU with the three thumbscrews **(image M)**. Run the PCIe power cable through the same hole as the ATX power cable and plug both 6-pin plugs into the GPU. Secure the PSU plate to the chassis with its four thumbscrews, double-check your wiring, and close the case back up. Screw the Wi-Fi antennae into their posts on the I/O ports.



1. The carrying handles make the case taller but much more luggable.

2. Thanks to this water cooler, we can get a nice overclock from our CPU.

3. It would have been nice to use a modular PSU, but the shallow compartment would have made it difficult.

FIRING IT UP

THE FIRST THING I did with the mini machine was boot into the BIOS and do a simple multiplier overclock on the CPU. I left the stock voltages and bclock the same but cranked up the turbo multipliers on all the cores to 44 for a single core, 43 for two cores, and 42 for more. This gave me a nice, stable conservative overclock of up to 4.4GHz for single-threaded tasks. The MSI GTX 670 is factory-overclocked, so I resisted further overclocking in an attempt to keep the noise from its fans down.

Against our zero-point, the mini-rig loses in every benchmark save ProShow Producer, where its high clock speeds are more important than the zero-point's 12 threads. But our zero-point has a hexa-core CPU , a dual GPU, and costs a lot more money—and it's not nearly as portable. For the price, we get a hell of a lot of rig in a small footprint, and we even get carrying handles. Besides, the fast CPU and GPU on this baby mean that it's still blisteringly good.

The downside of Mini-ITX is that you only get one PCIe slot and two RAM slots, so you've got to be judicious with your build. The good news is that this machine still has room for all the essentials and no wasted space, while still being upgradeable. We'd gladly build into the Prodigy again, and we're pleased we can build a kick-ass (and luggable) rig in such a small package.

BENCHMARKS

	ZERO POINT	
Premiere Pro CS6 (sec)	2,000	3,442 (-42%)
Stitch.Efx 2.0 (sec)	831	842 (-1%)
ProShow Producer 5.0 (sec)	1,446	1,377
x264 HD 5.0 (fps)	21.1	13.8 (-35%)
Batman: Arkham City (fps)	76	57 (-25%)
3DMark 11	5,847	3,004 (-49%)

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

Our current desktop test bed consists of a hexa-core 3.2GHz Core i7-3930K @3.8GHz, 8GB of Corsair DDR3/1600, on an Asus Sabertooth X79 motherboard. We are running a GeForce GTX 690, an OCZ Vertex 3 SSD, and 64-bit Windows 7 Professional.

REVIEWS

TESTED. REVIEWED. VERDICTIZED.

INSIDE

Asus GeForce GTX 690

SLI speeds on a single card

HELLO, GORGEOUS. That's what we said when we first laid eyes on Nvidia's reference design for the GeForce GTX 690, which combines two full 28nm GK104 GPUs into one PCB and covers them with the best-looking cooling shroud we've seen on any videocard. Our in-depth analysis of the reference card can be found in our August 2012 issue, but we can't verdictize a reference card. If you're wondering how this Asus GTX 690 differs from the reference card Nvidia sent us, wonder no more: It's exactly the same, except the edges of the PCB are a slightly different color.

Like the reference card, the Asus GTX 690 has a whopping 3,072 CUDA cores, 256 texture units, 64 ROPs, and 4GB of memory at 6,008MHz combined speed. Unlike previous dual-GPU cards, it has all the cores and texture units intact on each GPU, and each GPU is only slightly underclocked, to 915MHz with a 1,019MHz boost clock. The GTX 680 has a base clock of 1,006MHz and a boost clock of 1,058MHz.

Since this is essentially a duplicate of the reference design, it carries the same 48-lane PLX bridge chip connecting the GPUs to each other and to the x16 PCIe 3.0 interface. It also uses the reference cooling shroud, for which we can't fault Asus one bit. Why mess with a great thing?

The cooling shroud is chromium-plated cast aluminum with a magnesium-alloy fan housing in the center of the card. The fan takes in air centrally and blows it into vapor chambers atop each GPU, venting the hot air toward both the front and back of the card—not ideal for standard front-to-back airflow. The vapor chambers over the GPUs are covered with polycarbonate windows. The fan is fairly quiet even when running at full load. It's not silent, but it's less noise than a pair of cards would be.

The Asus GTX 690 has a TDP of just 300W (a single GTX 680 has a TDP of 195W) and requires two 8-pin PCIe power connectors. Its rear panel contains two dual-link DVI-I ports, one dual-link DVI-D, and a Mini DisplayPort 1.2 connector. The card, like the reference board, is 11 inches long.

Asus ships the GTX 690 with its GPU Tweak software, which allows for easy overclocking of the memory clock and GPU boost clock, as well as voltage tweaks. We were able to overclock the boost clock to around 1,100MHz without sacrificing stability, but the card got flaky as we went higher. More tweaking would doubtless have given us a long-term stable overclock.

In our benchmarks, the performance of the Asus GTX 690 was indistinguishable from the reference card—that is, it was within a few percentage points of a set of stock-clocked GTX 680s in SLI, while consuming less power. Depending on the benchmark, it's anywhere from 46 percent to 95 percent faster than a single stock-clocked GTX 680. On all but three benchmarks, it beat a pair of reference Radeon HD 7970s—we'll test it again against GHz edition 7970s when we track down a pair of them.

Very few people need the power of two top-of-the-line GPUs. But if you do, it's better to have them on one videocard rather than two: It'll draw less power, be easier to cool, and will give you the option of adding *another* GTX 690 down the line. We're still wild about the looks of the cooling shroud, if not about the fact that it exhausts hot air in both directions. So far the only GTX 690s we've seen on the market have been stock-clocked ones using the reference shroud, and AMD's dual-Radeon card is nowhere to be found, so a GTX 690 is your only dual-GPU option right now. Asus's is slightly more expensive than, say, EVGA's, and it's not clear what you get for the extra $50. But at that point, you're already spending a grand, so does the extra $50 really matter?

–NATHAN EDWARDS

VERDICT **9**

Asus GeForce GTX 690

+ MASSIVE Fastest single videocard you can buy; GPU Tweak makes overclocking easy; quieter and more power-efficient than SLI.

– PASSIVE Front-and-back airflow is hard to cool; gets flaky at high overclocks; $50 more expensive than competing cards.

