

PC & TECH AUTHORITY

TECH ADVICE YOU CAN TRUST

THE GAMER'S
EDGE

TOTAL GUIDE FOR ULTIMATE
GAME PC PERFORMANCE



BUILD YOUR
OWN CLOUD

8 NETWORK
STORAGE
DEVICES
COMPARED



SPECIAL REPORT

WHY IS APPLE RIPPING YOU OFF?

DISCOVER WHY YOUR IPHONE COSTS
YOU SO MUCH – AND APPLE SO LITTLE



REVIEWS

MAC PRO, ASUS ZENBOOK
UX301LA, APPLE IPAD MINI
WITH RETINA, LG G PAD,
CORSAIR H105, AMD KAVERI
APU AND MORE!



HOW TO:

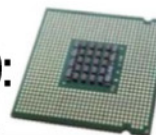
BUILD A RASPBERRY PI
WEATHER STATION

BEAT THE HEAT:
PC COOLING GUIDE

MS OFFICE BE GONE! IN-
DEPTH WEB APP GUIDE

PLUS

ALL-CPU'S ROADMAPED:
TODAY TO 2015 PLAN YOUR NEXT PC



GAME APP FRAUD
INVESTIGATED
PAY TO PLAY SCAMS

Wireless Dual Band Gigabit ADSL2+ Modem Router

AC1750 Archer D7

- Supports 802.11ac - the next generation of Wi-Fi standard
- 450Mbps 2.4GHz + 1300Mbps 5GHz
- 2 USB Ports for storage sharing, embedded FTP and Media Server
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Ready for
NBN

Tech advice you can trust!

- Our tests are performed by experienced reviewers in our Labs in accordance with strict benchmarking procedures
- Our brand new benchmarks have been tailor-made to reflect real-world computing needs
- We put tech through its paces – seriously. From processing power to battery life, from usability to screen brightness, our tests are exhaustive
- We will always offer an honest and unbiased opinion for every review



IT'S A PC WORLD

Hello, *PC & Tech Authority* readers! I'm Ben, your new editor. John's charted a thrilling new course for himself, now steering the good ship *PC PowerPlay* where he'll be laying down the same immensely high standards which he brought to you, here, and bringing his wit, wisdom and insight to bear on that legendary magazine.

For me, personally, to be here at *PC & Tech Authority* is utterly magical. I launched *Atomic Maximum Power Computing* magazine way back in 2000AD, and the desk next to mine was that of the editor of this very magazine; one Tim Dean. Not far from his desk was Mr Hollingworth's, and in my line of sight was John Gilloly's mountain of boxes of tech stuff, somewhere under which was a desk, and John.

It was Tim and *PC&TA's* meticulous and scientific approach to hardware benchmarking which helped us build the same quality of analysis in *Atomic*, and which every tech journalist who has ever been associated with *PC&TA* has followed ever since as law. But science only goes so far – our personal views and experience round off the advice we give to you, and that's a responsibility none of us take lightly.

It is that gold standard approach which has kept *PC&TA* at the top for a decade and a half, as the go-to source for the definitive word on great gear.

I love the PC. I love the bits that go inside it, plug into it, connect with it and revolve around it. I love that after all these years it's still not only a hotbed of incredible evolution and development, but is the stable stone of technology around which the ever-changing world of gear and gadgets also orbits.

And I know you do, too. So let's get going with it all, then.

Ben Mansill

E bmansill@nextmedia.com.au

Also, don't forget to check out the iPad version, packed with exclusive interactive content complementing the regular magazine. Here's a sample of what you can expect:



► **Video:** Get video tutorials, game trailers and more

► **Image Galleries:** Get a better look at some of the products reviewed

► **360 View:** Get up close with tech from every angle.

► **Get the app:** *PC & Tech Authority* for iPad <http://tinyurl.com/iPADPCTA>

THE TEAM...

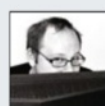


Managing Editor

David Hollingworth

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T @atomicmpc

I'm firmly of the opinion that 2014 will be a big one for *PC&TA* and the PC scene in general. Confidence is high!



Video Producer

Josh Lundberg

E jlundberg@nextmedia.com.au
T @MrJosh86

Hey! Idea! Let's do another 24hr gaming marathon like the one we did before Christmas! Guys! Guys? Um... guys...?



Art Director

Tim Frawley

Some say I remind them of David from the movie *Prometheus*. I assume they mean my robotic workflow management...

CONTACT US...

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- ◆ Cross-platform file sharing for Windows, Mac and Linux users.
- ◆ Ensure the safety of your data with RAID 1 mirroring.
- ◆ Access and share your data securely anywhere!
- ◆ Affordable yet powerful personal cloud storage.

1.2GHz Dual-core | 256MB RAM | dlna

TS-212-E



Silent NAS for the Living Room

HS-210

1.6GHz CPU | 512 MB RAM | Fanless | dlna

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- ◆ Perfect for your home theater!
- ◆ High performance without unwanted noise.
- ◆ Over 100 apps for extending NAS abilities.

Stream your stored video & photos via AirPlay



AirPlay - Use mobile devices to browse photos and play videos on TV via Apple TV.

Store photo albums on your personal cloud



Photo Station - Easily manage and share photos via email, social networking sites or secure sharing links.

Back up, share & enjoy your music collection



Music Station - Create and enjoy your personal music center in the cloud anywhere.



INBOX

IF YOU HAVE A STORY OR
POINT TO MAKE, SEND IT IN!
TELL US YOUR ANECDOTES,
OPINIONS & TALES OF WOE



Getting in touch

MAIL

Inbox, Level 6, Building A, 207 Pacific Highway, St Leonards NSW 2065

WEB

pcandtechauthority.com.au

EMAIL

inbox@pcandtechauthority.com.au
Please limit letters to 200 words, where possible. Letters may be edited for style and to a more suitable length.

64-bit versions. To see it running, open Task Manager, select Processes and scroll down to prio_svc.exe.

Start Task Manager (Alt-Ctrl-Del), select the Processes tab, move to the desired name, alternate click and set the Priority. Alternately, on the Applications tab, alternate click and select Go to Process, and then set priority.

P. Bailey

David Hollingworth says: Wow, handy little program! Thanks for sharing that with us and our readers.

NO GAMING, PLEASE

After many years of supporting this magazine, I will not be renewing my subscription because the issues now reflect more gamer than information tips.

This is why I started with my subscription when the issue started. I wish the publication well but hope I find a more informative magazine to satisfy my needs.

J. Nield

David Hollingworth says: That is a shame, but absolutely fair. That said, you may be interested to know that, now that PC PowerPlay is officially our sister magazine, we're looking at changing the way we cover games. And in a way I think you'll like, too...

TPYO

Just read the A-List Apps article in Issue 195 on page 24, you have created a mistake with OneNote where you have copied the same paragraph from Paprika Recipe Maker.

D. SHEATHER

David Hollingworth says: Oops.



LETTER OF THE MONTH

This month's letter of the month will receive the STM HOOD laptop backpack thanks to the guys at STM.

www.stmbags.com

TOP SITE COMMENTS

Needs to look more like the Mach 5...

Zen on Renault's new drone-equipped car.
Web ID: 371895

The Vaio line was way overpriced anyway.

j876 is glad to see Sony sell its Vaio line.
Web ID: 371611

They can go take a flying leap at themselves! Pay for the service and then get bombarded by ads! Not in my lifetime!

SBeS is not pleased with HBO's Game of Thrones monopoly.
Web ID: 371375

Yay! Vindicated! The inevitable victory of OpenGL is acknowledged in print by somebody else. Ahem... but, yes... what happens NOW?

Good question, Voxel.
Web ID: 371048

Wow, that was just...wow. I kept going and forced myself to the end of the story. I felt like turning away would be a disservice to the girl; to miss the message.

smegg was hit pretty hard – just like the rest of us.
Web ID: 371353

I don't have one, though one of the guys does, 2012 model. Swears it's very quiet.

amcmo's heard good things about GIGABYTE's BRIX
Web ID: 371283

Want to read more? Go to www.pcandtechauthority.com.au and search for the Web ID. And check out the Atomic forums: <http://forums.atomicmpc.com.au>

LETTER OF THE MONTH

I find your software reviews and downloads most helpful.

There is lots of software around that is designed to get your system back to running like new. However, they do not really help, probably because I have too many programs installed and generally too many Firefox add-ons with too many tabs open.

Also having too many USB 3.0 devices connected means the system bogs down and programs become unresponsive for long periods or even hang.

Finally I am now able to have all of the above and still get good performance with virtually nothing becoming unresponsive or if so then only for short periods.

My answer is to set the priority of major bottlenecks to high – in particular, Explorer, which struggles to compete with everything else when set to normal. I also set my email client Firefox, its plugin container and FlashPlayerPlugin to high, together with other main programs such as Office components.

There is one major flaw with this method: rebooting means the settings are lost and priority returns to normal.

Fortunately there is a tremendous program free for private use that stores the settings and automatically sets them. It is Prio – Process Priority Saver and it can be found at <http://www.prnwatch.com/prio/>. It is available in both 32- and

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APRIL
2014

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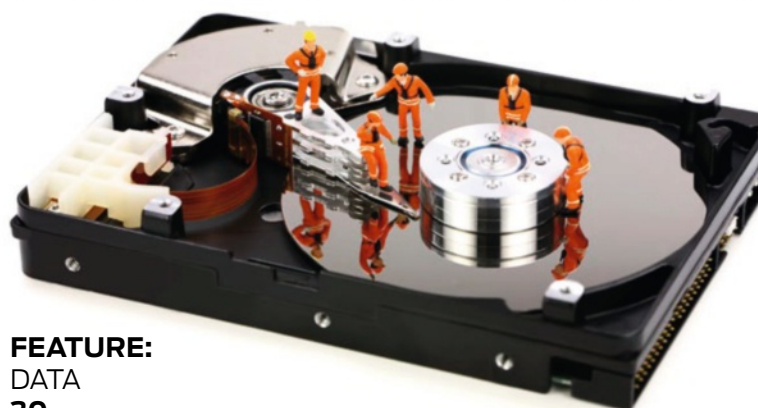
Create a silent yet effectively cooled PC92



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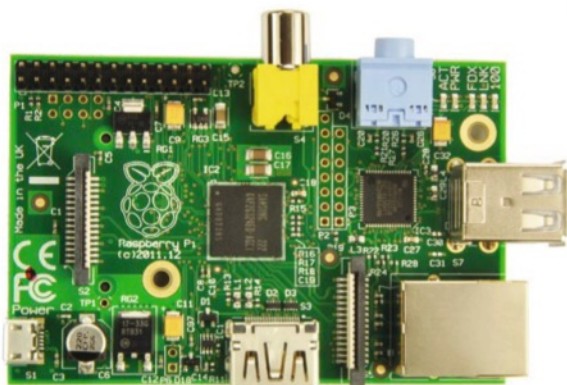
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TECH NEWS

LATEST TRENDS AND PRODUCTS IN THE WORLD OF TECHNOLOGY

WANT TO UPGRADE FROM XP? MICROSOFT SAYS BUY A NEW PC

MICROSOFT OFFERS INTRIGUING ADVICE TO THOSE STILL USING WINDOWS XP

The best way to upgrade from Windows XP is to buy a new PC, according to Microsoft.

That's the advice it's doling out via a Windows blog post marking 60 days until the end of support for the ageing XP.

Communications manager Brandon LeBlanc notes that readers of the official Windows blog are "unlikely" still to be running XP on their PCs – and backs this up with data in the comments – but suggests that "you may know someone who is and have even served as their tech support".

Microsoft has therefore created a help page to make it easier for IT-savvy users to explain the looming end of support to their less technically skilled friends and family. One recommendation is to run the Windows Upgrade Assistant to see if their machine can run Windows 8.1.

However, LeBlanc suggests the best approach is to get a new PC – a statement

Microsoft's PC-making partners will appreciate, in light of stalling system hardware sales.

"The easiest path to Windows 8.1 is with new devices and there are offers and deals from many retailers to help people get a new device," he said, pointing to the many discount offers available.

TOUGH CONVINCING

The advice hasn't been popular among the very readers of the blog where Microsoft is asking more experienced users to help their less tech-savvy friends.

One wrote that it would be hard to convince people to upgrade to a new PC running Windows 8.1, which "isn't an attractive choice to begin with".

"Most of the people I know feel like they are forced to buy a new computer for money which they don't have, and forced to upgrade to a new version of Windows which they aren't convinced is a good choice," the commenter noted.

Another echoed concerns over the cost of upgrading, saying she'd been hit hard by the struggling economy. "I understand your need to discontinue support for older programs. It's an expense of time and money that could be used to develop new products," noted Ruth Brown.

"But I am nearing retirement age, and with money tight, and possibly tight for the foreseeable future, I don't know when I'll be able to upgrade to a new Windows product." She asked for Microsoft to extend support for XP.

We, and most of you, think we knew this was coming. The issue that wasn't foreseen at the time was that the then-unseen Windows 8 would be a less-than-compelling upgrade over the desktop-centric Windows XP.



HBO AND FOXTEL PRETTY MUCH ASK AUSTRALIANS TO PIRATE GAME OF THRONES

FOXTEL GETS IMPRESSIVE NEW RIGHTS TO THE FOURTH SEASON OF GAME OF THRONES. GOOD FOR THEM, PRETTY BAD FOR EVERYONE ELSE.

If you thought Australian audiences were already a fiend for pirating hit fantasy drama Game of Thrones, you ain't seen nothing yet. Foxtel has recently announced that it's signed a juicy exclusivity deal with HBO.

Whereas previous seasons could be purchased via the Australian iTunes store – albeit at less than HD resolution – this year the only way to watch the show will be via Foxtel subscription.

"I think having it in Australia exclusively on the Foxtel platform is indicative of the way we're approaching a lot of our acquired content now," Foxtel's Brian Walsh told TV Tonight. "Our absolute desire is to increase our subscriber numbers and exclusively acquiring Game of Thrones is important."

It will also be an important factor in many people's decision to continue pirating the show, or to even turn to that avenue for the first time.

The level of subscription viewers will need to access Game of Thrones – which airs in early April – costs over \$70 a month, often with a set contract period. The old season pass on iTunes was in the realm of \$30 or so. Both options also have some element of delay.

Accessing a torrent service and downloading a 720p version costs nothing but bandwidth.





LG REVEALS PRODUCT ROADMAP FOR FIRST HALF OF 2014

LG'S GOT A TONNE OF PRODUCTS COMING TO MARKET THIS YEAR – AND IT'S JUST THE START OF THINGS...

The product that seems most good to the Life's Good crew is LG's new ChromeBase all-in-one PC.

Powered by Google's lightweight Chrome OS, the ChromeBase is designed to do its heavy lifting in the cloud, but still feature some grunt in terms of hardware. With a Haswell-based Celeron processor, 2GB of RAM (which seems tiny these days), and 16GB of storage.

For all that, LG wants a fairly reasonable \$599, and it is planned to be available in April. It's a neat unit, perfect as a secondary PC or media device, or as a lightweight desktop for businesses.

While the ChromeBase is light on the specs, the same can't be said of the impressively large 21:9 UltraWide QHD 34in monitor. It sounds a mouthful, and it looks like one, too – boasting an impressive 3440 x 1440 IPS display, LG's aiming this monitor

at colour professionals. With a range of connectivity options including Thunderbolt 2, it's very versatile, and retailing for \$1299, it's rather affordable for 4K.

Give us one with a 60hz refresh rate, and we are there.

Finally, LG's refreshing its Ultrabook range with the new UltraPC. This now comes with a 4th gen Core i5/i7 Haswell processor, and has gotten a display with a downright tiny bezel, and a choice of clamshell colours. The Misty Rose and Baby Blue options may not appeal, personally, but the Glam Metal iteration ain't bad. The i5 model retails for \$1298 and the i7 for \$1898.

They're out this month, and are pretty elegant units to behold.

LG's also got a new range of battery rechargers coming, and a very impressive combination mouse/scanner in the mix.

Life is, apparently, good.

HOT... OR NOT

HOT

FITBIT FLEX

There are many personal fitness bands just like it, but this one is mine. It's always there to remind me to eat well and walk far. Its subtle-yet-groovy design does not attract comment or conversation. It showers with me.



NOT

SOME ULTRABOOKS

Too much form, not enough function. We're looking at you; wobbly screen hinges and small vents under the chassis that whine under low-load and mean you can't rest it on the couch without blocking the only cooling duct.



SATYA NADELLA MICROSOFT'S NEW CEO

MICROSOFT CONFIRMS INSIDER SATYA NADELLA AS NEW CEO, WHILE BILL GATES WILL TAKE ON NEW ROLE AS HIS TECHNOLOGY ADVISER

Microsoft has confirmed that Satya Nadella will take over from Steve Ballmer as CEO.

Nadella's appointment is effective immediately, allowing Ballmer to retire early.

Promoted from his position as executive vice president of Microsoft's cloud and enterprise group, Nadella has been a long-running favourite to take the top job. His appointment concludes a five-month hunt by Microsoft, which considered more than 100 candidates to succeed Steve Ballmer.

Nadella's enterprise pedigree will also intensify speculation about Microsoft's attempt to transition to a "devices and services" -oriented company.

"Today is a very humbling day for me," said Nadella, according to an internal memo. "While

we have seen great success, we are hungry to do more. Our industry does not respect tradition – it only respects innovation."

"This is a critical time for the industry and for Microsoft," he added. "Make no mistake, we are headed for greater places – as technology evolves and we evolve with and ahead of it. Our job is to ensure that Microsoft thrives in a mobile and cloud-first world."

As part of the reshuffle, Bill Gates will step down as chairman of the board and instead take on a new role as founder and technology adviser. Nadella said Gates would "devote additional time to the company" with a focus on technology and products. Ballmer, meanwhile, will keep a position on Microsoft's board of directors.



GAMING NEWS

ALL THE NEWS THAT'S FIT TO PRINT FROM THE GAMING WORLD

CONSOLES, NOT PCS, WILL GET PUPILS CODING

MICROSOFT AND SONY PUSH TO GET CONSOLES INTO STUDENTS' HANDS

Games consoles can help get children interested in coding, according to manufacturers - and Microsoft is offering cut-price Xbox 360s to help get them into classrooms.

Sony and Microsoft are racing to get their own consoles into the hands of pupils ahead of a new computing curriculum, which will be introduced in the United Kingdom in September.

Speaking to us at the BETT education technology show, both firms said consoles were a natural segue into computer science.

"A lot of people use Xbox consoles and PlayStation consoles at home," said Steve Beswick, Microsoft's senior director of education. "If you can use that as a device to do programming, it can entice the student by coming from an Xbox environment into computer science rather than coming in from a PC or laptop."

Dr. Maria Stukoff, the head of academic development at Sony Computer Entertainment Europe, added that game development gave children more than just computing skills.

"Why do we use PCs when it could be PS?" she said. "Especially when you look at future skills, getting gaming technology skill sets [helps with] coding, story telling, teamwork and problem solving."

DISCOUNTED XBOX CONSOLES

Microsoft will offer discounted previous-

generation Xbox 360 consoles and software development kits to UK schools from today, as part of a wider educational drive.

Some local schools in Canberra are trialling similar coding courses with Xbox 360 consoles.

This is the first time Microsoft will specifically target the education market with Xbox 360 bundles, with Beswick saying the demand had come from schools.

"More people are using Xbox to do programming," said Beswick.

"As part of our investment into [the] education market, we'll [offer] bundles where schools where schools can go up and buy technology that includes our developer programmes as well as Xboxes. In the same way that we sell devices and software in a much-reduced way to schools, we're looking to do the same with Xbox."



SAGA AGAINST SAGA: THE KING VS STOIC TRADEMARK CASE

ESSENTIAL LINKAGE: THE MAKER OF CANDY CRASH SAGA IS ENGAGING IN SOME LEGAL SHENANIGANS TO OWN THE WORD SAGA, AND THE MAKERS OF THE BANNER SAGA ARE NOT HAPPY

As you may guess, we're a little fond of Stoic's excellent game, The Banner Saga. We're not fond of - though hold nothing against - games like Candy Crush Saga. That's a matter of mere taste, but recent moves by Candy Crush Saga's developer, King, may lead us to dislike the game, and developer, for more legalistic reasons.

King has recently applied for trademarks for a lot of the terms it regularly uses in its games, insisting that it has claim on common words like 'candy', which I'm sure Iggy Pop and Kate Pierson may have something to say about, but also 'saga'.

Which, of course, is bit of a problem for Stoic. It effectively means Stoic cannot trademark its own brand.

It's a complex legal conundrum, and one expertly reported by the big heads over at Rock Paper Shotgun.

There's a lot of misinformation and trumpeted claims being bandied around about the need to "defend trademarks". It's certainly true that if a company does not make an appropriate effort to assert its ownership of a product name, that name can eventually be considered to have entered the public domain. However, this arguably does not directly translate to stamping on every small studio whose game name bears a passing resemblance to your own. And it certainly doesn't mean asserting rights to a single word for which the trademark has not been granted.

The article's really worth reading, with comment from both sides and solid exploration of the trademark claim in question. It's at <http://www.rockpapershotgun.com/2014/01/22/the-candy-crush-banner-saga-saga-stoic-speak-up/>.

Incidentally, this is what we in the office refer to as "going the full Games Workshop", given that company's fondness for draconianly enforcing its own copyrighted terms.

HEARTHSTONE GOES INTO OPEN BETA

BLIZZARD'S WARCRAFT-INSPIRED DIGITAL CARD GAME GETS CLOSER TO FINAL RELEASE

Against our better judgement, we rather enjoyed Hearthstone: Heroes of Warcraft. It's a rather flavoursome take on the whole collectible cardgame malarkey, combining the classes and tropes of Warcraft with the just-one-more-pack mentality of games like Magic: The Gathering.

And now, it's moved into an open beta phase, meaning current players will have a whole swathe of fresh mea... I mean, opponents, to enjoy.

Hearthstone now includes a ranked play mode, can track down players close to you on your local network, and keeps track of who you've recently played.

Blizzards points out "this is an open beta test, so we are still very much in the testing phase as we prepare for the official launch," so there's a mess of tweaking and updates to come. But if you like WoW and Magic, this could be the new crack you're looking for.

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If you want to build a Mini-ITX system without compromising expansion, flexibility, or performance, the Obsidian Series 250D is your answer. Though it's small on the outside, the 250D has room for standard components like a full-size 5.25" optical drive, a full-length GPU, a 240mm radiator, and even a full-size ATX power supply.

The sleek, aluminum front fascia provides the striking yet subtle design that Obsidian Series cases are known for, and a top window gives you a close-up view of your high-performance components. The 250D is a great choice if you want full size performance in a small space.

Designed for Enthusiasts. Engineered for Performance.

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- Great for dorm rooms, desktops, bookcases, or anywhere else space is an issue
- Fits full-size, high-performance components
- Windowed top panel for showing off your work



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MICE



HEADSETS

MOST WANTED

THE NEWEST HOTTEST PRODUCTS THAT WE SIMPLY CANNOT WAIT TO REVIEW!



◀ MAGIC THE GATHERING – BORN OF THE GODS EXPANSION

It's that time of the year again when addicted card gamers feel their palms getting itchy, the brows furrowing in sweaty concentration, and their wallets in imminent danger of getting massively lightened.

Yes. It's a new Magic The Gathering release.

Born of the Gods is the latest expansion to the world-dominating card game, and pushes on the game's narrative while adding a literal box-full of new cards. There are 165 black-bordered cards in total, and premium versions of each, available in a range of packs.

www.magicthegathering.com

▶ DENON DHT-S514 SOUNDBAR

Whether you're getting your kicks listening to tunes, watching Blu-rays, or arguing over My Kitchen Rules, having good hardware can really make a difference. Big screens are only half of the equation - you need big sound, too.

Reality TV, Eminem (chosen at random - don't judge), even Man of Steel (not chosen at random - don't judge); they all sound great coming through Denon's new soundbar. It's a great alternative to when you can't quite invest in a big multi-speaker setup, but still delivers hi-fi sound, a range of inputs (including built-in Bluetooth streaming), and a range of listening modes. It can even learn commands from your existing remote control, and has an IR repeater just in case it blocks your TV's own IR input. Clever!

(I promise, we'll stop parenthesising stuff now.)

www.denon.com.au



▼ CANON IXUS 155

Just announced almost the very day we went to press, Canon's brought out three new cameras in its IXUS range.

It's the top of the line IXUS155 we're most keen on, with a detail-monstering 20MP sensor and an impressive 10x optical zoom. Being an ultra-compact, it's handy and easy to travel with, and in three colours (silver, blue and red) you can even accessorise with it.

If you're into that kind of thing (we are).

With a Smart Auto mode for one-click perfect photos, it's sounding like a remarkable happy snapper.

www.canon.com.au



▲ BIOSHOCK INFINITE GEORGE WASHINGTON PATRIOT

Washington, Washington... 9in tall, with a really big gun.

One of the more harrowing enemies from the last BioShock game were the mini-gun-armed automatons modelled on great American general and President, George Washington. With gears and armatures poking through torn clothes, and draped in tattered flags, this 9in tall articulated figure manages to capture a good portion of the in-game Washington's menace.

www.thinkgeek.com

► G-DRIVE MOBILE WITH THUNDERBOLT

If you want reliable and super-fast storage on the go, this is just the kind of product you're going to find indispensable.

Combining a whopping 1TB capacity and speedy Thunderbolt connectivity for fast transfers of any kind of file, at speeds of up to 136MB per second. It's also compatible with Apple's Time Machine, making it an ideal back up device. And, for perfect mobility, it's bus-powered, so you don't have to carry around any additional power-cables.

www.hgst.com

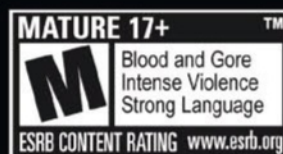


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The rules of the game

ROSALYN PAGE EXAMINES THE MECHANICS OF ONLINE GAME *DRAGONS OF ATLANTIS*

Is a game just chance or should it be fair? The question is one that PC&TA reader Bill has posed after playing *Dragons of Atlantis: Heirs of the Dragon* game on his iPad. He's played it a lot and doesn't like the odds because he thinks it's fixed against the player winning.

The game is free and anything other than minor progression is only made by purchasing "rubies", which are roughly (AUD) 10 cents each, to buy troops and other resources that enhance your capabilities.

Freemium apps, so called because they're free to download but cost a premium to buy tokens to get them working, have come to the attention of the Australian Competition and Consumer Commission (ACCC). Investigator has written about the campaign the ACCC is running with other protection agencies to find these apps and press Apple and Google to provide better consumer protection. The ACCC is particularly concerned about these apps being targeted at children.

The issue that Bill sees is that players must buy rubies to play a game within the app without knowing if the game is truly fair in how it allocates prizes.

"Within *Dragons of Atlantis* there is a mini-game called the Dragon Vault, which costs five rubies to play. There are nine chests that start open and the screen shows the potential prize within each chest. Recently, the main prize on offer has been the 'Earth Dragon Egg', with the other eight chests containing minor prizes. The chests are closed and then 'shuffled' and the player selects one, revealing the prize."

Bill has applied some maths to calculate the odds of winning. To test the odds in reality he has also played the game 85 times to see if he won any time. He didn't.

"The chance of winning any individual gamble by gaining the egg is implied to be 1 in 9, so the chance of not getting it is 8/9 or 88.889%. The chance of not getting it after two games is (8/9)*(8/9) or 79.012%. The chance of not getting it after 10 games is (8/9)*(8/9)*(8/9)*(8/9)*(8/9)*(8/9)*(8/9)*(8/9)*(8/9)*(8/9) or 51.315%."



▲ Pay to play, or play to win game apps are increasingly being scrutinised for ethics and honesty

1/9*(8/9)*(8/9)*(8/9)*(8/9)*(8/9), or 30.795%."

On the Kabam website, the terms of service talk about the virtual currency having no value and that Kabam has the right to charge fees to access or use site items. It makes no mention of a game of chance and says nothing about odds or how winning prizes are calculated. It says that it has the right to manage and regulate virtual currencies.

Investigator approached Kabam for an explanation. Kabam says that "Players do win a prize of varying value every time they play the Dragon Vault mini-game." They're going to look into Bill's account details. Investigator also contacted the ACCC about the game and to inquire about what rules there are for in-game games.

It provided general advice that Australian Consumer Law prohibits false, misleading or deceptive conduct and that includes within games on electronic devices. It says

"...players must buy rubies to play a game within the app without knowing if the game is truly fair..."

that whether conduct is misleading will depend on the circumstances.

"The issue is one that the ACCC is particularly interested in and it will consider any concerns raised by consumers or representative groups."

Bill has found what many other consumers have found, which is that the process of making complaints about anything to do with apps is very convoluted and time consuming. Some requests go to the app store, while others go to the developer and a satisfactory response can't be guaranteed.

Bill says the game is fixed so that the chance of winning is not 1 in 9 as implied but is something much less. He has written to the game's maker Kabam and Apple, but he has not received any feedback other than generic responses and having the case closed.

The best advice for consumers is to let the ACCC know about any dodgy apps that have unfair systems or require excessive purchases to get the app to function fully. The ACCC can investigate if they contravene the Australian Consumer Law and is in a position to take action against the game's creator and the platform provider to change their processes, provide a fairer system and mandate that clearer information is given to consumers before they purchase the app.



ROSALYN PAGE

has been a journalist for over 10 years specialising in the areas of consumer issues, technology and lifestyle. Rosalyn is the 2008 winner of the Best Consumer Technology Journalist at the IT Journalism awards. Her work is published in a range of newspapers and magazines

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THE PERIPHERAL EDGE

NATHAN LAWRENCE WADES THROUGH A MOUNTAIN OF PERIPHERAL GAMING HARDWARE TO DISCOVER WHICH ONES OFFER THE BEST COMPETITIVE EDGE AND EXPLORES WHETHER THEIR USE CONSTITUTES CHEATING

One of the greatest things about the potency of the PC is the near unlimited customisation options on offer for the ultimate in personalisation prowess. When it comes to forging a gaming PC, it's easy to get lost in the sheer number of available hardware peripherals; particularly for savvy gamers seeking the right gear to gain a competitive edge.

By 'peripherals', we're referring to non-essential computer hardware that isn't required to run your game/s of choice. These peripheral items do have the potential to greatly impact your gaming experience, though. In this regard, this article is more skewed towards professional or semi-pro gamers. In saying that, there are some key consideration points that will be of interest to any dedicated gamer, or those looking to enhance their gaming potential.

Ultimately, though, the exploration of the competitive edge afforded by non-essential computer hardware also raises a question of fairness. Can it be considered cheating if gamers are using supplementary equipment that isn't being used by all competing gamers? Before we have a crack at that debate, though, let's take a look at the all-important peripheral hardware considerations.





INTERNAL HARDWARE

Before considering the purchase of any peripheral hardware, there are some crucial internal hardware assumptions to take into account. You'll want to possess a mid-to-high-end PC that's capable of running the latest games at a constant minimum of 60 frames per second (fps) in order to be competitive on the ground level. Particularly when it comes to fast-paced shooters such as *Call of Duty: Ghosts* or *Battlefield 4*, a consistently high frame-rate is essential to being a competitor in the online foray. The potent combination of high-end motherboards, multi-core/thread CPUs and one or more video cards are par for the course of streamlining the optimal gaming experience before looking at peripheral options.

This may mean the sacrifice of high-level visual fidelity in favour of a smoother/faster frame-rate, whether on a laptop or desktop. If you're serious about gaming, you're most likely already using a desktop, which offer a greater range of flexibility when it comes to hardware upgrades. External to your PC, you'll also want to have a fast and stable internet connection to ensure the best possible chance of measuring a competitive edge increase online.

SOLID-STATE DECISIONS

Now that they're more commonplace, solid-state drives (SSDs) are fast becoming essential gaming hardware. Particularly when playing titles such as *Battlefield 4*—which has done away with the start-of-round countdown timer that used to allow a grace period for slower-connecting players—having a game installed on an SSD can mean the difference between scoring a coveted vehicle or lugging it across the digital battlefield on foot. No matter how fast the rest of your rig may be, there's no denying the start-of-round competitive edge afforded to those players who can load the game before anyone else can get in.

Despite speed increases over the years, traditional moving-parts hard-drive technology can't compete with the lightning-fast speed of an SSD. SSDs such as the Crucial M500, available in a



variety of capacities, are a great place to start when looking to upgrade a gaming machine on a budget. There's no need to fork out for the highest-capacity model, either, as even an entry-level 120GB (\$104.81) capacity can do the trick when coupled with a spare internal or external hard drive. For example, install the 120GB M500 as a primary drive with your preferred operating system, and popular gaming digital-distribution programs such as Steam and Origin allow you to install specific games to specific drives. Alternatively, keep the SSD as a dedicated gaming drive if you don't want an overall performance increase on your operating system. The games you play the most can be installed on the 120GB SSD, while everything else can go on another drive.

If you have a bigger budget, consider the respected Samsung 840 PRO range; ideally, in a size larger than the 128GB (\$137.71) base model to allow for the installation and faster operation of more software. The higher price nets you an SSD that beats the M500 across the crucial read/write speed comparisons.

Still not fast enough? Forego the SATA bottlenecks of 2.5-inch SSDs and opt for a PCI express (PCIe) drive. OCZ offers comparatively moderate pricing for the speedy category in its Revodrive 3 range of SSDs. Bear in mind that SSDs offer little-to-negligible real-time performance once the game has fully loaded, which means you're investing quite a chunk of coin in a relatively small edge that's relevant to only

▲ Don't let your squad down by failing through inferior gear

certain games which don't have start-of-round timers.

SOUND ADVICE

Nowadays, it's a little easier to cheat and circumvent the 'need' for a peripheral sound device, thanks to often impressive on-board sound that's part and parcel with mid-to-high-end motherboards. You may already have access to sound potential you're not currently using. Furthermore, USB audio devices such as surround-sound headphones and less-common (and pricy) external digital-to-analogue (DAC) can be purchased to avoid the installation of internal sound cards which may cause analogue interference.

The trick to remember is your sound quality is ultimately controlled by your output device. Series such as *Battlefield* which boast award-winning sound design can only be experienced in their full glory—along with the subsequent access to a competitive edge—if you have

▼ Almost every sound card offers better audio quality than almost every motherboard solution



the appropriate equipment. ASUS offers a range of internal sound card options, including the affordable Xonar DG (\$28.60) to the more expensive Xonar Essence ST (\$75.02), for players who want to keep the superior sound potential of a sound card tucked away. For those that want an external option for easy access, the price jumps again for the hybrid DAC/USB sound card ASUS Xonar Essence One (\$166.74), or pricier again with the versatile and full-bodied audio of Arcam's irDAC (\$649). Bear in mind you'd mainly buy these to take advantage of digital (optical) sound output to a set of surround-sound speakers or studio-quality headphones.

SURROUND SPEAKERS

If money isn't a restriction and you have the space for a proper setup, consider investing in a proper 5.1 or, better yet, 7.1 speaker home theatre system, and connect it to your internal or external

"The purpose of 7.1 headphones is accurate sound"

sound card. The objective with any surround-sound speaker configuration is to put yourself at the centre of the sound to ensure you can take advantage of the soundscape that comes from in front of you, behind you and to your side. Space is a big concern for ensuring you're in the centre of the sound.

SURROUND HEADPHONES

There's no real need to go down this expensive path, though; especially considering the impressive performance of cable-connected and wireless headsets. The key is to opt for a 7.1 Dolby-certified headset, with USB-cable models cheaper than their wireless counterparts. It's worth noting the USB cable can prove to be a pain if not positioned correctly, and can easily get in the way of your hands. Wireless solutions such as the Turtle Beach Z300 (\$218) are a comparatively affordable starting point, whose biggest selling point is 7.1 channel Dolby surround sound via 50mm



► Dell's UltraSharp U2414H is a great value proposition

internal speakers. If you're willing to invest more in your sound, the multiplatform Astro A50 (\$299.99) wireless gaming headset boast incredible 5.1 and 7.1 sound quality.

The purpose of investing in 7.1 headphones is simple: accurate sound identification. This is particularly essential in shooters (mainstream options such as Ghosts, or hardcore titles such as Arma 3) which, coupled with thorough map knowledge, can offer an identifiable competitive edge by allowing you to accurately track the movements of enemy combatants or incoming threats before you've even seen them.

ON DISPLAY

While LCD screens with low response times are the norm nowadays, there's the potential for a greater gaming edge depending on your monitor configuration. For shooter fans looking for a single-monitor option, AOC's G2460P (\$345) combines a 144Hz refresh rate with a 1ms response time on a 24-inch screen for the ultimate in negligible input lag. During our tests, AOC's bold claim that the G2460P offers a competitive edge proved true. We found it felt like we were spotting enemies a breath before they saw us in

head-on encounters, which is a consistently handy advantage in fast-paced shooters.

If twitch gameplay isn't as essential, AOC also offers the 29-inch 21:9 aspect ratio Q2963PM (\$489), which doesn't have the speedy refresh rate (60Hz) and response time (5ms) of the G2460P. It's intended as a cinema monitor, but it also offers a competitive single-monitor advantage thanks to wider 2,560 x 1,080 game resolutions. In practical terms, running a game in a widescreen resolution means you have a wider view of the digital battlefield, meaning anyone fighting against you on a Full HD (1,920 x 1,080) resolution has less lateral visibility. If you're looking to splurge and up the resolution again, the Dell UltraSharp U3014 (\$1,789) offers 30-inches of screen real estate at 2,560 x 1,600 resolution.

MULTI-SCREEN GAMING

Naturally, a higher resolution puts greater demand on your computer, meaning you need the appropriate silicon innards to ensure the aforementioned smooth frame rate, but it can also overwhelm with additional visual information. If that's not of concern to you, the current gaming-feature zeitgeist is multi-screen gaming. While certain integration leaves a lot to be desired, games such as our go-to example Battlefield 4 include second-screen gameplay that offers a full view of the map, complete with spotted enemies, for at-a-glance information that can help plan attacks and spot enemy assaults. Anticipate this type of second-screen functionality to be included with more games down the track, too.

If the full gamut of an ocular assault really isn't of concern and you're looking for the ultimate widescreen experience, consider

To 3D, or not 3D

3D gaming isn't usually advised for gaining a competitive edge, even if it does offer a more immersive experience. On the downside, increased eye strain is a real concern (particularly over lengthy gaming sessions), but it does have the added potential benefit of separating HUD and text notifications into the foreground for relevant games, making them easier to notice among the visual noise.



investing in an AMD Eyefinity or NVIDIA Surround setup that links a single image across multiple monitors. This option is great for patient shooter fans that like to sit back and have a full view of the battlefield. It's best to stick with three of the same monitors (brand and model), but this isn't absolutely essential.

One of the key peripheral considerations is monitor bezel width; even though clever bezel compensation takes into account the non-display space between monitors. You'll also need to be aware that your video card/s will be put under immense strain, especially if you're pushing for, say, the maximum Eyefinity resolution of 7,680 x 3,200 (across six monitors). The ASUS VG278HE (\$429) presents a 27-inch, 144Hz offering (at 2ms) for a responsive multi-monitor configuration (recommended across three), but also consider Dell's UltraSharp U2414H monitor (\$348), which boast a 6.05mm bezel and can be shifted between portrait and landscape mode for different display options. The 8ms response time and 60Hz refresh rate rule this option out for shooter fans who like to play at speed, though.

GAMING MICE

If there's one item at the top of the list of peripheral purchases, it should be a decent mouse. While the humble mouse is an easy acquisition, gaming mice come in some key varieties. Wired versus wireless is the first consideration. If USB cable length isn't an issue, or you don't mind running a USB extension cable for extra cable slack, there are many affordable gaming mice. Shooter fans will want to invest in one that, at the very least, has adjustable sensitivity buttons. These allow the player to increase or decrease sensitivity on the fly, and will come in handy for games that slow down aiming sensitivity in contextual situations: such as inside vehicles or when aiming down weapon sights.

It's also handy to have a button or two readily available near your thumb for binding to key in-game commands, but it's not essential. If possible, test drive a mouse before you commit to buying it, as one that feels comfortable in your hand is paramount. For

an affordable option with an impressive 6400 dot-per-inch (dpi) optical sensor for accurate movement translation, get your hands on the Razer DeathAdder (\$45). Logitech has a history of offering solid gaming mice, such as the G500 (\$45), which includes the option to add a variety of internal weights to alter how the mouse glides in your hand.

For entry-level wireless gaming, the Logitech G602 (\$99.95RRP/\$69) mouse boasts an impressive 25 hours of battery life before it needs recharging, while 11 intuitively placed buttons offer a variety of control alternatives for your fingers. If you want to go next-level with your mouse personalisation, jump online and order the R.A.T. 9 (\$126.95), which has zero-latency wireless responsiveness, a 6400dpi sensor and six programmable buttons. Precision aiming is a paramount consideration for shooters and real-time strategy (RTS) titles, while the number of programmable buttons comes into play when looking to lift your game in RTS or some complex role-playing games.

GAMING MOUSE MATS

There's no point forking out on a decent gaming mouse if you're not going to get the most out of it with an appropriate mouse mat, though. While your choice of a hard or soft mouse mat may seem like personal preference, harder mats tend to provide less resistance, which increases mouse glide. The opposite is true of soft mouse pads. Hard mouse mats are great if faster movements are more important

Laser versus optical

Optical mice have been around longest, with laser mice being the new kids on the block. Laser mice tend to have higher precision compared to optical sensors, thanks to their lack of a reliance on optical imaging to simulate mouse movement. Optical mice do, however, perform well on both hard and soft surfaces, which may sway your decision depending on your preference of mouse pad. Laser mice perform best on rigid, uniform surfaces such as hard mouse mats to accurately translate all mouse movements. Ultimately, a high-dpi sensor and appropriate mouse pad make the best combination.



▲ The Corsair Vengeance K95 keyboard features mechanical switches

◀ Logitech's G602 mouse

than precision aiming. The Logitech G440 (\$21) hard gaming mouse pad is a perfect example of this. You can learn to adapt to the additional glide for semi-precise aiming, but it really is a mouse mat that's best served for those looking to aim centre mass, more so than the sniper targeting headshots. It's also great for fast movements in strategy titles.

For precision aiming, cloth mats are the way to go, with options such as the Logitech G240 (\$16.83) feeling more ergonomic over lengthy gaming sessions thanks to the softer material. On the topic of ergonomics, be careful when sourcing a soft mouse pad that's too thick. This type of pad may result in the mouse sinking into it, which can erroneously interpret mouse movements thanks to an inconsistent surface. For greater variety, SteelSeries offers a range of mouse pads in its QcK line from light to heavy, thick to thin, with a number of texture options to customise the level of resistance you want from your mouse mat.

GAMING KEYBOARDS

Serious gamers should consider arming themselves with a keyboard that has individual mechanical key switches for each keyboard button. The traditional keyboard uses a membrane design, whereby all keycaps are placed above rubber domes, all of which rest on a plastic membrane which spreads across the entire length of the keyboard. This approach is problematic across

gaming genres as it requires a key to be fully depressed for the keyboard to register a keystroke. Mechanical keys register a keystroke when a key has been only half depressed.

KEYBOARD OPTIONS

The result is a more responsive keyboard, which affords a speed advantage to mechanical users fighting against membrane wielders. Unfortunately, the vast majority of available gaming keyboards are still built on non-mechanical technologies. It's difficult to go past the Logitech G range of keyboards, with programmable keys for binding various in-game commands to specific macro keys you can reach with your pinkie. The G105 (\$44.95) is a great entry-level option with six programmable G-keys, but the G510s (\$99) boasts 18 adjustable G-keys and

“Serious gamers should arm themselves with a keyboard with mechanical key switches”

a customisable LCD screen, with contextual screens for games and gaming software.

Unfortunately, both of these options are membrane keyboards.

MECHANICAL KEYBOARDS

For an entry-level mechanical keyboard, the SteelSeries 6G v2 (\$89) is an entry-level option. The (\$174.92) is a fully mechanical keyboard with 18 programmable G-Keys. Logitech also sells the G710 (\$139) mechanical keyboard, which is short on G-Keys and lacks an LCD screen, but boasts whisper-quiet mechanical keys (loud keys can be a distracting problem for most mechanical keyboards). If you want a more responsive keyboard—essential for both fast-paced shooters and micro-intensive real-time-strategy games such as StarCraft II—mechanical will provide a noticeable speed advantage.

Bite-sized keyboard

It's an old piece of hardware, but the Logitech G13 (\$78.50) offers a keyboard alternative for shooter fans. It's essentially a mini-keyboard with 25 programmable G-keys, with three different modes that allow for a total of up to 75 functions. The real kicker, though, is the programmable thumb joystick. It's best used to control avatar movement, which leaves your four fingers free to take care of other in-game functions, as opposed to the traditional method of using three fingers for WASD/directional-arrow movement controls. It takes a bit of mental rewiring to get used to it but, once you've mastered the joystick, your ability to dedicate four fingers towards non-movements functions soon pays dividends.



BUT IS IT FAIR?

All of the aforementioned peripheral options list the main ways you can acquire a measurable competitive edge which, when combined, makes for a considerable advantage that leaves room for debate as to how fair it really is. Unlike hardware 'cheating', software cheating is incredibly easy to identify as it offers a competitive gameplay advantage not afforded in the original design of the game. Anything which buffs your abilities—speed, aiming, ghostly sight through physical objects, etcetera—beyond what can be fairly earned in a game is classifiable as cheating.

GLITCHES AND EXPLOITS

Software glitches are a far less black-and-white affair, with a pertinent grey area wide open for discussion in terms of which ones constitute in-game cheating. A glitch to one gamer may be seen by another as opportunistic exploitation that is, technically, allowed for within a game's design. In many ways, gaining a competitive edge by way of the purchase of equipment that's supported by a game's design is akin to the debate between whether glitching is cheating or whether it's advantageous gaming. The key difference is that glitches often result in community outcry that pressure developers into amending such exploits in future game updates.

TOURNAMENT GAMING

Interestingly, even at a tournament level, there are certain hardware restrictions in place, but they're nowhere near as limiting as they could be. Major League Gaming (MLG) forces players to play on a provided desktop and monitor, but asks them to bring their own headset, keyboard, mouse (no wireless models, though) and mouse pad to compete in StarCraft II. This means, in the instance of StarCraft II where speed is everything, mechanical keyboards, high-dpi and/or multi-button mice all offer the potential for an all-important speed boost on the actions-per-minute (APM) front; and all of these can be potentially used by contenders. That being said, the MLG equipment guidelines do include the disclaimer that all equipment is subject to approval.

AND YOU, AT HOME

For a home user, though, every piece of hardware installable on an operating system and supported in a game is technically fair play. The fact remains that all of the aforementioned equipment is really only fully useful to semi-pro or pro gamers. While it can certainly give any gamer the potential for an edge when stacked next to stock peripheral hardware, there's still a requirement of a higher skill level before the advantages become noticeable. If you're competing at a high skill level, the chances are good you're already flirting with the top of the leaderboard.

GEAR UP, SOLDIER

Arming yourself with the aforementioned equipment is more likely to value-add to your gaming experience, as opposed to converting you from ladder loser to the lofty heights of best player.

In this respect, the use of hardware peripherals to gain a competitive edge is comparable to motorsports: teams are allowed to tune the parts of their cars as they see fit to unlock better performance. Running with that comparison, purchasing relevant gaming peripherals isn't cheating; it's smart.

There has been great evolution in the gaming scene over the years, turn it to your advantage. ■

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RIP-OFF...

AND HOW IT WORKS

NICOLE KOBIE REVEALS WHY THE TRUE COST OF DEVICES ISN'T IN THEIR SPECIFICATIONS OR HARDWARE, BUT RATHER IN HOW MANUFACTURERS RUN THEIR BUSINESSES

How much do you want to pay for your next smartphone or tablet? If you're looking to cut costs, you don't need to skimp on the specification: there's so much more to pricing devices than what's in the box.

Compare the Apple iPhone 5s to the Motorola Moto G. Buying Apple's handset SIM-free in the US - we'll stick with US dollars for now, for easier comparison with analysts' reports - costs \$649 for a 16GB model and a whopping \$849 for the 64GB version. Not long after the arrival of the iPhone 5s, Google-owned Motorola released the Moto G, selling it for \$179. How can two similar devices be priced so differently? Is the difference really worth a not-inconsiderable \$450?

Of course, the specification matters: component breakdowns show that the iPhone's parts are worth almost double that of the Moto G's. Plus, there's design and licensing to consider. But none of those bridge the gulf in pricing between such devices. Consumers need to consider how appealing the brand name is

but also how well specified the device is and how much the marketing budget tops out at. Experts agree, as Gartner analyst Jon Erensen says, that the most important consideration is "what this company's goal [is] and how they plan to make the money".

Here, we explain what drives prices up - and down.

COMPONENT COSTS

Analyst firm IHS iSuppli tots up the price of components into a bill of materials (BoM), revealing how much each manufacturer spends on hardware and assembly. Battery aside, every component of the Moto G is less expensive than those in the iPhone 5s. The Moto G's 8GB NAND flash and 1GB LPDDR2 DRAM is \$6 cheaper than Apple's 16GB and 1GB LPDDR2 combination; its respectable 1280 x 720 display is \$22 cheaper than the Retina version; and the interface and sensors are almost half the price, partly due to the iPhone's fingerprint sensor. Even the contents of the box differ - what comes with the Moto G costs Motorola \$3.50, while Apple's inclusions total \$7.

All in, according to iSuppli's preliminary estimates, the Moto G costs \$109.75 for components and assembly, while the 16GB iPhone 5s racks up \$198.70. However, the Moto G's retail price is only \$73 more than its physical costs, while the iPhone's final price adds an eye-watering \$450.

"The Moto G has very thin margins - thinner than we'd expect," says iSuppli analyst Wayne Lam. "Think about it as a budget: everybody has a budget for materials, and then they add on the development [costs] and price it accordingly, with a margin built in. That's the profitability. For Motorola, since the margin has shrunk, they're aiming for this product to break-even."

It's "a little more tricky to do the design" in smaller devices such as smartphones and tablets, admits Erensen, and you may have to pay for more expensive components to fit smaller form factors, but otherwise the main difference is the radio. Most tablets don't have 3G or 4G connectivity, and adding that bumps up the price. For the Nexus 7, mobile connectivity is available only on the more expensive 32GB version, and bumps up the price from \$269 to \$349. On the Apple iPad Air, iSuppli's BoM breakdown shows the radio costs at \$32, but that option adds \$130 to the retail price.

In reality, connectivity costs aren't only about the hardware. "You have to work with standards bodies in the different countries to make sure that the device is certified, and work with



service providers, and go through all the testing. When you add that cellular piece, there are lots of extra steps that can add up, in addition to the hardware costs," says Erensen. "Depending on the type, adding cellular can cost anywhere from \$15-20, all the way up to \$30 if you're using the latest LTE standards."

MOORE'S LAW

Thanks to Moore's law, component costs fall over time - but that doesn't mean retail prices will. "There's obviously cost erosion over time, most noticeably with the big-ticket items such as displays and memory - specifically flash memory and system memory," says Lam. "For example, 16GB NAND flash storage that cost \$15 two years ago costs only a fraction of that now. These types of erosion are predictable. Memory and display costs will go down over time."

"These types of manufacturing follow Moore's law - the equipment gets better, the process gets better, the yield improves, and the costs go down," he says. "But if you look at how those components contribute to the overall BoM, the proportion of the cost remains the same."

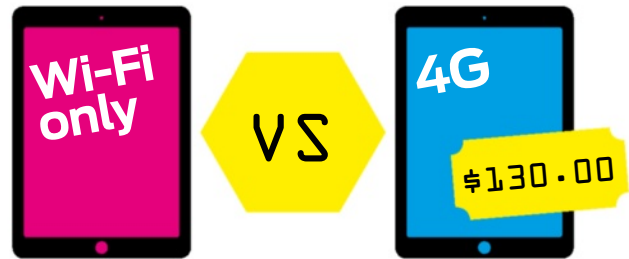
"Handset OEMs typically build around an unspoken BoM budget. If they're selling a \$600 phone, they know that they're going to throw a lot of resources and cost into the display, memory and processors. That bucket of costs usually remains steady, since [OEMs] can leverage cost improvements over time. A screen that was \$40 last year will stay around \$40 the following year, because they've improved the quality or the size. That's typically how the BoM cost evolves."

Indeed, despite Moore's law, tech costs don't necessarily fall with each new version, since manufacturers add better-quality parts or new features. The iPhone's BoM has been steadily increasing: the iPhone 3GS was \$179, the iPhone 4S \$188, and the iPhone 5s is \$199, according to IHS iSuppli data. For example, the price of the processor has increased from \$14.46 on the iPhone 3GS to \$19 on the iPhone 5s.

Improving specifications can also lead to retail prices going up: the 2013 version of the Nexus 7 was \$30 more than its predecessor. "With the Nexus, the new one was slightly more expensive because some of the features, plus memory and connectivity,

The business model is a big piece of the pricing puzzle

HOW MUCH DOES IT REALLY COST TO ADD MOBILE CONNECTIVITY?



Cost of buying an iPad Air 16GB with 4G versus Wi-Fi only



Component cost of adding 4G to the iPad Air

were improved," says IDC analyst Chrystelle Labesque. Since the margins on the Nexus are so tight, Google had to increase the price.

DOUBLING UP DESIGN

Other costs for a smartphone or tablet are more difficult to pin down: for example, marketing, design, R&D, engineering and licensing. But how those costs are included on a handset's balance sheet is down to the specific manufacturer.

Indeed, the price of certain elements can be offset by a previous device, helping to reduce costs. For example, handset makers can apply the engineering nous garnered by working on one product to the manufacturing process of a similar, later model - a practice which Lam calls "trickle-down design".

"[Motorola] could say it incurred most of its non-recurring engineering (NRE) costs with the Moto X, so for the Moto G, NRE is virtually zero," he says. "That all boils down to accounting. They've gotten a lot of leverage of the design from the Moto X, a lot of that design has just trickled down."

NRE costs are a key reason why tablets can be made more cheaply than smartphones. "The components are very similar," notes Erensen.

"Companies take smartphone designs and leverage them to make tablets - and even portable media players such as Apple's iPod touch - using the same building blocks."

HOW TO MAKE MONEY

While the specification makes up a large proportion of the cost of a device, it isn't the key element that goes into deciding the retail price: the company's business model is. When looking at the price, Labesque notes: "What is the strategy? How does the manufacturer position itself on the market, and how does it aim to make money?"

This is a key reason why Apple products cost more: the company is aiming to make money on hardware. Samsung has the same strategy, but on tighter margins, while Motorola, Amazon and Google are happy to break even. "Vendors adopt different strategies when positioning their products," says Labesque. "It's clear that when Google is pushing the Nexus, it isn't earning money by selling the device, but by selling the content later. There's an economic model behind that, which means the different players are earning their money in a different way."

According to Gartner's Erensen, the business model is the "big piece" of the pricing puzzle. "Apple has very high margins on the iPhone, and that's where it drives a lot of its profit - it needs those prices to stay high," he notes. "Apple can justify it because

All of a sudden, companies aren't playing by the same rules

of demand, the brand name and the quality of the product. Look at Google and its Nexus devices - it's trying to showcase Android as a platform. It's trying to get it into as many hands as possible, because the company doesn't make its money through hardware, but through advertising, search and the services it ends up providing to users.

"Amazon's another good example: it's almost willing to sell these devices at cost, because it knows well that once it has them in consumers' hands, they're likely going to use them to purchase content - and even physical goods - from Amazon."

For example, Amazon's Kindle Fire HD retails at \$199, but its BoM was \$174, leaving the company little in the

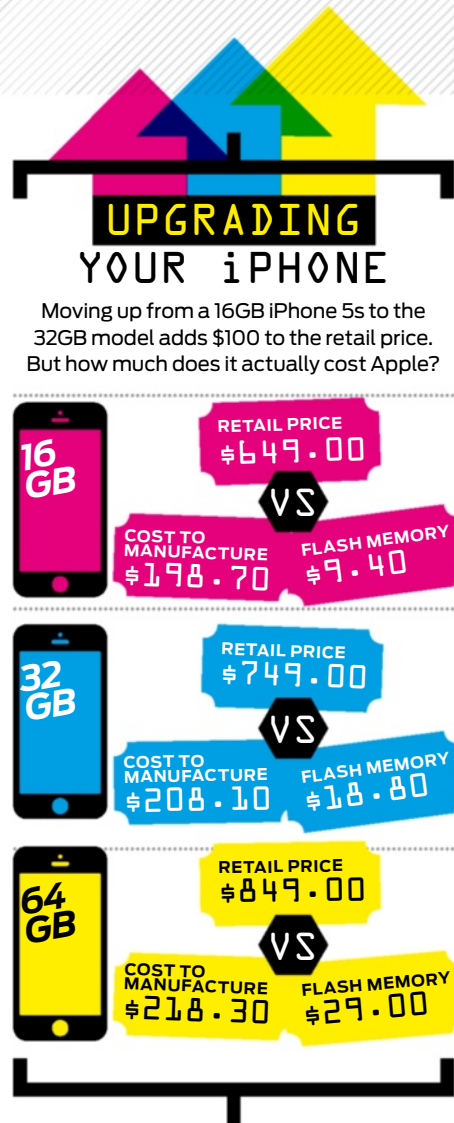
way of margin - especially after the marketing and design spend is taken into consideration.

BIT OF BOTH

Of course, Apple also sells content via its App Store, and because of its head start in the market, and its premium brand, can earn profit from both hardware and content sales. As iSuppli's Lam notes: "Why is the Apple iPad so much more expensive than the other guy? Because Apple isn't operating in the same playing field."

However, content sales don't provide as much profit as you'd think, claims Lam. "Apple is making money from hardware; that's shown in its balance sheets if you look through its earnings. It isn't a case that they're pulling in from all angles." Strictly speaking, the company is pulling in from both angles, but hardware adds much more to its coffers than software or content; in its latest quarterly results, the iPhone contributed \$19.5 billion and the iPad \$6.2 billion, while the App Store and software sales brought in \$4.3 billion - significant, but far from the most important part of Apple's bottom line.

Samsung also focuses mostly on hardware sales, notes IDC's Labesque. "What Samsung has is a very large product portfolio [that ranges] from the more



THE TIGER THREAT

While Amazon, Google and Samsung have their eyes on long-term software sales, not all low-cost products are supported by an app store. Consider the ASUS Fonepad. Not only does ASUS use Android, and therefore make no money on content sales, but the "phablet" also boasts mobile connectivity, meaning it faces higher component costs and associated regulatory issues. The Fonepad 8GB retails for \$A319 via staticICE, more than Google's 8GB Nexus 7 at \$A229, and more than the 8GB Amazon Kindle Fire HDX 7in, priced at \$A219.

Generally though, ASUS is likely taking a hit on margins in order to grow its brand as the priority. "Some companies need to price aggressively because they want market share," says Gartner analyst Jon Erensen. "They want to establish a position, particularly if they're a late-comer and their brand doesn't hold the same value as the market-leaders. You're forced to take lower margins, and then hopefully as you build a reputation, you can start to make more money."

This pattern is seen in the influx of Chinese manufacturers churning out cheap devices - and cheap doesn't necessarily mean poor quality. Erensen

says he purchased a phone during his last trip to Asia: "It was \$250, and has a specification equivalent to something twice as much from a tier-one vendor."

Margins will be tight, and such firms also won't bother to invest as much on marketing, hoping the low price will be enough to draw punters. They also save money on R&D and design, helped by chip makers who develop prototypes for them to work from.

"One of the interesting trends we're seeing is that a lot of the semiconductor vendors are developing turnkey solutions - basically building phones," Erensen says. "Then they give those reference designs to customers so they can get to market quickly. It's allowing more people to jump into the market who were previously hindered by the engineering resources needed. It used to be big companies with lots of R&D and engineers. You still need them, but the barrier to entry isn't as high, so you're seeing this flood of new companies come in."

"It's a challenge, because they're [offering] similar specs to tier-one, high-end phones, but they're pricing them 30% to 50% less than competitors," he says. "How do you position your products against something like that?"

TABLET WARS

NEXUS 7

8GB, Wi-Fi only (2012)



**COST TO
MANUFACTURE**
\$159.25

VS

RETAIL PRICE
\$199.00

Ignoring other costs,
Google makes:

\$39.75

KINDLE FIRE HD



**COST TO
MANUFACTURE**
\$174.00

VS

RETAIL PRICE
\$199.00

Ignoring other costs,
Amazon makes:

\$25.00

”



iPAD AIR

16GB, Wi-Fi only

**COST TO
MANUFACTURE**
\$274.00

VS

RETAIL PRICE
\$499.00

Ignoring other costs,
Apple makes:

\$225.00

price-sensitive to the high-end. For Samsung, its strategy is more in the volume [of sales],” she says. However, Samsung is shifting to Google’s model, skinning Android and pushing its own services by including them on its handsets in place of Google’s.

DISRUPTIVE CHANGE

The biggest changes have come from Google and Amazon, which have both pushed prices well below what Apple and Samsung are selling at. “It’s one of those markets where you have to identify the motivation of the provider: where are they making their money?” Erensen says. “In the case of Amazon, it’s making its money out of the lifetime of the customer. It’s trying to capture them and lock them into that ecosystem. Similarly, Google is offering as affordable a device as it can, so it can keep users within its ecosystem, and provide a platform for its key businesses, which are internet search and advertising.”

Lam agrees, saying that Amazon and Google are playing a longer game. “They’re interested in making money from the lifetime value of the subscriber or customer,” says iSuppli’s Lam. “Amazon has calculated that each Kindle owner will be worth so much additional value through shopping or content – so that’s its business model.”

As far as margins are concerned, Amazon isn’t even the most extreme case: game consoles are sold at a loss, in the hope that customers will shell out enough on games to make up for it. “The new PS4 and Xbox One are still basically wrapping money around each box, since it takes more for them to build than to sell,” says Lam. “That business model goes into the red because the console manufacturers know they can recoup the costs through game purchases.”

“It’s a very different approach. Now it isn’t really held to the same profitability expectations as Wall Street, because all it has to do is not lose money,” says Lam. It’s what will change the market, Erensen says, as consumers realise that they will be getting more for their money if they buy from companies where making a profit on the hardware isn’t the primary motivation. “You get the most interesting kind of disruptions when different business models come into play; all of a sudden, companies aren’t playing by the same rules,” he says. “Some of these companies are looking to do different things, and they’re not necessarily making all their money upfront on the hardware.” ■

Data recovery: Inside the clean room

WHERE CAN YOU TURN WHEN A DISK FAILS OR A MEMORY CARD IS CORRUPTED? **DARIEN GRAHAM-SMITH** TALKS TO THE EXPERTS WHO CAN RESCUE YOUR LOST FILES

No matter how careful you are, accidents happen. If you work with computers, it's almost inevitable that sooner or later you'll end up inadvertently deleting an important file, or losing data due to a hardware failure. Naturally, your first line of defence is a strong backup regime. For businesses in particular, it's crucial to keep at least one copy of everything. For some types of data, it's a legal requirement.

In the real world, however, things do slip through the cracks, and that's where the data-recovery experts come in and save the day: companies that specialise in rescuing unreadable data, even if the disk has been wiped or physically damaged.

WHO USES DATA-RECOVERY SERVICES?

Data recovery is big business, but you don't have to be a large organisation to make use of such services. "Home users, small organisations, large multinationals - you name it, we've done it," declares Phil Bridge, MD of Kroll Ontrack, a company specialising in data recovery.

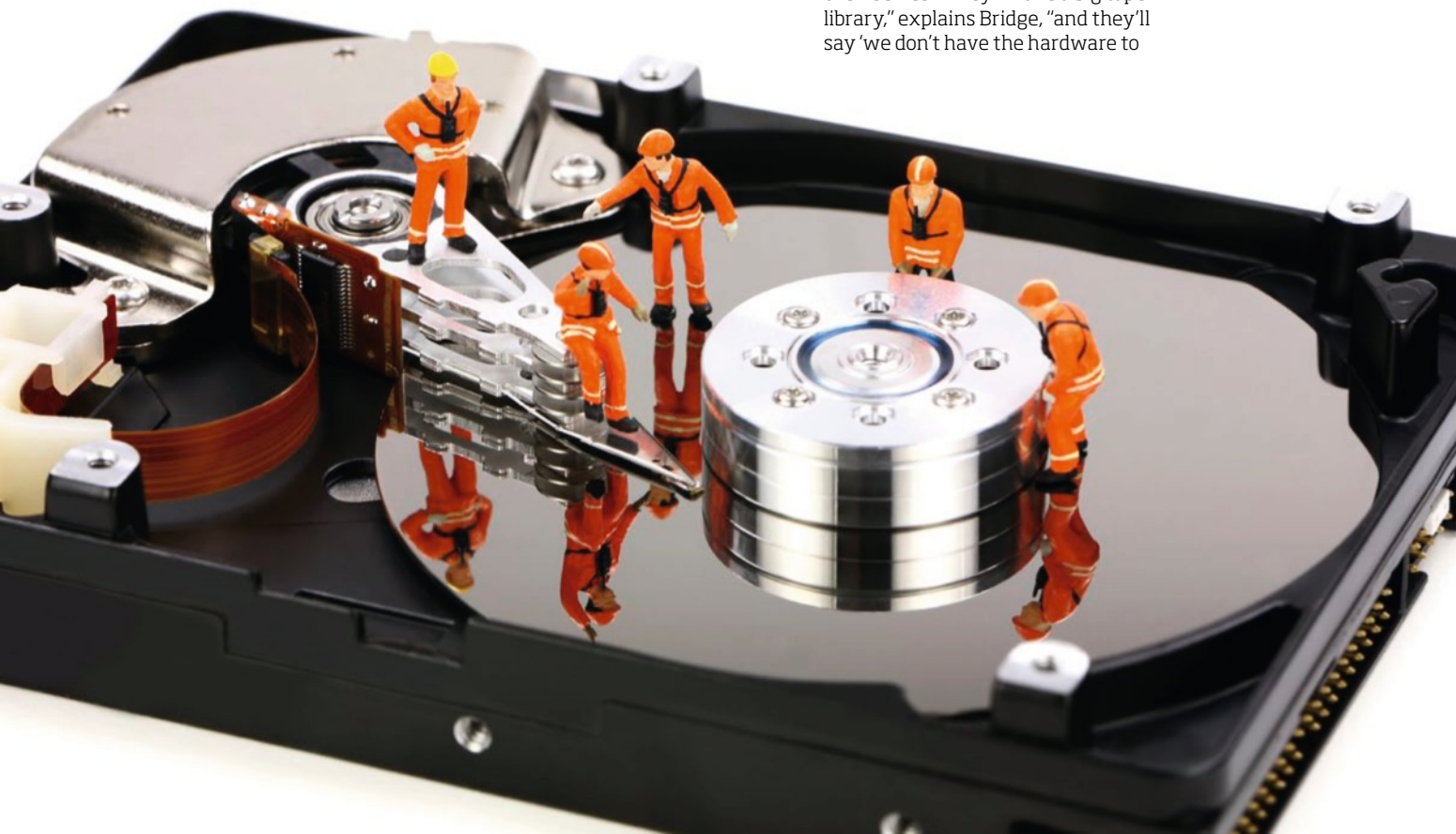
"We get a variety," agrees Grant Woods of LC Technology, an agency specialising in flash media recovery. "We get Joe Bloggs round the corner, and we get a lot of corporate companies. Probably our main source of custom is professional photographers, who come to us when a card's corrupted and they can't reproduce the data - for example, from a wedding.

"We're also starting to do a lot for TV companies now. We've had a cameraman who hand-delivered a card: he'd been on location in Syria, obviously being shot at every now and again, and he had a corrupted card. We recover these things, and then a week later it's been edited and

recovering data can take months if the damage is severe

it's on TV. That's very satisfying."

Data recovery isn't only about corruption. Sometimes customers need help restoring data from legacy media they can no longer read themselves. "They'll have a big tape library," explains Bridge, "and they'll say 'we don't have the hardware to





▲ Hard disk internals are sometimes so fragile that a speck of dust could permanently destroy data

read it, we don't know what software was used'. They'll send a big crate of media to us, so when they need to produce data we can get that off for them. It's a pretty big business, tape, and one that I think is growing."

To serve this business, Kroll Ontrack maintains a collection of legacy drives - and it isn't only tape that's covered. "We can read pretty much everything," claims senior engineer Robin England. "We can recover old floppy disks, both hard- and soft-sectored. We're quite stringent in maintaining a lot of old 3in drives, and even the 2in floppy disks used by Zenith laptops. If you came to us with a ZX Microdrive cartridge, we'd dive on eBay and see what we could do. It may require some R&D work, but I'm sure we could come up with a solution to read the tape. Bring us a punched card and... well, it depends on the encoding. And how much you've got of it."

At the other extreme, modern storage methods that spread files across multiple physical and virtual volumes present a different sort of challenge. "Enterprise SAN systems use dynamic mapping," explains recovery specialist Richard Holbrook. "We first have to work out how the low-level RAID array is set up, then figure out the dynamic mappings. Then there might be another RAID level, then a virtual system on top of that. It's layers upon layers upon layers. Recovering data can sometimes take weeks or months if the damage is quite severe, and the cost can run into tens of thousands for larger systems."

THE RECOVERY PROCESS

Regardless of the job, and even the media type, the initial recovery process is broadly the same. Before touching the media, the first step is to work out the legal status of the data in question: "If there's any hint of a legal process behind the request for discovery or extraction, we pass it to our legal specialists," says Bridge. "We have to follow a chain of custody, and the data may need to be presented in a way that's legally defensible."

It may even be necessary for a data-recovery team to visit the client's premises and try to perform data recovery on-site. Ordinarily, though, the recovery experts are able to test the disk or flash drive in their own laboratory. "The first

▲ A bank of computers running custom software can analyse and image 20 hard disks at once

▼ A special room at Kroll Ontrack's offices is set up purely for restoring damaged archives from tape drives

thing we do is plug it in and see what it does, and see if it gives us an error," says Woods. "That will give us an indication of whether there's any power, or whether there's power but the card's corrupted." At Kroll Ontrack, a bank of dedicated computers running custom software probes dozens of hard disks at once, reading each one sector by sector to see what can be accessed.

If the media is in a functional state, a digital image is then made of its contents, so that analysts can study and try to reconstitute its contents without danger of overwriting or further damaging the original. This could be as simple as recreating a file table, as often the critical ones and zeros are still there, just inaccessible. That's true whether you're dealing with corruption or an accidental file deletion: "You can format the card in your camera 20 times in a row, and it's still not going to erase the data," explains David Zimmerman, CEO of LC Technology. "All that does is clear out the file-table entries. The





▲ A dedicated suite of enterprise-class systems is used to reconstitute damaged RAID arrays

actual data still resides on the chip until you've overwritten it."

Indeed, data lost in this way can often be repaired in-place with consumer-grade software, and both Kroll Ontrack and LC Technology offer their own software packages. Third-party tools should be used with caution, however: "Anything you do with software is potentially putting the data at more risk," warns Bridge. "Some software approaches go in quite aggressively to recover data. They aren't concerned about the damage they cause. Have-a-go heroes end up coming to us as a last resort, and sometimes the software they've been playing with has rendered what would have been recoverable, irrecoverable."

THE CLEAN ROOM

If the data-recovery experts can't access the contents of a disk or memory card in the normal way, the process moves on to the clean room - a controlled environment where disks can be safely disassembled. Bridge estimates that around 70% of the recovery jobs his company handles end up going through the clean-room process.

Kroll Ontrack's clean room is a "class 100" dust-free environment, constantly filtered to ensure the air contains no more than 100 dust particles of 0.5µm or larger per cubic foot. However, if you're imagining a hermetically sealed space, inhabited by workers in sterile coveralls, you're in for a surprise. Such precautions may be de rigueur

for a semiconductor production line, but hard disks are robust enough to be handled without the need for gloves or hairnets. Since magnetic data won't be disrupted by someone breathing nearby, face coverings aren't needed either. The main environmental hazard is dust brought in on technicians' shoes: employees must walk across a sticky mat to remove loose particles before entering the clean room.

Indeed, the clean room looks less like the interior of a nuclear power plant and more like an electronics workshop. That's because the best way to recover data from a broken hard disk is usually to replace broken components or graft on new circuit boards to bring the unit back to life - and an important part of the data-recovery specialist's job is tracking down compatible drives to use for spare parts.

"In the case of old hardware, there might be only a handful of drives out there that can be used as donors to get your drive going," explains Bridge. The company maintains a collection of hundreds of disk models, and is always on the lookout for spares of particular models. "To find parts, we used to go to Saturday computer markets," laughs engineer Ade Komolafe. "Sometimes you'd get lucky and find a good one: there are certain drives that you know are rare, so if you see one you just want to get it and keep it."

For flash media specialists, tracking down spare parts isn't such a problem. "We've got some

the data that hard disks store can take a battering

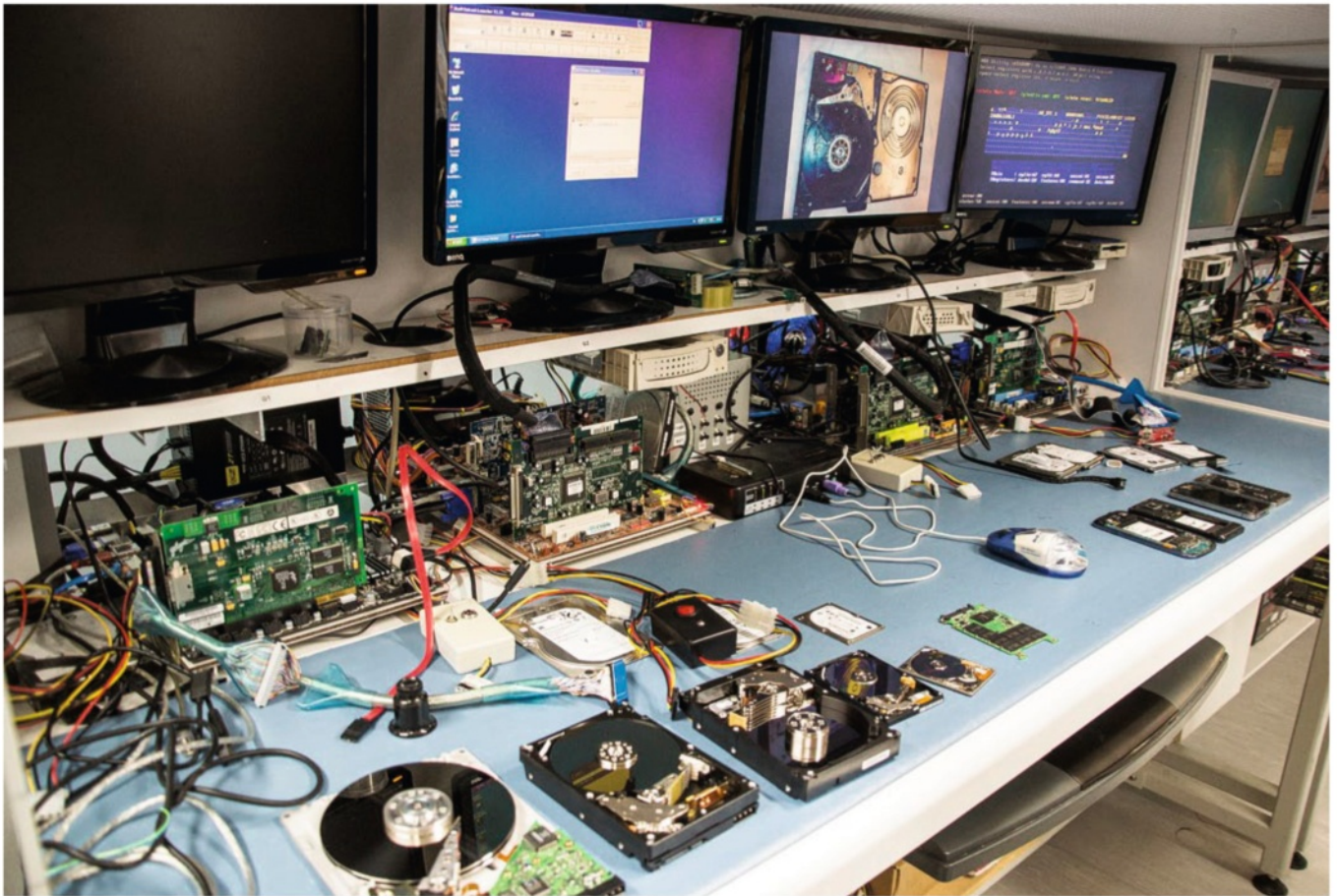
very clever technology," explains LC Technology's Woods, "whereby we can remove the working memory chips from a damaged SD card and wire them up. There's a lot of clever NAND-reading technology now; we can emulate the controller that should be on the board, so we can image it and pull the data directly from that image."