$1,050, www.asus.com

SPECIFICATIONS

	Asus GTX 690	Nvidia GTX 690 Reference	Nvidia GTX 680 SLI	AMD Radeon HD 7970 CrossFireX	EVGA GTX 680
3DMark 11 Perf	P15,056	P15,104	**P15,804**	P13,817	P9,555
3DMark 11 Extreme	X5832	X5800	**X6072**	X5352	X3249
3DMark Vantage Perf	P44,501	P44,501	**P45,205**	P44,180	P34,339
Unigine Heaven 2.5 (fps)	59.8	59.8	**60.8**	57.6	31
Shogun 2 (fps)	35.4	37.9	**38**	75	18.7
Far Cry 2 / Long (fps)	183.7	184.7	**187.9**	186.3	107.3
Dirt 3 (fps)	123	122.9	**124.5**	114.5	73
HAWX 2 (fps)	WNR	224	225	229	**131**
Metro 2033 (fps)	29	**29.6**	29.5	29	16.3
STALKER: CoP DX11 (fps)	64.2	64.6	66.1	**76.7**	34.3
Just Cause 2 (fps)	80	79.31	81.03	**91.85**	54.7
Batman: Arkham City (fps)	103	102	**104**	86	58
Base Clock (Actual)	915MHz	915MHz	1,006MHz	1,000MHz	1,006MHz
Boost Clock	1,019MHz	985MHz	1,056MHz	N/A	1,056MHz
Memory Clock	1,502MHz	1,502MHz	1,502MHz	1,425MHz	1,502MHz

Best scores bolded. Our GPU test bed consists of a stock-clocked Intel Core i7-3960X on an Asus P9X79 Deluxe board with 16GB DDR3/1600, a 256GB Samsung 830 Series boot SSD, and a 1,050W Thermaltake Toughpower Grand PSU, in a Cosmos II chassis. All tests performed at 2560x1600 with all settings maxed and 4x MSAA except where noted. Power use measured with a Watts Up Pro.

Still gorgeous. Still massive.

Polywell H7700i-400B

Desktop power in a tiny box

A handsome aluminum chassis is marred by chintzy rubber feet that easily come loose.

WE HAD a tough time figuring out how to categorize Polywell's H770i-400B PC. Its small size puts it clearly in the class of HTPCs or mini PCs that get tucked behind a monitor or TV.

What's confusing about the Polywell H7700i-400B is its power curve. PCs in this class typically pack AMD's Fusion CPUs or Intel's lower-voltage CPUs to balance price, thermals, acoustics, and the typically modest performance requirements of a mini PC.

Instead of going for low power, however, Polywell stuffed a 3.4GHz Core i7-3770 part into its diminutive rig and topped it off with a 120GB OCZ mSATA SSD (along with a 500GB notebook hard drive). This makes the Polywell the fastest HTPC-class PC we've ever tested in most tasks. How fast? In our older Photoshop CS3 test that we still use to judge HTPC-class boxes, most Fusion and Atom boxes take upward of seven minutes to complete the action-script test. The Polywell rolls through it in just over one minute. In encoding tests, a typical AMD E-350 box will take more than an hour to complete, with some Atom chips pushing it to two hours. The Polywell? Just 14 minutes.

Perhaps more interesting is how the Polywell stacks up against our previous performance champ: Asrock's Vision 3D. With its 2.4GHz Core i3-370M and GeForce GT 425M, the Vision 3D murderized all other HTPC boxes. That mobile Sandy Bridge CPU, however, has no chance against the Polywell's full-tilt Ivy Bridge part. The Polywell is easily twice as fast in compute-bound tasks. In graphics, though, we're putting an older discrete chip up against the latest integrated graphics. The winner? We'll call it a tie. The older GeForce GT 425M gives up 17,394 in 3DMark 2003, which isn't that much faster than the Polywell's 15,162. In games bound by the CPU, though, the Ivy Bridge part takes the front seat.

That's an impressive feat for integrated graphics. The Polywell is capable of playing some more modern titles if you're willing to tamp down visual quality and resolution, but don't think it substitutes for a good graphics card.

That brings up an important question. In compute-bound performance, the Polywell outclasses other HTPC-centric boxes. It also has reasonable graphics performance; but why even limit yourself graphically? Why not instead step into an Alienware X51 (reviewed May 2012)? The Alienware has since been upgraded to Ivy Bridge CPUs, as well, and lets you run fairly decent discrete graphics for under $1,000. Then again, is it even fair to pit the 8x8x3-inch Polywell against the Alienware X51 or the Falcon Tiki that we reviewed in September, both of which are two to three times larger than the Polywell?

That decision is, frankly, up to the you the consumer. It doesn't make sense to lay out the cash for discrete graphics if your HTPC needs won't include gaming. For that matter, do you really need a machine as fast as the Polywell sitting under your TV? Again, we think that depends on your usage. If you intend to watch streaming video and browse the web, a Fusion-based HTPC is more than enough. If, however, you intend to run a USB ATSC or USB CableCard tuner and encode video on your HTPC, then yes, you do need this much power. –GORDON MAH UNG

BENCHMARKS

	Polywell H7700i-400B	Giada i50	Dell Inspiron Zino	Giada Ion-100	Asrock Vision 3D	Zbox Plus Nano XS
CPU	3.4GHz Core i7-3770	1.2GHz Intel Core i5-430UM	1.5GHz Athlon X2 3250e	1.3 GHz Atom 330	2.4GHz Core i3-370M	1.65GHz E-450
GPU	IGP	IGP	IGP	IGP	GeForce GT 425M	IGP
Photoshop CS3 (sec)	**70**	272	449	552	162	423
MainConcept (sec)	**867**	4,736	7,080	8,858	2,452	4,560
3DMark 2003	15,162	1,189	2,540	3,371	**17,394**	6,954
Quake III (fps)	**668**	87	192	118	537	161
Quake 4 (fps)	**130**	9	29	29	112	40

Best scores are bolded.

VERDICT 8

Polywell H7700i-400B

LIBYA Outpaces other systems in its class.

LIBOR Slightly noisy; graphics aren't great.

$1,000, www.polywell.com

SPECIFICATIONS

Processor	Intel 3.4GHz Core i7-3770
Mobo	Intel DH77KC
RAM	8GB DDR3/1600
Graphics	Intel HD4000 integrated
Soundcard	Onboard
Storage	120GB OCZ Nocti mSATA, 500GB Hitachi 2.5-inch 7,200rpm HDD
PSU	120-watt power brick

Asus Zenbook UX32VD

Now with discrete graphics!

The UX32VD comes with a protective sleeve, as well as a small pouch for carrying two connector dongles: one USB-to-Ethernet, one Mini-VGA-to-VGA.

WHEN ASUS'S Zenbook UX31E debuted last year, it seemed to almost single-handedly put Ultrabooks on the map. Its intriguing mix of good looks, performance, and price convinced many a skeptic, us included, that PCs could compete with the likes of Apple's vaunted MacBook Air—at a price that catered to common folk.

Now Asus is back with its second-generation Zenbooks, and the company hasn't been slacking. Some of the specs have received a serious goosing, without a big hike in price. Indeed, the follow-up to the UX31E—the UX31A—is just $50 more than the original, at $1,100, despite boasting a new Ivy Bridge processor, which clock-for-clock offers approximately 10 percent more performance on the CPU side while improving graphics performance two-fold, as well as a superior IPS panel with an increased resolution of 1920x1080, and a backlit keyboard.