That doesn't mean it's easy to decipher the contents, however. "There are a lot of companies that make flash drives," warns Zimmerman. "You have all these companies making their own controllers and different versions of controllers, and some of them don't want anybody else to know what they're doing, so none of it's really published. It gets really, really complicated. When you get a new one, there's some manual work involved in trying to decipher the right patterns. It's an ongoing learning experience - and it always will be as the technology evolves."

"There are very few standards in the solid-state world," agrees

▼ One of Kroll Ontrack's most valuable assets is its library of legacy hard disks that can be used to provide spare parts for faulty hard drives





Bridge. "With solid-state, it's almost as if every drive that comes in has a different structure and different technology. Many of them require bespoke development to get the data back - whereas if someone sends in a Western Digital or Seagate hard drive, we've seen those a thousand times before."

For this reason, Bridge recommends that consumers use conventional magnetic media for storing personal data. "My wife asked me if she should buy a laptop with spinning media or solid-state storage," he reveals. "Honestly, I'd go with spinning media right now. Because I know that if something goes wrong, and we don't have a backup, that's going to be easier and cheaper to recover."

WHAT CAN'T BE RECOVERED?

In the case of conventional hard disks, the platters are sealed inside a tough metallic alloy case, so the data they store can take a battering, and may even survive extremes of heat and exposure to the elements. "There was a hard disk in the black box from the Space Shuttle Columbia that fell from space and sat at the

▲ The clean room is a dust-controlled environment where storage media can be safely disassembled and, in most cases, coaxed back to life

bottom of a lake for six months until it was discovered," Bridge mentions. "We got 99% of the data back."

However, there are some kinds of damage that can't be remedied. "If a platter has a dent or a hole in it, we'll try to read the data around that," England confirms, "but in the majority of cases, drilling a hole through the drive is sufficient to ensure your data isn't recoverable."

With flash storage, the question is whether or not the chips themselves

that and recover it.

"But if the chip in a microSD card is cracked, it's game over. Any sort of damage to that type of cards and it's impossible to recover the data."

SECURE DELETION

What if you're working with sensitive data, then, and deliberately want to ensure that it can't be recovered once you've erased it? The conventional wisdom is that properly destroying data means overwriting it several times on disk: the US Department of Defense, for example, mandates that drives be overwritten three times before disposal.

The experts we spoke to all suggest that this is overkill: "With today's magnetic media, overwriting the data once is enough to make it unrecoverable," affirms England. "With older drives, there was so much mechanical tolerance that the head might write in slightly different positions. If you skewed it slightly, it might still be possible to read old data that hadn't been completely overwritten by newer data." With modern drives, that's no longer the case.

In theory, it might be possible to

“you can't back everything up: that's an impossible task”

are intact. "CompactFlash cards - because they have a casing - might look totally battered on the outside, but the chips inside may be intact," says Woods. "It's the same with USB drives: we get sent USB drives that arrive in two pieces - perhaps the drive was in a laptop, and somebody dropped the laptop, and the head came off. As long as the internals are in good condition, we can work on



▲ The proliferation of tape-drive standards means that a data-recovery specialist needs to keep an extensive library of drives



▲ It's the job of a data-recovery business to keep around all the old hardware that might be needed to rescue a customer's data archives

study the magnetic patterns on a disk or memory cell with an electron microscope and make guesses about the overwritten data – but this is far from an exact science, and the results are likely to be so full of mistakes as to be unusable.

"There are a lot of people who think there's two levels of data," admits Woods. "We get that a lot – people want to salvage data that's been overwritten. But it's literally impossible. The old data is all gone. If we thought we could do it, we would try, but we have to tell customers it's not possible."

Is it possible that some top-secret government agency has the ability to scrape secrets from an overwritten hard drive or memory card? England hints coyly that he has "heard rumours" of it being tried, but in the absence of any firm evidence it seems likely that the US military's three-pass rule simply represents erring on the side of caution. All the same, it's fair to say that physical destruction of the drive is the only guaranteed way to make certain that your data won't fall into anybody else's hands.

AVOIDING THE NEED FOR DATA RECOVERY

In an ideal world, there'd be no need for data-recovery services – but there are several reasons why things fall through the cracks. Part of the problem, of course, is the fact that people don't back up as much as they should. But even the most rigorous backup regime can't be fully continuous – as Zimmerman acknowledges, "you can't back

everything up in real-time: that's an impossible task".

What's more, data loss can happen for all sorts of unpredictable reasons. Woods mentions that "photographers often come to us with cards that have become corrupted before they've had a chance to copy the data off.

"It could be user error – the user

70% of recovery jobs end up going through the clean room

could have pulled it out too quickly while it's copying or writing, or they could have bent it too hard. Or it can be caused by the hardware, whether it be the camera or the card reader. There might be voltage issues, or static, or moisture – you name it, it really is a different story every time."

Even if you're assiduous about your backups, they may not be as secure as you imagine – at least not if you don't keep direct control of your backup media. Leaving aside the issue of outdated tape drives, recovery experts unanimously warn against putting too much faith in cloud backup.

"I've talked to people trying to put all their stuff in the cloud," explains Zimmerman, "but the statistics I saw a couple of months ago were that 40% of the people that do use the cloud have lost data in the past year. The cloud isn't responsible for your data –

they make you sign a waiver, so if you lose your stuff it's not [the cloud services company's] fault."

Businesses ought to be especially wary, warns Bridge: "People push data to the cloud not even knowing what country that drive's in," he notes. "How do you know that the cleaner who works in the data centre has been checked for security? And who are you sharing your storage with? Are you going to have any legal challenges accessing media that has someone else's data on it?"

Ultimately, the message is to plan for failure. "I keep my stuff on three or four different PCs and probably about a dozen flash drives," reveals Zimmerman. "The message is redundancy, with your important stuff." Bridge takes a similar approach: "If I'm a home user and I want to preserve my personal data, and keep it readable in 20 years, my personal strategy is simply to buy a 2TB hard drive. And when it's full, I buy the latest one, I copy everything over, and I keep going." ■





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Fun times ahead

DAVID HOLLINGWORTH IS VERY HAPPY WITH HOW THE YEAR AHEAD IS SHAPING UP.

What an amazing period of change we're having. And not just in the office, where we are now all of a sudden part of a whole new team, and with a new Editor (*waves at Ben*), but in terms of the year ahead for hardware.

One of things that's going to be fascinating to watch in the next 12 months is how the PC market shapes up. On the back of growing tales of woe in terms of sales, we've had some interesting industry shifts. Lenovo is branching out into handsets after purchasing Motorola, while Sony has just sold of its Vaio PC business, and there are rumours that Toshiba may follow suit. There's no doubting that while laptop makers struggle to come to terms with growing threats from smartphones and tablets, that it is easy to think the PC is in trouble.

On the other hand, you've got companies like GIGABYTE, who broke sales records last year with motherboards. You've got game-maker Valve branching out into hardware and OS development with its Steam Machine initiative, and you've got any number of PC game developers going from strength to strength. Even if you're not a gamer, the success of companies like Paradox Interactive and Wargaming should make any PC enthusiast feel pleased.

The fact of the matter is that the PC market is not in decline - it's merely maturing. There are a growing number of devices that can replace the PC in terms of mobility and convenience, but there are still few devices that match the versatility and power of a hand-built desktop machine.

It's a good time for the builders.

DAVID HOLLINGWORTH

is our Managing Editor. In between reviewing games and hardware, he looks after *PC & Tech Authority's* website and social feeds.



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Our A-List award is reserved for the best products in each category we review. With a winner and an alternative pick in each, that's 92 products you know are first class.



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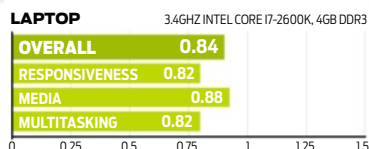
OUR BENCHMARKING TESTS ARE THE BEST IN THE BUSINESS. READ ON TO FIND HOW THEY WORK...

2D TESTS

We test desktop PCs, netbooks and laptops with our own, custom-built, 2011 Real World Benchmarks.

We split the results into three categories: Responsiveness, Media and Multitasking, with the Overall score an average of the three sub-scores.

For instance, responsiveness replicates light browser and productivity workloads. The Media test involves running iTunes for audio conversion, Photoshop CSS to crunch large images and Sony Vegas 10 to edit home video. This then gets run simultaneously alongside Cinebench 11 in order to get a handle on the multitasking ability of the system.



3D TESTS

We use pre-recorded demos in Crysis and DIRT 3 to test gaming performance where relevant. We have three standard test settings, depending on the power of the graphics card: Low, Medium and High.

To test gaming performance, we use our own recorded Crysis benchmark. We use the Low, Medium and High quality settings in 1366 x 768, 1600 x 900 and 1920 x 1080 screen modes respectively. Very high-end systems can also be tested using the ultra-intensive Very High settings, with all detail switched on, and varying levels of anti-aliasing enabled.

3D SPEED GOOD PLAYABLE UNPLAYABLE

HIGH SETTINGS	10FPS
MEDIUM SETTINGS	27FPS
LOW SETTINGS	86FPS

LAPTOP BATTERY LIFE

We subject laptops to two battery tests. In the light-use test, we optimise the system settings for the greatest power efficiency. We then disconnect the mains and run a script scrolling a selection of web pages until the system shuts down, giving you a realistic idea of the surfing time each laptop offers.

For the heavy-use test, we engage Windows' High Performance power profile, set the display brightness to maximum, and allow the taxing Cinebench 3D renderer to push the processor load to the limit. This gives a worst-case figure, revealing how long you can expect the battery to last under the most demanding conditions.



REVIEW: MAC PRO 38



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Photography: intros, Danny Bird; cutouts, Henry Carter

APPLE MAC PRO (2014)

COMPACT AND QUIET DESPITE A HUGE HELPING OF HORSEPOWER, THE MAC PRO'S REVOLUTIONARY DESIGN IS SET TO TURN THE WORKSTATION MARKET ON ITS HEAD

PRICE \$10,469 (as tested)
SUPPLIER www.apple.com/au

When Apple puts its mind to a task, it's a safe bet that the end product will be something special – but the new Mac Pro is out of this world.

After years of research and design work at Apple's labs, what has emerged is radically different from any desktop PC you've ever seen – a high-end workstation system, crammed with cutting-edge components, which looks more like a beautiful hi-tech bin than a computer.

In keeping with Apple's wider design ethos, the Mac Pro is a minimalist affair. Its unusual cylindrical shape, finished in a dark, polished gunmetal grey, is blemished by not a single mark – not even an Apple logo – until you reach the

"rear" of the device, where all the connections are elegantly arranged on a single panel.

Even this has been meticulously designed, with all Thunderbolt, USB and Ethernet ports stacked in two columns. Cleverly, the labels and lines surrounding each individual group are backlit, illuminating when the system fires up, or whenever movement is detected. If you happen to have your Mac Pro stowed under a desk, those backlit labels make it easier to locate the port you're looking for.

The Mac Pro's big party trick is how easy it is to open up. Flip the single catch at the top of the chassis next to the port panel, and (assuming all cables have been disconnected) it's possible to pull the entire exterior sheath up and off, with a satisfying, *Star Trek*-esque whoosh. It reveals a suitably exotic interior, with four

RAM sockets sitting in two spring-loaded banks on either side, and the rear of the two graphics cards between them, one of which has the system's single PCI Express-based SSD mounted on it.

INTERNAL DESIGN

The Mac Pro is certainly eye-catching, but what's really clever about the design is the way that Apple has completely deconstructed the traditional desktop. Instead of everything sprouting from a single, monolithic motherboard, Apple has opted for a modular approach, with each major component mounted on a separate board.

This explains how Apple has crammed so much into so little space (it really is compact, rising a mere 251mm from the desk and measuring 167mm in diameter). What it doesn't explain, though, is how the Mac Pro gets rid of the heat generated by all of its powerful components.

In more traditional high-end workstations and PCs, there's usually an assortment of fans and heatsinks, all working together to cool the system. They draw air into the chassis, distribute it to the graphics cards, CPU, power supply and other



KEY SPECS

2.7GHz Intel Xeon E5-2697 v2 • 32GB DDR3 ECC RAM • 512GB PCI-E SSD • 2 x AMD FirePro D700 • 4 x USB 3 • 6 x Thunderbolt 2 • 2 x Gigabit Ethernet • 1yr RTB warranty • OS X Mavericks • 167 x 167 x 251mm (WDH) • Power: 49W idle; 420W peak



▲ From the front, rear and even inside, the Mac Pro is a stunning design, but its beauty isn't just skin deep. Once the shell is removed – by flicking a switch and pulling it up – it's possible to access the system's four spring-loaded RAM slots, two on each side of the chassis

components, and push it back out of the box again. Inevitably, under load, such an arrangement can make a lot of noise. The smaller the chassis, the harder those fans have to work, and the louder they become.

In the comparatively tiny Mac Pro, the main heat-generating parts – the CPU and graphics cards – are attached to a single, Toblerone-shaped heatsink that runs up the centre of the tubular case, with one component on each side. Apple calls this the “thermal core”, and it requires only a single fan to keep things cool, which is mounted at the bottom of the heatsink. This sucks air in from outside, pushes it across the surface of the heatsink and vents it out of the

hole you see at the top.

It's an incredibly efficient system: despite the cramped nature of the chassis, the Mac Pro barely ever registers more than a quiet hum. Even with the 24 logical cores of our review unit at full pelt, we had to put our ear right over the vent to hear it over the office air conditioning.

INTERNAL SPECIFICATION

The hardware inside the Mac Pro is, inevitably, a touch less exotic than the exterior design. Nonetheless, the sheer amount of power it's possible to pack into it remains impressive. Our review unit came with a 12-core 2.7GHz Intel Xeon E5-2697 v2 CPU (complete with Hyper-Threading,

Turbo Boost capability up to 3.5GHz, 30MB of L3 cache and a QPI running at 8GT/sec). It also had 32GB of DDR3 RAM, a 512GB PCI Express SSD with a claimed throughput of 1GB/sec, and a pair of AMD FirePro D700 GPUs.

The graphics cards are custom parts, and thus can't be compared directly with AMD's retail FirePro boards. With AMD's Tahiti XT core at the centre of things, though, and 6GB of GDDR5 RAM, the closest comparison is with AMD's FirePro W9000 cards, which cost a breathtaking \$4450 each.

For the specification above, you'll be paying a handsome \$10,469. However, this isn't the only line-up available. The range starts at a much more reasonable \$3999, for which sum the Mac Pro comes equipped with a quad-core 3.7GHz Xeon

MAC PRO ALTERNATIVES

The Mac Pro's physical design is unique, but its core components certainly aren't. Anyone with half a mind to can get hold of a comparable workstation-class system, either by ordering the components and

constructing one themselves, or by ordering one from a PC manufacturer such as Dell.

Remarkably, though, despite all the custom engineering, the Mac Pro remains competitive on price. Below we compare the

cost of the individual components (or the closest equivalent in the case of the graphics cards) with Dell's current top-of-the-range, off-the-shelf workstation – the Precision T7610 – and our review Mac Pro.

	DIY workstation	Dell Precision T7610	Apple Mac Pro
CPU	Intel Xeon E5-2697 v2 (\$3493)	Dual Intel Xeon E5-2670 v2	Intel Xeon E5-2697 v2
RAM	32GB DDR3 ECC (\$500)	64GB DDR3 ECC	32GB DDR3 ECC
Storage	512GB Samsung 840 Pro (\$480)	2 x 256GB SATA 600 SSD	512GB PCI-E SSD
Graphics	2 x AMD FirePro W9000 (\$4450)	Nvidia Quadro K5000	2 x AMD FirePro D700
Motherboard, chassis, PSU	Various (total circa \$1150)	Dell proprietary	Apple proprietary
OS	\$120 (Windows 8.1 Pro)	Included	OS X Mavericks
Total cost	£7,163 (£8,592 inc VAT)	\$8,599	\$10,469

E5-1620 v2, 12GB of DDR3 RAM, a 256GB PCI Express SSD and twin AMD FirePro D300 cards. It tops out at \$11,299 for a 12-core system like our test unit, with 64GB of RAM and a 1TB SSD, and in between there are options based on six- and eight-core Xeon E5 v2s.

INPUT, OUTPUT

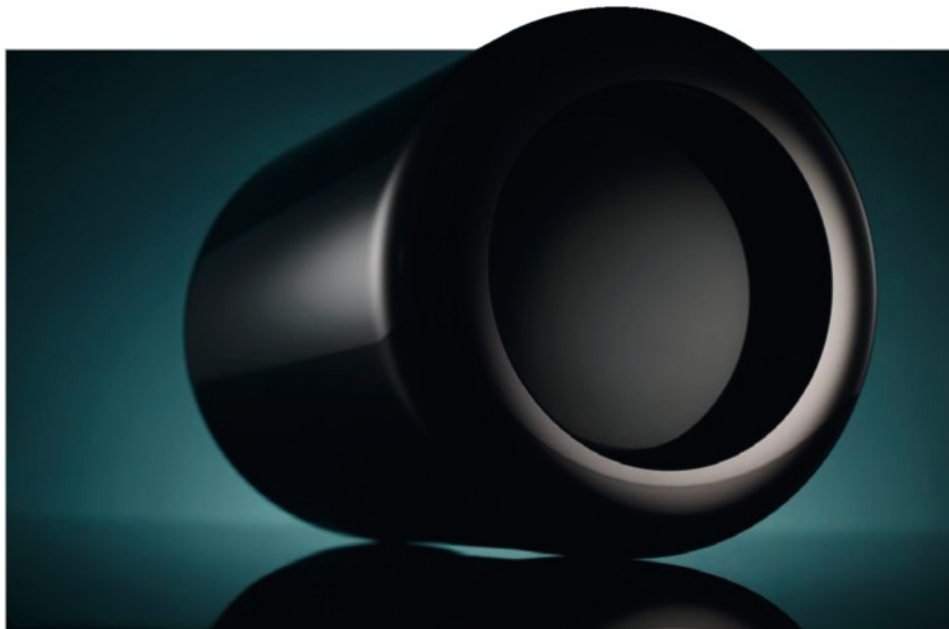
Whichever specification you opt for, you'll get the same – rather impressive – array of external connectivity: twin Gigabit Ethernet, four USB 3 ports, and six Thunderbolt 2 ports. Thunderbolt 2 uses the same technology as the first version, but it enables channel aggregation; so where the original Thunderbolt allowed no device to access more than 10Gbits/sec up and down, those two channels can be lumped together on the Mac Pro to give 20Gbits/sec transfers.

This means that not only does the Mac Pro possess the capability to shunt around a huge amount of data very quickly, but – since Thunderbolt also allows monitor connections – it's also possible to hook up higher-resolution displays. In the case of the Mac Pro, you can connect up to three 4K monitors simultaneously via its Thunderbolt ports – one for your video-editing window, one for a full-screen 4K preview and one for a 4K email client. If the budget won't stretch quite as far as three 4K monitors, you can drop down to 2560 x 1440 and hook up six of those screens instead.

Whichever way you look at it, when it comes to raw data-shunting prowess, the Mac Pro is an absolute beast, and that includes the 512GB Samsung SSD. As with recent iMacs and MacBooks, it's connected to the PCI Express bus, which Apple claims delivers throughput of up to 1GB/sec. Testing with AS SSD under Windows 8, we achieved close to these speeds, with maximum sequential read and write rates of 1080MB/sec and 850MB/sec, figures far in excess of anything we've seen from a SATA/600 drive.

BENCHMARKING THE MAC PRO

With so much power to burn in all sectors, it was always going to take more than just our standard tests to push the Mac Pro to the limits, and so it proved. Initial results had us puzzled: in our Real World Benchmark suite under Windows 8, the Mac Pro achieved an Overall score of only 1.31.



We say “only” because –despite the 12 physical cores in our test system, which with Hyper-Threading appear as a staggering 24 logical cores to the OS – this isn't the fastest Real World Benchmark result we've seen. That accolade belongs to the Chillblast Fusion Photo OC V (web ID: 385555), which scored 1.43 overall with its overlocked, six-core, 4.5GHz Intel Core i7-4930K Ivy Bridge-E CPU.

Why is this? The answer is straightforward. The majority of the applications in our test suite are single-threaded – with the exceptions of Sony Vegas Pro and Cinebench – and are thus unable to take full advantage of all of the Mac Pro's cores. With a clock speed much lower than the Chillblast's 4.5GHz

▲ The hole at the top of the Mac Pro isn't just for show – it's where all the hot air comes out

Intel Core i7-4930K, the system winds up being slower in those non-multicore tests.

Compare the results of only the intensively multithreaded Sony Vegas Pro test, however, and the Mac Pro streaks ahead. In that test, it cranked out a score of 2.39 – a full 10% faster than the Chillblast.

It isn't all about the CPU with the Mac Pro, though. Remember those twin GPUs? They're not there for window dressing, nor for gaming. They're there to provide parallel processing horsepower – to process video effects, help churn through heavy-duty video-rendering jobs, complex number-crunching tasks and 3D rendering in double-quick time.

But they're no good if the software you're running isn't aware of them. Alas, our benchmark suite doesn't help much here either. To really show off what the Mac Pro can do, you need software specifically written to take advantage of both GPUs. So we switched back to OS X Mavericks and loaded up the latest version of Final Cut Pro X, which Apple has tweaked to take full advantage of the Mac Pro's dual-GPU grunt.

Final Cut Pro X is intelligent about how it uses the CPU and GPUs, employing the Mac Pro's dual D700s not only to speed up rendering, but also to distribute the compute load. This ensures the editing system remains responsive, even with rendering and effects-processing jobs churning away in the background.

To give you an idea of what this means in terms of a real-life editing task, we carried out a quick stress test. We added three 1080p video clips to the timeline, reduced the

1 Storage comes in the form of a slender PCI Express SSD



▼ In keeping with Apple's design-driven ethos, even the base of the Mac Pro looks beautiful, surrounded by finely machined air intakes



opacity of each one, to force the preview engine to show them all at once, then applied a total of 24 effects, plus sharpening and colour correction. For a final touch, we overlaid a 4K video clip, adjusted its opacity, and then hit play.

This sort of effect- and clip-stacking doesn't represent a particularly realistic video-editing workload, but it would bring most video-editing software and hardware combinations to their knees. The Mac Pro and Final Cut Pro X were able to play a full-resolution preview of this project relatively smoothly. When we kicked off a full render in the background, we were able to continue editing with barely a hitch in performance.

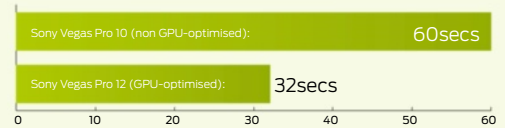
As another illustration of the potential of the Mac Pro's dual-GPU setup, we ran our benchmark on

Sony Vegas Pro 12, which features improved GPU acceleration over the PC&TA benchmark version (Vegas Pro 10). In this test, the Mac Pro finished the render in a mere 32 seconds. That's twice as fast as with Vegas Pro 10.

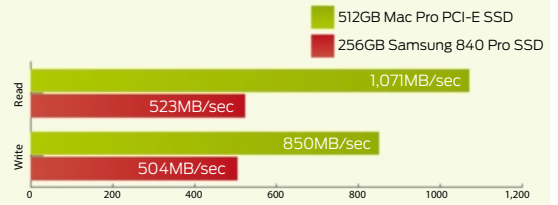
VERDICT

The Mac Pro is hugely impressive hardware, of that there is no doubt. It isn't unique in offering this level of power, but to do so in such a compact and efficient package is a truly impressive feat of engineering. To our knowledge, there isn't any other workstation machine that's as compact and portable, or as quiet. It's an unparalleled triumph in this regard. For that reason – and that reason alone – we can see an awful lot of individuals and

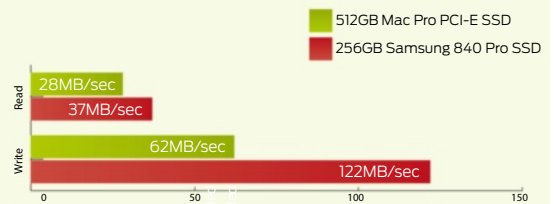
PC Pro Real World Benchmarks video render



AS SSD sequential tests



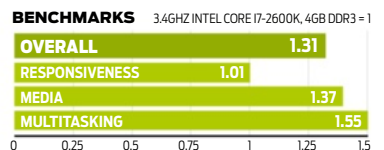
AS SSD 4K tests



businesses seriously considering purchasing a Mac Pro. Imagine being able to edit multiple streams of 4K video on location while shooting TV programmes or films, without having to ferry footage back to the studio. The sheer logistical advantage of using a Mac Pro over and above, say, a full-sized desktop tower is difficult to ignore.

The real killer blow, however, is likely to be the fact that Apple has managed to squeeze in all this custom engineering and potency at a price that doesn't – at least in comparison to equivalent workstation-class desktops – break the bank. If you need a workstation-class machine, especially if your software can take advantage of dual GPUs, the Mac Pro has to be on your shortlist.

Jonathan Bray



PERFORMANCE ★★★★★★
FEATURES&DESIGN ★★★★★★
VALUE FOR MONEY ★★★★★☆

OVERALL ★★★★★★



▼ The rear of one of the two graphics AMD FirePro cards

AMD KAVERI

NOT A PERFORMANCE LEAP OVER THE PREVIOUS GENERATION, BUT THE A8-7600 OFFERS A DECENT BUDGET OPTION

PRICE \$219 (A10-7850K); \$199 (A10-7700K); TBA (A8-7600)

SUPPLIER www.amd.com

AMD's accelerated processing units (APUs) combine CPU and GPU silicon on one die to provide cost-effective all-round computing. Its new Kaveri chips update last year's Richland models with AMD's new 28nm Steamroller CPU core and a new GPU based on AMD's Graphics Core Next (GCN) architecture. They also introduce the FM2+ socket – so be aware that you can't drop a Kaveri chip into a Trinity or Richland board.

Kaveri clock speeds are more modest than those of the previous generation. The flagship Richland A10-6800K had a stock speed of 4.1GHz, dynamically clocking up to 4.4GHz as necessary, plus a Radeon-branded GPU running at 844MHz. However, the new top-end A10-7850K dials this back to 3.7GHz, with Turbo speeds peaking at 4GHz, and features a 720MHz GPU. The A10-7700K and A8-7600 models offer even more restrained frequencies, and GPUs with lower shader counts.

The reduced speeds are offset by architectural improvements. AMD claims that Steamroller can execute up to 20% more instructions per clock cycle than its predecessor (the "enhanced Piledriver" core used by Richland). The Radeon R7 GPU, meanwhile, is designed not only for playing games, but also to accelerate application performance in software optimised for DirectCompute and OpenCL.

However, in regular desktop applications, we saw little benefit from these changes. We tested the A10-7850K and the A8-7600 under Windows 8.1, running with 8GB of RAM (of which 1GB was reserved for the GPU) and a 120GB Kingston SSDNow V300, on an ASUS A88XM-A motherboard.

The A10-7850K came out 10% slower than last year's A10-6800K, with an Overall score of 0.73 vs. the older chip's 0.81. Some of this can be attributed to testing under Windows 7, which is typically a few percentage points faster than Windows 8, but it still isn't performance to be proud of. Intel's comparably priced Core i5-4440 achieved 0.93 in the same test.

	Base speed	Max Turbo speed	Cores	Graphics	GPU frequency	GPU stream processors	L2 cache	TDP	Price inc VAT
A10-7850K	3.7GHz	4GHz	4	Radeon R7	720MHz	512	4MB	45/65/95W	\$219
A10-7700K	3.4GHz	3.8GHz	4	Radeon R7	720MHz	384	4MB	45/65/95W	\$199
A8-7600	3.3GHz	3.8GHz	4	Radeon R7	720MHz	384	4MB	45/65W	TBA

More impressive was the A8-7600. Despite its much lower price, this ranked only a fraction behind the A10-7850K, with an Overall score of 0.72. In our gaming test, too, we saw the A8-7600 almost match its pricier brother: the pair achieved 43fps and 44fps respectively in our Medium quality Crysis test. For comparison, Intel's Core i5-4440 mustered only 34fps in the latter test.

Since the hardware is new, it's possible that updated drivers could yet boost these benchmark scores. Also, for gamers, the "K" suffix on AMD's high-end models indicates the possibility of overclocking these chips to push performance higher.

An interesting technical feature introduced by Kaveri is user-configurable TDP, which allows you to switch the chip's energy-management

thresholds manually. It needs BIOS support, however, and our test system hadn't yet received the necessary update. At the default TDP of 95W, total power draw while sitting idle was a reasonable 35W, rising to 145W under 100% CPU load.

Other features in Kaveri include full support for 4K video playback at 60Hz, with dynamic upscaling of HD media. To partner these capabilities, the design has introduced new TrueAudio processing, which promises to clean up background noise and enhance the directionality of sound.

The A10-7850K may offer advantages for GPU computing, but in everyday applications we found performance didn't quite measure up against Intel's Core i5, or the older Richland A10-6800K. This makes Kaveri difficult to recommend right now.

While its retail price is still to be announced at the time of writing, it's highly likely the A8-7600 will stand out as an attractive choice for system-builders on a budget, and for gamers in particular. There's more power here than the model number might suggest, and when it comes to 3D gaming, it comfortably outpaces more expensive Intel hardware.

Darien Graham-Smith

3D SPEED

A10-7850K (MEDIUM SETTINGS)	44FPS
A8-7600 (MEDIUM SETTINGS)	43FPS

BENCHMARKS

OVERALL	0.73
RESPONSIVENESS	0.80
MEDIA	0.78
MULTITASKING	0.62

BENCHMARKS

OVERALL	0.72
RESPONSIVENESS	0.77
MEDIA	0.78
MULTITASKING	0.62

PERFORMANCE

FEATURES&DESIGN

VALUE FOR MONEY

OVERALL

★★★★★☆☆

★★★★★☆☆

★★★★★☆☆

★★★★★☆☆



▶ The touchscreen display is protected by two plates of Gorilla Glass

▶ The ASUS is beautifully made, pairing glass and metal



ASUS ZENBOOK INFINITY UX301LA

CAST FROM SHEETS OF GLASS AND METAL, THE ZENBOOK INFINITY UX301LA-DE002P IS A BEAUTY – THE ONLY PROBLEM IS THE PRICE

PRICE \$2999

SUPPLIER www.asusnotebook.com.au

Glass isn't the most obvious choice when it comes to crafting an Ultrabook, but the ASUS Zenbook UX301LA-DE002P throws caution to the wind. It clamps its 13.3in IPS (2560 x 1440 resolution) touchscreen between two plates of Gorilla Glass and partners a top-flight Haswell CPU with not one but two SSDs.

Purpose-built to induce irrational, credit-card-crushing desire, the UX301LA-DE002P's glass-clad lid shimmers in a deep, lustrous indigo blue. The brushed-metal base is honed to a silky, matte sheen, and the squared-off top half contrasts with the gently tapered curves of the base.

The ASUS' 1.44kg glass and metal chassis is beautifully constructed. There's barely a millimetre or two of flex in the base, and although the lid is more pliant, the Gorilla Glass promises to do its best to protect the Full HD display from harm. In a neat piece of design, the offset hinge raises the rear of the laptop when the lid is opened, tilting the keyboard forwards slightly.

Inside, ASUS features a potent Haswell CPU, the 2.8GHz Core i7-4558U, with a base frequency of 2.8GHz and a maximum turbo speed of 3.3GHz, which is obviously quite a hefty bit of CPU lifting power inside the elegant body. The integrated GPU is Intel's HD5100, which is adequate for general

gaming, though many games won't much like maximum detail in the game settings menu turned up too far. The Haswell engine is paired with 8GB of RAM and a pair of 256GB SSDs lashed together in a striped RAID0 array. With such a potent SSD configuration and a relatively generous amount of storage to boot, the ASUS is incredibly quick for file access and app loading.

The Core i7 CPU provides a fine balance of speedy application performance and impressive battery life. This range-topping model has a high-DPI, 2560 x 1440 touchscreen panel and colours and contrast are at the high end of what's available anywhere in the Ultrabook market. In some respects, though, the very high resolution of this screen can have its drawbacks. While your desktop, media and common apps such as Office will be sharp, with even the smallest fonts being perfectly readable, if you read our review of Lenovo's IdeaPad Yoga 2 Pro (p44) you'll note that high-DPI displays aren't always an asset; few applications take full advantage of the extra pixel density and many still need some fiddling in their settings to even get them to display correctly in the first place. Google's Chrome browser, as a somewhat stunning example, still doesn't properly support high-DPI screens without a tweak (to fix that, make a desktop shortcut to Chrome, right-click on it and select the Compatibility tab, then check the 'Disable display scaling on high DPI



KEY SPECS

2.8GHz Intel Core i7-4558U • 8GB RAM • 2 x 256GB SSDs (RAID0) • 13.3in 2560 x 1440 touchscreen • 2 x USB 3 • SD card reader • mini-DisplayPort • micro-HDMI • Gigabit Ethernet (via adapter) • dual-band 802.11ac Wi-Fi • Bluetooth 4 • Windows 8.1 64-bit • 2yr warranty • 325 x 226 x 16mm (WDH) • 1.44kg (1.66kg with charger)

settings' option).

It's a technically competent screen with brightness peaking at 400cd/m² and a high contrast ratio of 931:1. Yet closer inspection reveals weaknesses. Dark greys are reproduced as black, leaving detail obscured in the darker corners of images and movies, and the lightest greys blend into white.

The Scrabble-tile keyboard gets the UX301LA-DE002P back on track. The square keys depress with a refined, cushioned stroke, and the layout is perfect, with no unduly shrunken keys and a highly usable cursor cluster. It's also LED-backlit, with the backlighting conveniently adjustable through three brightness levels.

The ASUS' touchscreen is superb – it feels velvety smooth, and supports ten-point multitouch. While the touchpad isn't as cultured, it's perfectly acceptable, responding reliably to scrolling, tapping and edge-swipes.

Despite its lissome figure, this Ultrabook is packed with all the essentials. 802.11ac (the newest, fastest and longer range standard) provides high-speed wireless networking; twin USB 3 ports are accompanied by a full-sized SD card reader; and there are mini-DisplayPort and micro-HDMI video outputs. ASUS has also included USB Gigabit Ethernet and mini-DisplayPort-to-VGA adapters in the box.

All in all, the ASUS Zenbook UX301LA-DE002P is a gorgeous laptop. So much so that it deserves a spot in our A-List, where it now replaces the Dell XPS 13 as our Ultra Portable of choice. What's more, we're awarding it a PC & Tech Authority Recommended award as it's so beautifully made, beautiful to behold, and well configured with high-end components.

Sasha Muller & Ben Mansill

PERFORMANCE ★★★★★
FEATURES&DESIGN ★★★★★
VALUE FOR MONEY ★★★★★

OVERALL ★★★★★



ACER DA241HL

A GOOD DEAL ON PAPER, BUT THIS ANDROID ALL-IN-ONE IS TOO SLOW AND CLUNKY TO RECOMMEND

PRICE TBC
SUPPLIER www.acer.com.au

We've seen plenty of touchscreen all-in-ones since the debut of Windows 8, but the Acer DA241HL is the first we've seen running Android. It's an interesting idea, and externally it looks like a respectable system. It offers a 24in, Full HD infrared touchscreen, with sensors embedded in the gloss-black bezel to detect your fingers. Below this sits a row of buttons, embedded in the centre of the silver speaker grille. At the rear is a single leg that's used to prop up the whole thing.

The single-leg arrangement means you can't adjust the height, but you can tilt the display until it lies almost flat against the desk – useful if you want to put the Acer to use as a kitchen worktop machine, or while you're standing at a workbench.

Tap the power button and the DA241HL boots into Android 4.2. The OS has barely been customised, so if you've used a Nexus tablet or smartphone, you'll know what to expect. Since it's a desktop machine, the Acer comes with a compact wireless keyboard and a mouse. However, the keyboard feels rather

mushy, and the mouse isn't a natural fit for Android's touch-first interface: right-clicking, for instance, is substituted by a long press, which takes a lot of getting used to, and swiping down the notifications and quick settings areas doesn't work well. We felt more comfortable prodding, poking and swiping at the DA241HL as if it were a giant tablet.

Other aspects of the hardware are more practical. Under a panel at the rear are two full-sized USB 2 ports, which allow the connection of hard disks and wired peripherals, and an SD card slot. At the bottom, you'll find wired Ethernet and a full-sized HDMI input, which means the DA241HL can be used as a monitor (for a laptop or games console, perhaps). The port supports MHL, so you can mirror the screen of a smartphone or tablet via micro-USB, too.

The quality of the Full HD display is excellent for an all-in-one this cheap. While a maximum brightness of 235cd/m² doesn't sound like much, the display is a VA panel, so contrast is a superb 2350:1, and colours jump off the screen. Touch detection works well, too – it's responsive and accurate.

Things start to come unstuck with the core hardware. The DA241HL's

▲ What's not to like about a 24in, Full HD "PC" running Android? Well...