But we're not actually here to talk about the UX31A. Rather, we turn our attention to the brand-new Zenbook UX32VD—which boasts the same sleek form factor, same improvements to screen and keyboard, an even faster Ivy Bridge processor in the form of a 1.9GHz Intel Core i7-3517U, and discrete graphics. Yes, Asus has squeezed an Nvidia GeForce GT 620M GPU into this 13.3-inch slender wedge of brushed metal measuring just .70 inches at its thickest.

In other words, the UX32VD manages to still look and feel like an Ultrabook should, in our minds, as opposed to pushing the boundaries with a larger, thicker chassis, à la Acer's 15.6-inch Timeline M3 gaming Ultrabook (reviewed July 2012). The question is whether you can have your sliver of portable-gaming cake and eat it too. Or, in less labored terms, does a discrete GPU make sense in such a svelte device?

The UX32VD's GT 620M has the same GPU clock, memory clock, and boost as the Acer M3's GT 640M (625-, 900-, and 700MHz, respectively,) but just one-third the CUDA cores, or shaders (96 vs. 384). That made a big difference in our gaming benchmarks—by nearly 50 percent. In fact, under our standard testing conditions of 1680x1050 res, with 4x AA and 4x anisotropic filtering, Call of Duty 4 was just playable at 30.7fps—and that's an old game! We wouldn't even bother playing a modern title on the UX32VD's native 1920x1080 res.

Gaming weaknesses aside, the UX32VD still has a lot going for it. The screen itself is a real pleasure, atoning for the wrongs of the first gen's TN panels, with colors and image quality that hold up off axis, making for a much broader viewing angle. We also really like the semi-gloss surface, which lacks the glare and reflection of your typical glossy screen, without the dulling effect of most anti-glare coating. The keyboard is pretty much the same, save the aforementioned backlighting, easy enough to type on once you're accustomed to the shallow chiclet-key presses. The glass-surface touchpad provided a generally frustration-free experience.

The thing is, you can get all these neat features, as well as an SSD, in the new Zenbook UX31A, for $200 less, just by forgoing the discrete graphics. And frankly, we think that if portable gaming is what you're after, you're better served by a small powerhouse like Origin's Eon11-S (reviewed last month), as opposed to a rig that tries to be both an Ultrabook and a gaming machine, where one or both facets are bound to be compromised. **–KATHERINE STEVENSON**

BENCHMARKS

	ZERO-POINT	
Premiere Pro CS3 (sec)	1,069	840
Photoshop CS3 (sec)	111	126.3 (-49.1%)
Proshow Producer (sec)	1,340	1,108
MainConcept (sec)	2,280	1,808
Far Cry 2 (fps)	37.6	19.7 (-49.1%)
Call of Duty 4 (fps)	57.7	30.7 (-49.1%)
Battery Life (min)	330	235 (-49.1%)

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

Our zero-point notebook is an Acer Timeline M3 with a 1.7GHz Intel Core i7-2637M, 4GB of DDR3/1333, a 256GB SSD, a GeForce GT 640M, and Windows 7 Home Premium 64-bit.

VERDICT 8

Asus Zenbook UX32VD

+ MEDITATION Sexy Zenbook looks; lovely screen; lots of amenities at a competitive price.

– MEDICATION Wimpy GPU; despite Optimus, battery life isn't exceptional; HDD rather than SSD.

$1,300, www.asus.com

SPECIFICATIONS

CPU	1.9GHz Intel Core i7-3517U
RAM	4GB DDR3/1600
Chipset	Intel HM67
GPU	Nvidia GeForce GT 620M
Display	13.3-inch, LED-backlit, 1920x1080 IPS panel
Storage	Hitachi 500GB HDD, SanDisk 32GB SSD
Connectivity	Ethernet, Mini VGA, VGA, HDMI, headphone/mic, 3x USB 3.0, 2MP webcam, 2-in-1 media reader, Bluetooth 4.0, 802.11a/b/g/n
Lap / Carry	3 lbs, 3.9 oz / 3 lbs, 12.2 oz

The Nexus 7 seeks to go Roy Batty on Amazon's Kindle Fire.

Google Nexus 7

The 7-inch tablet you've been waiting for has arrived

MAKE NO MISTAKE: The launch of Google's Nexus 7 tablet is more of an effort to stomp out Amazon's unwelcome version of an Android tablet than it is an attempt to dethrone the iPad.

To do that, Google contracted Asus to craft what is arguably the best 7-inch tablet available. The Nexus 7 easily runs circles around Amazon's Kindle Fire and other competing Android tablets costing twice the price or more.

The specs for the Nexus 7 are quite impressive: a quad-core Tegra 3 with 1GB of RAM, and either 8GB of onboard storage for $200 or 16GB for $250. The 7-inch, 1200x800, HD, LED-backlit IPS display packs a respectable 216 pixels per inch onto the screen. Sure, it's not quite as impressive as a third-generation iPad at 264ppi, but given the price, users will have little to complain about from the display.

The front of the Nexus 7 is devoid of hardware-based buttons, but a 1.2MP front-facing camera rests at the top-front of the tablet, which is covered entirely by Corning glass (we're assuming Gorilla Glass, but Google isn't confirming).

Unlike the Kindle Fire, with its one lone button, Google has wisely opted for three basic hardware controls. On the right side is a power/sleep button with a two-stage volume rocker just below; the rest is done using Android's onscreen software buttons for back, home, and recent navigation, as well as rotation lock, which can be accessed via the notifications menu. While the Nexus 7 is primarily plastic and glass, it certainly doesn't feel cheap.

Inside, the Nexus 7 packs the usual assortment of features, including an accelerometer, magnetometer, and yes, even a gyroscope and GPS chip, nicely timed to take advantage of Google Maps' new offline mode for navigating when Wi-Fi isn't available.

Despite the device's size, Google and Asus managed to find space for a nice bezel around the screen itself, making it plenty comfortable to hold without your fingers or thumbs getting in the way.

While Google and Asus have checked all the right boxes on the Nexus 7's HD IPS display, and it is indeed bright and rich in color, we were disappointed to discover that overall contrast was somewhat muted on our review unit. (It's particularly noticeable on the home screens).

Maybe the iPad or Asus's own Transformer has spoiled us, but the Nexus 7 seems to lack the kind of deep, rich black levels you might find on something like the Samsung Galaxy Nexus (which admittedly uses a more saturated, contrast-rich Super AMOLED display instead).

This quibble aside, viewing photos or other content on the Nexus 7 is quite enjoyable, with overall contrast faring much better while displaying such media. Without a second unit to compare it against, we're left to wonder if the brand-new Android 4.1 might be to blame for the lower contrast levels.