KEY SPECS

1.6GHz Nvidia Tegra 3 T33 CPU • 1GB RAM • 24in 1920 x 1080 VA LCD • 16GB storage • 802.11n Wi-Fi • Bluetooth 2.1 • Android 4.2 • 1yr RTB warranty • 604 x 192 x 410mm (WDH)

quad-core, 1.6GHz Tegra 3 T33 processor is 2012 tech, and it's backed up by a stingy 1GB of RAM. The result is a mediocre experience: OS screen transitions have no zip or fluidity, and browsing the web is a laggy business – scrolling and zooming actions are far from instantaneous.

Benchmark results backed up our real-world observations. Respective scores of 1227ms and 722 in the SunSpider and Peacekeeper browser benchmarks would be considered subpar for a modern phone or tablet, let alone a desktop system. A score of 4fps in the GFXBench 2.7 T-Rex HD test indicates that the hardware is capable of playing games, but certainly not at the highest quality settings.

However, the biggest problem isn't performance: it's the fact that Android and its apps simply aren't designed for a desktop role. Full-screen interfaces created for 7in or 10in screens feel absurdly outsized when blown up to 24in, yet there's no way to run them side by side in separate windows. Even desktop-style productivity software feels horribly clunky in use.

Also, thanks to the DA241HL's unusual screen dimensions, various apps are considered incompatible by Google Play and can't be downloaded at all. Printing, meanwhile, requires a special app or app-enabled printer, and if you want to hook up thumbdrives and hard disks, they must be formatted as FAT.

On top of that come a few niggles specific to the design of the DA241HL. Adjusting the volume without the keyboard to hand is a real faff, for example: the plus and minus buttons below the screen don't tweak the sound, but rather switch to the HDMI input.

We can see the appeal of Android on the desktop. The apps are cheap and easy to install, and the system is less vulnerable to malware than Windows.

But using the Acer DA241HL is such an unsatisfactory experience, in terms of both hardware and software, that we'd counsel anyone who's considering buying it to hold off, at least until the final local pricing is announced (which wasn't available as we went to press).

Jonathan Bray

PERFORMANCE



FEATURES&DESIGN



VALUE FOR MONEY



OVERALL



LENOVO YOGA TABLET 10

GREAT BATTERY LIFE AND AN INGENUOUS DESIGN, BUT PERFORMANCE IS WELL BELOW PAR

PRICE \$399

SUPPLIER www.lenovo.com.au

Lenovo's latest Android tablet boasts an unusual design. It isn't flat and featureless like most tablets, but rather features a cylindrical bulge along its bottom edge.

This serves a number of purposes: it acts as a grip to make holding the tablet in portrait orientation easier; it provides a convenient housing for the integrated stand, which flips out from the rear; and it creates room for a decent-sized battery.

This battery is a huge 9000mAh power pack, which powered the Yoga Tablet 10 to an impressive 15hrs 25mins in our looping video test; only the Amazon Kindle Fire HDX 8.9in (web ID: 385594) has lasted longer.

This isn't the end of the Lenovo's clever touches: a battery-powered Bluetooth keyboard is included as standard. This can be clipped to the front of the tablet's display when you're not using it, thus doubling as a slimline screen protector.

Unfortunately, it isn't the highest-quality piece of kit. It's flimsy and plasticky, the touchpad is small, and its built-in buttons are unresponsive.



▲ The keyboard is an optional extra

We're also less than impressed with the non-standard charger port, which is found just above the keyboard, under a fiddly plastic flap.

Connectivity is surprisingly good for a tablet of this price. There's a 3.5mm audio jack, micro-USB for charging the tablet, and a microSD slot hidden just behind the stand. Elsewhere, there's single-band Wi-Fi, Bluetooth 4 and a 5-megapixel rear camera, the snaps from which are reasonably sharp.

The Yoga Tablet 10's display is decent, but not exceptional. Resolution is a low 1280 x 800, stretched across a 10.1in screen. As such, it delivers a low pixel density of 148ppi, resulting in somewhat pixellated text and images.

KEY SPECS

Quad-core 1.2GHz
MediaTek 8125 CPU •
1GB RAM • 16GB
storage • 10.1in 1280 x
800 display • single-
band 802.11n Wi-Fi •
Bluetooth 4 • 1 x
microSD • 1 x micro-
HDMI • 3.5mm audio
jack • 5MP rear/1.6MP
front cameras •
Android 4.2 • 1yr RTB
warranty • 262 x 8 x
180mm (WDH) • 604g
(808g with keyboard)

Brightness is excellent, however, measuring 495cd/m² (brighter than the Kindle Fire HDX 8.9in), and the 900:1 contrast ratio lends dynamism to photos and movies. The colours aren't particularly convincing, but that's a small complaint in the grand scheme of things.

The quad-core 1.2GHz MediaTek 8125 CPU is less inspiring, however. It recorded unimpressive scores of 326 and 1091 respectively in the single- and multicore Geekbench 3 tests, and proved similarly sluggish when we ran the SunSpider JavaScript test, clocking in at 1333ms, way behind Kindle Fire HDX 8.9in's 704ms.

Likewise, gaming ability is compromised. In the GFXBench 2.7 T-Rex HD test, it scored 4.8fps, once again lagging well behind the Kindle Fire HDX 8.9in, which scored 14fps. This lack of power also saw the frame rate dip and stutter in Asphalt 8: Airborne, even at lower quality settings.

The ingenious design, battery life and price all contribute to a tablet that's packed with potential, but ultimately the Yoga Tablet 10 falls short. The flimsy keyboard, the low resolution of the display and the sluggish performance mean we can't recommend it.

Bobby MacPherson



► The pop-out stand can hold the tablet at almost any angle, making it quite useful as a desktop device.

PERFORMANCE
FEATURES&DESIGN
VALUE FOR MONEY



OVERALL





◀ The iPad mini is a mere 7.5mm thick

APPLE IPAD MINI WITH RETINA DISPLAY

APPLE UPGRADES ITS IPAD MINI WITH A RETINA DISPLAY AND NEW PROCESSOR – A SUPERB, IF PRICEY, TABLET

PRICE 16GB Wi-Fi, \$479; 4G, extra \$150
SUPPLIER www.apple.com/au

After the fanfare that heralded the new iPad Air, Apple was rather less effusive about the new, upgraded edition of its compact tablet – the iPad mini with Retina display. Yet, while it shares the same body as last year's model (which remains on sale at the lower price of \$349), there's plenty to get excited about.

From a distance, you'd be hard-pressed to distinguish the new model from the old. Place the two generations of iPad mini side by side, however, and it's possible to note that the new model is just a hair thicker – 7.5mm to the previous model's 7.2mm. It's put on a few grams, too, with the Wi-Fi model weighing 331g, and the 4G model, 341g; last year's Wi-Fi-equipped iPad mini weighed 308g, and the 3G model was 312g.

It's all change beneath the iPad mini's familiar brushed-metal body. Apple has replaced the 768 x 1024 display of the previous model with a 1536 x 2048 panel, and it's a very welcome sight. You can wave goodbye to the slightly rough, pixellated look of the original. Cramping such a high resolution into

a 7.9in panel makes for a crystal-clear pixel density of 326ppi, and the maximum brightness of 396cd/m2 and contrast ratio of 792:1 are respectable results, too.

More crucially, though, Apple has done more than simply pack in four times the pixels; the panel is now more colour-accurate. The colour temperature is just short of a perfect 6500K, where the previous model measured a slightly warmer, ruddier 6176K. As a result, images look noticeably more natural; skin tones more lifelike; and black-and-white images are completely tint-free. The only issue is that colour reproduction isn't as rich and punchy as the iPad Air.

Behind the Retina display, Apple's new 64-bit A7 chip now powers the whole show. It's clocked at 1.3GHz, a little slower than the 1.4GHz chip in the iPad Air, but it's still blisteringly fast. We recorded a SunSpider result of 418ms, almost three times faster than both its predecessor (which took 1293ms), and well ahead of any of its Android rivals. In fact, it was only narrowly behind its larger sibling in all of our benchmark tests, and gaming power is identical: the iPad mini eased to an average of 21fps in GFXBench's demanding T-Rex HD test.

Despite the significant performance

boost, battery life hasn't suffered. With the screen dialled down to a brightness of 120cd/m2, the iPad mini survived our video-rundown test for 12hrs 17mins. That isn't only significantly longer than Apple's claimed ten hours, but also good enough to best the 11hrs 48mins of the Nexus 7 and put the new iPad mini significantly ahead of its predecessor – we re-ran the battery test on the original iPad mini after upgrading it to iOS 7.0.4, and it lasted 11hrs 16mins.

The addition of a second antenna and MIMO technology to the dual-band 802.11n networking is welcome, as is the debut of 4G support for the mobile broadband-equipped model. The absence of 802.11ac is a small niggle, but Bluetooth 4 still makes the cut. Apple has also tweaked the stereo speakers on the iPad mini's bottom edge: the new speakers project a far richer, more detailed performance than the previous model.

The front-facing 1.2-megapixel and rear-facing 5-megapixel cameras are identical to those of the iPad Air. Working in tandem with the image-signal processor in the Apple A7 chip, the results mark an improvement on the original iPad mini, with better-quality images in low light, finer detail and fewer compression artefacts.

Apple has taken a great compact tablet and tweaked it to near perfection. The additional power makes iOS 7.0.4 feel supremely slick and responsive, and now that the excellent GarageBand, iPhoto and iMovie apps and the iWork suite are freely downloadable, the package is more alluring than ever.

But it's expensive. The 16GB model costs \$479, only \$119 less than the iPad Air, and with no recourse to expand storage via a microSD card, we'd suggest that anything less than the \$598 32GB model will soon start to feel very cramped indeed, especially once you've downloaded all the apps that come free of charge.

Other tablets are substantially cheaper, but the iPad mini is more powerful and longer-lasting, and the sheer quantity and quality of choice in the Apple App Store remain ahead of rival devices. If you can afford it, this is the best compact tablet going.

Sasha Muller



KEY SPECS

1.3GHz Apple A7 • 1GB RAM • 16/32/64/128GB storage • 7.9in 1536 x 2048 display • dual-band 802.11n Wi-Fi • Bluetooth 4 • optional 4G • iOS 7.0.4 • Lightning connector • 1yr RTB warranty • 200 x 135 x 7.5mm (WDH) • Wi-Fi, 331g; 4G, 341g

PERFORMANCE ★★★★★
FEATURES&DESIGN ★★★★★
VALUE FOR MONEY ★★★★★

OVERALL ★★★★★



KEY SPECS

Qualcomm Snapdragon 600 1.7 GHz Quad-Core Processor • 2GB RAM • 16GB eMMC storage (Support up to 64GB MicroSD) • 8.3in IPS display (1920 x 1200 pixels) • 4600 mAh Li-Polymer battery • 216.8 x 126.5 x 8.3mm • 338gm

“And all this for a price that’s far cheaper than its Apple-flavoured competition, with great battery life.”

integrity of the device. It feels safe to carry around in a pocket or a bag.

The screen may not be as super-sharp as the iPad Mini with Retina, but it is still very sharp, with vibrant colours and clear, bright aspect. Reading on the G Pad is a pleasure, as is gaming and watching videos. It’s a very responsive touchscreen, and the Quad-core Snapdragon processor means that snappiness is evident in all the tablet’s operations. Even the LG craft doesn’t slow the G Pad down.

And all this for a price that’s far cheaper than its Apple-flavoured competition, with great battery life. Even with the odd spot of gaming and watching YouTube videos, we were able to go nearly four days on a single charge.

There are a few niggles in the hardware design – the battery tends to run very hot, and when using the tablet in landscape mode, and that heat is vented pretty much straight into your left hand. For media consumption and gaming in the long term, it’s a bit uncomfortable. The speakers are easily blocked by hands in a similar position, but nine times out of ten we, at least, are using headphones. No one on the train to work each morning needs to hear the Angry Birds soundtrack over and over. And if you like the odd happy snap with your tablet, the G Pad’s camera does leave a little to be desired.

Overall, however, the benefits do outweigh the flaws, and hopefully this is a product that will continue to improve in the next revision. And with rumours that LG could be manufacturing the next Nexus tablet, it’s a strong sign of things to come.

David Hollingworth

LG G PAD 8.3

LG PRODUCES A VERY SOLID, IF EVER SO SLIGHTLY UNINSPIRING, TABLET.

PRICE \$399

SUPPLIER www.lg.com

There’s an awful lot to like about LG’s iPad Mini rival. It’s sleek, light, and very well engineered. But for all those not inconsiderable successes, the design and hardware is let down by the changes wrought to the tablet’s Android 4.2-based OS.

It’s almost dripping in unnecessary bloat. The vast majority of the added, LG-flavoured functionality is either of little practical use (like being able to preview the screen as you swipe the device on), or actually hampers practical usage (we’re looking at you Q Slide, and what you do to the Notifications panel). They also aren’t all that reliable, either; being able to turn the device off or on with a simple double-tap to the screen sounds good, but it is haphazard in practice. Q Pair, on the other hand, is handy, letting you pair the G Pad with your Android phone to get access to greater connectivity. It’s rather draining to both devices, but very handy for traveling. But it’s the lone light.

Which is all a shame, because otherwise there’s a lot to like about the G Pad.

Its slightly narrow shape makes it possible to grasp in a single hand, and the thin bezel on the sides of the screen (or top and bottom, when on its side), make for an elegant display.



▲ Thin bezel edges create a minimalist feel

The curves of the surrounding fascia are more than a little reminiscent of Samsung’s mobile products, but there are really only so many ways to make a tablet of this size. The plastic corners are reinforced by an aluminium backing plate that not only looks good, but adds to the structural

PERFORMANCE
FEATURES&DESIGN
VALUE FOR MONEY



OVERALL



COOLERMASTER HAF STACKER RANGE

A CRAZY AMOUNT OF VERSATILITY, AND A TRULY CRAZY AMOUNT OF BUILD OPTIONS. BUT ONLY FOR THE MOST SERIOUS OF BUILDERS AND GAMERS.

PRICE \$99 (HAF 915 & 915F),
\$228 (HAF 935 combo)

SUPPLIER www.coolermaster.com

We've said of a few products over the years that they may not be for everyone.

So, it doesn't quite seem nearly as strong a phrase as we need to explain the sheer niche value of Cooler Master's smashing together of the HAF (which stands for high air flow) series and the modular Stacker series.

So let's just say it's bonkers and get on with it.

Lunacy aside, this modular, stackable, high-performance family (and a mighty in-bred family it is, too) offers some incredible build options. For instance, if you want to put together a render farm machine that can also still play games while you're rebuilding the Battle of Pelennor Fields in 4K resolution, this is the case for you. BitCoin mining? You bet. A game box that has a built-in, detachable Steam Machine, or a guest machine for when random PC gamers drop round? And both built in such a way that you can actually detach the smaller system to take to a LAN event? Yeah.

The HAF Stacker has pretty much every base covered. And for a fully water-cooled, overclocked performance rig, this range would excel, as there's room for radiators and cooling loops all over the place.

The series consists of three (or four, depending) individual units, that you

can purchase separately. The 915F is a great little Mini-ITX case with a front-mounted PSU, and room for lots of cooling on the CPU – though video card length does suffer. It would make a great Home theatre build, but is rather long. The 915R mounts the PSU just above the motherboard, but does have room for more than one optical bay. Then there's the monolith-sized 935, which combines a 915R and a 925 tower.

And you can stack all of them, in a bewildering array of configurations. You can even do neat things like have your PSU and storage systems in one case, and everything else in thermally discrete areas.

It's all amazingly engineered, too, with every panel and moving part feeling precise and crisp. The HAF styling is a little more understated than in previous generations, but still has a bit of an aggressive gaming edge to the design. It's without doubt an excellent achievement in case design, and there are a tonne of things we can think to build into the cases – but whether or not it's anything we really need is the debatable thing.

If you must have the cutting edge in home server farms or machine-on-machine gaming, great.

Otherwise, look on in awe, but back away slowly. This is the rare case where we're scoring a product very highly, but just can't bring ourselves to recommend it to all users.

David Hollingworth



KEY SPECS

HAF 915: 228 x 248 x 578mm; 5.1kg; 2x expansion slots; 1x 5.25in drive bays, 3x 3.5in drive bays; 1x 120mm fan (rear); 2x USB3, audio ports.

HAF 915R: 228 x 248 x 578mm; 5.5kg; 2x expansion slots; 1x 5.25in drive bays (plus 3x in cage), 3x 3.5in drive bays (converted); 1x 92mm fan (front); 2x USB3, audio ports.

HAF 935: 235 x 719 x 578mm; 15.6kg; 8+1x expansion slots; 3+1x 5.25in drive bays, 9x 3.5in drive bays; 2x 120mm fan plus 1x 92mm fan (front), 1x 140mm fan (rear); 2x USB3, 2x USB2, audio ports.

PERFORMANCE

FEATURES&DESIGN

VALUE FOR MONEY

OVERALL



THERMALTAKE CORE V71

THERE'S A LOT TO LIKE IN THERMALTAKE'S LATEST, BUT A HANDFUL OF GLARING BUILD FLAWS REALLY LETS THE CORE V71 DOWN.

PRICE \$229
SUPPLIER www.thermaltake.com

The Core V71 is one wide case. It's 23cm wide, in fact, making for a roomy interior and a rather majestic aesthetic. With all that room, this case is in fact almost as perfect for liquid cooling – of all stripes – as Thermaltake promises. However, even with all that size there are some build options that are almost baffling in their implications.

So let's knock off that downside first. Both the front fascia and top panel snap off, giving you access to fan mounts and dust filters. This is neat, and not too unusual, but because the entire outer surface comes away, it reveals the circuitry for the power and reset buttons, plus a few other electronics. Removing the top panel requires a little force, and while it's not something you're going

KEY SPECS
583 x 230 x 560mm (H x W x D) • 13.2kg; 8x expansion slots • 2x 5.25in drive bays, up to 8x 3.5/2.5in drive bays • 2x 200mm fans (front), 1x 200mm fan (top), 1x 140mm fan (rear) • up to EATX motherboard

to be doing a lot, it only took a couple of removals for us to nearly sheer off one coil of copper wiring. This is less than ideal.

It's a shame, because if you want great airflow, or lots of room for radiators for a completely liquid-cooled PC, this is a great case. It's also highly modular – you can remove the entire HDD cage assembly, or just a portion of it, to make room for large video cards or just to increase airflow, and you can even remove it entirely and use the two drive caddies that sit flat on the case's right hand inner surface. There are rubber grommets to keep drives and PSU quiet, and ample room for drive management. Even if you don't go liquid, three large 200mm fans (and one smaller 140mm jobbie) will push a lot of air, and do it fairly quietly to boot.

But it's just hard to like a case where damaging the internal electronics



is this easy. And, for all of that, it is rather expensive, though the cooling options do justify it. It's a bold statement from Thermaltake, but one we just can't get behind.

David Hollingworth

PERFORMANCE	★★★★★
FEATURES&DESIGN	★★★★★
VALUE FOR MONEY	★★★★★
OVERALL	★★★★★

With APC Back-UPS, your digital life goes on... even when the power goes off.

Preserve what's most important to you.

Reliable power backup for 24/7 availability

Whether DVRing your favorite show, updating your Facebook status, or playing a live networked game, you depend on your home electronics every day, all day. That's why APC by Schneider Electric has designed battery backup solutions that protect the constant availability and connectivity you expect... and depend on.

Peace-of-mind protection on two levels

When the power goes out, our popular Back-UPS units go to work. They instantly switch your home technologies to emergency power, allowing you to work through brief power outages or safely shut down your systems so you won't lose valuable files—such as digital photos and media libraries. They also feature surge outlets to guard your electronics and data from "dirty" power and damaging power surges—even lightning. So you get two levels of protection in every APC Back-UPS unit!

Energy-saving insurance for what matters most

Our Back-UPS units protect your home office, digital living and home media applications, notebook computers, DVRs, and gaming application. And since we now offer energy-efficient models that reduce electricity costs through unique power-saving outlets, you can realise true energy savings regardless of the applications you're backing up. Throughout your home, the APC Back-UPS is the cost-saving insurance you need to stay up and running and reliably safeguarded from both unpredictable power and wasteful energy drains.



Power up to **WIN 1** of 3 APC ES700G Battery Back-UPS units.

Visit www.apc.com/promo and enter key code **53553K**



Keep your electronics up and
your energy use down!

ES Series

The ever-popular ES models are priced affordably yet provide enough extended runtime to allow you to work through short and medium power outages. Some power-saving models have been designed to actively reduce energy costs.

The energy-efficient ES 750G

The ES 750G boasts innovative power-saving outlets, which automatically shut off power to unused devices when your electronics are turned off or asleep, eliminating wasteful electricity drains.

- 10 Outlets • 450 Watts / 750VA
- 70 Minutes Maximum Runtime
- Telephone/Network Protection



The best-value ES 550G

The ES 550 uses an ultra-efficient design that consumes less power during normal operation than any other battery backup in its class, saving you money on your electricity bill.

- 8 Outlets • 330 Watts / 550VA
- 43 minutes Maximum Runtime
- Telephone/Network Protection



APC
by Schneider Electric

NZXT PHANTOM 530

NO SKULL RING, BUT A VERY SHINY CASE WITH ROOM TO MOVE AND SOME GREAT FEATURES.

PRICE \$165

SUPPLIER www.nzxt.com

In the past when we've looked at NZXT products, they've had a distinctly... budget feel. They've always been nearly perfectly adequate, but simply unable to compete with the monsters of case design such as Corsair and Silverstone. The Phantom range, while large, may not be all perfect, and even this – arguably our favourite – has a little way to go to really compete, but it's certainly a very pleasant surprise.

The first thing which is kind of amazing is that despite boasting a very high-gloss finish, we don't hate it! Some tech that comes to us in over-shiny form simply ends up accruing so much obvious hand-gunk that it's soon distinctly unpleasant to even look at, but the Phantom's glossy-coating is impressively gunk-resistant.

Which means you can simply enjoy the rather striking finish. It even comes in three colours – white, black, and a very fetching red.

The external design is likewise striking, with a single, slightly bevelled panel embracing the front upper edge, above black mesh filter material to the back rear and the lower front. The left sidepanel has a window and another, slightly more curious mesh-panel (there are no fan mounts, but it would be useful if you

mount a radiator for liquid cooling nearby) inset. The right-hand panel is plain. If it's not mesh, it's glossy; even the backplate is nice and shiny.

The glossy front fascia is in fact a door panel, magnetically-locked, and swinging this away reveals the external drive bays – probably more than most people need, but handy for enthusiasts who want to have temperature displays or fan control panels on show.

The shiny fun continues inside, too. It's not quite as glossy, but it's certainly not matte, and it is definitely very roomy. There's a generous cutout on the motherboard

“...despite boasting a very high-gloss finish, we don't hate it!”

plate for attaching and detaching CPU coolers, and a lot of room for shuffling cables politely out of the way for maximum airflow. It's also very modular. Not only does it have a similarly useful HDD cage system that can be swapped out or re-arranged, but even the PSU bracket can be moved backward and forward to suit your build.

The drive caddies all open to the right-hand side of the case, which is an odd choice, admittedly – this means all the cabling mounted to the rear of each drive has to be then



tracked back to the motherboard, which could be messy. Each caddy can also fit either a normal HDD, or an SSD, and there's another hidden SSD slot on the back of the motherboard plate, and the mounting points all feature a rubber grommet to damp down platter noise and vibration. Also back here is a very neat fan hub, so that any extra fans you install can all be controlled by the fan controller on the top of the case itself. There are ten inputs, four of which are already taken.

The 530 even boasts one of the more secure tool-less mechanisms we've seen on the optical bays.

All up it's an impressive effort from a manufacturer we've often looked down on in the past. The gloss finish and high design will not be for everyone, but if you want a PC case that breaks clear of the pack on looks, and has some unique features to boot, this Phantom packs a punch.

David Hollingworth



KEY SPECS

235 x 572 x 543mm (W x H x D) • 10.5kg • 8x expansion slots • 3x 5.25in drive bays, 6x 3.5/2.5in drive bays, 1x 2.5in drive bays • 1x 200mm fan (front), 1x140mm fan (rear) • 2x USB3 audio ports.



PERFORMANCE
FEATURES&DESIGN
VALUE FOR MONEY



OVERALL





SONY MOVIE STUDIO 13 PLATINUM

REDESIGNED FOR TOUCHSCREENS WITH MIXED RESULTS, BUT 4K SUPPORT IS ELEGANT

PRICE US\$79.95
UPGRADE US\$49.95
SUPPLIER www.sonycreative-software.com

The success of tablets has had a dramatic effect on PCs, and consumer software developers need to adapt if they're to survive. That's the thinking behind this update to Movie Studio. It's still recognisably the same software as before, but its buttons and tabs are bigger, making them easier to prod on Windows 8 touchscreen devices.

Sony has taken this opportunity to redesign the layout. Buttons are now grouped more logically, with housekeeping at the top, editing at the bottom, and transport controls below the preview panel. It makes sense, but the bigger buttons mean there's less space for the timeline and preview panel. Video-editing software invariably demands a high-resolution monitor, and that's especially true here.

We're disappointed the dedicated button for ripple-editing options has disappeared. Movie Studio Platinum handles ripple editing better than any consumer editor, with precise control over how edits affect the timing of other clips on the timeline. An Auto Ripple option is available via the Config button, but full access to the modes is tucked away in the Options menu.

The default setting caused events on different tracks to become out of sync.

Touchscreen support also means the various handles that appear on clips in the timeline are no longer available simultaneously. As before, clicking and dragging the end of a clip trims its start or endpoint. The target area is bigger than it used to be, and we often accidentally trimmed a clip when we intended to move it. Fading a clip in or out used to be a simple matter of dragging the top-left or top-right corner, but this would be too fiddly for touchscreens. Instead, a Fade tool must be selected first. This is a step backwards for existing users with no plans to switch to touchscreen control.

Version 13 introduces a Simple Edit mode, which hides various features to help new users find the ones they need. The omitted features are well chosen, and much can be achieved without switching to Advanced Edit. Annotations give a quick overview.

Export options have been overhauled, but they're not ideal. The Save to Hard Drive dialog box offers six preset templates, but QuickTime and MPEG2 convert everything to standard definition, and MP4 uses a low bitrate that makes a mess of footage. This leaves only WMV and AVCHD, neither of which are widely supported. Clicking Advanced Options provides detailed export options, but the touch-

◀ The businesslike appearance remains, but Movie Studio Platinum supports some advanced creative techniques



▲ Simple Edit mode cuts down on clutter, but there's also a lot of unused space

friendly design seems to have been forgotten, as has accommodating less-experienced users.

It isn't all doom and gloom. There's a new effect called Color Match, which clones the colour palette of one clip onto another. It's handy for consecutive clips shot under variable lighting, or with different cameras. There are also seven new effects from FXhome, including sophisticated lens-flare, glow and bleach-bypass effects. We're a little wary of bundled third-party effects, since they tend to come and go with each update, causing problems when revisiting old projects.

Another key change is support for 4K resolutions up to 3840 x 2160. With four times as many pixels as 1080p, manipulating 4K footage is a serious challenge, so the arrival of proxy editing in Movie Studio is perfectly timed. By default, 4K footage is converted to 720p proxy files on import for smooth previewing while editing, returning to the original footage for export. You can edit using the original files by switching the preview quality from Preview to Good. A dedicated, properly labelled button would have made more sense, but it works well enough. 4K exports are in Sony XAVC S format, which produced excellent results.

Proxy editing is also available for 1080p editing, via the right-click menu in the Project Media panel. This boosted preview performance from an impressive seven simultaneous AVCHD streams to a record-breaking 11 streams in our standard test on a Core i7-870 PC.

This update is great news for Windows 8 tablet users. 4K support is timely, too, and it's great to see preview performance improve. Adobe Premiere Elements 12 does more for both casual and demanding users, but Movie Studio Platinum is leaner, more efficient and capable in its own right.

Ben Pitt

EASE OF USE ★★★★★☆
 FEATURES&DESIGN ★★★★★☆
 VALUE FOR MONEY ★★★★★☆

OVERALL ★★★★★☆

APPS ROUND-UP

JENNETH ORANTIA REVIEWS THE LATEST AND OCCASIONALLY GREATEST APPS ACROSS ALL THE AVAILABLE MOBILE PLATFORMS

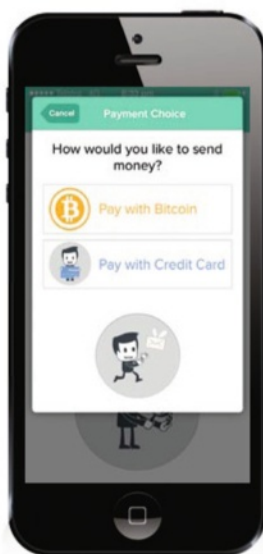
► QUICKLYPAY.IT

QuicklyPay.it takes the awkwardness out of chasing friends and flatmates for money. An intuitive design makes it easy to request payment in just three taps, and you can also use it to proactively pay someone if you're that way inclined.

The concept isn't a new one, but QuicklyPay.it is one of the few apps that let you pay people directly using a credit card or Bitcoin. The money is deposited into the recipient's bank account, and since it's locally developed, it fully supports Australian banks. But this privilege doesn't come free: the app charges 10c per transaction, which comes out of the pocket of the person initiating the payment.

QuicklyPay.it has plenty of potential uses. Flatmates can use it to split rent and utility bills, friends and family can use it to divvy up a restaurant bill, and anyone can use it to chase up those one-off cash loans. That uncomfortable conversation never needs to happen – you can simply key in what you're owed, and the app sends a notification to that person's smartphone.

The app's homescreen shows a running tally of all of the money you're owed and all the money you owe. On each transaction screen, you can see who has seen the



PRICE FREE **DEVELOPER** IMAGINE TEAM
PLATFORM IPHONE, ANDROID

payment request, and there's also a chat facility to discuss the money in question.

If the person you request payment off doesn't have the app installed, they'll receive an SMS asking them to download the app. Since there's no other way to make payments, however, BlackBerry, Windows Phone and 'dumbphone' users are locked out. Nor can you use the SMS itself as a payment reminder, as the message doesn't specify how much money is owed.

The more pressing issue, however, is whether you're comfortable with giving QuicklyPay.it your credit card, Bitcoin and bank account details. According to the app's website, bank account details aren't stored, credit card data is encrypted and all data is transferred using SSL, but it's still a valid concern given the developers are unknown entities. The other issue is that there's no way to pay anyone through your bank account.

EASE OF USE

FEATURES

VALUE FOR MONEY



OVERALL



► SWIFTKEY NOTE

Swiftkey has finally come to iOS – sort of. Apple doesn't actually allow third party developers to replace the stock keyboard, so Swiftkey has opted for workaround that sticks its highly feted predictive keyboard into a dedicated app called Swiftkey Note.

Almost all of the features in Swiftkey for Android have been ported over to the keyboard in Swiftkey Note, such as the advanced auto-correct, contextual word suggestions and an algorithm that learns the words and phrases you use on a regular basis. The app also supports one-way syncing to an Evernote account – notes you write in Swiftkey are synced to your Evernote account, but not vice versa.

One major feature that hasn't made the cut, however, is Swiftkey Flow, which lets you write whole words without lifting your finger off the keyboard. In Swiftkey Note, the keyboard looks exactly like the stock keyboard, but its auto-correct functionality is a lot better, and uses predictive text technology via three word suggestions on top of the keyboard. While you're typing, it predicts the full word; after you press the space bar, it guesses the next word you're going to write.



PRICE FREE **DEVELOPER** TOUCHTYPE LTD
PLATFORM IPHONE, IPAD

Even without the Swiftkey Flow feature, it's a big improvement over the stock iOS keyboard. While you can't use the Swiftkey keyboard in other iOS apps, you can share the text to the Message and Mail apps (doing so creates a new SMS or email with the text pasted in) or copy the text to the system clipboard to use in other apps.

As a note-taking app, Swiftkey Note is fairly simple, with basic formatting options and the ability to organise your notes using tags and notebooks. However there's no way to search across your notes for specific words or phrases or add non-text items to a note such as images or audio clips. This is where the Evernote sync comes in handy, as you can search across Swiftkey notes using the Evernote app and add rich media. Any non-text items you add to your Swiftkey notes via Evernote, however, can't be displayed in the Swiftkey Notes app.

EASE OF USE

FEATURES

VALUE FOR MONEY



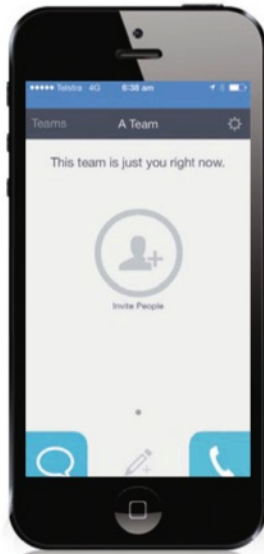
OVERALL



► CITRIX CONVOI

PRICE : FREE
DEVELOPER CITRIX
PLATFORM IPHONE

Apps that support one-on-one calling and messaging are a dime a dozen, but it's harder to find decent solutions for group communication. Well-known enterprise developer Citrix has tackled the problem head on with 'Convoi', an app that lets you make unlimited calls and messages to teams that you set up within the app. Ostensibly it's designed for use in work environments, but you can just as easily use it to keep in touch with friendship groups, family members, and other social groupings. Since it connects to people using their email address, you don't need to give your mobile phone number to join a Convoi team. Using the app is also extremely straightforward, with group calls or messages initiated with a single tap.



OVERALL



► MILESTONE

PRICE FREE
DEVELOPER MARCEL WANDERS
PLATFORM IPHONE

Milestone is a slickly-designed app that lets you keep track of your personal – you guessed it – milestones. Whether it's your birthdate, the day you met your significant other or that fateful moment you decided to quit smoking, the app will send you push notifications when you reach the next milestone for that event. The first milestone you're asked to program in is your birthdate and time – from there you can see where your next major milestones are. You could, for example, be 20 million minutes old on 23 December 2017, 30,000 hours old on 5 March 2014, and 12,500 days old on 5 March 2014.



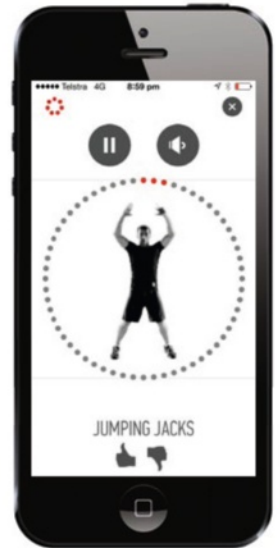
OVERALL



► THE JOHNSON & JOHNSON OFFICIAL 7 MINUTE WORKOUT APP

PRICE FREE **DEVELOPER** CITRIX
PLATFORM IPHONE

Never heard of the 7-minute workout? It's all the rage in fitness circles, promising the equivalent of an hour-long workout in only seven minutes, with no special exercise equipment necessary. Chris Jordan, the creator of this exercise phenomenon, has teamed up with multinational consumer goods corporation Johnson & Johnson to develop a free 7-minute workout app. Don't be fooled by the short time period – this is a high-intensity workout with only 10 seconds of rest between each set. The app itself is well-designed and intuitive, with videos to accompany each workout, and over 20 intensity levels.



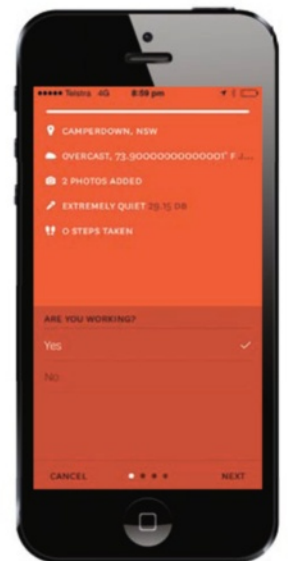
OVERALL



► REPORTER

PRICE \$4.49
DEVELOPER REPORTERAPP INC
PLATFORM IPHONE

Reporter collects personal data using spontaneous quizzes throughout the day about what you're currently up to, which it then crunches into graphs and percentages so you can quantify your answers over a period of time. The stock questions include who you're with, how many coffees you've had, and where you are, and over time, you'll be able to see whether you're with a particular person most of the time or you tend to sleep poorly. Sadly, the app is lacking in features and is a little buggy. While you can customise the questions that it asks as well as the types of answers that are available, the overall execution of this otherwise clever concept is somewhat lacking – especially given the asking price.



OVERALL



BRIEFS

► SENNHEISER GAME ONE

PRICE \$500**WEBSITE** en-au.sennheiser.com

Yes. Five, hundred, dollars. And what do you get for a half-a-grand?

Not enough, I think.

The drivers and design leverage Sennheiser's music headphone tech. Compared to a similarly priced music equivalent you can quickly sense the quality. I spent a couple of days listening to music and the mids and highs were crisp and clear, though bass was a little lacking. That, though, is how gaming headphones are designed. Too much bass drowns out all-important audio queues which can keep a player alive longer. Little did I realise during that period of testing here in the office, that these are of the open design, so the entire office was enjoying my music along with me.

A noise-cancelling mic proved itself in gaming, with my voice apparently being the clearest and best volume-balanced in the session. But there simply isn't \$500 worth of value here. Older Sennheiser PC 350 gaming headphones are almost as good at half the price making these tough to recommend for value.

Ben Mansill

**OVERALL**

► RAZER IPHONE 5 PROTECTION FRAME

PRICE \$35**WEBSITE** www.razer.com

So now we have a Razer iPhone frame. Didn't see that coming. While an iPhone frame isn't going to set the world on fire, there's plenty of room for innovation in this area for a company like Razer. The result is a composite design featuring a soft plastic (which feels like rubber) inner and tough aluminium outer. This virtually guarantees your precious will be cradled firmly and without any movement from the frame sliding around. It also means no scratches from the frame itself. The aluminium outer is as tough as any iPhone frame can be, and is Razer's canvas to impart a bit of its unique styling.

This isn't just a bit of plastic and metal in a box for thirty five bucks, though. A rather beautiful instruction manual describes how to use the included cloth to first clean your screen, then apply the included transparent screen cover and finally screw it all together with the included screws and screwdriver. Not bad at all.

The look is rugged with sharp edges and a textured surface.

Ben Mansill

**OVERALL**

► CORSAIR H105

PRICE \$159**WEBSITE** www.corsair.com

Corsair continues to round its all-in-one Hydro series of coolers with the H105, a unit that seems very similar in price and even performance to the rest of the family, but that has a few unique advantages.