This brings us to the other star of the show: Android 4.1, Jelly Bean. Jelly Bean introduces under-the-hood improvements such as "Project Butter," the company's initiative to address the lag Android is notorious for. Coupled with the Tegra 3 and the 1GB of RAM, the Nexus 7 makes a great initial showcase for Jelly Bean. Swiping through screens is fast and responsive—even on apps that haven't yet been updated for 4.1. Ridiculous name aside, Project Butter delivers the goods.

Perhaps the best compliment we can pay to the Nexus 7 is that it validates the form factor. Like a bucket of water being used to douse the Kindle's flames, Google appears poised to reclaim any tablet ground lost since the introduction of Amazon's forked version of Android. It may not tread a lot of new ground, but the Nexus 7 is a solid performer and easily the best tablet a couple hundred bucks can buy. **–J.R. BOOKWALTER**

SPECIFICATIONS

CPU	Tegra 3 T30L
GPU	ULP GeForce
RAM	1GB LP-DDR3
Storage	8GB or 16GB (no expansion slot)
Radios	802.11n, Bluetooth 4.0, NFC
Camera	1.2MP front-facing camera
Ports	Micro USB, 1/8-inch headphone jack

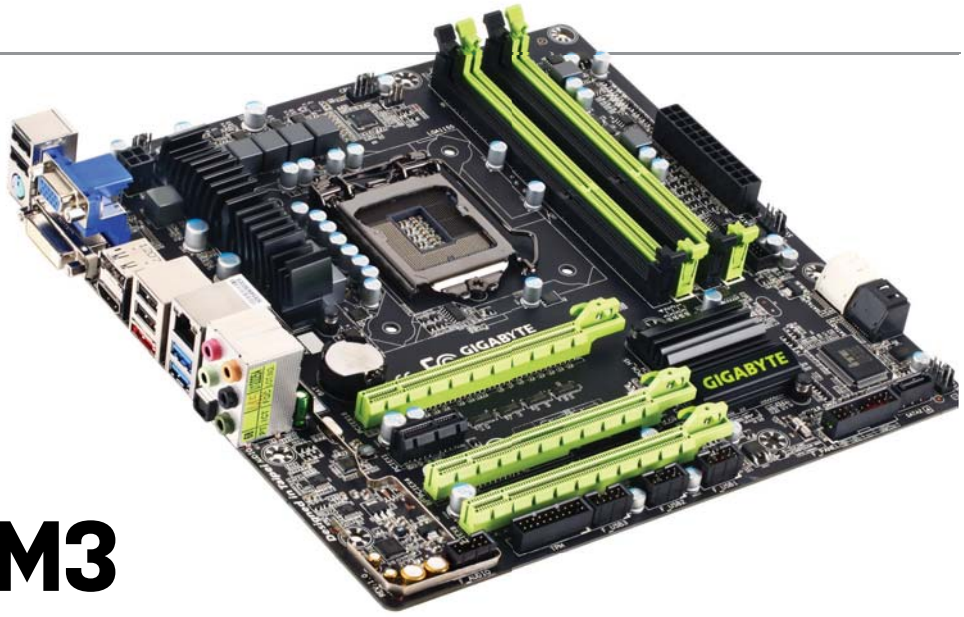
VERDICT 9 KICK ASS!

Google Nexus 7

+ JELLY BELLYS NFC, Jelly Bean, and bundled Google Play freebies.

– ALMOND JOY Weak IPS display contrast.

$200, www.google.com



The G1.Sniper M3 gets you SLI and CrossFireX in a compact package.

Gigabyte G1.Sniper M3

MicroATX board shoots for your dollar

GIGABYTE'S G1.KILLER series of motherboards have always been love-it-or-leave-it affairs. While some laud the gun-shaped heatsinks of the series, others think them garish or just plain tacky.

With the G1.Sniper M3, Gigabyte does away with the gun-sinks (though you still get a sheet of stickers riddled with faux bullet holes). More importantly, the board isn't some budget microATX jobbie designed to get the price under or near $100. It's based on Intel's performance Z77 chipset and features Lucid Logix' Virtu as well as CrossFireX and SLI support out of the box.

The highlight of the board is the Creative Core3D sound chip using a CA0132. That's the same part used in Creative's new line of USB and PCIe audio devices. The most notable feature of the Core 3D is probably its "scout mode," which reduces some sound effects (like explosions) and amplifies footsteps so you can better discern someone approaching you in a game. If you think that's cheating, then Steve Austin was cheating with his bionic hearing, too. There's also more to the audio: The audio circuits feature a low-profile metallic RF shield, and an additional preamp is integrated to help gamers who run headsets from the front-panel connector. The result is very clean sound and a possible advantage in gaming.

Space is at a premium on microATX boards, so many features are kicked overboard. The most notable is the lack of a Killer NIC controller, a prominent feature of the original Killer motherboards. An Intel network card is included instead. Also gone are surface-mounted power switches, and secondary USB 3.0 and SATA controllers. As we said, SLI and CrossFireX are there, but like all performance microATX boards we've tested, the second card sits over the USB, audio, and front-panel connectors. That will make it a very tight squeeze if you run dual cards. Since a multicard config would leave the second card also hanging over the edge of the board, you'll want a case that's designed for it.

In performance, the G1.Sniper M3 performs on par with the Gigabyte Z77X-UD5H from our Z77 roundup in August but the Asus P8Z77-V board from that same roundup slightly leads in performance, especially in USB 3.0 mode with Asus's Turbo Mode activated. The G1.Sniper M3 auto-overclocked the furthest, though. The board's auto-tune successfully took the CPU to a stable 4.6GHz overclock, which is higher than what we saw from all previous Z77 boards. We did hit a snag trying to get the board back to stock speeds, however—the utility would not revert the speeds to stock no matter what we did. We had to finally load the defaults in the BIOS to get it back to its original state.

Overall, it's a good board for someone looking to work within the constrained spaces of microATX. Yes, we really wanted more USB and SATA ports, but frankly, when you've made the decision to go microATX, you've already made a compromise, so just suck it up. **–GORDON MAH UNG**

BENCHMARKS

	Gigabyte G1.Sniper M3	Gigabyte Z77X-UD5H	Asus P8Z77-V
Price	$179	$189	$189
3DMark 11 Overall	P6,015	P6,052	**P6,308**
3DMark 11 GPU	5,542	5,570	**5,856**
PCMark 7 Overall	3,644	3,549	**3,739**
Valve Particle (fps)	204	203	**208**
SISoft Sandra 2012 (GB/s)	19	21	21.3
SATA 6Gb/s Read / Write (MB/s)	499 / 223	497.9 / 230.4	**509.9 / 247.1**
USB 3.0 Read / Write (MB/s)	252 / 184	250.2 / 177.5	**429.9 / 181.9**
SLI Compliance	Yes	Yes	Yes
32GB Compliance	Yes	Yes	Yes
Auto Overclock	4.6GHz	4.5GHz	4.2GHz

Best scores are bolded. We used a Core i7-3770, 8GB DDR3/1866 set at DDR3/1600, a WD Raptor 150, a GeForce GTX 580, and 64-bit Windows 7 Professional. SATA 6Gb/s speeds were measured with CrystalDiskMark and a Patriot Wildfire SSD in a USB 3.0 enclosure using an ASMedia controller. 32GB compliance was checked with four 8GB DDR3 modules and SLI was run using two GeForce GTX 580 cards.

VERDICT **8**

Gigabyte G1.Sniper M3

+ TOM BERENGER Auto-overclocks well; Core3D sound system; CrossFire/SLI support.

– BILLY ZANE Finicky overclocking utility; could use more USB 3.0 and SATA ports.

$180, www.gigabyte.us

The Define R4 isn't much to look at on the outside, but Fractal Design has made some good tweaks to the system's insides to take it above and beyond its predecessor.

Fractal Design Define R4

A good, quiet case that needs more 'oomph'

FRACTAL DESIGN'S Define R3 chassis, which we reviewed in January 2011, impressed us with its combination of functionality and customizability at a low price. The Define R4 is an updated version of that chassis, and like its predecessor is tricked out for noise control—if not enthusiast building.

The first question you'll ask yourself when you unscrew the thumbscrews and remove the side panel from the Define R4 will probably be, "Where are the 5.25-inch bays?" Like its predecessor, the R4 comes with just two. That's not the best of news for those looking to do anything but slap an optical drive into their rigs. Water coolers will have to look elsewhere to place a reservoir. Unlike in the R3, the cage holding the top five (of eight) 3.5-inch bays slides right out of the case—perfect for those needing a bit of extra room for a long videocard, a pump/reservoir setup, or just good ol'-fashioned airflow. The back of the motherboard tray can hold up to two SSDs, but the mounting system amounts to a few extra screw holes in the tray. Hardly fancy.

The drive trays require four screws each to secure your drives into place through rubber washers. The case's 5.25-inch bays also require screws. In other words, there's nothing toolless about this case, except the process of snapping fans onto the chassis' front, which can accommodate two clip-in fans or a slimline 240mm radiator.

The case comes with the standard armada of rubber-grommeted cable-routing holes around the motherboard area, as well as a larger CPU backplate cutout than was found in the R3. The routing holes are smaller than on many other cases; at least there are a number of them to work with. The rubber grommets have been beefed up from the flimsy ones found in the R3. A built-in fan controller, while a convenient touch, requires a Molex connector for power. On the plus side, it makes it a lot easier to hook up the case's two major fans: 14cm intake and exhaust fans (no LEDs).

Installing the motherboard standoffs was a bit of a pain, given that one of the drilled-in standoff holes was too big for the standoff itself. Those looking to install additional cooling into the case at the expense of silence can unscrew two top panels to add additional 12- or 14-centimeter fans or a slim 240mm radiator (though you'll have a tight squeeze). Otherwise, the foam-covered panels stay put. It's a great method for giving builders the best of both cooling and soundproofing. A similar setup can be found on the case's side panel, which builds in room for a single 14-centimeter fan.

Two front-panel USB 3.0 ports and two USB 2.0 ports (found on the top of the case) are all the connectivity you get on this system. And that's just fine with us, especially since the USB 3.0 is an internal header instead of a pass-through.

With the stock fans in place, the Define R4's thermal performance was around the middle of the pack—nothing to write home about, which is good news for a case designed to be quiet, since they can often run a little hot. Though it isn't perfect, it's hard to deny the pleasantness of Fractal Design's Define R4 case if silence and savings are your big concerns. It's essentially the same case as the R3, with some modest but much-needed improvements.

–DAVID MURPHY

We love sound-dampening foam, especially when it doesn't hurt a case's ability to keep your system cool.

VERDICT 8

Fractal Design Define R4

ABRAHAM LINCOLN Plenty of drive storage; built-in fan controller; good connectivity (and lots of fan mounts).

VAMPIRES Nothing's screwless; tougher design for more extreme system builds; limited 5.25-inch bay support.

$109, www.fractal-design.com

Apricorn Aegis Secure Key 16GB

A secure-but-poky USB flash drive

EVERYTHING ABOUT the Aegis Secure Key telegraphs that Apricorn is serious about the whole data-security thing. The Secure Key has 256-bit AES full hardware encryption, so it doesn't require software or drivers—it's completely platform-independent, and it will even work with USB On-the-Go devices like Android tablets. This is a big deal—many drives ship with software encryption clients, but those rarely include software compatibility beyond Mac and Windows.

The Aegis has a 10-digit alphanumeric keyboard and requires a 7-15 digit PIN before it unlocks. Its onboard lithium-polymer battery allows it to unlock even when not plugged into a computer, but it'll lock again the instant you pull it out of one—or if the power to the USB port is cut. The drive automatically shreds all its data after 10 incorrect PIN attempts, and you can have separate user and administrator PINs.

The Secure Key's enclosure is aluminum, and it has an aluminum sheath with a rubber gasket to make it water-resistant. The innards are epoxy-sealed to prevent tampering.

All this stuff—the aluminum shell, the epoxied insides, the rechargeable battery, and the hardware encryption—adds to the cost and physical size of the device. It's 3.15 inches long, .7 inches wide, and .36 inches tall, and weighs just under an ounce. The capacity caps out at 16GB, and it ain't cheap—at $125 for a USB 2.0 device, you have to really want the hardware encryption for this to make any financial sense. A much faster 16GB USB 3.0 flash drive can be had for as little as $10 online.

Thanks to the on-the-fly hardware encryption, the Aegis is quite slow—USB 2.0 caps out at around 30MB/s reads and writes, but the Secure Key's reads seldom top 12MB/s and its writes were around 8MB/s. That's a hefty penalty to pay for security.

From a technical and security perspective, the Aegis Secure Key mops the floor with software-encrypted drives, but people with less sensitive jobs and those who don't need full hardware encryption might prefer to buy a larger, faster USB 3.0 drive and secure it with TrueCrypt.

–NATHAN EDWARDS

VERDICT

8

Apricorn Aegis Secure Key

+ KEYMASTER AES-256 full hardware encryption; secure keycodes; hardened chassis.

– LITTLE CAESAR Pricey and slow compared to less-secure options; expensive.

$125 (16GB), www.apricorn.com

Enter the wrong PIN 10 times and the Aegis will shred your data to prevent brute-force attacks.

Special effects keep the card-on-card combat in Duels of the Planeswalkers entertaining.