If you're wanting to hook up the H105 to your Corsair Link set-up, though, you'll be disappointed, as this cooler does not support it. That aside, it offers different coloured plastic rings on the pump-unit so you can at least match it to the rest of your components. At full fan-speed, the H105 is noisy, but if you let onboard PWM take control, the cooler's thicker radiator comes into play and you end up with a quite and very setup.

That thickness, though, does mean it won't fit into every case on the market, so you'll want to do some research if you have particular case in mind. Otherwise this is another verstatle out-of-the box cooler from Corsair, and one we can easily recommend.

David Hollingworth

**OVERALL**

► TESORO LOBERA SUPREME GAMING KEYBOARD

PRICE \$169**WEBSITE** www.tesorotec.com

Your personal taste will be the deciding factor, upon which will hinge your decision to purchase, or mock, this keyboard. The actual important thing - being the keys and their action - is terrific. A choice of Blue, Black, Brown and Red Cherry switches is available and the keys are nicely spaced and raised quite high. You won't be missing that critical button-press in a firefight.

It's also packing 512Kb of memory onboard for storing macros, very nice, and you can program every key on the board individually if you like. Audio-in as well as mic-in ports are included, plus a couple of USB 2 ports. That all makes this quite a useful all-in-one device to take along to LANs or tournaments. It's heavy, feels very well made and doesn't have a too-oversized footprint, also nice.

But its killer feature, which killed me a little inside, is that each and every key can be set to illuminate in any of 16.8 million of your favourite colours. Glaringly brightly, too. Should you choose, certain sets of keys could be a set colour for their action, another group another colour to indicate theirs, and so on.

Ben Mansill

**OVERALL**

► KEF XM500 HI-FI HEADPHONES

PRICE \$379

WEBSITE www.kef.com

These are incredible. Especially so, for the price. KEF has pulled off an audio triumph with its M500 headphones. They look divinely beautiful, and the sound... oh my. It's faultlessly clear, precisely defined and the rich tonality puts you in the middle of a lovely soundscape, pumping incredibly detailed purity through your grateful ears. If you'll allow me some hyperbolic excess - it's like angels are pouring warm honey into your ears.

Somehow - and many cans twice the price of these can't manage this, each instrument, along with its variations and personality, carries through clearly and independantly. There's no 'blending' of instruments going on here. No matter how complex the music the M500s tell you exactly what each part of the voice, or the entire orchestra is doing. It does so while balancing the various elements of the music into a delightful presence which will have you excitedly digging up CDs you may not have listened to in years, just to see what these bad boys can do to them. Also nice - there's no sound leakage to annoy nearby folks whatsoever.

Ben Mansill

OVERALL



► THERMALTAKE POSEIDON Z

PRICE \$TBA

WEBSITE www.ttesports.com

This is the illuminated version of the regular Poseidon X, which means it's a ruggedly solid performer without the extravagant adornments of, say, the Tesoro Lobera.

Our test model came with Cherry Blue switches. A Brown version is also available. The Blue model we used had a very loud key-click, but that's typically what you get with the Blue key mechanicals. Not so good for use in an office, then, else you'll be driving the locals mad with all your clickity clacks.

In-game, it's another story. The placement and movement of the keys is exquisite. The level of illumination is just right. Its clear but not overwhelming blue glow was quite lovely in a darkened gaming room, and four levels of brightness adjustment are there for the tweaking.

There is one other thing it includes, which really is a bit of design genius and hats off to the boffins at TT for including a button which disables the Windows key. Bravo, chaps.

In a classy matte finish with a barely perceptible texture, this is a good looker and effective gaming tool you'll appreciate.

Ben Mansill

OVERALL



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GROUP OF EIGHT

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Buyer's guide

It's been fascinating to watch the NAS evolve over the years. It's gone from an awkward black box loved by small-business IT managers and PC enthusiasts, to a must-have appliance for the office and home.

Its growing appeal can be largely laid at the foot of cloud services such as Dropbox. Finally, the masses are beginning to understand what connected, centralised storage can offer. Manufacturers are recognising that fact, too, building in more personal- and business-focused cloud services than ever before.

Broadly speaking, the devices on test this month can be divided into two categories. On the one hand, there are basic units, built around

cheap, power-efficient ARM hardware and available either diskless or with one or two preinstalled drives.

If you're looking for a simple solution to back up important files, share documents between small teams, or stream photos, music and video to media players around the home, one of these will be up to the job. Personal cloud features tend to be rudimentary, focusing on accessing and streaming content rather than file synchronisation (see Dropbox vs personal cloud, right), but that may be all you need.

The more advanced devices now come with Intel Atom processors and 1GB or more of RAM, making them closer to small, low-performance



servers than intelligent, connected hard disks. These have more versatile and sophisticated operating systems; downloadable apps to make them more adaptable; and two, four or even



	Buffalo LinkStation 421DE	D-Link DNS-327L	LaCie 2big NAS 6TB	RECOMMENDED Netgear ReadyNAS 314 2TB	
OVERALL	★★★★★	★★★★★	★★★★★	★★★★★	
Performance	★★★★★	★★★★★	★★★★★	★★★★★	
Features & Design	★★★★★	★★★★★	★★★★★	★★★★★	
Value for Money	★★★★★	★★★★★	★★★★★	★★★★★	
PRICING					
Part code	LS421DE	NS-327L	9000226	RN31421D-100EUS	
Manufacturer	au.buffalo-asia.com	www.dlink.com.au	www.lacie.com/au	www.netgear.com.au	
Basic warranty	2yr	2yr	3yr	3yr	
MAIN FEATURES					
Processor	1.2GHz Marvell Armada 370	1.2GHz Marvell Armada 370	2GHz Marvell Kirkwood 88F6282	2.1GHz Intel Atom D2700	
RAM	512MB	512MB	256MB	2GB	
Capacity (HDD details)	Diskless	Diskless	2 x 3TB	2 x 1TB	
Number of drive bays	2	2	2	4	
User-replaceable drives	✓	✓	✓	✓	
USB/eSATA support	1x USB 3; 1x USB 2	1x USB 3	1x USB 2; 1x eSATA	2x USB 3; 1x USB 2	
Network protocols	AFP, SMB	AFP, NTP, SMB, WebDAV	AFP, NFS, NTP, SFTP, SMB	AFP, NFS, SMB	
FUNCTIONS					
Mobile applications	iOS, Android	iOS, Android	iOS, Android	iOS, Android	
External device support	✓	✓	✓	✓	
Media server functions	UPnP/DLNA, iTunes	UPnP/DLNA, iTunes	UPnP/DLNA, iTunes	UPnP/DLNA, iTunes	
Web hosting	✗	✓	✗	✗	
Managed backup	✓	✓	✓	✓	
Apple Time Machine	✓	✓	✓	✓	
RAID options	RAID0,1; JBOD	RAID0,1; JBOD	RAID0,1; JBOD	RAID0,1, 5, 10; JBOD	
OS support	Windows XP and above; OS X 10.6-10.8	Windows XP and above; OS X 10.6-10.8	Windows XP and above; OS X 10.5-10.8	Windows XP and above; OS X 10.6-10.8	
PHYSICAL ATTRIBUTES					
Dimensions (WDH)	87 x 205 x 128mm	90 x 195 x 144mm	91 x 200 x 172mm	134 x 205 x 223mm	

more drive bays for adding capacity as you go. They're capable of handling file storage and sharing for a small- to medium-sized business, or media storage for a large household; some of them will even double up as media players.

Their cloud features are correspondingly more powerful, too, offering Dropbox-style synchronisation across several users and multiple devices. In general, however, they're more expensive and less energy-efficient. The more complex user interfaces can make them more difficult to manage and use, too.

Many NAS devices are sold either diskless or enclosure-only, or with some or all of the bays fitted with drives. The latter approach means you're good to go out of the box, but it's worth checking whether you can save by buying the enclosure then fitting your own drives.

DROPBOX VS PERSONAL CLOUD

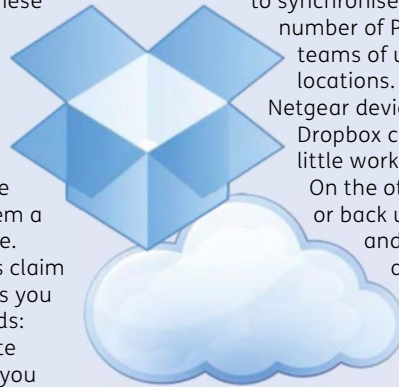
The idea of the NAS as a personal cloud is a reaction to the rise of cloud-based storage services such as Dropbox and Google Drive. While these can't match local storage for speed or affordable capacity, their combination of convenience and any time, anywhere access across multiple devices has made them a compelling alternative.

NAS manufacturers claim a personal cloud gives you the best of both worlds: your own large, private storage space where you can store and retrieve files rapidly on a LAN, but one that can also be accessed remotely.

The reality is more complex. None of

the personal cloud services we tested here was as easy to set up as Dropbox, and Dropbox is still the most effective way to synchronise files and folders across a number of PCs and Macs, or between teams of users working from different locations. The Qnap, Synology and Netgear devices can do everything Dropbox can, but there's usually a little work involved.

On the other hand, you can copy or back up gigabytes of data to and from a personal cloud in a fraction of the time it takes to do so to Dropbox. And with terabytes of available capacity, there's no need to worry about running out of space – or money. Just be aware that your personal cloud is hostage to your upstream internet connection's performance and availability.



	Qnap TS-420	LABS WINNER Synology DiskStation DS214play	Thecus N4560	Western Digital My Cloud 2TB
	★★★★☆ ★★★★☆ ★★★★☆ ★★★★☆	★★★★★ ★★★★★ ★★★★☆ ★★★★★	★★★★☆ ★★★★☆ ★★★★☆ ★★★★☆	★★★★☆ ★★★★☆ ★★★★☆ ★★★★☆
	TS-420 www.qnap.com 2yr	DS214PLAY www.synology.com 2yr	N4560 www.thecus.com 2yr	WDBCTL0020HWT www.wdc.com 2yr
	1.6GHz Marvell Kirkwood 88F6282 512MB Diskless 4 ✓ 2 x USB 3; 2 x USB 2; 2 x eSATA AFP, NFS, SFTP, SMB, SMSC, SSH	1.6GHz Intel Atom CE5335 1GB Diskless 4 ✓ 2 x USB 3; 1 x USB 2; 1 x eSATA AFP, NFS, SFTP, SMB, SSH	1.6GHz Intel Atom CE5335 2GB Diskless 4 ✓ 1 x USB 3; 2 x USB 2 AFP, NFS, SMB	650MHz Marvel Armada XP 256MB 1x 2TB 1 ✗ 1 x USB 3 AFP, SMB
	iOS, Android ✓ UPnP/DLNA, iTunes ✓ ✓ ✓ RAID0,1, 5, 6, 10; JBOD Windows XP and above; OS X 10.6-10.8; Linux	iOS, Android, Windows Phone ✓ UPnP/DLNA, iTunes ✓ ✓ ✓ RAID0,1; JBOD; Synology Hybrid Windows XP and above; OS X 10.6-10.8; Linux	iOS, Android ✓ UPnP/DLNA, iTunes ✓ ✓ ✓ RAID0,1,5,10; JBOD Windows XP and above; OS X 10.6-10.8	iOS, Android ✓ UPnP/DLNA, iTunes ✗ ✓ ✓ N/A Windows XP and above; OS X 10.6-10.8
	180 x 177 x 235mm	108 x 165 x 233mm	165 x 226 x 192mm	49 x 170 x 139mm



▲ The ReadyNAS 314's chassis is businesslike and practical

NETGEAR READYNAS 314 2TB

A POWERFUL, EASY-TO-USE NAS WITH EXCELLENT CLOUD FEATURES AND A GOOD TURN OF SPEED – THE DISKLESS VERSION IS BETTER VALUE FOR MONEY, THOUGH

PRICE \$999
SUPPLIER www.netgear.com.au

The ReadyNAS 314 isn't the fastest, most feature-packed or best-value NAS on test, but if you want a speedy, reliable and easy-to-manage appliance for the home or office, it's hard to do much better than this.

The chassis is compact, businesslike and practical. Open the plastic door covering the four drive bays and you can install new drives in slide-in, slide-out caddies without needing any tools, and they fit back into place with a reassuring click.

Connectivity is excellent: there are two USB 3 and two eSATA ports, plus an HDMI output for playing media directly to a projector or TV. This is a NAS with the capacity and expansion potential for the most ambitious

enthusiast or small business.

It's also incredibly easy to set up: simply log on to Netgear's ReadyCLOUD portal with the NAS attached to the same network, and the site will discover the NAS and set it up. While you're at it, you can register your new appliance and set it up for life as a private cloud server. Within the browser-based interface, you can create new shared folders, drag and drop files, and configure users and permissions.

The ReadyNAS 314 has an attractive and intuitive user interface, and it's extensible as well. If you want to use your NAS to run a WordPress blog, a website or a private cloud server using BarracudaDrive or ownCloud, that's also easy to achieve.

Netgear's own cloud service works effectively. ReadyCLOUD gives you remote access from a Windows

applet, or iOS and Android mobile apps, while ReadyDROP delivers Dropbox-like synchronisation of a folder or folders across multiple clients. In terms of usability, speed and response, it's a close match for the real deal, spotting changes to a synced local file within seconds and uploading them to the NAS across the LAN or WAN. Few of the services offered by rival devices can replicate the ease of use and functionality of the big public cloud options. This one actually can.

With a dual-core 2.1GHz Atom D2700 processor and 2GB of RAM, we expected a good performance from the Netgear. Its benchmark results were neck and neck with those of the Lenovo and Synology devices until we ran our backup tests, in which the Netgear struggled to keep up. That said, it's certainly a speedy NAS by any standards.

Combine these results with the rich feature set, the ease of use and the potential for expansion, and you have a four-bay NAS that's easy to recommend. However, we'd suggest you buy the diskless version and fit your own drives; 2TB isn't much for a four-bay NAS, and you'd be paying slightly over the odds for two preinstalled 1TB drives.



PERFORMANCE
FEATURES&DESIGN
VALUE FOR MONEY



OVERALL





▲ Connectivity on the DS214play is excellent

SYNOLOGY DISKSTATION DS214PLAY

A SUPERB NAS WITH SUPERFAST PERFORMANCE AND A HUGE RAFT OF FEATURES, MADE EVEN BETTER BY TOP-NOTCH CLOUD CAPABILITIES AND A REASONABLE PRICE

PRICE \$450
SUPPLIER www.synology.com

The DS214play is the fastest NAS on test, but it isn't merely speed that gains it the Labs Winner award. It's hugely versatile, with excellent media-streaming capabilities and some of the best cloud features we've seen.

It's well designed and solidly built, packing a lot of power into a compact, relatively stylish unit. With an eSATA, one USB 2 and two USB 3 ports, connectivity is excellent, and there's even an SD card slot. Best of all, it's affordable: a DS214play with 6TB of storage can be built for less than \$750.

The reasons to be cheerful start as soon as you begin installing the drives. The drive cover pulls off, the caddies unlock and slide out, and a clip-on

assembly means you can mount a drive without touching a screwdriver. The browser-based setup routine works flawlessly, downloading new firmware for you, and there's zero pain in configuring the RAID and initialising your storage space.

It isn't always this easy to use. The UI is excellent for advanced users, with features such as multiple windows and multitasking that you won't find on most NAS devices, but there's little hand-holding for novices, and navigating the control panels and settings takes a little getting used to.

It's a great media device, however, acting as a DLNA media server without any problems. Thanks to a hardware transcoding engine, it can convert 1080p video from one format to another on the fly (although we found some files that wouldn't play



on an iPad from the NAS). In addition, Synology provides enough add-on modules for the DS214play to moonlight as a mail server, IP security camera station, VPN or web server.

It's the cloud features that swing it for us, though. Synology Cloud Station works just like Dropbox: drop a file into the Cloud Station folder on your PC and it's replicated within seconds on the NAS, with any changes synchronising within two seconds across a local network. Different apps for Android, iOS and Windows Phone take you directly to the music, photo, video and file servers on the DS214play, with files playing back flawlessly (providing your connection is fast enough). Finally, Synology's QuickConnect service provides a simple address to enter in the apps or browser, so you don't have to set up port forwarding.

The DS214play is fast. With a 1.6GHz dual-core Atom processor and 1GB of RAM, and twin Seagate 1TB drives installed, we saw average read rates of 103MB/sec and average write speeds of 91MB/sec. Even in our backup test, the Synology hit an average of 87MB/sec. Our conclusion? This is a champion NAS in almost every respect.

PERFORMANCE ★★★★★
FEATURES&DESIGN ★★★★★
VALUE FOR MONEY ★★★★★

OVERALL ★★★★★

BUFFALO LINKSTATION 421DE

A DECENT BUDGET HOME NAS, BUT A POOR SELECTION OF CLOUD FEATURES MEANS IT FALLS SHORT THIS MONTH

PRICE \$199
SUPPLIER <http://au.buffalo-asia.com>

If you're looking for a cheap and cheerful diskless NAS, Buffalo's LinkStation 421DE has plenty going for it. First, it's an affordable two-bay unit, and while the build quality feels cheap and plasticky, and the style is nothing special, the design is practical.

Attach the supplied rails and drives will slide into place and lock into position. The 421DE is frugal in terms of power consumption, using only 16W at full pelt, and reasonably quiet while running. It even has a USB 3 port at the front to go with the USB 2 at the rear.

Setup via Buffalo's LinkStation software is fairly easy. By default, drives are configured in a RAID0 formation, but it's easy to change that if you need RAID1 protection, and it's no problem to map shared folders to a Windows drive for ease of access.

The browser-based UI isn't the most user-friendly, but the different options are sorted in a logical manner, and you can install add-on packages from a reasonably extensive range.

The specification – a 1.2GHz ARM processor and 512MB of RAM – is good for a budget NAS, and performance is impressive. With dual 1TB Seagate drives installed, average read speeds were 102MB/sec in our large-file test. However, write speeds reached only 54MB/sec with the same large files, and our backup test crawled along at 48MB/sec: the ARM processor struggled to handle so many smaller files.

Cloud features disappoint. You can access files and folders online, but the interface has all the style and usability of a router control panel, and there are no Dropbox-style sync options. Apps offering similar functions are available for Android and iOS, but they're basic. We also found the 421DE slow while



browsing or streaming media from the DLNA server.

If you're looking for a cheap home or small-business NAS with the option to access files remotely, the LinkStation is worth a look, but it doesn't cut the mustard as the basis for a personal cloud.

PERFORMANCE	★★★★☆
FEATURES&DESIGN	★★★★☆
VALUE FOR MONEY	★★★★☆
OVERALL	★★★★☆

D-LINK DNS-327L

A FLAWED BUDGET NAS WITH GOOD CLOUD FEATURES, BUT NO DROPBOX-STYLE SYNCHRONISATION

PRICE \$149
SUPPLIER www.dlink.com.au

The DNS-327L may be the most stylish of our budget NAS enclosures, but its sleek, unobtrusive looks come at a cost. In theory, it should be easy to fit your hard disks – you detach the top lid, screw on two plastic handles and slide the drives into place. In practice, we found the drives hard to locate in their connectors without a good push, and it took us several attempts to get the D-Link up and running.

On the plus side, once you get it going, the DNS-327L is easy to set up, thanks to a wizard that asks basic questions, sets up the drives and checks which RAID configuration you'd prefer. Shared folders are mapped to a network drive, and it's easy to get media-streaming services online. In fact, D-Link's intuitive, browser-based control panel is one of the DNS-

327L's best features; even when a setting or option isn't in the most logical place, you'll find a hint to tell you where to go and what to do.

Setting up the device's cloud services is equally straightforward. Register an account online at www.mydlink.com.au and the site will find and register your device – there's no need to mess around with port forwarding. There are browser-based apps for browsing, uploading and downloading your files remotely, plus strong features for streaming music, photos and video, not to mention decent iOS and Android apps. If the DNS-327L also had Dropbox-like sync facilities, we'd be praising it as a great budget option for a personal cloud.



Unfortunately, it doesn't.

The DNS-327L has a specification similar to that of the Buffalo LinkStation 421DE, with a 1.2GHz ARM processor and 512MB of RAM (although it has only a single USB 3 port at the rear). Its write speeds and backup performance were superior to the Buffalo's, but its read speeds were significantly slower. It must be said, however, that the D-Link feels nippier and more responsive when browsing and streaming.

The D-Link DNS-327L is easier to use than the LinkStation and has better cloud features, not to mention a good range of downloadable add-on modules. Both factors help to justify the higher price.

PERFORMANCE	★★★★☆
FEATURES&DESIGN	★★★★☆
VALUE FOR MONEY	★★★★☆
OVERALL	★★★★☆

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DS214_{play}

**TWO-BAY NAS SERVER FEATURING
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BACKED UP WITH ENHANCED COMPUTING PERFORMANCE

Dual core CPU powered by a built-in Floating-Point Unit and hardware transcoding engine, speeds up thumbnail processing and enables photo-viewing. A refreshingly new experience.

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Multimedia
Technology

Silicon

Accolades for Synology



Synology apps available on

iOS



LACIE 2BIG NAS 6TB

SOLID, ATTRACTIVE TO LOOK AT AND EASY TO USE, BUT THIS NAS LACKS THE SPEED AND FEATURES TO MAKE IT TO THE TOP

PRICE \$549
SUPPLIER www.lacie.com/au

As with most LaCie products, the 2big NAS isn't so much a piece of storage hardware as a design statement – it's more comfortable sitting on a designer's desk than loitering in a dark corner of the office. It's a little noisier than your average external hard disk, but not hugely so.

LaCie gets a lot right with this two-bay NAS. Ours came with two 3TB drives fitted, but you can buy it without and slide your own drives into the bays provided, which lock with a coin-screw at the back.

It's easy to set up, and has a clean and stylish browser-based control panel for configuring drives, users and more advanced features, such as iTunes and DLNA media streaming. By default, the drives are configured in

a RAID0 setup, prioritising speed and capacity over data protection.

It even makes light work of its cloud features, since the 2big NAS ties into the LaCie-owned Wuala cloud storage service. Folders on the NAS can be synchronised with folders on Wuala, and accessed remotely via the excellent apps for Windows, OS X, Linux, iOS and Android, or a browser-based interface. It's simple to set up, and runs seamlessly.

The first downside to this approach is that you'll end up paying for Wuala once the three-month 100GB trial is over. The second is that your data will be stored on Wuala. While it's one of the more security-conscious online services (it doesn't even store your password), storing data on a third-party service defeats the point of having a personal cloud.

Features and speed are even bigger concerns. The 2big NAS has USB 2



and eSATA ports, but it could do with USB 3, and it forgoes extra functions to do a few jobs well. Meanwhile, performance is average. Read speeds aren't bad – 88MB/sec in our large-file test – but write speeds top out at an unimpressive 52MB/sec.

Given the solid build quality, the ease of use and the 6TB capacity, the LaCie 2big NAS is a decent option as a home NAS with cloud features, not to mention its attractive design, but there are better alternatives.

PERFORMANCE	★ ★ ★ ★ ☆ ☆
FEATURES&DESIGN	★ ★ ★ ★ ☆ ☆
VALUE FOR MONEY	★ ★ ★ ★ ☆ ☆
OVERALL	★ ★ ★ ★ ☆ ☆

QNAP TS-420

THE TS-420 IS NO SPEED DEMON, BUT IT IS BOTH FEATURE-PACKED AND CLOUD-FRIENDLY

PRICE \$399
SUPPLIER www.qnap.com

If you want a NAS that starts big and keeps getting bigger, it's hard to beat Qnap's TS-420. It starts out as a four-bay NAS, and with two USB 2 ports, two USB 3 and two eSATA ports, you can plug in a lot of extra drives. The design isn't discrete or attractive, though it's certainly purposeful, but on the upside it's easy to lock disks into the slide-in caddies. We just wish it wasn't so noisy.

Usability is a mixed bag. On the one hand, the wizard-based setup utility offers a choice of quick or detailed setups, asks for basic details and gets on with the initial configuration. On the other, many tasks seem unnecessarily fiddly, and we struggled to do basic things such as set up the media player and personal cloud services. There are too many control panels, and the system isn't always logical. Setting up

a new RAID array and updating the firmware involved tedious waits.

That said, the Qnap has so many add-on modules that there's almost no limit to what it can do, and its cloud features are worth persevering with. The CloudLink service helps you set up remote features with minimum configuration and port forwarding, while the MyQnapcloud service allows you to stream media or browse, view, download and upload files, and you can easily send links for others to directly download.

Qsync is a fine imitation of Dropbox, right down to the ticks on icons when an item has synced. It works extremely well, too, with changes to a local file reflected on the NAS within two seconds over a LAN. The Qfile iOS and Android apps provide remote file access from smartphones and tablets, while QMobile does the same for media (although only when the device in question is hooked up to the LAN).



Speed is the TS-420's Achilles heel. It's noticeably slower than its Thecus, Netgear and Synology rivals; but you're unlikely to find this a huge drawback in everyday use. If you're prepared to put up with its quirks, it's a good-quality four-bay alternative to the two-bay Synology DiskStation DS214play, but our winner is faster, easier to use and every bit as versatile.

PERFORMANCE	★ ★ ★ ★ ☆ ☆
FEATURES&DESIGN	★ ★ ★ ★ ☆ ☆
VALUE FOR MONEY	★ ★ ★ ★ ☆ ☆
OVERALL	★ ★ ★ ★ ☆ ☆

I'm versatile

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FUJITSU

THECUS N4560

A NAS WITH HANDY MEDIA FEATURES, BUT IT HAS LIMITED APPEAL FOR THOSE AFTER A CLOUD-FOCUSED STORAGE APPLIANCE

PRICE \$489
SUPPLIER www.thecus.com

It's hard to fault the Thecus N4560 as a NAS for more ambitious users.

It's a chunky four-bay device – the drives fit into slick, slide-in lockable caddies – and it can function as a media player, thanks to built-in HDMI and optical digital audio outputs. An LCD panel at the front keeps you up to date on the current status, and two USB 2 ports and one USB 3 port can host additional drives and printers.

Thecus' Intelligent NAS utility does a decent job of the initial configuration. You can change your RAID configuration as you go, should you not like the defaults – RAID1 with two disks, RAID5 with three or four disks – and you're always kept informed about what's going on and how long it's going to take.

Things aren't so good when you get

to the N4560's browser-based user interface, which seems to delight in spreading settings around in an ad hoc manner and squirrelling key options away inconveniently.

The N4560 is a tinkerer's delight, with a wide selection of add-on modules to download and deploy; but the process for configuring these is often long-winded.

This is also true of its cloud features. It's possible to sync a folder on your NAS with Dropbox or back up to ElephantDrive and Acronis, but while the Dropbox synchronisation works efficiently, it's a chore to get going. We also struggle to see the advantage of having a local version of your Dropbox folder on a NAS rather than on a PC, unless storage is severely limited.

Other cloud-based tools include the Piczza photo server, for streaming photos to a browser or a mobile app, and the Thecus T-OnTheGo app, which



delivers remote file access.

With a dual-core Intel Atom CE5335 processor and 2GB of RAM onboard, the Thecus is no slouch. It's a little off the blistering pace set by the Netgear, Synology and Lenovo devices, but it's a fine NAS, particularly if your needs revolve around home entertainment. However, it isn't strong enough to take home any awards this month.

PERFORMANCE	★★★★☆
FEATURES&DESIGN	★★★★☆
VALUE FOR MONEY	★★★★☆
OVERALL	★★★★☆

WESTERN DIGITAL MY CLOUD 2TB

A SOUND ENTRY-LEVEL NAS THAT DRAWS VERY LITTLE POWER, BUT ITS CLOUD FUNCTIONS ARE LIMITED

PRICE \$179
SUPPLIER www.wdc.com

Western Digital's My Cloud has done more than any other device to popularise the idea of a NAS as a personal cloud, and you won't find a cheaper or smaller way of getting one up and running. The device is no bigger than your average external HDD, and it's similarly easy to hide away, where it will work quietly and unobtrusively. Of course, you're stuck with the existing capacity, and you'll have to do without RAID1 protection. However, if you're looking for networked backup and media streaming, it will more than do the job.

My Cloud is incredibly easy to set up, either via an applet or WD's My Cloud portal. Enter a username and an email address for remote access login and you're ready to go. The browser-based control panel

is intuitive, with clearly designed, at-a-glance views of the device's status, and simple control panels for adding new users or shared folders. You can create and restore snapshots, called SafePoints, and it's hard to imagine any technically competent user struggling to manage their data or the NAS. DLNA media streaming works like a dream, too.

Unfortunately, the features on offer are disappointing. Oddly, the My Cloud software for Windows is less feature-packed than the apps for iOS and Android: with the mobile apps, you can browse and view files, and copy them to and from public cloud storage



services such as Dropbox and Google Drive; on a PC, you can only browse and view, although Office documents can be opened from within the application and saved to the NAS without fuss.

Performance is adequate: some way off the leaders, but ahead of the cheaper budget NAS drives. Given that the My Cloud is likely to be used by only one user at a time, this isn't a major disaster.

If you're looking for a simple NAS that's easy to use with basic cloud features, the My Cloud is well worth considering – just don't think of it as the last word in cloud-focused network storage.

PERFORMANCE	★★★★☆
FEATURES&DESIGN	★★★★☆
VALUE FOR MONEY	★★★★☆
OVERALL	★★★★☆

Results

Take a quick glance at the results below and you'll see a wide variation in performance. The fastest NAS devices come out between 151% and 157% faster than the slowest devices in our file-copy tests – a much wider gap than we'd see in a Labs test of external or internal hard disks.

Some of the differences are due to software tuning and hard disk speed, but by far the biggest contribution to the discrepancies seen below is the CPU. Correlate the results below with the feature table on p58/59, and you'll see that, bar a small handful of exceptions, those at the top of the charts employ Intel Atoms, while those languishing at the bottom run on ARM-based Marvell CPUs.

However, with increased performance comes higher power consumption. In the power chart, the tables are turned, with the Marvell-based NAS drives leading the way.



HOW WE TEST

The idea of the NAS as a personal cloud is a reaction to the rise of cloud-based storage services such as Dropbox and Google Drive. While these can't match local storage for speed or affordable capacity, their combination of convenience and any time, anywhere access across multiple devices has made them a compelling alternative.

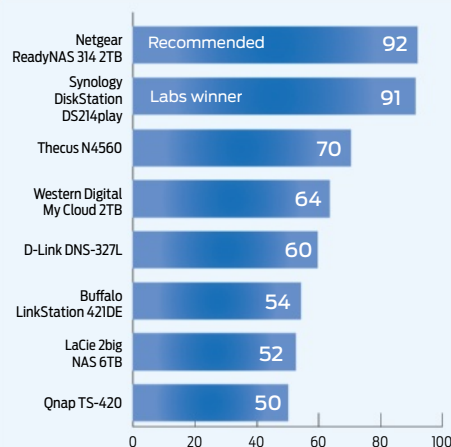
NAS manufacturers claim a personal cloud gives you the best of both worlds: your own large, private storage space where you can store and retrieve files rapidly on a LAN, but one that can also be accessed remotely.

The reality is more complex. None of the personal cloud services we tested here was as easy to set up as Dropbox, and Dropbox is still the most effective way to synchronise files and folders across a number of PCs and Macs, or between teams of users working from different locations. The Qnap, Synology and Netgear devices can do everything Dropbox can, but there's usually a little work involved.

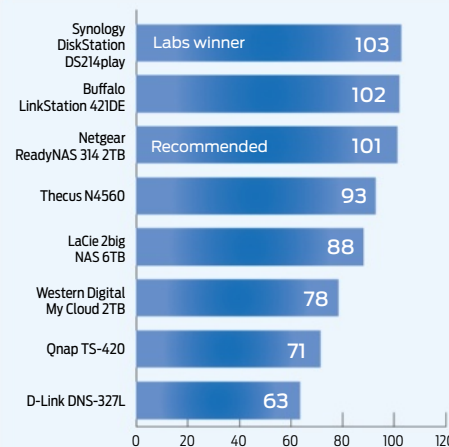
On the other hand, you can copy or back up gigabytes of data to and from a personal cloud in a fraction of the time it takes to do so to Dropbox. And with terabytes of available capacity, there's no need to worry about running out of space – or money. Just be aware that your personal cloud is hostage to your upstream internet connection.



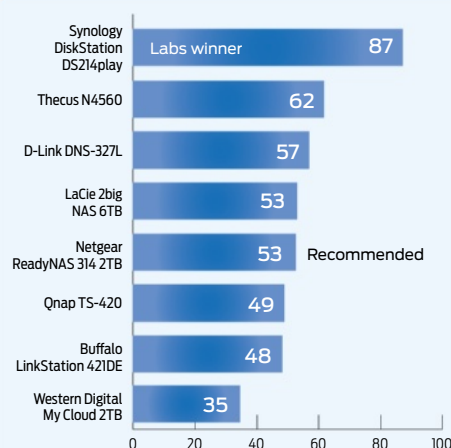
WRITE TRANSFER SPEED MB/sec



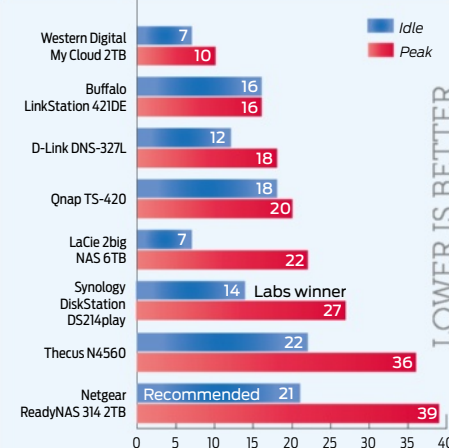
READ TRANSFER SPEED MB/sec



BACKUP TRANSFER SPEED MB/sec



POWER Watts



Build your own NAS

In last month's *PC & Tech Authority*, we discussed the possibility of turning an old PC into a NAS drive using the free, open-source FreeNAS software (see issue 196, p86). It's a simple job: FreeNAS is designed to run from a USB thumbdrive, and getting started is easy. If all you want to do is give it a test drive, you can even run it on a spare laptop and provision a USB stick or SD card as storage.

To find out whether a homebrew FreeNAS system can compete with a commercial NAS, we set about building our own in the *PC & Tech Authority* labs, and subjected it to the same suite of tests as this month's dedicated hardware.

BUILDING THE BOX

As the basis of our FreeNAS system, we used an old Fujitsu Siemens Esprimo E5720 refurbished business PC. Inside is an Intel Core 2 Duo E4600, 2GB of RAM and an 80GB hard disk – a

far more powerful setup than any of the ARM- or Atom-based hardware used by this month's dedicated NAS drives. We ran our tests using the same 1TB Seagate Barracuda drives as in the diskless NAS units this month, to enable a like-for-like comparison of performance results, but it's possible to use any disks you have lying around.

INITIAL SETUP

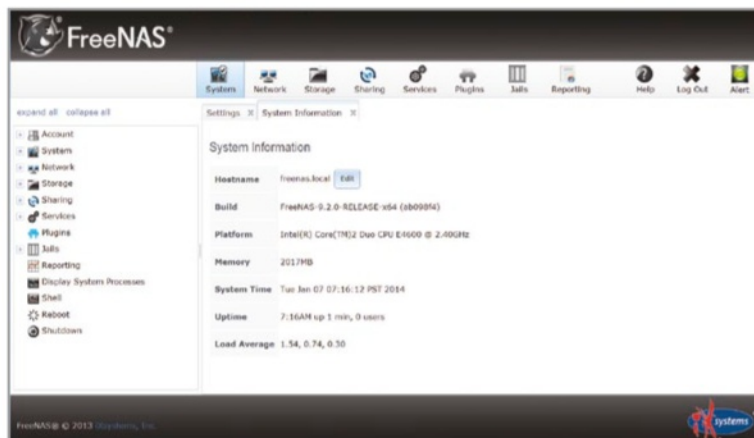
After we'd created our bootable USB stick, it took ten minutes or so to start up FreeNAS for the first time, after which we were able to log on to the web-page admin console and configure the system. A big difference between the DIY NAS and our commercial NAS drives was immediately apparent: compared with the best devices on test, FreeNAS is fiddly to set up. There's no hand-holding, wizard-based help here; you're dropped right in at the deep end.

First, you must pick your file system so that your drives can be prepared. To unleash the full potential of our FreeNAS system, we went for a ZFS array, as we'll discuss below. You can go for UFS if

“If you can cope with its quirks, you'll find a FreeNAS system is incredibly powerful”

you're short on RAM, but you'll miss out on ZFS's advanced features.

After this, you need to fiddle further with the settings, permissions, shares and user accounts before you can start transferring files back and forth. For our Windows shares, we opted for a guest setup for simplicity, but it's possible to create multiple user and group accounts, all with different levels of permission, if you want.



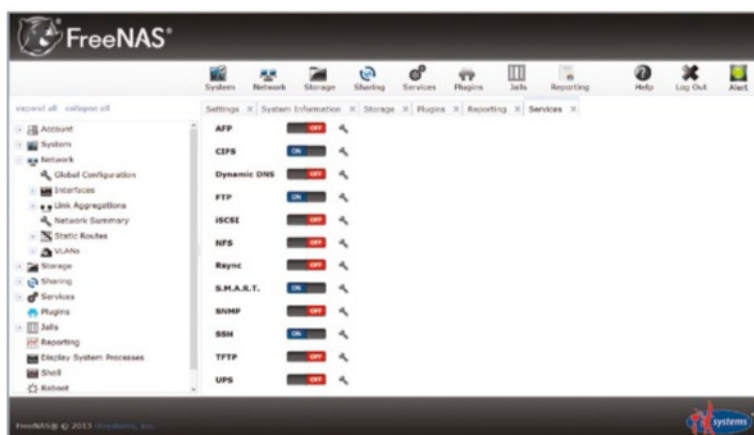
FreeNAS can be managed entirely via a web browser, although initial setup is fiddly

FEATURES

Most commercial NAS drives handle initial setup much better, but if you can cope with its quirks, you'll find a FreeNAS system is incredibly powerful, offering features that rival enterprise-grade NAS appliances at many times the price.

The most attractive feature of FreeNAS is the ZFS file system, which, as mentioned above, offers a number of useful features. First on the list is software RAID. If you choose ZFS as your file system, you'll be able to set up multiple disks in a RAID array, without the need for hardware support. Two physical disks can be set up as a striped array (equivalent to RAID0), or mirrored for data protection. With three or more disks, you can make use of RAID-Z – a system similar to RAID5 that spreads data across multiple disks to improve speed, while providing parity-based redundancy, so one disk can fail without data loss. RAID-Z is more space-efficient than a mirrored array. Roughly two-thirds of the installed capacity will be available in a three-disk array; with two disks mirrored, it's half.

The ZFS file system also allows you to set up Snapshots, which freeze the state of the system's storage periodically, allowing you to retrieve older versions of files or folders that may have been



Plugins let you extend the capabilities of a FreeNAS appliance, adding media servers, cloud backup and synchronisation services



FUJITSU SIEMENS ESPRIMO E5720

- **PROCESSOR**
2.4GHz Intel Core 2 Duo E4600
- **RAM**
2GB DDR2
- **STORAGE**
3 x 1TB Seagate Barracuda
in a RAID-Z array
- **CONNECTIVITY**
Broadcom BCM5754 Gigabit
Ethernet

deleted by accident. Snapshots also allow you to back up files that are in use without causing conflicts.

Other standard features of a FreeNAS system include support for AFP, FTP, iSCSI, rsync, and Active Directory, and the capabilities of a FreeNAS system can be further extended using plugins. In this way it's possible to add everything from BitTorrent downloaders to media servers, online backup and even Dropbox-style synchronisation via ownCloud. Once again, though, there's a steep learning curve, and you'll need a degree of perseverance to get these set up and running smoothly.

PERFORMANCE AND PRACTICALITY

It's clear that there's plenty of scope for expansion and a lot of flexibility with a FreeNAS box, but how about

- ▼ The ZFS file system allows you to set up RAID5-esque software RAID on systems with more than two disks

performance? With its desktop-class CPU, our FreeNAS system would be expected to more than match the NAS drives in this test, and so it proved in several tests. With a mirrored disk array, large-file read and writes hit speeds of 85MB/sec and 98MB/sec, results that put the FreeNAS PC right at the top of the performance tables in this month's test.

Adding a third disk and using a RAID-Z array instead upped performance even further, with both reads and writes returning tremendously quick 107MB/sec read and write speeds, eclipsing every commercial system on test here. However, the backup job saw speeds dragged right down to a bottom-of-the-class 23MB/sec.

This mixed performance could be explained by our PC's specification. To maximise the performance of a FreeNAS system, the rule of thumb is to allow at least 1GB of RAM per terabyte of storage. Our test system has only 2GB. Performance can also be helped by the right network interface card (NIC): Intel-based NICs provide the most reliably quick performance - our system has a Broadcom BCM5754.

Power consumption further diminishes the appeal of a FreeNAS system. Our FreeNAS PC delivers reasonably fast file transfers and a fantastic selection of features, but it runs

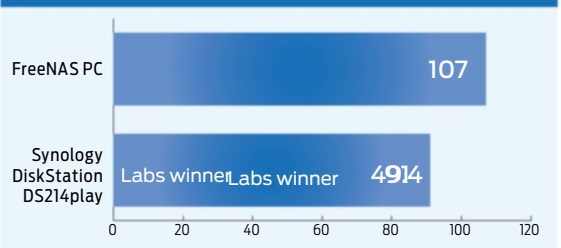
at 49W while idle, and 69W at peak power consumption - making it more than twice as power-hungry as our award-winning Synology NAS in this month's round-up.

VERDICT

Clearly a FreeNAS system can be an effective alternative to a commercial NAS drive, but it comes with some caveats. It's fiddly to set up; to get the best out of it, you'll need plenty of RAM and a fast network card; and its power demands are much higher than with an ARM- or Atom-based NAS appliance. If you're not shy about doing a bit of storage DIY, however, it's certainly worth trying.

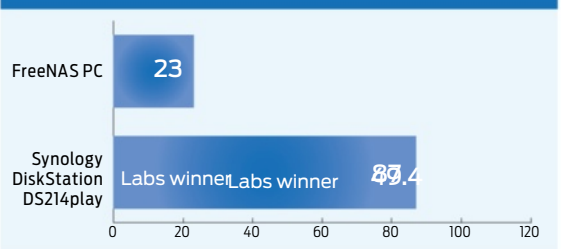
WRITE TRANSFER SPEED

MB/sec



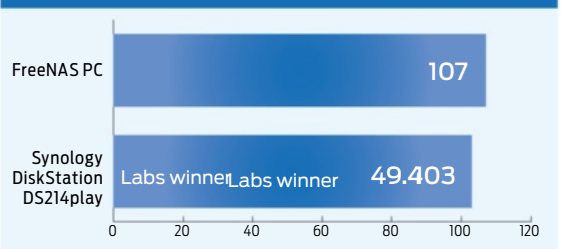
BACKUP TRANSFER SPEED

MB/sec



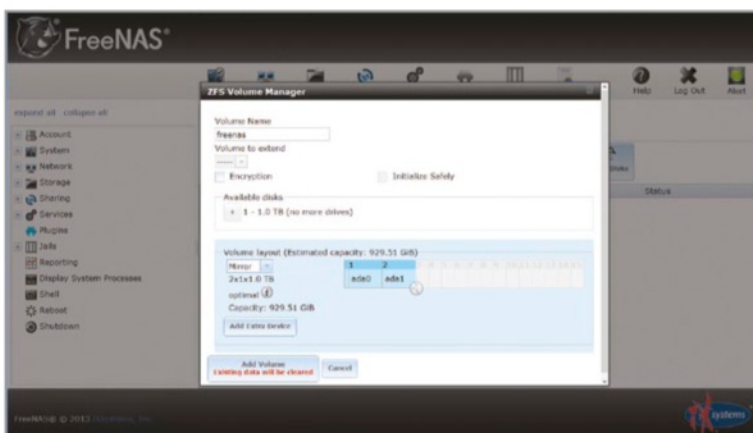
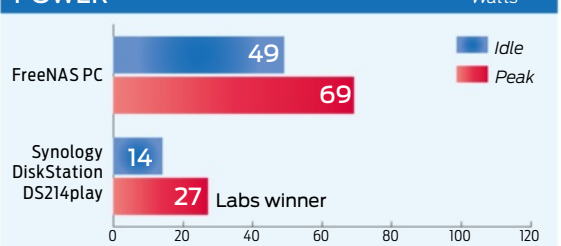
READ TRANSFER SPEED

MB/sec



POWER

Watts



THE STANLEY PARABLE

AN ODD AND WONDERFUL GAME, THE STANLEY PARABLE IS A UNIQUE PSYCHOLOGICAL EXPERIENCE – OR SHOULD WE SAY ‘EXPERIMENT’?

DEVELOPER Galactic Cafe
PUBLISHER Steam
WEBSITE www.thestanleyparable.com

The Stanley Parable is an exceptional game. By that, I don't necessarily mean it's especially *great* – for it's certainly not to everyone's taste – but it is *unusual*. It's so distinctly unusual that there's simply nothing it can be compared to. It lives alone in a niche of its own creation, though it most certainly does take little bits of influence here and there.

Such is the nature of this game that I would absolutely love to be able to offer up how it's 'like this' or that' to help you understand it, but that's not possible, and that is in itself a problem because when describing The Stanley Parable it's so very important to not give too much away, lest the experience be ruined for you.

So now you're thinking: "what's he talking about? I don't understand anything yet, I'm feeling a little lost." And, that is exactly how The Stanley Parable will make you feel, both as you begin playing, and increasingly so as you progress.

But 'progression' is a relative term here. I've 'finished' the game several times, and don't feel like I've actually progressed anywhere, understood much, or achieved anything. All that is by design, and like a lemming to a cliff you plunge ahead happily.

You are Stanley, a little man in a big office, subservient to the job and clueless as to what it all means beyond the buttons you push at your desk. Vague sniffs of Terry Gilliam's Brazil, here. The game starts you alone in your office, the voice-over narrative describing in a third-person

story the sad and pointless life of poor Stanley as you look around your bland office world, listening to someone describe your irrelevance.

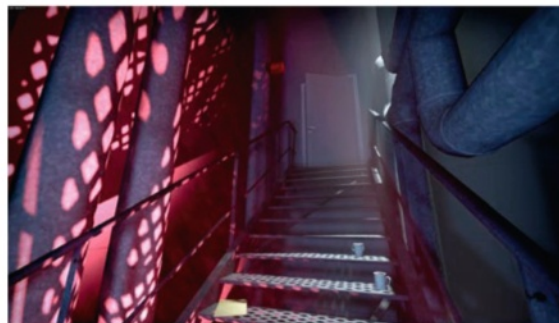
The narration, delivered in award-winning quality by actor Kevin Brighting, teases you sardonically as you go. He's ever-present and responds to your every move and decision, mockingly usually, but with just enough encouragement at times to help clue you in that you've actually made the right decision, and with that, small hope. It all being described about you, not to you, is super effective in making you feel small, powerless and a fool not knowing quite why he's so obtuse, just that he is.

The decisions to be made are simply where in the office to walk. From the get-go something's not right. The entire office – and it's quite sprawling – is abandoned, and quite recently, too, it seems from the Mary Celeste kind of half-finished meals and still-steaming coffee cups.

Alright then, you think, I'll just have a bit of a wander and find stuff. Things will happen, sense will be made. Surely. And so you go. Quite soon you will indeed find things of interest. You may even think you have it all figured out fairly soon. But any lifting confidence you may feel is a mechanism used by the game so very cleverly, and always against you.

No sooner do you think you have a clue – and the essence of the game is to wander, see and do, and accumulate knowledge along the way, piecing it all together to figure it all out – that some part of it is contradicted, or shattered, or twisted, leaving you with ideas that may only be partly true, or not at all – but too apparently important to discard entirely.

Because you play in a first-person view, but with a narrator who seems to be offering commentary to somebody else about what you're doing, the motivation to smack it to them by solving it all is strong, and drives you onwards. The game knows this and messes with you – seemingly for its own amusement – via the narrator, perhaps, or the game world



PLATFORMS
PC only

itself, which isn't always as it seems, or is reliably consistent.

Unless you're an instant-gratification type, or simply aren't interested in trying something very different, then do take a look. There's a free demo, and the whole game can be 'finished' in an afternoon, in a manner of speaking, though, oddly, it has high re-playability value.

Despite all the confusion and apparent walls it puts up, The Stanley Parable is actually a warm world to be in, for most of it, at least. It's not the type of game where half the people who play it give up after a few minutes because they just don't like it. It's a honey pot, a cruel manipulative taunting bullying honey pot, and I think you should play it.

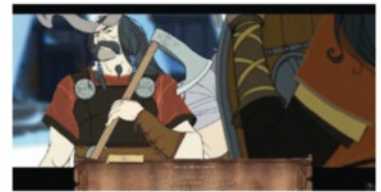
Ben Mansill



It's a bit of creative genius unlike any other.

RATING





BANNER SAGA

THIS TURN-BASED STRATEGY ROLEPLAYING GAME FEATURES A RICH, VIKING-THEMED NARRATIVE WITH A LOT OF CHOICE.

DEVELOPER Stoic
PUBLISHER Stoic
WEBSITE www.stoicstudio.com

From the get-go with Banner Saga, you know you're in for something very special. With just the load screen in front of you, you've got a glimpse into the game's fantastic art, and wistful, rich soundtrack. From then on, everything just gets better.

Banner Saga sprang from a successful Kickstarter campaign, but is out now on Steam. And for the price - \$15 or so, specials notwithstanding - you get a lot of game. At its heart, is a combination of multiple narratives involving classic, grid- and turn-based combat. But it's so much more.

Inspired, obviously, by the Viking sagas, Banner Saga follows two stories of travelling parties seeking shelter across a continent invaded by your more or less standard 'dark forces'. These Dredge are human-like, but rush forth from the mountains, attacking everything in their path. It's not their first invasion, either - there are many veterans of previous wars amongst the two parties you control at the start of the game.

And, to make matters worse, the gods of the world are kind of dead, and the sun has stopped moving in the sky, now hanging there in perpetual daylight. There's a sense of hovering dread over everything, as if Ragnarok itself were just around the corner, and the end of days has begun.

There are essentially four parts to the game, and they weave together seamlessly. The roleplaying side covers



conversational and narrative choices, and while some of the dialogue is a little weakly written, the voice acting - what little there is of it - is great. The choices, though, are tough, and very well implemented. You'll choose how to punish miscreants in your party, whether to recruit strangers into your caravans, and even when to stop and camp, or whether to stretch on and risk hurting your caravan's morale. You'll also find settlements and cities, where you can rest up, talk to various NPCs, and go shopping, but spending too much time may let your enemies get closer. As we said - every choice is a hard one.

On the other hand, you get to level your fighting parties, choosing stats and items to improve, and then manage them on isometric battlefields.

When these battles kick off - perhaps part of a larger, more strategic fight, sometimes as you're ambushed by enemies while exploring alone - you get to position your fighters, and then one by one activate them, taking turns with enemy troops. You'll usually have one or two special abilities with each character, and choosing the right mix of abilities is paramount to winning. You can block some parts of the map

with your shield-bearing tanks, while charging forward with powerful melee fighters, while some characters have ranged attacks, or even devastating area attacks. The game also uses a dual health/armour system, so you'll need to knock down the protection of heavily armoured targets before your damage dealers can hurt them.

It's not particularly innovative, and it could use a little more in terms of gameplay explanations, but it's still gripping stuff. You get to know each character, and you really do feel for them, on the battlefield. And it doesn't hurt that the game's excellent hand-drawn art looks good at this scale, too, with some wonderfully elegant animations.

But what holds the game together is its amazing artistic integrity. Whether watching your caravans travel across rolling hills, or enjoying the details of each character during conversations, the art is so atmospheric that it draws you into the world as well as any dialogue or musical cue during the fighting portions of the game.

Banner Saga is the first in a series of focused singleplayer games, and if you want a change from brash shooters and graphically overwrought games, this is one saga you will love.

David Hollingworth



PLATFORMS
 PC only



RATING



Great art, stellar music, and strong combat and narrative choices. Get Banner Saga now.

ASSETTO CORSA

PCS AND GREAT SIMS GO TOGETHER LIKE KIMI AND ICE CREAM. HERE'S THE TRIPLE CHOC CORNETTO OF THE SIM RACING WORLD.

DEVELOPER Kunos Simulazioni
PUBLISHER Steam
WEBSITE www.asettocorsa.net

The journey developer Kunos Simulazioni took to reach Aspetto Corsa underlines its impeccable credibility, which in turn, I hope, will encourage you to take a look at this wonderful racing sim. The company has at its helm one Stefano Casillo, who was the company for its first couple of years. Coder, graphics and sound engineer, and part time racer, Stefano is the epitome of the small dev heroic leader.

netKar Pro was its first successful consumer sim, which continues to be loved by many for its hyper-realistic physics and handling. But it was a sideline project; Kunos' chief business was the development of custom simulator software for professional racing teams, which continues today. Ferrari liked what it saw and commissioned Ferrari Virtual Academy, a time trial F1 sim which challenges you to beat Massa and Alonso's times, which they set using the sim.

The company office is a small building inside an Italian race track, and most of its small but growing team are amateur or semi-professional race drivers, who happen to also be master coders and software engineers.

So, to Aspetto Corsa. This is Kunos' big push into the consumer market and it's been in development for several years. And, it's still in development. After missing the planned final release over a year ago, and again towards the end of 2013, Kunos chose to release it under Steam's Early Access program, which turned out to be the right move.

For US\$39 you get a fully playable sim right now, and the promise of major fortnightly updates – which typically include a new car and track or two, plus a generally huge list of fixes and enhancements. The fans are happy and are right behind it. It's an enthusiastic and supportive community with the devs right



in amongst it.

They, and I, love Aspetto Corsa because it is, unequivocally, the very best racing sim ever made on PC (being the only place you'll find any truly great racing sim). Even in its beta stage, it is already head and shoulders above the competition, which includes Project C.A.R.S and rFactor 2. Though, it's unlikely it will ever compete with iRacing's well developed online service (and cost).

Here's why: at its heart is the sensation of driving, and that's perfect. Each of the many cars feels exactly right, so much so that anyone who has ever spent any time in any other sim realises instantly that this truly is the one. Some are difficult to get the hang of, like the overpowered and twitchy Ferrari F40, or the completely insane Pagani Zonda. Others, like the Lotus Elise road car or single-seat Tatuus Abarth (my favourite), can be connected with straight off and impart a wonderful confidence to drive aggressively.

See those car brands I just name-dropped, above? Many more great marques are throwing themselves at Kunos to be included, at least those who aren't locked into exclusive deals with other game devs. BMW has most of its road and track cars in, Lotus seems to have its entire range included, Ferrari

are strongly represented with several models, as is Mercedes Benz, McLaren's stupendous new MP4 12C is included, as are many smaller but equally impressive names such as KTM and Scuderia Glickenhaus. And, almost every fortnight Kunos surprise (that's their style) with stunning new inclusions.

The circuits are laser-scanned, meaning the team spent days or weeks at each location, meticulously moving an array of laser send and receive devices along the track, centimetre by centimetre, until every single bump and bend, plus surrounding environment, is captured exactly perfectly. They're a lovely collection, too, which so far includes the likes of Silverstone, Nurburgring, Monza and several rarely seen but wonderful tracks like Mugello, Vallelunga and Imola.

Naturally the mod scene is going crazy – which the sim fully supports. Everything from cars and tracks to clever on-screen display items are beginning to flow forth.

Multiplayer isn't in yet; that should be with us by the end of March, but vs AI racing is in now.

There's a lot to love. Just being part of its excited community as the sim and its scene keeps expanding is remarkably worthwhile.

You'll want a wheel and pedals, of course, though control pads are reportedly well implemented. Aspetto Corsa is a wonderful success story, incredible driving experience, and another reason why PC gaming is rocking so hard right now.

Ben Mansill

PLATFORMS
 PC only

atomic

Only its incomplete beta status holds us back from awarding 6 stars – for now. Best racing sim ever.

RATING

★★★★★☆☆

EVOLVE

DEVELOPER Turtle Rock Studios

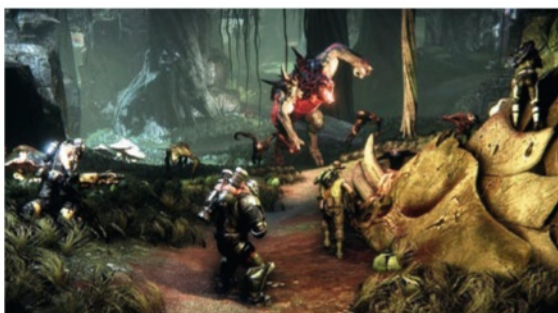
PUBLISHER 2K Games

WEBSITE www.evolvegame.com

Very few developers would be able to pull off a concept like Evolve. It is a multiplayer focused game, part cooperative and part adversarial. It uses a 4 v 1 setup, in which one player takes control of a monster and is pitched against four other players who form a team of hunters.

Thankfully it is the product of one of the most accomplished multiplayer developers out there, Turtle Rock Studios, makers of Left 4 Dead at Valve software. They have since left Valve and reformed, and the result is Evolve.

The game shows this legacy well - it subtly encourages hunters to stick together and work as a team, while the monster role is perfect for those who eschew teamwork and go off on their own. The mode that we played was called Hunt, and involves the hunters tracking the monster through a large map, trying to pin it down, whittle



PLATFORMS

PC • Xbox One • PS4

away health and eventually kill it.

The monster, however, has to evade the hunters while eating local fauna.

Eat enough and you can evolve, becoming more powerful and unlocking more abilities. Hit level 3 and you become a very formidable opponent indeed, turning the tables on

the hunters and their bags of tricks.

This all comes together in a truly spectacular way, with every game playing out differently. It is incredibly fun whether you win or lose, and the pull to play one more round becomes almost unbreakable.

John Gillooly

THE ELDER SCROLLS ONLINE

DEVELOPER Zenimax Online

PUBLISHER Bethesda

WEBSITE www.elderscrollsonline.com

In this day and age it is a pretty ballsy move to try and launch a subscription MMO, especially one based upon a franchise famous for its open worlds and encouragement of going off on tangents. But after the runaway success of Skyrim, if anyone can do it Bethesda can.

It is incredibly hard to gauge an MMO based upon a few preview weekends, even after spending over 10 hours in the world. Our takeaway from this time was that it has potential, and in most ways feels like a traditional Elder Scrolls game, but the

various crafting and levelling systems need more explanation and hand holding to make them more user friendly.

The world itself is gorgeous, and the look and feel is certainly true to the franchise.

However it lacks that all too crucial ability to wander off the main path, following questlines like those from the various guilds to completion while neglecting the main storyline. This is largely down to the inability for an MMO like this to scale enemy difficulty according to player level, which means

PLATFORMS

PC • Xbox One • PS4



that the storyline is broken down into hub areas roughly segregated by level.

Of course, this is just our experience from the early levels, and what remains to be seen is the all too crucial endgame component where the most time will be spent. Without a true handle on what that holds, all we can say is that the game is shaping up better than we expected, and we look forward to getting a better idea of whether it is worth the monthly subscription.

John Gillooly



THE A-LIST

ONLY THE BEST OF THE BEST MAKE IT TO PC & TECH AUTHORITY'S A-LIST

Our A-List contains a collection of the best products to pass through our testing labs in recent times. We've revamped and trimmed down the previous list, and updated some of the out of date products. You'll also find that we have incorporated the Atomic Kitlog, replacing the old collection of components on the A-List with two potential system builds, a reasonably priced all-rounder and the bleeding-edge perfect PC.

Another thing we have done is to step away from adding pricing to categories like software. Given the amount of fluctuation that we see from month to month, it is worth searching out pricing for yourself. We personally use the price aggregators www.staticice.com.au and www.shopbot.com.au but there are a myriad other options that will give you current pricing for tech items, pricing that will be a lot more timely than anything we supply.

ALSO RECOMMENDED

▶ ADOBE LIGHTROOM 5

★★★★★☆☆

We really enjoyed our time with the beta, and we're still finding it to be an even more essential suite for photographers of any stripe. However, as the beta is all that's available, we've left Lightroom 4 listed here in the A-List for this issue. But if you're at all curious, check it out for yourself!



PCS DESKTOPS ▼

HIGH-END TI DELUXE 4670K

★★★★★☆☆

PRICE \$1885 SUPPLIER www.ticomputers.com.au

With an overclocked Core i5 CPU boosted up to 4.2GHz, and a speedy GeForce GTX 770, this is a great system for anything you could throw at it.

SPECIFICATIONS Core i5-4670K @ 4.2GHz • ASUS Z87-A • 16GB DDR3 • 2GB GeForce GTX 770 • 120GB HDD • 2TB 7200rpm HDD • 750W PSU • Blu-ray combo drive. **WEB ID** N/A



GAMING SCORPTEC THERMALTAKE GTX 760 PC

★★★★★☆☆

PRICE \$1499 SUPPLIER www.scorpvec.com.au

This Haswell-based PC strikes a great balance between gaming grunt and cost effectiveness – a great all-rounder.

SPECIFICATIONS Intel Core i5-4570; 8GB DDR3 RAM; 120GB SSD; 1TB 7200rpm HDD; DVD-RW; NVIDIA GeForce GTX 760; Thermaltake Chaser A31 case. **WEB ID** N/A



ALL-IN-ONE APPLE IMAC 27IN

★★★★★☆☆

PRICE \$1949 SUPPLIER www.apple.com/au

If you can afford it, the 27in iMac is the finest piece of all-in-one engineering on the market. A truly powerful beast with performance to match its looks.

SPECIFICATIONS 2.7GHz Core i5-2500S; 4GB DDR3 RAM; 1TB Western Digital Caviar Black HDD; DVD writer; AMD Radeon HD 6770M graphics; 27in 2560 x 1440 LCD. **WEB ID** N/A



HANDHELDS ▼

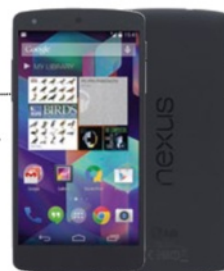
SMARTPHONE NEXUS 5

★★★★★☆☆

PRICE From \$399 SUPPLIER www.google.com

At half the price of some more popular phones, the Nexus 5 still delivers incredible performance and battery life, with pure KitKat goodness!

SPECIFICATIONS 2.3GHz Quad-core Snapdragon CPU; 16GB internal memory; 4.95in 1920x1080 IPS display; 8MP camera; 136g



TABLET APPLE IPAD AIR

★★★★★☆☆

PRICE \$539 SUPPLIER store.apple.com/au

The new iPad is pretty much the king of the hill when it comes to tablets, smaller and more powerful than ever before.

SPECIFICATIONS 9.7in 1536x2048 widescreen Multi-Touch display; 16GHz A5X processor, 16, 32 or 64 GB available; 3G and/or Wi-Fi connectivity; max 652g weight.



EBOOK READER KINDLE

★★★★★☆☆

PRICE \$109 SUPPLIER www.amazon.com

The new model is quicker, slimmer, lighter and cheaper than before. If all you want to do is read books, its simple design and performance are perfect.

SPECIFICATIONS 6in e-Ink screen, 170g weight, 114 x 87 x 166 mm, 2GB memory, 10-day battery life. **WEB ID** 279534



PCS LAPTOPS ▼

VALUE ASUS X202E

★★★★★

PRICE \$699 **SUPPLIER** www.asus.com.au

This touch-enabled Windows 8 laptop may not technically qualify as an Ultrabook, but it comes pretty close, and combines decent performance with a slick design for an excellent price.

SPECIFICATIONS Intel Core i3-3217U; 4GB DDR3; 500GB HDD; 11.6in 1366x768 Touch LCD; Wi-Fi; Ethernet; HDMI.



GAMING VENOM BLACKBOOK 17

★★★★★

PRICE \$3199 **SUPPLIER** venomcomputers.com.au

Packed with powerful components, and featuring some of the best quality video and audio we have encountered, this is a true gaming powerhouse.

SPECIFICATIONS 2.2GHz Core i7-3630QM; 4GB Nvidia GTX 680M; 16GB DDR3; 1920 x 1080 17.3in screen; 1GB HDD + 256 GB SSD; 802.11a/g/n; USB 3.



HIGH-END LENOVO THINKPAD X1 CARBON

★★★★★

PRICE \$2127 **SUPPLIER** www.lenovo.com/au

We've been waiting a long time for a truly modern ThinkPad, and the X1 Carbon does not disappoint. It is powerful, very well-engineered, and looks the part.

SPECIFICATIONS 1.8GHz Intel Core i5-3427U; 8GB RAM; 128GB SSD; 14in 1600 x 900 LCD; 1 x USB 3; 1 x USB 2; dual-band 802.11abgn Wi-Fi; Bluetooth 4; 3G; 3yr RTB warranty; 331 x 226 x 19mm (WDH); 1.36kg. **WEB ID** N/A



ULTRA PORTABLE DELL XPS 13

★★★★★

PRICE \$1899 **SUPPLIER** www.dell.com.au

Our previous favourite Ultrabook achieves perfection, thanks to an update to Ivy Bridge and the inclusion of a gorgeous Full HD 1080p screen.

SPECIFICATIONS 2.50GHz Intel Core i7-3537U; 8GB DDR3; 256GB SSD; 802.11n; Bluetooth 4; 13in 1920 x 1080 screen



PERIPHERALS ▼

WIRELESS ROUTER ASUS DSL-N55U

★★★★★

SUPPLIER www.asus.com.au

A high-speed router that looks striking and delivers everything you could want for home connectivity

SPECIFICATIONS 802.11abgn wireless router; 4 x Gigabit Ethernet ports; 2 x USB; PPOE; PPP; L2TP; 145x63x174mm.

DESKTOP STORAGE SEAGATE 2TB BACKUP PLUS DESKTOP

★★★★★

SUPPLIER www.seagate.com

This 2TB external drive still offers good value despite the rise of higher capacity drives. The USB 3.0 adaptor makes for excellent transfer speeds and the design is tasteful and compact.

SPECIFICATIONS 2TB external hard disk with NTFS; USB 3.0, with other docks available as optional; 44 x 124 x 158mm 894g.

NAS BUFFALO CLOUDSTATION 2TB

★★★★★

SUPPLIER www.buffalotech.com

Remarkably easy to set up, the Cloudstation features support for the highly functional Pogoplug smartphone app, letting you access all your stored data remotely – a great product for the price.

SPECIFICATIONS Gigabit Ethernet; Android and iOS apps; 45 x 150 x 175mm; persistent Internet connection required.

ALL-IN-ONE PRINTER CANON PIXMA MG5460

★★★★★

SUPPLIER www.canon.com.au

The winner of our most recent printer group test, this combines excellent print quality with decent costs.

SPECIFICATIONS 9600 x 2400dpi print; 2400 x 4800dpi scan; USB; 802.11n WLAN; 125-sheet tray; 455 x 369 x 148mm

LASER PRINTER DELL B1160W

★★★★★

SUPPLIER www.dell.com.au

The best all-rounder in our printer group test, with excellent text printing and decent costs.

SPECIFICATIONS 1800 x 600dpi resolution; USB 2; Wi-Fi; 150-sheet input trays; 331 x 215 x 178

SOFTWARE ▼

SECURITY KASPERSKY INTERNET SECURITY 2014

★★★★★

SUPPLIER www.kaspersky.com/au

The winner of this year's security software group test, a big improvement over recent years, and a good solution for beginners and more advanced users.

BACK UP ACRONIS TRUE IMAGE 2013

★★★★★

SUPPLIER www.acronis.com.au

A clear and well-organised front end makes this easier to use than ever. Not much has changed from previous years, but it remains our go-to backup solution.

OFFICE SUITE MICROSOFT OFFICE 2013

★★★★★

SUPPLIER www.microsoft.com.au

Amidst new touch features, there are some fantastic new additions to the latest office.

WEB DEV ADOBE DREAMWEAVER CS5

★★★★★

SUPPLIER www.adobe.com.au

This edition makes PHP and CMS its core focus, which gives it the new lease of life it so desperately needed.

AUDIO CUBASE 7.5

★★★★★

SUPPLIER www.steinberg.net

The addition of better filters solidifies this program's continued place on the A-List.

VIDEO SONY VEGAS MOVIE STUDIO HD PLATINUM 10

★★★★★

SUPPLIER www.sony.com.au

May not have the bells and whistles of other consumer editing packages, but its tools are efficient.

PHOTO ADOBE PHOTOSHOP LIGHTROOM 4

★★★★★

SUPPLIER www.adobe.com.au

An excellent tool for photo management and light editing, now available at a very reasonable price.

KITLOG

These are two basic systems, with something for every taste. The Game Box is put together with money saving in mind, but also an eye to getting as much bang for your buck as possible. Our build may be a little more expensive than what you could technically get away with, but for that extra few hundred you're also getting cutting edge performance and one of the most overclockable chips you can get today.

The Perfect PC, on the other hand, is the system everyone aspires to, with nothing but the best parts - without going crazy, though. It's a collection of all the greatest hardware that we'd pick without a budget, sure to impress with performance and sheer style.

Whether you choose to go specifically for these builds or use them as a baseline to work on, you'll find that these are the best components and peripherals that we have encountered in recent times. As with our A-List, it is worth checking out price aggregator websites to get the best deal on components, with some parts like RAM and hard drives renowned for varying on an almost daily basis due to market factors.

One thing to keep in mind if you are choosing to build your own PC: you'll need to add the cost of a copy of Windows onto the overall price. At the time of writing, this was around \$120 for an OEM 64-Bit copy of Windows 8. We also don't include optical drives. If you need an optical drive we suggest going for a USB model, which can perform double duty with Ultrabooks and other laptops, rather than being stuck inside your PC.

ASUS ROG MARS 760

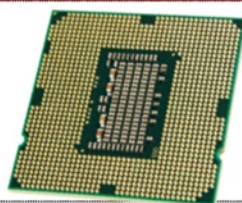
The Perfect PC has a new addition with the ASUS ROG MARS 760 jumping into our recommended videocard spot. We like the immense power of the dual-760 GPUs and we love the impeccable build-quality and effective cooling. As we said in our review in the February issue of *PC & Tech Authority*:

"The card itself is a work of art, differing in design from the DCUII coolers that we are used to. The shroud is made of metal, with a soft-touch rubberised coating, accentuated by anodised red aluminium highlights. It also features a brushed aluminium backplate and a glowing red MARS logo, designed to be visible through a case window"



THE GAME BOX

CPU



INTEL CORE I5 3570K

PRICE \$245

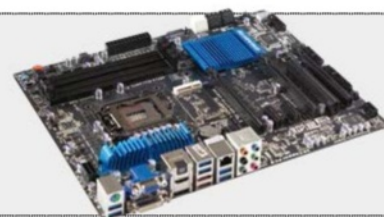
Remove the Hyper Threading, and save \$150? DEAL! You can always opt for a non-K version CPU if overclocking isn't your thing.

MOTHERBOARD

GIGABYTE Z77X-UD3H

PRICE \$185

Affordable gaming performance and features, without the overkill seen with a lot of gaming-specific motherboards on the market.



MEMORY



G.SKILL RIPJAWS F3-12800CL9D-8GBXL

PRICE \$55

Great value, decent performance, and some flexibility. RAM is universally cheap now, so higher capacities are still viable for budget builds.

VIDEOCARD

GIGABYTE HD7870 OVERCLOCKED

PRICE \$260

Performance close to the 7950, with a pricetag nowhere near. It also looks like there won't be new GPUs for a while yet, so this card will last a while.



THE PERFECT PC

CPU



INTEL CORE I7 3770K

PRICE \$350

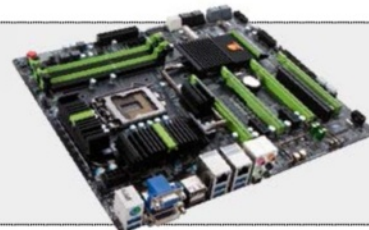
8 Threads of Ivy Bridge efficiency. Overclock for justice! This CPU is so good it has rendered the Socket 2011 enthusiast platform redundant.

MOTHERBOARD

GIGABYTE G1 SNIPER 3

PRICE \$380

It's about as super-premium as you could get, or want, thanks to added features like SoundBlaster audio and Killer NIC.



MEMORY



CORSAIR VENGEANCE LOW PROFILE CML16GX3M4A1600C9B

PRICE \$120

16GB of fast memory. Virtualise everything! The low profile design means that it won't fight for space with your cooling solution.

VIDEOCARD

ASUS ROG MARS 760

PRICE \$820

Dual-GTX 760 GPUs which is enough to power through almost anything in high detail and high res, with exquisite build quality.



SUBTOTAL: **\$1694**RIG ONLY: **\$1084**

COOLER



ANTEC KUHLER 620

PRICE \$85
Water cooling is the future, today! These closed loop coolers make it much cleaner inside your PC case.

CASE



BITFENIX RONIN

PRICE \$99
BitFenix continues to deliver great budget cases that look and build great.

SYSTEMDRIVES

2TB HDD
PRICE \$90
2000 gigabyte storage drive on the cheap. 3TB are coming down in price too.



PIONEER DVR-219L

PRICE \$35
Discs. You need 'em. A USB DVD drive is also a viable alternative.

KEYBOARD

RAZER ARCTOSA

PRICE \$50
A cool-looking keyboard that'll serve you very well if you can't afford the jump to mechanical.



DISPLAY



LG IPS277L

PRICE \$400
27 inches of IPS glory. The resolution isn't perfect, but the price is. The thin bezel makes this a very attractive screen.

MOUSE



CORSAIR VENGEANCE M60

PRICE \$70
Exceptional mousing value with a great, unique design and a very handy sniper mode button for the FPS fans

AUDIO

TT ESPORTS CRONOS

PRICE \$80
Fantastic set of headphones that delivers great 2.1 audio for gaming and music without swamping you with bass.



ONBOARD REALTEK ALC889A

PRICE N/A
A decent chip that does the job.

POWER SUPPLY

SILVERSTONE STRIDER 500W

PRICE \$65
A solid PSU, capable of powering much more if you ever choose to upgrade.

SUBTOTAL: **\$4505**RIG ONLY: **\$3390**

COOLER



CORSAIR H100i WATER COOLER

PRICE \$160
Fits perfectly in the Cosmos S II, mounting directly on the roof!

CASE



COOLER MASTER COSMOS II

PRICE \$400
The only case you'll ever need. Premium luxurious bliss.

SYSTEMDRIVES

OCZ REVO DRIVE 3 X2 & WD 1TB VELOCIRAPTOR
PRICE \$490 + \$350
Superfast SSD and zippy storage make for a monstrous system indeed.



KEYBOARD

RAZER BLACKWIDOW ULTIMATE

PRICE \$160
Mechanical gorgeousness.



DISPLAY



ASUS PB278Q

PRICE \$690
One of the best 27in monitors on the market, with a pricetag that makes us forget the competition even exists.

MOUSE



RAZER OUROBORUS

PRICE \$135
An excellent performer and highly configurable mouse that suits both left- and right-handers.

AUDIO

PLANTRONICS RIG

PRICE \$130
For sheer features and flexibility, possibly the best cans on the market today.



POWER SUPPLY

ANTEC HCP 1200W

PRICE \$320
Plug in a graphics card. Or four. The HCP won't care, coping with everything you throw at it.





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VOLOS

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Octagon	02 8212 5161
MSY	02 9648 4116
PC DIY	02 9648 1001
NorthShore	02 9939 1548
Online Computer	02 9211 0898

SA

MSY	08 8212 1656
PC DIY	08 8410 0446

VIC

Nexus	03 9663 9988
PC DIY	03 9077 9811
Scorptec	1300 726 770
Centrecom	03 8311 7600
CPL	03 8542 8688
MSY	03 9560 2288

QLD

Computer - Alliance	07 3421 3200
Gamedude	07 3387 1531
MSY	07 3217 9070
Umart	07 3369 3928

WA

Austin	08 9201 2788
MSY	08 9344 1002
PLE	08 9309 4771

HOW TO

Each month our experts get under the hood to provide you with detailed How To guides on hardware, software and everything in-between.