Magic: The Gathering – Duels of the Planeswalkers 2013

America's nerdiest hobby gets its annual digital update, but is it worthwhile?

IF YOU'VE EVER PLAYED (or tried to play) Magic: The Gathering, you know it can be tricky to get started. Between the complicated rules, intricate strategy, and the roster of more than 12,000 unique cards, it's not a game that would traditionally be called "accessible."

Duels of the Planeswalkers is Wizards of the Coast's attempt to make an "arcade" version of Magic, with a streamlined play experience that still keeps much of the original CCG's depth and strategy. The DotP series debuted two years ago, and has been a major success, both as a video game and as a way to introduce new players to Magic: The Gathering. Duels 2013 is the third yearly installment in the series, and offers the most compelling experience yet.

If you're unfamiliar with Magic, the very simplified synopsis is this: Each game represents a magical duel between powerful wizards called Planeswalkers. To win the duel, you must reduce your opponent's life total to zero, which you accomplish by casting spells and summoning creatures, all of which are represented by the cards in your deck. There's luck involved (you start with seven cards, and draw one per turn; draw none of the cards you need and you'll lose the match), but there's a lot of strategy as well, as you decide when to play which spells and when to order your creatures to attack and defend. Duels of the Planeswalkers offers this core Magic experience in a digital form, with nice graphics, a single-player campaign to defeat, and ranked online multiplayer.

Where it differs most from traditional Magic is in deck construction. In paper Magic, building your deck of 60 cards is a major part of the game. Even if you play the smallest format, there can be more than 1,500 cards to choose from, and tweaking your deck to beat the people you play with is an addictive and expensive meta-game. Duels of the Planeswalkers essentially does away with deck-building, instead offering you a choice of 10 premade decks, each designed around a different theme. As you play and win matches with a deck, you unlock additional cards (up to 40 additional cards per deck, including 10 that are only available through promo codes that are available for free online), which you can substitute into that deck at will. Choosing the right cards to add to the base decks is skill-testing, and offers a nice bit of customization, even if you can never change the basic nature of the deck.

A side note: Many people have been calling for a more full-featured deck editor in the DotP series, but we'd be very surprised to see it happen. The simple fact is that people

In puzzle matches, you're given a complicated premade game board, and told to win in one turn.

buying cards to build their decks is the core of Wizards of the Coast's business model. If you enjoy Duels but want the full deck-building experience, they'll be happy to direct you to your local game store or the official Magic Online digital client, where you can buy cards just like everyone else—for $4 a pack.

If you own last year's installment of Duels of the Planeswalkers, you're probably more interested in whether it's worth paying the $15 to upgrade to Duels 2013. This year's version is definitely more evolutionary than revolutionary, but should still hold some surprises for returning players.

As you play through the game's single-player campaign, the most noticeable new feature is the addition of "encounter" levels, which play differently than normal matches. In an encounter, your deck and hand play as usual, but your opponent plays a predetermined series of cards, regardless of what you do. The opponent's actions can be straightforward (the first simply plays a single small creature every single turn) or complicated (one plays a creature that can return from the dead every turn, then kills all creatures on the board every four turns). Some encounters can be very difficult, and many cannot be beaten by every deck—picking the right one is part of the challenge. The predetermined nature of the encounters makes them play like an interesting hybrid of a normal match and a "puzzle" match, where you must win in a single turn with a specific set of cards. They're a welcome addition that gives the campaign more depth and variety.

The other major change is the inclusion of the "Planechase" format, which replaces last year's "Archenemy" format. Planechase is a multiplayer game mode where four players compete in a free-for-all while also playing cards at random from a central Planechase deck. Each Planechase card fundamentally alters the rules of the game, making for a chaotic match where you can have a commanding lead one turn and be totally screwed the next. It's a fun format, though the wild shifts can be frustrating.

Of course, the main draw of any new entry in the series is the list of new decks, which make up the core of how every game plays out. Duels of the Planeswalkers 2013's lineup of all-new decks is a bit of a mixed bag. The five "basic" decks are very similar to last year's: They feature plenty of new cards, but if you spent much time playing with last year's basic red deck, for instance, this year's will feel like more of the same. It's a shame, then, that the other five decks feel like something of a letdown. Some of them are a lot of fun, like the blisteringly-fast goblin deck, or the black-white "Exhalted" deck, but others fall flat.

There are 40 cards to unlock for each deck—way more than in previous years. Unfortunately, many of the unlocks aren't worth adding to the deck, meaning they only serve to delay you from getting at the later unlocks that you really want. Additionally, nine of the 10 decks are single-color. In the past versions, there's been a nice mix of one- and two-color decks. It's rumored that Wizards of the Coast is planning a multicolor DLC pack for the game in the next few months, but the selection available now is a bit lacking.

All in all, Duels of the Planeswalkers 2013 is by far the most polished and fun game in the series to date, and we'd highly recommend it to anyone looking to get into Magic. If you're a returning player, the game offers new decks, encounters, and puzzles to conquer, but it's not a must-buy—you may want to wait for more information about the upcoming DLC before you make your decision. **–ALEX CASTLE**

VERDICT **8**

Magic: The Gathering – Duels of the Planeswalkers 2013

+ MAGIC Overall presentation is as good as ever; encounters are a fun new addition.

– TRAGIC Deck lists aren't too exciting; may not be enough new features for returning players.

$10, www.wizards.com/magic, ESRB: T

LAB NOTES

NATHAN EDWARDS **SENIOR EDITOR**

Win 8 as a Desktop Daily Driver

It's not so bad if you think of Metro as a Start menu, not a destination

LAST MONTH I powered off my work-issued desktop, threw the Windows 8 Release Preview onto the Chromebird PC (see September's Build It), and decided to use the new OS for everything, just to see how it impacts my workflow. Here's what I discovered.

I don't spend any time in Metro. It has mail, messaging, calendar, and social media apps that are nicely presented but incredibly inefficient on my workstation, with its dual 1920x1200 monitors. I like being able to see more than nine tweets at a time. Metro is fun and intuitive on a touchscreen, but on a dual-monitor desktop it's mostly useful as a Start menu.

I spend all my time in the desktop, which behaves like a slightly souped-up version of Windows 7. There are a lot of small improvements, like multimonitor support and better compressed-folder, file transfer, and flash drive encryption. It's a better version of Windows 7, and I'll definitely keep using it at work and at home, but the emphasis on Metro will confuse desktop adopters at first.

Michael Brown
Contributing Writer

Windows 8 will have us all wanting touchscreens, which will create interesting tension for all-in-one PC manufacturers. This market has never offered so many great choices, but large touchscreens must be prohibitively expensive to manufacture, because none of the 27-inch all-in-ones I just reviewed had one. Personally, that won't stop me from buying an AiO for my kitchen.

Katherine Stevenson
Editor-in-Chief

I don't know what took me so long, but I've finally started using Evernote, and I love it. Previously, I had been using Dropbox to share notes and ideas among my various computers, but I could only use Dropbox Viewer on my Windows Phone. No more. I especially love Evernote's web-clipper integration and the ability to email stuff to specific notebooks within the app.

Gordon Mah Ung
Deputy Editor

Logitech's Revue, aka Google TV, was by definition a dismal failure, but the K700 keyboard it shipped with was an attractive and capable product. So, if you were unlucky enough to have purchased the Revue, can you at least repurpose the keyboard for your HTPC? Yes, sir. Just pick up a Logitech Unifying receiver for $10, and you'll have a fairly awesome compact, AA-based HTPC keyboard.

Richard Koscher
Art Director

For the last couple of years I've been using the MotoGP Live Experience App to get even more enjoyment from the MotoGP World Championship at Laguna Seca. While being at this mother of all motorcycle races is exciting in itself, the app gives me a much more detailed and immersive experience than I get from just sitting in the grandstand. A real enhancement!

LETTERS

WE TACKLE TOUGH READER QUESTIONS ON...

> Windows Tip #100
> Our Benchmark Update
> Long Live the PC

Where's 100th Windows Tip?!

I'm sure you have already been bombarded by others on this, but in James Stables' article "100 Ways to Speed Up Windows" in the August 2012 issue, you have only given us 99 tips. Tip #58 and tip #70 (both found on page 31) are the same.

So where's my tip #100?

—Joe Philipp

EDITOR-IN-CHIEF KATHERINE STEVENSON RESPONDS: Good catch, Joe. We certainly didn't mean to cheat readers out of a speedup tip by offering the same Windows-key shortcut twice. To make it right, here's a Windows-key shortcut that wasn't on that list: Windows key + P lets you choose your display mode—a handy tip for dual-monitor users. We good now?

We Stand Corrected

Regarding tip #50 in your "Speed Up Windows" article, you can only chose a default printer for different networks in Ultimate and Pro, not Windows 7 Home edition.

—Matthew Terrill

Pick Up Your Cadence, Man

I read with interest your article on the new zero-point system configuration and the newer benchmarking programs you will be using (August 2012). As I did, it occurred to me that it has been a while since the last article of this type.

The outgoing system and related benchmark tests were in need of an update, but with technology advancing so quickly these days, is it time to consider a more regular update schedule to keep things in perspective?

Even without innovations in the market, things can become obsolete much more quickly these days. Perhaps a more accelerated update pace? Maybe every two years (á la Intel's tick-tock cadence) or whenever an innovation makes old hardware and benchmarks, shall we say, "quaint"?

Just an early morning thought.

—Dave Bennett

DEPUTY EDITOR GORDON MAH UNG RESPONDS: Thanks, Dave. We try to keep our readers happy. I agree that it would be nice to update our benchmarks at an accelerated cadence, and 24 months is about right considering how fast technology is moving these days. There is one advantage to a slower cadence, though: It always gives you valuable context when you can compare and contrast one or two generations of CPUs, SSDs, and GPUs. If we went to a shorter cadence, say 12 months, we'd lose the historical view, as we would not have access to older machines to run the newer benchmarks on. I will say that our benchmarks are likely due for a "tick" later this year when Windows 8 is formally released. We'll probably update our zero-point system and our tests since the new OS will be a convenient break from the past.

What about the Software?

I have SSDs in all the PCs and laptops in my home. Although I know performance varies between SSDs, the boost I get from each of them seems pretty similar. I have two OCZ drives, four Samsungs, and a Crucial. Because of the great utility included with the Samsung, I will continue to buy and recommend the company's product. The Samsung utility makes configuration, tweaking, firmware updates, and diagnostics a breeze. Utilities from OCZ and Crucial are nonexistent. Please include a review of the included utilities when you review SSDs in the future.

—John Parlett

SENIOR EDITOR NATHAN EDWARDS RESPONDS: Well, OCZ does have a toolbox utility for most of its drives, available at OCZtechnology.com, but your point is taken: A good software utility can be a great help in managing garbage collection, firmware updates, and SMART status (though SMART isn't that useful for predicting drive failures before they happen). We'll be sure to mention the software in the reviews going forward.

End of Days?

I've been thinking about this for some time, but is this the end of the PC as we know it? With smartphones, iPads, and other miniature devices, does this mean that people will no longer purchase desktop and laptop computers? I recently purchased a desktop computer and had a hell of a time finding one. However, I did see an abundance of laptops, tablets,

↘ submit your questions to: comments@maximumpc.com

> CAN YOU IMAGINE GOING BACK TO DOING ALL YOUR WORK ON A 10-INCH SCREEN?

and other small computer devices. What is your professional opinion?

—Curtis Hilyard

DEPUTY EDITOR GORDON MAH UNG RESPONDS: Curtis, I think what you mean to ask is, "Is the desktop PC dead?" I won't lie to you: Consumer appetites have trended toward laptop computers over desktops for years. More recently, the demand for tablets has also been surging. But does this mean the desktop PC is dead? My professional opinion is *hell no*.

First, gamers and enthusiasts aren't going anywhere. Want evidence? Nvidia's desktop GPU sales were up 23 percent last year, and this year the company is taking a hit because it can't get enough desktop GPUs to fulfill demand. Those GPUs are not going into tablets and laptops, mind you. And Intel, which is essentially invisible in tablets and phones today, is still dialing up revenues in the billions despite world economic instability.

Second, one thing I know about human nature is that we like things bigger and faster. I will trade my pair of 24-inch panels for a 10-inch tablet when you can pry them from my warm, sweaty hands. Can you imagine going back to doing all your work on a 10-inch screen? I don't think so.

The desktop PC isn't dead, it just isn't flashy nor does it get headlines. But it's clearly here to stay.

Not Enough Channels?

Howdy! I am reading the 2012 Dream Machine feature (September), and you have the Corsair Dominator Platinum listed as quad-channel, but Corsair has only dual-channel Dominator Platinum listed on its website. Do they have a secret quad kit coming or are you using only dual-channel RAM in your Dream Machine?

—Jon Stolki

SENIOR EDITOR NATHAN EDWARDS RESPONDS: Though vendors frequently market their RAM kits as dual-channel or triple-channel based on the number of DIMMs in the kit, the number of RAM channels is determined by the motherboard, not the RAM itself. If you put RAM into all four channels on a quad-channel board, you'll have quad-channel memory. If you only populate two channels, you'll have dual-channel RAM, and so forth. Dream Machine 2012 is most definitely quad-channel.

Fold This!