SYSTEMBUILDER

CPU roadmaps explained



82

HOW TO

Create a Raspberry Pi weather station



86

HOW TO

Find the best cooling for your PC



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SYSTEM BUILDER: CPU roadmaps: what you need to know

DARIEN GRAHAM-SMITH SIFTS THROUGH THE OFFICIAL ANNOUNCEMENTS
– AND THE RUMOURS – TO UNEARTH THE TRUTH ABOUT THE VENDORS' PLANS

It's a perennial question: should you buy now, wait for the next generation of hardware, or even hold out for something further down the line? The answer isn't always obvious, partly because the main processor manufacturers don't like to shout about what's coming next year, or the year after that; they'd prefer you to buy now.

LOOKING AHEAD

There's information available if you know where to look. Some of it comes from official sources: at events such as the Intel Developer Forum, the chip giant regularly reveals advance information of its CPU "roadmap" for the coming years; AMD also gives similar briefings to its press and technical partners.

Additional details can be gleaned from leaked internal documents, which often turn out to be surprisingly accurate. It's been estimated that a CPU takes five years to design and manufacture, so the technical details of a processor that's several years away from launch may

already be set in stone.

If you know what lies a few generations ahead, you're in a great position to decide when to upgrade. Knowing the roadmap can help you decide whether to hold out for one of the latest and greatest processors or to try to save money by choosing a last-generation model.

THE TICK-TOCK CADENCE

For much of the last decade, both AMD and Intel released a fairly constant trickle of processors. Most of these were variations on existing themes, punctuated every so often by a process shrink (see Process shrinks, p85) or a new technical design, such as when Intel moved from the Pentium 4 to the Core range. In 2007, however, Intel adopted a more regimented approach for its mainstream CPU business, which it calls the "tick-tock cadence".

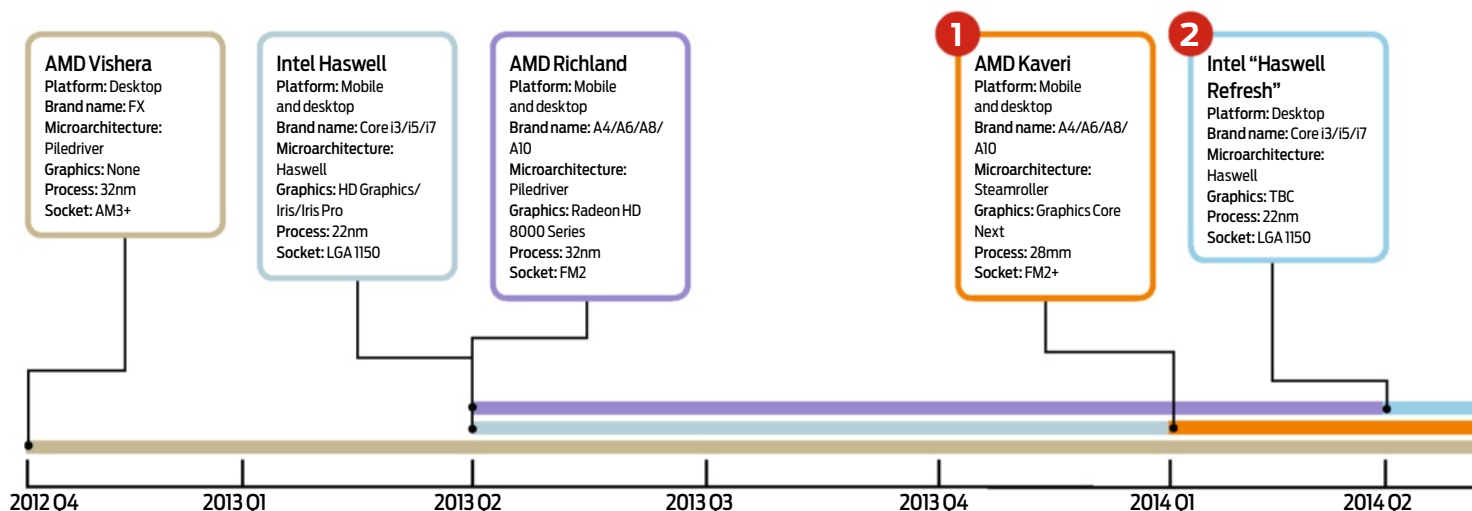
As the name implies, tick-tock aims to produce design and engineering improvements to a predictable schedule, alternating between "tick"

generations - that is, process shrinks - and "tock" generations, which introduce a new architecture without changing the process size.

In reality, the timing hasn't been perfectly regular, which is

"At the most fundamental level, a chip's capabilities are defined by its microarchitecture"

understandable given the practical challenges involved (Intel says a complete cycle lasts "a couple of years"). That said, the momentum has been impressive: since the launch of the Core 2 Duo, Intel has launched a new generation of processors roughly every 14 months. It's even managed to build technical improvements into "ticks" as well as "tocks": for example, 2012's Ivy Bridge processors shrank down the Sandy Bridge microarchitecture and introduced a stronger graphics processor, useful for more demanding games.



Tick-tock is obviously good news for upgraders, and in its early years the progressive ramping up of performance and efficiency also helped Intel pull ahead of AMD. As such, it wasn't a huge surprise when AMD announced, in late 2010, that it too was moving to an annual schedule of technology upgrades.

MICROARCHITECTURES, PROCESSORS AND PLATFORMS

To understand a CPU roadmap, you need to know a bit about how processors are put together. At the most fundamental level, a chip's capabilities are defined by its microarchitecture – that is, the arrangement of transistors that forms a functional processing core. Newer microarchitectures almost always improve on the performance or power efficiency of their forebears (it would make little sense to release them if they didn't).

Microarchitecture isn't the whole story, however. A single microarchitecture usually appears in a variety of different packages, with different brandings and capabilities tailored to suit various budgets and roles. For example, Intel's Haswell microarchitecture forms the basis of an entire range of consumer CPUs, from the lightweight Core i3-4000M to the high-end Core i7-4770. These models perform very differently. Key differentiating factors include the number of cores packed onto each chip; the clock speed at which the whole thing runs; the amount

of onboard cache memory provided to speed up operations; and the inclusion or otherwise of specific features such as Hyper-Threading and Turbo Boost.

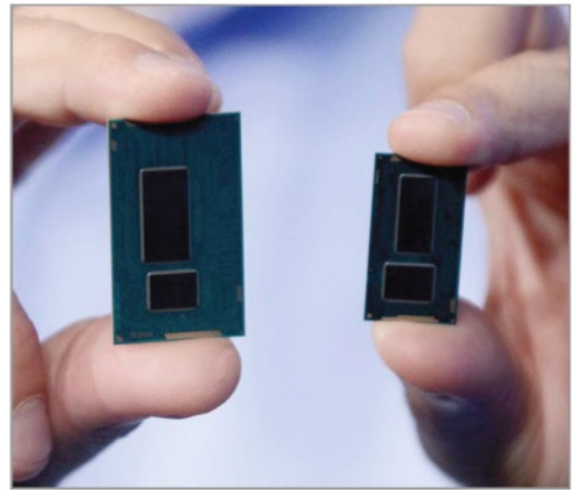
In recent years, Intel microarchitectures have been named after places (both real and imaginary), the most recent being Sandy Bridge, Ivy Bridge and Haswell. AMD has chosen more straightforward symbolism: the last generation was called Bulldozer, the current generation is dubbed Piledriver and upcoming models include Steamroller and Excavator.

AMD also gives codenames to families of chips within a particular microarchitecture. Its current range of "Accelerated Processing Units" – processors combining Piledriver CPU cores with powerful Radeon-branded graphics cores – is known as Richland, while desktop chips with no GPU make up the Vishera platform.

MAINSTREAM PROCESSORS

So, what do we know about Intel and AMD's forthcoming chips? First, let's look at the mainstream processors, by which we mean designs aimed at desktop PCs, laptops and Ultrabooks. (We'll look at low-end stuff later.)

The timeline on pp82-84 shows where we are now, and what's expected to emerge in the next two years. It's based on information collected from a variety of sources, so we can't guarantee its accuracy, but the information appears to be well corroborated; the thing that's most

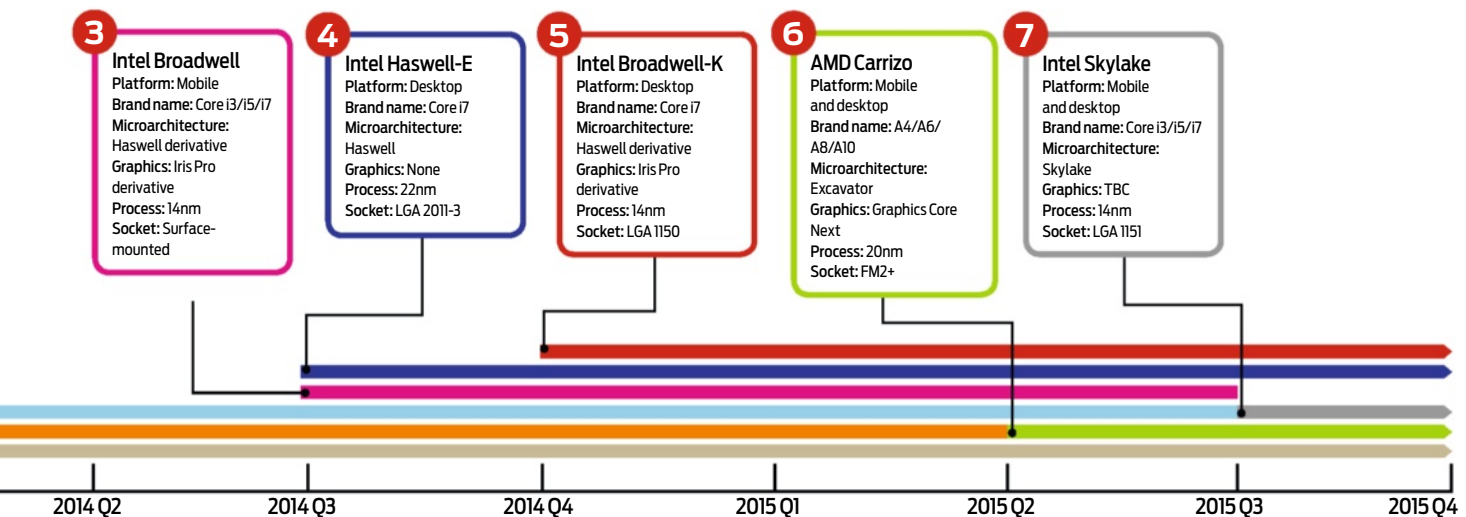


▲ Ever-smaller transistors allow chip makers to manufacture increasingly powerful processors

likely to change is release dates.

On the AMD side, it's a simple story. You can buy a Kaveri system (see 1) this year – the high-end desktop A10-7700K and A10-7850K models are with us already, and mobile and mid-range models will follow in the coming months. Or you can wait until 2015 for Carrizo (see 6). On desktops, this will fit the same motherboards as Kaveri, but it will bring a new microarchitecture and a smaller process size, which will improve performance and cut power consumption. It's also rumoured that Carrizo will support DDR4, which enables the CPU to fetch data from RAM more quickly.

You may notice there's no upgrade path for AMD's CPU-only Vishera platform; according to the latest information we've seen, the firm plans to focus on APUs in 2014 and



14cm fan for better cooling



PSU status monitor



Cable management



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– Pure Overclock

ARM

When it comes to lightweight devices such as smartphones and tablets, the ruler of the CPU roost isn't AMD or Intel – it's British chip designer ARM. The ARM architecture is based on reduced instruction set computing (RISC) principles, so while it won't run Windows or OS X, it's much more energy-efficient than AMD and Intel's complex x86 cores. That's why various manufacturers have chosen it as the native platform for Android, iOS, Windows Phone and Windows RT, as well as the dinky Raspberry Pi.

While AMD and Intel handle both the design and manufacture of their branded CPUs, ARM only creates designs, which it then licenses to others to package and manufacture as they see fit. ARM cores are thus normally found integrated into other companies' "system on a chip" designs, such as the Apple A series, Nvidia Tegra, Samsung Exynos and Qualcomm Snapdragon platforms. With so many firms producing their own variations on the ARM formula, you'll look in vain for a clear, authoritative roadmap for the ARM platform.

However, there's one prediction we can make with confidence. Most current mobile devices are based on 2005's ARMv7 architecture – specifically ARMv7-A, ARM's "profile" for general-purpose computing



devices. The most common implementations of this are ARM's Cortex-A9 design – as found in the Apple iPad 2 and the Samsung Galaxy S III – and the more powerful A15 design, used in the Microsoft Surface 2 and the Samsung Galaxy Note 3.

In 2012, ARM released the ARMv8 architecture, which introduces 64-bit processing and new SIMD (single instruction, multiple data) instructions to improve performance when working with large datasets. So far, we've only seen one implementation of ARMv8, namely Apple's A7, found in the iPhone 5s and the iPad Air. But that's been enough to show what the design can do – those devices outpace almost every other smartphone and tablet we've seen – so it seems safe to predict that the coming generation of mobile devices will see a switch to ARMv8 designs.

ARM can't expect to have the market wholly to itself, however. While the x86 architecture is inherently less power-efficient than ARM's ultra-simple designs, Intel hopes its continual microarchitecture improvements and process shrinks will make up for that. It's already ported Android to its own platform, as seen in the Atom-based Motorola Razer i smartphone and the Asus Fonepad tablet. This year, Intel promises Android devices based on its Bay Trail platform, further improving performance and battery life.

to battery life and – like Ivy Bridge – upgraded GPUs. Next year, mobile Skylake processors will bring a new core design to the 14nm process.

Things are less straightforward on the desktop. Instead of new Broadwell processors, mainstream desktop users are set to get a "Haswell Refresh" (see 2) later this year. It's rumoured that Intel has taken longer than planned to get production of 14nm silicon up to full capacity; whether that's true or not, it seems that most of its desktop chips will stay at 22nm during 2014, while its 14nm facilities focus on producing mobile processors. It's an approach that makes sense, since driving down power consumption is a much more pressing task for laptops than desktops. We don't know precisely what the refresh will involve, but the obvious guess is that an upgraded family of desktop processors will combine a Haswell core with a Broadwell-class GPU.

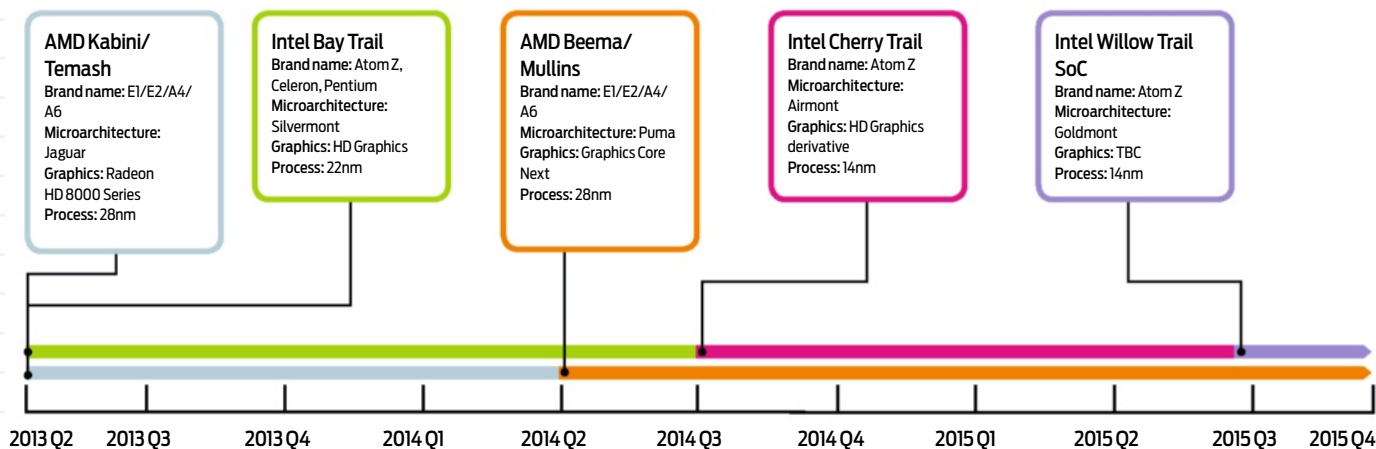
Some "real" Broadwell CPUs will also make it to the desktop, including Broadwell-K (see 5), a 14nm Broadwell chip designed for a desktop socket. However, the "K" designation strongly suggests this will be a high-end release only, like Intel's Core i7-3770K and i7-4770K models. Traditionally, K models have had unlocked Turbo multipliers, enabling them to be overclocked; since smaller transistors don't overheat so easily, 14nm chips are likely to achieve higher frequencies than 22nm parts.

Alternatively, desktop diehards may choose to invest in Haswell-E (see 4), a so-called "enthusiast-class" implementation of Haswell with generous onboard caches and

into next year. The Vishera platform will continue to be sold, given its strong appeal to certain markets and uses, though perhaps with tweaks such as faster clock speeds or larger caches. Also, since work is well under way on the Steamroller and Excavator cores, it shouldn't be hard for AMD to build these into CPU-only packages to meet demand.

EXTENDED LIFE FOR HASWELL

When it comes to Intel processors, the situation depends on whether you're using a mobile or desktop system. For laptop users, 14nm Broadwell chips (see 3) are on course to replace Haswell in the second half of this year, bringing improvements



Toughpower XT
Power Supply



Life-time Warranty

Available in:
675W, 775W, & 875W

superfast memory access, supporting DDR4 over Intel's QuickPath Interconnect. These models won't be for everyone: Ivy Bridge-E processors cost \$300-400 for the chip alone and don't include graphics. Haswell-E will also introduce a new socket, LGA 2011-3, which isn't compatible with current LGA 2011 motherboards used by Sandy Bridge-E and Ivy Bridge-E processors.

Finally, there's Skylake (see 7). As the release is so far away, details are sketchy, but since we know it's a "tock", we can expect it to introduce a new microarchitecture on a 14nm process. It's also expected to bring new AVX 3.2 extensions that can speed up certain types of operation, and it's almost certain to support DDR4. We may also see SATA Express, a new connector that lets solid-state drives use the full speed of a PCI Express bus over a regular SATA connector. This permits transfer rates of up to 16Gbits/sec – two-and-a-half times the maximum currently supported by SATA.

LOW-POWER PROCESSORS

Both AMD and Intel are seeing demand grow for low-power CPUs with a focus on battery life and price, for markets where raw performance isn't the priority (see ARM, *opposite*).

That said, performance remains an issue for everyday computing. If you bought a netbook a few years ago, you'll know the frustration of waiting for applications and web pages to load. Today's low-power hardware is starting to feel truly responsive in everyday tasks – even games – but you may still find yourself waiting if you want to multitask or run demanding applications.

Like their mainstream cousins, low-power CPUs are based on named microarchitectures – Intel's current microarchitecture is called Silvermont – which may be implemented in a variety of packages. Typically, these take the form of "system on a chip" (SoC) designs, which include not only the CPU but also key components such as the memory controller and storage interfaces, and have their own names.

SoCs are produced for all types of devices, from smartphones to servers. The ones we're interested in are normally found in laptops and tablets, although they may crop up



in low-power all-in-ones and other lightweight PCs. AMD's Kabini/Temash and Beema/Mullins pairings are based on one microarchitecture, but designed for different types of device: Kabini and Beema can draw up to 25W, making them viable

▲ Intel senior vice president Mooly Eden unveils a new design at the Intel Developer Forum

PROCESS SHRINKS

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for mainstream laptops; Temash is intended for lighter, tablet-style devices with a typical usage of 4W; the forthcoming Mullins chip cuts that to 2W.

Intel-wise, the current Bay Trail platform comes in configurations ranging from 2W tablet SoCs to Celeron- and Pentium-branded laptop and desktop processors drawing up to 10W. Later this year, its successor – Airmont – will shrink to 14nm, but nothing has been revealed regarding what architectural improvements Airmont might bring, or in what sort of packages it will be offered.

Nor are we any the wiser at this point in time about the next core but for one, codenamed Goldmont, scheduled for 2015. As with Skylake on the desktop, we know it's slated to stay at 14nm, which implies that the focus will likely be a new microarchitecture. ■



▲ Wafers – thin slices of semiconductor material – are used to make microchips



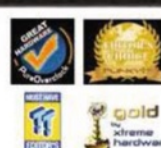
14cm fan for better cooling



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– Pure Overclock

HOW TO:

Create a Raspberry Pi weather station: Part 1

KEVIN PARTNER EXPLAINS HOW TO CREATE A WORKING WEATHER STATION USING A RASPBERRY PI, SOME AFFORDABLE SENSORS AND A FEW MODULES OF PYTHON

The Raspberry Pi has a number of features that make it ideal for real-world projects. It's cheap, small and rugged, and it needs only a modest power supply.

Here, we're going to discover how to turn a Pi into a climate-monitoring station that can take measurements of the temperature, air pressure and light levels outside, and save them in a form you can then analyse using

a spreadsheet program such as the common Microsoft Excel.

We're also going to cover how to connect to Dropbox, so that our project can share its results across multiple devices. Finally, we're going to look at how to use a Raspberry Pi without a keyboard, monitor or mouse, so that you can use your Pi in a wide range of small-scale projects.

This project assumes a certain degree of familiarity with Raspbian and the principles of creating programs

in Python, but especially advanced skills aren't required.

THE PROJECT OBJECTIVES

Every home, school or workplace has its own microclimate, so by taking measurements you're generating unique local data. You can record seasonal fluctuations, for example, or observe how your climate readings relate to weather.

Here are some questions for which you might want to design experiments:

- Does higher air pressure correlate with higher temperatures and clear sky?
- Can a trend in air pressure predict temperature and/or light levels? If so, how far ahead?
- What is the range of temperatures experienced at your location this year? What is the average?
- How does this compare with the average at your local weather station and across the region/country? How does it compare with historical averages?
- Is there a correlation between light level and temperature on any given day?
- How does the length of the day vary during the year? Is the speed of lengthening/shortening consistent, or does it change with the seasons?

The list of theories to test is almost endless, but we're going to design our experiment with these six in mind. We can always add extra sensors and code to enhance it later. For a full list of the components we'll use, see *Equipment list*, left.

CHOOSING A LOCATION

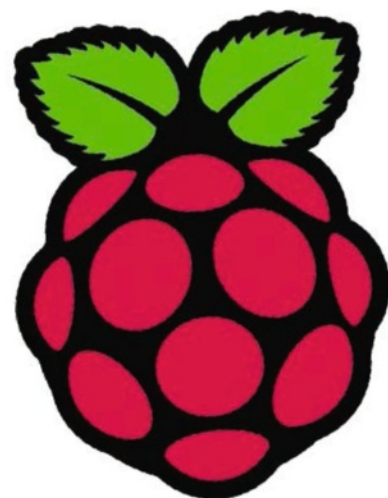
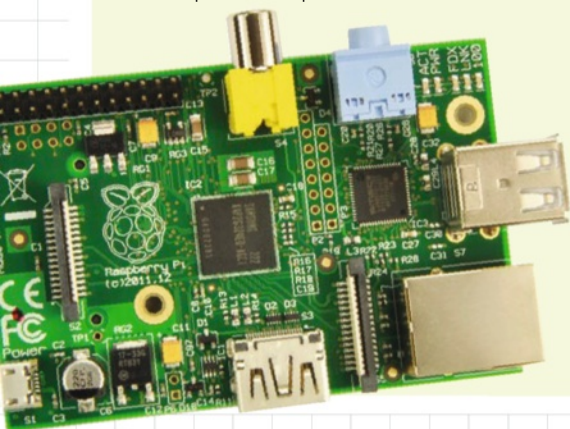
The Raspberry Pi must be within range

EQUIPMENT LIST

To create our weather station, we need sensors to read temperature, light levels and air pressure, as well as somewhere to house them. You can hook sensors directly to the Raspberry Pi's GPIO pins (or via a breakout board), but we've opted for a system based on USB. This makes the hardware setup simple – no soldering is required – and it means you could use a laptop as the host computer if you don't have a Pi.

We'll use the TinkerForge system (www.tinkerforge.com), which consists of controllers ("Bricks") that plug into the Pi's USB socket, and sensors ("Bricklets") that connect to the bricks. This tutorial has been written specifically for these components; you can find direct links to buy them at <http://rpilab.net/resources>. The complete list of parts is:

- Raspberry Pi and case – any version (we used a Model A).
- Raspberry Pi power supply.
- Four-port unpowered USB hub.
- Compatible USB wireless dongle – see <http://tinyurl.com/lf28r3w> for a list of possible options. We used the TP-Link TL-WN723N in this project.
- 4GB (or larger) SD card with Raspbian and Geany.
- Keyboard, mouse and monitor (only necessary for development).
- TinkerForge Master Brick, Temperature Bricklet, Ambient Light Bricklet, Barometer Bricklet and optional Humidity Bricklet.
- A 3m USB cable and mounting kit for the Master Brick, plus cables and mounting kits for each Bricklet. The length of the Bricklet connector cables will depend on your specific project; if in doubt, get the largest size. The mounting kits consist of four small pillars. Each sensor is fixed to the pillars with the included bolts, which can then be screwed into a mount of your choice.
- Bird nesting box – yes, really. We're going to use this to house our sensors and the Master Brick. Drill holes in the front and sides to allow airflow (if the holes are big enough for birds to fit through, use gauze or chicken wire to prevent this), and paint it white to reflect heat. You also need to drill a hole in the back to feed through cables.





of a Wi-Fi router, unless you're able to connect it directly to a wired network. The bird box containing your sensors must be outside in a position where it isn't exposed to direct sunlight at any time, since this would affect the temperature readings. It should be sited around 4ft off the ground and positioned so that there's reasonable airflow around it.

The Pi itself will need to be protected from the rain. One option is to attach the bird box to the outside of a house, school building or garden shed with the Pi inside. You can try housing the Raspberry Pi in a weatherproof box (don't put it in the bird box), but you'll need to think about how you will provide it with power.

SETTING UP THE PI AND BRICKS

Our development process will involve using the Raspberry Pi in the normal way, connected to a monitor, keyboard and mouse. Once we know everything is working, we'll move it to its final position and log in to

it remotely. Prepare your sensors by connecting the USB cable to the Master Brick, then connect the sensors to the brick - don't plug these into the Pi yet (you can get further instructions from TinkerForge). Boot into the desktop.

We'll now set up the driver that allows the Raspberry Pi to communicate with the Brick - the Brick Daemon - and a utility called the Brick Viewer, which allows us to see the status and readings from the Brick and its sensors.

Begin by starting LXTerminal and typing the following:

```
sudo apt-get install python-
twisted
python-gudev libusb-1.0-0
```

This will install the relevant libraries. Then, type the following two lines to get the latest version of the Brick Daemon from the TinkerForge website and extract and install the driver:

```
wget http://download.tinkerforge.
```

▲ We'll use a standard bird nesting box to house our sensors and the Master Brick

BUY THE BOOK!

This feature is adapted from the MagBook Raspberry Pi for beginners, available now online at: <http://tinyurl.com/prv8jak>. It guides you through your first steps in setting up the Raspberry Pi and programming for it in Python.



```
com/
tools/brickd/linux/brickd_linux_
latest_
armhf.deb
sudo dpkg -i brickd_linux_latest_
armhf.
deb
```

Once the Daemon is installed, return to LXTerminal and type the following:

```
cd /home/pi
sudo apt-get install python
python-qt4
python-qt4-gi python-qt5-qt4
python-
opengl
wget http://download.tinkerforge.
com/
tools/brickv/linux/brickv_linux_
latest.
deb
sudo dpkg -i brickv_linux_latest.
deb
```

Shut down the Pi, plug the Master Brick into the computer's USB port and start it up again. You can then launch Brick Viewer (it's in the folder called Other) and click the Connect button. After a couple of seconds, the Master Brick and Bricklets will appear. Click the tab for the temperature sensor and you'll see the reading it's reporting.

Before we go any further, we can make life easier for ourselves by installing Python's Setup Tools library. This will make it simple to install the additional Python tools we need to communicate with our various Bricklets. To install the library, go to <http://tinyurl.com/otnh4ay> and download the appropriate version for your system. Once this has been downloaded, return to LXTerminal and then type:

```
sudo sh
setuptools-0.6c11-py2.7.egg
```

Replace the setuptools version with the name of the file you've actually

downloaded (the above line is for a Pi running Python 2.7). An egg file is the Python equivalent of a standard Linux package. It contains all the necessary files, as well as setup information that ensures the package is properly installed into the operating system.

Once this process is complete, we'll have access to a new command, `easy_install`, which we can use to set up Python tools with one line.

CODING THE BASIC APP

We've now set up a working connection between our sensors and the Raspberry Pi. The next step is to make them programmable through Python. To do this, we need to install the language bindings - a code library that forms a bridge between the Bricks and our application.

To begin, go to <http://tinyurl.com/mxw8omx> and download the

Python bindings. Right-click the file and extract the contents to `home/pi/tinkerforge`. We now need to set up the library so that Python knows where to find it. Open a terminal and type the following:

```
cd tinkerforge
sudo easy_install tinkerforge.egg
```

The first line moves the terminal into the TinkerForge folder; the second one uses `easy_install` to set up the libraries. We can now use "import tinkerforge" in Python code we write.

Once our program is up and running, we want our code to take periodic readings and save them in a form we can use. If we also intended our code to process our measurements into charts and tables, we'd probably choose SQLite as the method for saving data, since it lets us retrieve the results

using sophisticated database queries.

However, it's much simpler to use a spreadsheet application such as Microsoft Excel or Google Drive to analyse and graph data. So, we're going to output our data in CSV format, which can be read by all spreadsheet programs. It's a simple format - effectively it's a text file, which, in our case, will contain each set of measurements on its own row.

Since we want to make repeated measurements, our main structure will be a loop, exactly as in a game, except that we'll want the code to loop much more slowly - we've chosen to capture a weather reading every 15 minutes. You can, of course, simply pick a different interval.

GETTING CONNECTED

Each TinkerForge sensor has its own unique ID (UID), which allows you to have more than one of the same sensor type connected at once. For example, you may want to measure the temperature both inside and outside a building. The easiest way to find out the UID of a sensor is to start up the Brick Viewer and click the tab representing each one; you'll see the identifier listed here.

Once you have the IDs, it's time to start coding; we'll use the Geany development environment to do this. If Geany isn't on your Pi already, you can install it by going to LXTerminal and entering the following line:

```
sudo apt-get install geany
```

Once Geany is up and running, create a new file in it called `MAIN.PY`, then you're ready to go. On these pages, we'll walk you through the process of how the code was created, and you can download a ZIP file containing the complete code for this project from <http://tinyurl.com/mxw8omx> (note that this code includes some extra functions that we'll be covering next month).

For now, we'll start by entering the import statements we need into Geany (see *Reading the sensors*, lines 1-13, below). Once again, we import Pygame to handle keyboard events, plus the CSV module to save our spreadsheet file. We then set up a number of variables including the UIDs for each of the sensors. Finally, we import four TinkerForge libraries: the first is the code for connecting to the Master Brick; the remaining lines import libraries for each of the sensors we're using in this project.

For testing purposes, we'll write a loop that senses every two seconds

READING THE SENSORS

```
1 import pygame, csv
2
3 HOST="localhost"
4 PORT=4223
5
6 AMBIENT_UID="am9"
7 TEMP_UID="bPb"
8 BARO_UID="bMW"
9
10 from tinkerforge.ip_connection import IPConnection
11 from tinkerforge.bricklet_barometer import Barometer
12 from tinkerforge.bricklet_temperature import Temperature
13 from tinkerforge.bricklet_ambient_light import AmbientLight
14
15 def main():
16     ipcon=IPConnection()
17     barometer=Barometer(BARO_UID,ipcon)
18     temp_sensor=Temperature(TEMP_UID, ipcon)
19     light_sensor=AmbientLight(AMBIENT_UID,ipcon)
20
21     ipcon.connect(HOST,PORT) #connect to the master brick
22     pygame.init()
23     clock=pygame.time.Clock()
24
25     end_prog=False
26
27     while end_prog==False:
28         for event in pygame.event.get():
29             if event.type==pygame.KEYDOWN:
30                 if event.key==pygame.K_ESCAPE:
31                     end_prog=True
32
33             air_pressure=barometer.get_air_pressure()/1000
34             temperature=temp_sensor.get_temperature()/100.0
35             light_level=light_sensor.get_illuminance()/10.0
36
37             print('Air pressure: '+str(air_pressure)+' mbar')
38             print('Temperature: '+str(temperature)+'C')
39             print('Illuminance: '+str(light_level)+' Lux')
40
41     pygame.time.wait(2000)
```


(see Reading the sensors, lines 15-41, below); waiting 15 minutes to see if our code is working is clearly daft.

It begins by creating variables based on the IPConnection object, plus one variable for each sensor. We then make the connection to the Master Brick and set up a loop that keeps cycling until we press the Escape key.

Lines 33-35 read the measurements from the sensors and convert them to the standard form: millibars for air pressure; degrees Celsius for temperature; and lux for light. Finally, we output the values. Give it a go - you should see the current readings appear in the terminal every couple of seconds.

SAVING TO A SPREADSHEET

For our project, we'll need to keep track of dates and times of day; these are complicated parameters for computers to handle. Thanks to the ancient Babylonians, our time-measurement system is based on the number 60, which isn't exactly computer-friendly. Also, since the Earth takes approximately 365.25 days to orbit the Sun, we need to account for leap years. A final complication is the fact that the same point in time represents different times of day in different locations - and those times vary throughout the year. In the UK, we use Greenwich Mean Time (GMT) in the winter and British Summer Time (GMT+1) in the summer.

What our project requires is a standard, accurate way of recording when measurements were made. For example, we may want to compare the time of sunrise throughout the year; if we stick to local time, this will appear to spring forward by an hour in March and fall back in October.

The best approach is to use GMT (or its international equivalent, Co-ordinated Universal Time, abbreviated to UTC) throughout the year and add an extra column to our data that records how many hours to add or deduct to arrive at the local time.

Fortunately, Python provides libraries to help with managing time. We need to add the following lines to the top of the code (see *Saving to a spreadsheet*, lines 3-4, right):

```
from datetime import datetime
import pytz
```

The second of these modules, pytz, adds time-zone information to make it easy to work out how many hours to add. Building on this, we can create a module called get_formatted_time

SAVING TO A SPREADSHEET

```
1 import pygame, csv, os
2 from pygame.locals import *
3 from datetime import datetime
4 import pytz
5
6 HOST="localhost"
7 PORT=4223
8
9 AMBIENT_UID="am9"
10 TEMP_UID="bPb"
11 BARO_UID="bMW"
12 OUTPUT_FILE="climate_data.csv"
13
14 from tinkerforge.ip_connection import IPConnection
15 from tinkerforge.bricklet_barometer import Barometer
16 from tinkerforge.bricklet_temperature import Temperature
17 from tinkerforge.bricklet_ambient_light import AmbientLight
18
19 def save_csv(line):
20     csv_file=open(OUTPUT_FILE,'a+')
21     writer=csv.writer(csv_file)
22     writer.writerow(line)
23     csv_file.close()
24
25 def get_formatted_time():
26     GMT=pytz.timezone('Europe/London')
27     utc_time=datetime.now()
28     the_time={}
29     gmt_time=GMT.localize(utc_time)
30     the_time['date']=gmt_time.strftime('%d/%m/%y')
31     the_time['time']=gmt_time.strftime('%H:%M:%S')
32     the_time['zone']=gmt_time.strftime('%z')
33     return the_time
34
35 def main():
36     ipcon=IPConnection()
37     barometer=Barometer(BARO_UID,ipcon)
38     temp_sensor=Temperature(TEMP_UID, ipcon)
39     light_sensor=AmbientLight(AMBIENT_UID,ipcon)
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46
47     while end_prog==False:
48         for event in pygame.event.get():
49             if event.type==pygame.KEYDOWN:
50                 if event.key==pygame.K_ESCAPE:
51                     end_prog=True
52
53         air_pressure=barometer.get_air_pressure()/1000
54         temperature=temp_sensor.get_temperature()/100.0
55         light_level=light_sensor.get_illuminance()/10.0
56
57         time_info=get_formatted_time()
58
59         this_row=(time_info['date'],time_info['time'],time_info
60 ['zone'],temperature, air_pressure,light_level)
61         save_csv(this_row)
62         pygame.time.wait(2000)
```



that returns the current time in the format we want.

We begin by defining a time zone using `pytz`'s built-in definitions and calling it GMT. We then retrieve the current UTC time using the `now()` method of `datetime` before using `localize` to return the GMT equivalent (see *Saving to a spreadsheet*, lines 25-29, right):

```
def get_formatted_time():
    GMT=pytz.
    timezone('Europe/
    London')
    utc_time=datetime.now()
    the_time={}
    gmt_time=GMT.
    localize(utc_time)
```

Once this is done, we create a date in the format `dd/mm/yy`, using the string-format conventions common to most programming languages. We then do the same for the time, and store the current zone offset. In the summer, this will be a 1, since the UK time will be one hour ahead of UTC. Finally, we return these values to the calling function in the form of a dictionary with date, time and zone entries (see *Saving to a spreadsheet*, lines 30-33):

```
the_time['date']=gmt_time.
strftime
('%d/%m/%y')
the_time['time']=gmt_time.
strftime
('%H:%M:%S')
the_time['zone']=gmt_time.
strftime('%z')
return the_time
```

Back in the main loop, we can now remove the temporary print statements that write temperature, pressure and illuminance values to the screen. We'll replace them with a call to our new `get_formatted_time` function and assemble a new list object that contains the information returned

▲ The TinkerForge system consists of controllers ("Bricks") and sensors ("Bricklets")

from this function (see *Saving to a spreadsheet*, lines 53-60, p61):

```
air_pressure=barometer.get_air_
pressure
()/1000
temperature=temp_sensor.get_
temperature
()/100.0
light_level=light_sensor.get_
illuminance
()/10.0

time_info=get_formatted_time()
```

```
this_row=(time_info['date'],time_
info
['time'],timeinfo['zone'],tempera
ture,
air_pressure,light_level)
```

Our new object will contain a list such as "06/12/2013,10:30:16,0.675,1027.594.3". Now, all we need to do is save this information to a CSV file. We'll implement this by creating a new function, as follows, that we'll place before our main loop (see *Saving to a spreadsheet*, lines 19-23):

```
def save_csv(line):
    csv_file=open(OUTPUT_
    FILE,'a+')
    writer=csv.writer(csv_
    file)
    writer.writerow(line)
    csv_file.close()
```

You may notice that this code refers to a new constant, `OUTPUT_FILE`, which holds the name we're giving to this file: we'll need to declare this at the start of the program and set its value; we've chosen "climate_data.csv" (see *Saving to a spreadsheet*, line 12).