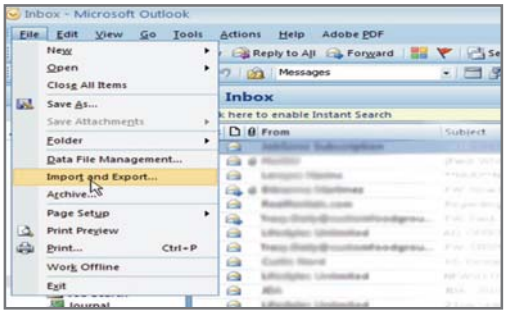
I just read about your new Dream Machine and love it. The only thing I would like to have seen in the benchmark section was how many points per day that computer could crank out in Folding@Home. Think about it—16 CPUs, four GPUs, that's a lot of Folding potential. By the way, I just built a computer for my use. Your CPU cost a little more than my entire machine.

—Scott Knipfing

[NOW ONLINE]

5 THINGS TO DO BEFORE YOU GIVE BACK YOUR WORK PC

So you got a new job and you're ready to kiss your old cubicle goodbye. Well, not so fast, Dilbert. Before you make the break, there are a few important steps you should perform on the work computer you'll be leaving behind. These five tips could mean the difference between a departure free of worry and one filled with regrets. bit.ly/PlJ6DH



[NEXT MONTH]

COMING IN MAXIMUM PC'S

FULLY TOUCH-ENABLED NOVEMBER ISSUE

Where's the Sweet Spot?

Next month, we turn our attention away from top-tier hardware in search of the parts that actually offer the best bang for the buck.

Discover Linux

If Windows 8 doesn't end up floating your boat, it might be time to try Linux. Our primer will tell you everything you need to know to get started.

PC Tune-Up: Fact or Fiction?

You know those utilities that promise to scan your PC and optimize it for improved performance? We're going to put a bunch of them to the test.

THE BUILDS

BASELINE

INGREDIENTS

PART		URL
Case	Fractal Design Define R4	www.fractal-design.com
PSU	Corsair HX650	www.corsair.com
Mobo	Asus P8Z77-V	www.asus.com
CPU	Intel Core i5-3570K @3.4GHz	www.intel.com
Cooler	Cooler Master Hyper 212 Evo	www.coolermaster.com
GPU	XFX Double D Radeon HD 7850	www.xfxforce.com
RAM	8GB Patriot Gamer DDR3/1600	www.patriotmemory.com
Optical Drive	Samsung SH-222BB	www.samsung.com
Solid-State Drive	128GB Samsung 830 Series	www.samsung.com
Hard Drive	Seagate Barracuda 3TB	www.seagate.com
OS	Windows 7 Home Premium 64-bit	www.microsoft.com

Approximate Price: $1,330

THIS IS a no-BS, sweet-spot gaming machine that's forward-compatible and powerful without being overkill. It's exactly what the Doctor ordered.

There are some minor changes this month: We've swapped the Fractal Define to its new R4 version, changed out the budget SSD for one we like better, and finally gone for the Radeon HD 7850 instead of the 560 Ti 448 for its power savings and cost. We'd recommend holding off this month, though; the GTX 660 Ti is coming soon and may take the sweet spot.

PERFORMANCE

INGREDIENTS

PART		URL
Case	NZXT Phantom 410	www.nzxt.com
PSU	Corsair HX850	www.corsair.com
Mobo	Asus Sabertooth X79	www.asus.com
CPU	Intel i7-3820 @4.7GHz (overclocked)	www.intel.com
Cooler	NZXT Havik 120	wwww.nzxt.com
GPU	Asus GTX 670 DirectCU II TOP	www.asus.com
RAM	16GB Corsair Vengeance DDR3/1600	www.corsair.com
Optical Drive	LG WH12LS39 BD-R burner	www.lg.com
Solid-State Drive	128GB Samsung 830 Series	www.samsung.com
Hard Drive	Seagate Barracuda 3TB	www.seagate.com
OS	Windows 7 Professional 64-bit	www.microsoft.com

Approximate Price: $1,870

OUR BASELINE is everything you need for high-resolution, high-quality gaming. Full stop. But if you add an extra $500 to your budget, you get more stuff: eight processor threads instead of four, eight RAM slots, and an upgrade path to a six-core CPU down the line. You also get a Blu-ray burner and one of the fastest GPUs we've ever tested. This Sandy Bridge-E rig stays pretty much the same as it was in September, except for the SSD, which we've swapped for the Samsung 830. We just like it better. We're curious, though: For Deluxe, should we go Ivy Bridge? How important is Sandy Bridge-E to you at this price range?

ULTRA

OUR ULTRA configuration is for the *Maximum PC* reader who needs ultra-fast encoding and rendering, tip-top graphical prowess, and speedy storage. Intel's Core i7-3930K is $600 worth of six-core madness, and the Corsair H100 cooler makes it easy to push the CPU to 4.8GHz from its 3.6GHz stock speed.

Cooler Master's Cosmos II case is huge and luxurious, with plenty of airflow to cool everything. And the Asus motherboard is great for overclocking and will hold another GTX 690, if you go absolutely out of your gourd for power. We're keeping the 256GB Samsung 830 SSD and 6TB of speedy mass storage.

Also, we've heard your input! From now on we'll be alternating the Ultra configuration with a sub-$1,000 build on a monthly basis, starting next month with a rig based on this month's Cheapskate PC and reader feedback! So read the Cheapskate feature and send your rig opinions to comments@maximumpc.com

For our complete Best of the Best list of recommended components, visit www.maximumpc.com/best-of-the-best.

INGREDIENTS

PART		URL
Case	Cooler Master Cosmos II	www.coolermaster.com
PSU	Thermaltake Toughpower Grand 1050W	www.thermaltakeusa.com
Mobo	Asus P9X79 Deluxe	www.asus.com
CPU	Intel i7-3930K @4.8GHz (overclocked)	www.intel.com
Cooler	Corsair H100	www.corsair.com
GPU	Asus GTX 690	www.asus.com
RAM	16GB Corsair Vengeance DDR3/1600	www.corsair.com
Optical Drive	LG WH12LS39 BD-R burner	www.lg.com
Solid-State Drive	Samsung 830 Series 256GB	www.samsung.com
Hard Drive	Seagate Barracuda 3TB (x2)	www.seagate.com
OS	Windows 7 Professional 64-bit	www.microsoft.com

Approximate Price: $3,368

SUGGESTED PAIRINGS

Kick-ass peripherals for your new rig

MIDRANGE MONITOR
Asus PA238Q
$300, ww.asus.com

KEYBOARD
Razer BlackWidow Ultimate
$130, www.razerzone.com

MOUSE
Cyborg R.A.T. 9
$100, www.cyborggaming.com

GAMING HEADSET
Corsair Vengeance 1500
$100, www.corsair.com

SPEAKERS
Corsair SP2500
$205, www.corsair.com

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