The function starts by opening the named file; it will be created if it doesn't exist already. The parameter `a+` tells Python that we want to append this measurement to the end of the file. We

“Even when we slow the loop to run every 15 minutes, we'll still generate a lot of data”

then create a new CSV object, drawing on the CSV library we imported at the start of the code, then use the CSV library's `writerow` function to save the measurements to the CSV file as a single line. Finally, close the file.

If you run this version of the program, you should notice the CSV file being created, and lines being added every two seconds. When you end the

program and open the CSV file in your spreadsheet program, you'll see that several rows have appeared. To see how the completed code should look, see *Saving to a spreadsheet*.

ADDING A SUMMARY

Even when we deploy our weather station for real, and slow the loop to run every 15 minutes (which we'll do by increasing the interval in `pygame.time.wait` to 900,000ms), we'll still generate a lot of data over time.

For most purposes, this is good. If we want to see if there's a correlation between light levels and temperature, for example, having plenty of data to analyse from any particular day is also very helpful.

However, if you wanted to examine the link between average temperature and air pressure over a month or more, it would be more convenient to have the data summarised and organised by date. Fortunately, the work involved in saving a second set of data is minimal: all we need to do is tot up the day's readings and save them once a day.

We'll do this by creating a class called `Today`. It will live in a separate file on disk called `today.py`, which we can call from our main module at the appropriate time. This class has three variables (also called properties) that keep running totals of the temperature, air pressure and light levels. Every time measurements are made, we tell `Today` to update its totals and check whether the day has finished by calling a new function called `update` (see *The Today class*).

The first thing our function does is work out whether the day has ended. This is simple: all we do is pass the current day number to the function and check whether it equals the one stored by `Today` (see *The Today class*, lines 10-13). For example, if we took a reading at 11.50pm on 21 July, `today._day` would have a value of 21 and the value of day passed by the main loop would also be 21. Fifteen minutes later, the day value in the main loop would have increased to 22, as it would now be 22 July. When day was compared with `today._day`, the two would now be unequal, so we'd set `newday` to `True`. This triggers a call to a function called `summarise`, to which we send the final set of measurements.

If it isn't a new day, we add the current measurements to the lists, then save them using Python's pickle module (see *The Today class*, lines 15-19); if we didn't do this and the program was stopped at any point during the day, all the previous

measurements would be lost.

If it is a new day, our variables are cleared – and the latest set of measurements is added to the new lists (see *The Today class*, lines 21–28).

Once we've read the pickle data

into the lists, we want our summary to include minimum and maximum temperatures for the day, along with the average temperature. We do the same with average pressure, and also report the maximum light level

(see *The Today class*, lines 30–39).

We don't report the minimum light level, since that will always be zero at night – although if you wanted to do so, you could create an extra function to calculate the average light level during a particular period of the day.

You can see that, since we've stored each set of measurements in a list, we can use Python's built-in functions to make finding the maximum and minimum easy. Once all the desired values have been calculated, we write them out into a new list object called `summary` and return this (see *The Today class*, lines 40–42).

Now, we simply need to insert three lines into our main loop, immediately before the `save_csv(this_row)` statement, to trigger the required update:

```
newday=today.update(time_
info['date'],
this_row)
if newday<False:
    save_summary(newday)
```

The variable `newday` is a little chameleonic in this section of code: if we simply updated the current day's running totals, the value of `newday` would be `False`; if midnight had just passed, it would be a list. In the latter case, we'd then trigger the new `save_summary` function (see *The Today class*, lines 44–58) from the main module, which does just what you'd assume.

If our summary file doesn't already exist, the first part of the function creates it and writes a header row. This is a matter of convenience, since there will be quite a few values written to this summary, and it wouldn't necessarily be obvious what each one represents. The function then writes the summary data line. In this case, we use the "w" parameter for opening the file. This is because we're writing a new file rather than appending an existing one.

If the file exists, the `else` branch of the code saves the additional row in exactly the same way as the 15-minute measurements are handled. ■

THE TODAY CLASS

```
1 class Today:
2     def __init__(self):
3         self._temp=[]
4         self._lux=[]
5         self._pressure=[]
6
7     def update(self,day,row):
8         newday=False
9
10        if day<>self._day:
11            self._day=day
12            daysummary=self.summarise(row[0])
13            newday=True
14
15        else:
16            self._temp.append(row[3])
17            self._lux.append(row[5])
18            self._pressure.append(row[4])
19            self.pickle_data()
20
21        if newday==True:
22            self.clear_values(day)
23            self._temp.append(row[3])
24            self._lux.append(row[5])
25            self._pressure.append(row[4])
26            return daysummary
27        else:
28            return newday
29
30    def summarise(self,date):
31        self.unpickle_data()
32        maxtemp=max(self._temp)
33        mintemp=min(self._temp)
34        avgtemp=int(sum(self._temp)/len(self._temp)*100)
35        avgtemp=avgtemp/100.00
36        maxpressure=max(self._pressure)
37        minpressure=min(self._pressure)
38        avgpressure=sum(self._pressure)//len(self._pressure)
39        maxlux=max(self._lux)
40        summary=(date,maxtemp,mintemp,avgtemp,maxpressure,
41 minpressure,avgpressure,maxlux)
42        return summary
43
44    def save_summary(thedata):
45        summary_file="climate_summary"+" .csv"
46
47        if os.path.exists(summary_file)==False:
48            csv_file=open(summary_file,'w')
49            writer=csv.writer(csv_file)
50            writer.writerow(('Date','MaxTemp','MinTemp','AvgTemp','Max
51 Pressure','MinPressure','AvgPressure','Max Light'))
52            writer.writerow(thedata)
53        else:
54            csv_file=open(summary_file,'a+')
55            writer=csv.writer(csv_file)
56            writer.writerow(thedata)
57
58        csv_file.close()
```

NEXT MONTH

This concludes the main code for setting up your weather station. Next month, we'll look at setting up your weather station for remote access, so you can control it wirelessly using TightVNC, and pick up data via Dropbox.

HOW TO: Choose the best cooling solution for your PC

COOLING ISN'T QUITE SO IMPORTANT TO YOUR COMPUTING AS IT USED TO BE, BUT IT CAN STILL MAKE ALL THE DIFFERENCE WITH A FEW CLEVER TWEAKS. **DAVID HOLLINGWORTH** EXPLAINS HOW.

Here's a not uncommon usage scenario for PC cooling: you have relatively powerful PC - whether for gaming, video editing, or just because you have a love for raw computing power, it doesn't really matter. But, you have a modern, high-end video card, an overclocked CPU, and an array of hard drives. There are fans - it's all installed in an open case that errs toward airflow over sound management - but, we also all live approximately 23 kilometers from the face of the sun.

I mean, oops, Australia.

As it happens, I'm talking about my own PC, but I'm sure it describes a lot of other machines out there. And my problem? Heat - but not in the way you'd expect.

Basically my machine lives under my desk, upstairs. It's up against a wall, in the corner, so is closed in on three sides which means that even though the machine itself is well vented and cooled, it means my legs are not. In summer, it can get pretty nasty in that room.

This not only shows that I really need to re-think my cooling setup,

but also that cooling a PC is about more than what's happening inside the case.

BEST CASE SCENARIO

Once upon a time keeping performance machines cool was quite the art, but these days advances in chip design have dropped hardware temperatures considerably. Even high-end gaming rigs are pretty easy to keep running

“...the first step in any cooling is to be aware of what your hardware is capable of.”

smoothly these days.

That said, a number of factors can come in to play to raise the internal temperature of your PC. More than a couple of hard drives can raise temperatures, and when you move into multiple video card territory in a PC build, that too can increase internal temps. It's also a truism that the more hardware you have installed, the more cables and clutter you're going to have inside your

case, and this too can get in the way of airflow.

It doesn't take a lot, then, to make your average PC case with only two or three smaller fans start to struggle as you add more parts. So the first step in any cooling arrangement is to be aware of what your hardware is capable of, and choosing the best case - and fans - for the job.

Fan size is important here, as it impacts case design in a couple of interesting ways. First up, the smaller the fan, the faster it has to spin to push air into the case, and the louder it's going to be. On the upside, being smaller, it's going to be less intrusive visually. Larger fans, however, can move slower and still push more air, thus making less noise. However, they do need larger in- or outtakes, so you end up with a completely different aesthetic.

That's what influences the design of a lot of gaming cases. They're designed for airflow first, and the kind of aggressive styling a lot of them boast is predicated on those large, obvious intakes.

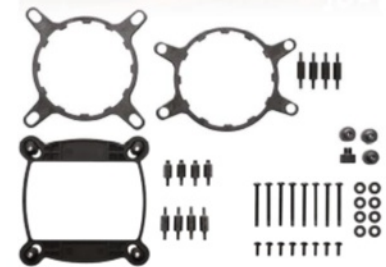
And because of those larger

◀ Nowadays water cooling is simpler and safer. The Corsair H105 is a self-contained unit which is as easy to install as a regular heat sink fan





◀ Modular water cooling don't take up nearly as much room as they used to



▲ Quality water cooling kits should include all the connecting adaptors compatible with modern systems

A lot of PC builders are still a little leery of liquid cooling, but there's no need to be. Installing one is really not that different to installing any other CPU cooler. The only thing to be aware of is having room for the radiator assembly - this typically goes on a case's upper, internal, surface, where it can safely vent heat out of the case. And with less bulk in the case's center, you also get a boost to any fan-based airflow, which in turn has one less component to worry about, making your case's cooling more efficient across the board. With all that in train, you may not even need to be too picky about where your case sits, like in our own setup.

You'll probably still need to worry about that stupid Australian summer, though. Sadly, that's out of our control. ■

intakes, and the because there are many higher-end chassis that come complete with lots of open grills and mesh panels, the sound issue becomes a problem even then, as the smaller, internal fans on items like CPUs and video cards become that much more audible. It's a balancing act where one action in one direction can greatly throw out performance in another.

BUILDING A BETTER PC

When you're putting all your new parts together, or even just upgrading, working out how to install kit without impeding airflow is paramount. A lot of cases, for instance, talk up front fans which blow air over their hard drive cages, but if you have a few drives, this can not only impede airflow for the rest of the internals, but it could be heating up the air that does get in. If you've the option to move those front fans around to the side (modern HDDs are already engineered with a lot of built in heat management), they'll be able to introduce cool air straight onto your CPU and video card, for instance.

Managing cables is also going to make a difference. Lots of random power cables or connectors will also impede airflow, but they'll also gather dust - which is bad for a whole tonne of reasons - and create turbulence, which can in turn make the extraction fans on the rear or top of your case run louder. Tuck everything away behind the motherboard for the best cooling.

GOING ONE BETTER

You can also take matters even further into your own hands by adding whole other cooling systems into your case. You can add more

fans - many cases allow you to at least triple your fan count - but more fans can make for more noise.

You can also replace some of those smaller fans by ditching the stock cooler on your CPU and going for something with a larger heatsink and fan combination, but that too is not always an option, especially in smaller cases.

One of the best choices, though, if you want to cool your system is

“One action in one direction can greatly throw out performance in another.”

to get into liquid cooling. Once the domain of dedicated overclocking enthusiasts, who would handpick individual components like tubing, radiators, and heatsinks, all-in-one cooling kits are now quite common. Corsair's recent H105, in its Hydro series, is a perfect case in point, offering a complete closed loop system capable of cooling your CPU better than any fan.



▲ Cooling block goes on CPU, radiator attaches to the rear of the case. Job done.



The best reason to buy an iPad

Your favourite technology magazine now has an iPad edition featuring everything you love in the magazine plus exclusive extras each month including additional photography and video. Change the way you view your tech. Head to iTunes now to download the app.

Small steps into handling Big Data

STEVE CASSIDY LOOKS AT THE CHALLENGE OF HANDLING BIG DATA ON YOUR NETWORK, AND INVESTIGATES AN UNUSUAL PROBLEM ON A NAS SYSTEM

It's hard not to run into Big Data when running any kind of network these days. Either you're scared by the prospect of having to support it, or you're drowning in it from your own devices. According to HP - in a presentation during their Discover conference - Big Data is far more about machine-generated records (HP especially likes smartphones, which should satisfy the most paranoid reader) than it is about well-behaved, cleanly expressed corporate data stores and records.

Before you start to write me that disgusted email, no, this isn't a stealthy way of converting my Networks column into a Database column. It's merely a sober appraisal of what we can expect to be hit by as the Big Data juggernaut revs up to full speed - along with some neat experiments you can perform before the tsunami actually hits the beach (to thoroughly mix the metaphor). This way, you'll at least be familiar with the basic ideas once the buzzwords start flying thick and fast.

Thinking up appropriate experiments is an ingrained habit for me, a product of the moderately far-off days of my economics course. Almost all economists start off their case studies from the assumption that "you have \$100", in order to make the effect of this or that market force as clear as possible. In networks, especially when it comes to managing internet access and monitoring a firewall, there's no simple equivalent to this \$100 case study. There's no handy site named "www.thisisnotpornreally.com" that nonetheless trips the content filter on your unified security device. Setting up to record Big Data from all the website accesses that pass through your firewall is a baptism of fire, a fat hosepipe of data that gushes relentlessly into whatever unfortunate syslog server and repository you have managed to cobble together.

Incidentally, before I go any further with this simple example, please note that when mega-corporations talk about this vast and unending recording of the sum of human

The fat hosepipe of data will gush relentlessly into your unfortunate syslog server

activity through their phone networks and web-surfing stats, they're usually talking about syslog formatted files. Syslog has become the ubiquitous logging format, one of those quietly maintained open formats that everyone finds it in their interest to use, as both generators and analysers of log data from an Internet of Things. So my little example really does scale, in all likelihood, right up to NSA level, and can give you a peek into just what they might be able - and might not be able - to do using basic, known tools and techniques.

Anyway, back to the simple example setup. My suggested scenario requires a set of parts and a policy decision to really work - although of course, if you're trying this on your own home network, the policy decision meeting will be pleasingly short. You'll need a firewall or router that can emit syslog (most of them do, although it may take a bit of digging to find the right config setting and establish that it's actually running). Then you need a syslog server, which is a fairly simple and lightweight utility program that mercifully hasn't yet been seized upon by the griefware developers. The go-to resource for Windows users

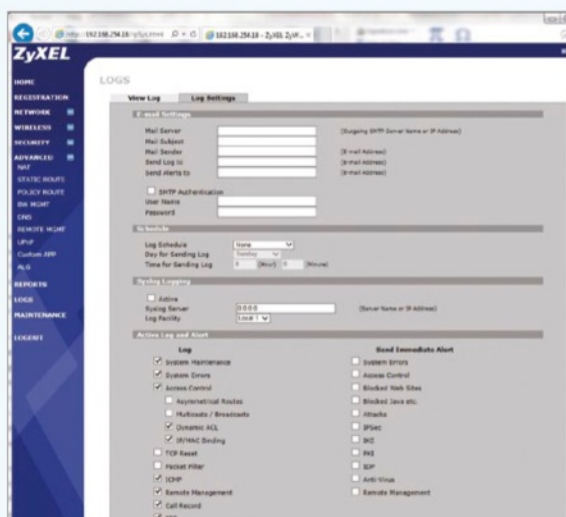


▲ The Dell Precision 690 makes an excellent NAS box

investigating syslog is the SolarWinds Kiwi Syslog Server at <http://www.kiwisyslog.com/>. Of course, Linux types have various in-built OS components that will do this job, but if you're capable of getting one of these working then you probably won't need me to explain what can be done with it.

Kiwi is a very lightweight program - deceptively so, given that it's capable of receiving hundreds of megabytes of log entries per hour - and it doesn't need much more than a laptop to run on. You will have to RTFM about how to open the relevant traffic ports on the machine firewall, though. Do keep some disk space free, too: even the smallest businesses can generate





megabytes of syslog per day from a firewall or router logging internet-address accesses; some will manage that much per hour.

As the best TV chefs say, leave this cooking overnight and take a look in the morning; you'll then discover just how incomprehensible the stream of raw data from a syslog device can be. Each line for each access contains everything you want to know - who; which machine; which website; what time and date; how much data. You can (maybe) load it all into Excel and flip it around using PivotTables to find the view you need, but you'll see an awful lot of the hourglass cursor - or the Hula Hoop of Doom in recent versions - when you try to import and play with even the smallest of syslog files.

What you need to make sense of almost any subtype of syslog file is a dedicated utility such as Sawmill, which you'll find at www.sawmill.net. At first glance, it may look as though its authors are most interested in web server logs, but don't worry - device logs use the same format. When discussing the immense torrent of machine-generated data pouring out of every device under the sun - from your washing machine to your car, your phone and your smart TV - I'll be emphasising over and over again that these all employ existing web-style standards for the kind of information they present and the format they present it in. Any single tool that manipulates this stuff and comes preloaded with the more common types of report will be a big winner in the next few years.

Incidentally, I already know which report is most popular for small businesses to run when examining their internet traffic during their Sawmill trial download period. It's

▲ Most firewalls and routers can keep logs in the appropriate format

called "Top ten internet sites sorted by amount of data exchanged", and it frequently prompts an outbreak of red-faced shouting when presented to the boss, since it shows him how much time is being wasted and on what.

Just to focus your mind on the scale of the problem, it won't be long after you start playing with Sawmill that you'll discover quite how large a machine you need in order to store the database Sawmill employs to ingest plain-text log files and render them sortable and searchable. The storage needed escalates rapidly as the logs become bigger, and as the span of the questions you want to ask of the resource becomes ever greater. This is only one of the increasing swarm of signals telling you that the basic skill most desperately needed in this fast-changing IT business is the skill of handling, maintaining and distilling some sense out of this never-ending, high-pressure hosepipe of data.

AN IMPROPER COMPARISON

There are some server and network tasks that are quite exciting while you're actually doing them, but which sound as dull as ditchwater once you try to write a blow-by-blow account. Sometimes, however, it's the other way around: it's easy to describe how, when a server ran out of sharing resources, we upgraded it - but the reality contained much more drama than such a crisp description suggests.

On this occasion, my client had a very large, very simple NAS system, running as an iSCSI disk device on Windows Server 2008 R2. It had 8TB of disk, presented as a single RAIDed volume of around 6TB after redundancy was taken into account. It had been put together in a bit of a rush, since their original file server was munching steadily through all the disks we'd put aside as spares, and no matching new replacements were going to do the job. I know that hardcore server guys will be frowning in puzzlement at that, so here's the explanation: even though the onboard RAID controller would recognise new replacement drives with different geometries and sizes, it wouldn't use them as warm spares for the live array.

The prospect of a lost weekend was looming, to be spent pulling the data off those drives and composing an all-new array to put it all back onto. Instead of that boring prospect, we put up the iSCSI NAS box, running the 32-bit version of FreeNAS, on a

solid, large Dell Precision 690 deskside workstation. With four disk bays and a fast motherboard, this machine makes an excellent NAS box for a fraction of the price you'd pay for even an unpopulated dedicated NAS device these days. The data was then moved across to this box on a permanent rather than temporary basis, and after a bit of hacking about to divert iSCSI traffic through the secondary LAN card on the server, it ran that way very happily for almost a year.

iSCSI in Windows is a very resilient protocol. Unplug a lead, move a switch, reboot either end of the two-machine partnership - and it will just keep on reconnecting. Crucially, the horrible performance deficit that commonly afflicts bottom-end NAS hardware in small Windows networks is swept away - the Windows server does all the heavy lifting, and the iSCSI volume just talks to the single publishing server, living a quiet and highly compatible life. At least, that's the idea.

In this case, users started to find their files had jumped back a few versions, in between one open/save cycle and the next. This was disturbing, to say the least. The reason was more disturbing still. Their files were being presented via Windows Distributed File System (DFS), which holds many copies on many servers, and accesses whichever machine is fastest at the time of request. This always seemed to be the iSCSI server, so when it started taking itself offline, they'd suddenly (and without any error message or warning from the kit) be directed to a different DFS node, which had unaccountably not replicated the changed files for 24 or 48 hours or longer.

Further investigation produced a sinking feeling. The first and most obvious symptom was that the FreeNAS machine would be locked up solid, the (usually incomprehensible) FreeBSD monitor gasping "PANIC: memory full" with its last breaths. Rebooting would always bring everything back in surprisingly good order, but this could take anywhere from 20 to 30 minutes, since all these *NIX clones are inclined to trip off a low-level disk check when they think they've had an unexpected shutdown. As messages go, PANIC is a pretty unambiguous one - while this machine had 10GB of physical memory, the 32-bit installation of FreeNAS was only ever able to use 3.3GB of it. The fix for this was easy to describe, but difficult to implement without using a second physical machine; one would prefer not to erase



STEVE CASSIDY
Steve mixes network technologies with human resources consultancy work

that 8TB array by accident during a routine update.

The second symptom was that the DFS setup on the server had grown both insanely vast (almost half a terabyte may not be big in disk terms nowadays, but a million files certainly is) and completely detuned. DFS shares on servers like to keep staging areas – separate folders, ideally on separate disks, where open files can be held before replication to other nodes or writing back to the principal store. By default, the DFS staging area isn't put onto a separate disk (because the installer can't tell how your machine is laid out), and its size is set to a maximum of 4GB. Microsoft is reluctant to admit this is a bad choice, but various documents on the limits of DFS are reasonably clear that beyond a few hundred GB, it will probably prove to be inadequate.

DISK THRASHING

Lastly, there was something a trifle peculiar about the way the iSCSI conversation was happening across the LAN. For comparison, I can get a Netgear professional-grade NAS device to talk to my PCs at home at above 80MB/sec, but this box was happier trundling at around 24-25MB/sec. A little research into the way FreeNAS and OpenBSD (the basic OS lying beneath the FreeNAS veneer) handle Gigabit Ethernet flow control suggested that the switch being used in this system might be fibbing a bit during auto-negotiate.

That already makes three equally uncomfortable reasons why this iSCSI was crashing so badly, and an extra one quickly popped up – among that half-terabyte of files, quite a number were being opened in “database mode”, a woolly jargon term that means



opening something rather like an Excel sheet but leaving it on the disk instead of loading it entirely into memory. Hence “database mode” files produce a lot of round trips on and off the disk.

In case you think I'm being cruel to a well-regarded piece of free software, I should also say that the circumstances surrounding the shared data weren't entirely without blame. Almost a terabyte of data, all on a single, shared drive letter, were being hit by a ragtag group of PCs – some well controlled, others merrily hatching THUMBS.DB files wherever they came to rest. Several unexplored corners of a huge dataset turned out to contain almost 20% by space – and almost 40% by number of files – of the overall terabyte, held in files left over from a 2007 upgrade that didn't go according to plan.

Even when merely chopping out that 20% (and yes, I'm being non-specific here to protect the guilty), I was still looking at a huge copy operation that could at any moment have provoked another PANIC. The only bright side at the start of the weekend was that the newly built target iSCSI machine appeared to be performing rather well – and here's where the comparison kicks in. This was another Precision 690, so old that its memory had been scraped together by dumpster-diving into the dead server pile in the client's storeroom. However, it was presenting a matching set of four drives and also using the up-to-date, 64-bit version of FreeNAS. Its disks were formatted using the

new ZFS file system. All I really cared about was that it was a newer system a bit more resource-hungry but quite likely to be faster. And so it proved to ultimately be.

That ~25MB/sec speed limit on the old implementation appeared to be caused by a buried part of the software stack, because we could now run several ~25MB/sec streams of file copy from the old server up to the Windows host, then down to the new ZFS-formatted iSCSI target, all at the same time. Given what I've said about their baroque, many-layers-deep, badly abused and decade-old file structure being copied, you may think that this would lead to an appalling mishmash of interlaced copies; however, on this occasion I took advantage of the crash to split the former single labyrinth of folders up into four somewhat smaller labyrinths.

I'll fast-forward through the tedium that ensued, and only mention in passing the important matter of separating your iSCSI transport so that disk traffic doesn't share the same LAN card as user traffic. The final comparison speaks for itself. Remember this is a highly unusual situation in that the updated device is the same hardware that it's replacing: we had to put Post-it notes onto the two identical black cases to keep track of new and old. Out came Precision 690 with 8TB of disk, 10GB of RAM – only 3.3GB of which was used by 32-bit FreeNAS. In went Precision 690 with 8TB of disk, 12GB of RAM and 64-bit FreeNAS 9.1.1. Before: random crashes resulting from zero free memory.

After four distinct Windows shares instead of one, no crashes, and performance that occasionally showed speed bursts of anything up to 130MB/sec on very large files. Anyone still unsure about the benefits of 64-bit over 32-bit may want to ponder these revealing figures. ■

▼ A dedicated utility such as Sawmill will help you to make sense of syslog files



HEAVY METAL

Dell's Precision line of workstation PCs has a long history of providing seriously heavy metal.

The 690 was the start of four-core, multithreaded computing, and the line has continued through to machines able to deliver 12 cores and 128GB of RAM in the T7500 series. No wonder they're just as in demand for infrastructure projects as by CAD or architectural workers.

DVD CONTENTS

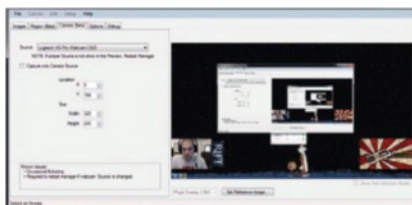
GAMES, ESSENTIALS, FULL SOFTWARE, DRIVERS & MORE!

Each issue, we aim to provide all *PC & Tech Authority* readers with a full suite of simple yet important applications, along with a variety of extended trials and full programs that are both useful and interesting.

This month we're focusing on gaming, offering a range of apps and utilities. You can record and share your best gaming session, and tweak your PC to get the most from your hardware – and maybe get a slight edge on the opposition.

And we have a demo of the great game *Blackguards*, a dark take on RPG tactical comeback that takes a look at some classic fantasy tropes from the side of the badguys!

We hope you enjoy the selection!



FFSplit

IT'S COMPLETELY FREE!

FFSPLIT is a freeware program that allows you to capture or record your desktop in different high quality video format.

Capture and Record

You can capture and record what is happening on your desktop. Stream it live or save it to your desktop to upload and share on your favorite websites.

Plenty of Features

There are plenty of features such as hotkeys, webcam and overlay for you to use to make your streams and videos more professional and unique.

Helpful Community

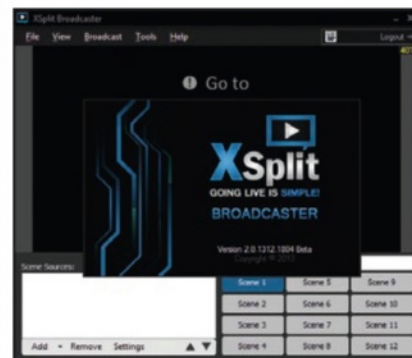
FFSPLIT is a growing community that has members continuously trying to improve the program and helping others use it.



OBS Open Broadcaster Software

Open Broadcaster Software is free and open source software for recording and live streaming. Source code is available to everyone to contribute and improve. Both 32 and 64 bit versions are available and it's absolutely free!

OBS has an API allowing developers to create their own unique plugins, giving them and others complete control of their streaming experience.



XSplit Broadcaster

XSplit Broadcaster is a desktop application designed to make your multimedia broadcasting and recording a lot easier and more fun to do. With its live output broadcasting feature, you can self-produce video broadcasts, conferences, distance learning courses, campus-wide newscasts, game broadcasts and more!

XSplit Broadcaster is free to use but users need to have an account.



GeForce Experience

KEEP DRIVERS UP TO DATE.

The GeForce Experience application automatically notifies you of new driver releases from NVIDIA. With a single click, you'll be able to update the driver directly, without leaving your desktop.

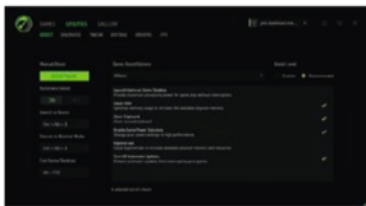
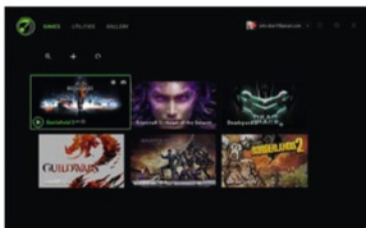
Auto-Optimise Your Games

GeForce Experience connects you to NVIDIA's cloud datacenter to download optimal game settings tailored to your PC, CPU, GPU and monitor. This means you

GAMERS

Your special
collection of
software and
utilities - share
and frag!

always get the best image quality while maintaining great performance. Plus, a built-in interactive screenshot viewer tells you about each setting and its benefit.

**Razer Game Booster**

Getting the absolute best performance out of your system and games isn't rocket science but it can sure be tough to figure out. In partnership with IObit, Razer Game Booster is your simple yet powerful solution.

All it takes is a click of a button, and it will automatically enhance the state of your system and focus all its resources purely for gaming, allowing you to zone in on your game the way it's supposed to be played without wasting time searching online for the best game settings or configurations.

Simplify the process of setting up your PC's performance by conveniently providing you with the option to Tweak, Defrag, or update any outdated drivers.

Don't know where to start to optimize your computer and gaming settings? Remove all the confusion with the "Tweak" tool, which will automatically analyze your PC and enhance all configurations for you.

If you want to decrease the load time of your games, try using the "Defrag" tool. Defrag will organize your game file folders and keep it organized to run more efficiently.

**DEMO: Blackguards**

What happens when the only hope of a threatened world lies not with heroes in shining armor, but is placed in the hands of a band of misfits and criminals? Blackguards, the new turn-based RPG by Daedalic Entertainment, explores this very question. The player takes on the role of a convicted murderer who must use the help of a team of more than questionable characters to save the world from a dark menace. Through this wild chase throughout the South of Aventuria, the world of The Dark Eye, there is more to fight than vicious creatures. Chapter by chapter you'll encounter a story full of intrigue and surprising twists.

**DVD CONTENTS**

WINDOWS • VLC Media Player • CCleaner • CutePDF Writer • Deep Burner • Defraggler • Foxit Reader • Apple iTunes • Malwarebytes Anti-Malware • Sandboxie • Songbird • Spybot Search & Destroy • Teracopy • WinRAR • WinZip • 7Zip • Avast Free Antivirus • AVG AntiVirus Free Edition 2011 • PC Tools AntiVirus Free **INTERNET** • AOL Instant Messenger • Vuze • Google Chrome • Dropbox • Feed Reader • Filezilla • Internet Explorer • Microsoft Security Essentials • Mozilla Firefox • Mozilla Thunderbird • Skype • Steam • ZoneAlarm **DRIVERS** • Realtek Audio Codecs • VIA Hyperion Drivers • Nvidia • Direct X • ATI • Broadcasting • FFsplit • OBS • XSplit **GAMES UTILITIES** • Razer Game Booster • Geforce Experience • XBOX360 Emulator for PS3 Controllers **GAME DEMO** Blackguards

INSTRUCTIONS: Open Windows Explorer, navigate to your DVD drive and double-click Index.html in the root directory. **DISC PROBLEMS:** To replace faulty DVDs, please send the discs to: PC&Tech Authority DVD Replacements, R50 Victoria St, McMahon's Point NSW 2060

Make sure to include your name and postal address on the back of the package so that we know where to send the replacements. For all other DVD related issues email cd@pcauthority.com.au. As the delivery platform only, PC&TA and Haymarket Media cannot and will not provide support for any of the software or data contained on these discs. Although all discs are virus scanned, Haymarket Media cannot accept any responsibility for any loss, damage or disruption to your data or computer system that may occur while using the discs, the programs or the data on them. There are no explicit or implied warranties for any of the software products on the discs. Use of these discs is strictly at your own risk.

Input Output



DAN RUTTER BRINGS THE ANSWERS TO YOUR QUESTIONS LIKE NO-ONE ELSE CAN

TARGETED KILLING

I At my work we've got some custom software that I won't identify because of possible trade-secret stuff, but let's just call it BlargForce.

BlargForce is not good software, and hangs several times a day, usually doing something weird to a database connection that makes everybody else's BlargForce freeze, but not actually crash, until the hung copy is forcibly killed in Task Manager.

This is tolerable (which is good because the people who made BlargForce do not appear to speak any human language), but it's occurred to me that it'd be nice if you didn't have to go to Task Manager, Processes, sort by name, find blargforce.exe, End Process, confirm, every time, which everybody in this office can now do by feel in their sleep.

Windows has a command-line process killer, right? Could you make a batch file that kills the BlargForce process number in one step? How do you find the right process number? Does it change whenever you run a new instance of BlargForce, or is it fixed for each program?

Henry Jönsson

O The standard command-line utility you're looking for is "taskkill", and it can indeed kill tasks by process ID (PID). You can display PIDs in Task Manager via View -> Select Columns. But that's the wrong way to go about it, because PIDs do indeed change when you run the same program again.

Fortunately, taskkill can also kill tasks by *name*, and the task name will always be the same for a given executable. So in your case you just need a text file called killzombie.bat (or whatever, all it needs is the .bat suffix to make it run as a batch file), that says

```
taskkill /IM blargforce.exe
```

...or whatever task name matches the actual program you want to kill. Note that if there are spaces in the task name, the name has to be enclosed in quotes.

OPEN-REGISTRY SURGERY

I I upgraded my computer recently after the CPU in my old one carked it, and I've plugged the C drive from the old computer into the new one and called it X, which has made it pretty easy to transfer settings from old programs and such.

I'm at a loss for my video playing software, though, Media Player Classic Home Cinema. The only setting I care about for that is the huge list of bookmarked unfinished video files I had, but there doesn't seem to be a config file anywhere that I can copy to the new computer's MPC-HC folder (or another folder in C:\Users or whatever) to get all of the bookmarks back.

Everything's on the same drive letters it was before, so a bookmark to "e:\somemovie.mkv, 76 minutes 8 seconds" would still work, but I don't know where MPC-HC KEEPS all of those bookmarks.

Do you know? How can I copy them over?

Chelsea Bayldon

O By default, MPC keeps its favorites settings in the registry. So to move them to the new computer, you have to extract them from the old computer's registry and insert them into the new. This is a mildly terrifying process - screw up your registry and you screw up your computer, though modern Windows versions should be able to roll back to a last-known-good operable state.

Registry editing is well within the capabilities of a careful home user, though, and it can be a lifesaver if something really important is lurking in the registry on the still-working hard drive of a deceased computer. This can actually be the case depressingly frequently, since a lot of dodgy software stores all sorts of important data in the registry, and many people (see above) have to use dodgy software to do their job.

In a situation like that you may think you've got everything backed up properly, but if the registry's huge

encoded Windows mystery files aren't backed up, then you actually don't. And even if the registry is backed up, you may have to do stuff like this to get the data back out if there's a major failure.

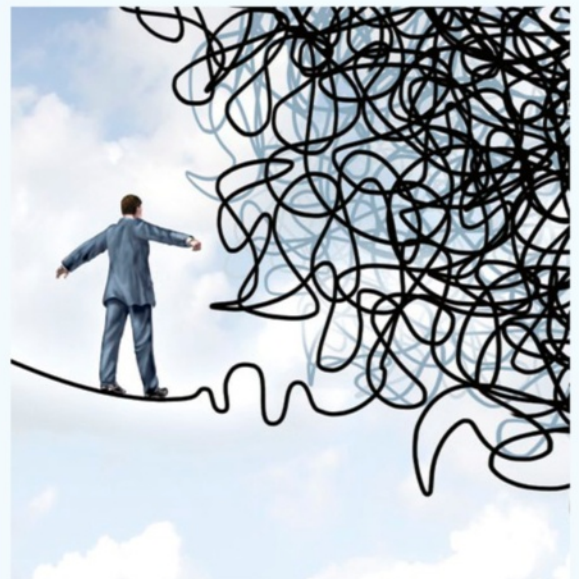
Aaaaanyway, here's how to solve this particular problem, with the same techniques you can use for other registry data transplants:

First, you need to run regedit.exe, and back up the whole registry by right-clicking "Computer", selecting "Export" and saving it wherever you want. If you screw up the registry, double-clicking that file and telling Windows that yes, you do want to copy its data to the registry, should rescue you.

Now, select HKEY_USERS and load the registry "hive" (File -> Load Hive) from the old computer. The hive you want will be a file called ntuser.dat in the subdirectory of Users on the old C drive that matches the account-name you were using on that computer.

(Allow me to digress to again recommend "Everything Search" from voidtools.com. It allows you to, for instance, *instantly* find every ntuser.dat on any drive that's on your computer.)

You now have to give the old registry a name to appear under



in your own registry - make it something noticeable like "aaaaaa". It'll appear under that name, and you'll now be able to drill down in it to the keys containing the data you need. In this case, the place where your current MPC-HC will save its bookmarks is HKEY_CURRENT_USER\Software\MPC\HC\Favorites\Files, and the old one's data should now be findable in HKEY_USERS\aaaaaa\Software\MPC\HC\Favorites\Files.

If you're having trouble finding the data for a given program, use regedit's F3 search function to look through the whole registry for a string from the program name. There are several different versions of Media Player Classic, for instance, which have different registry locations; the original ones from Gabest Software keep their bookmarks in ...\\Gabest\\Media Player Classic\\...

Now for the tricky bit.

Drill down to the "Files" key in the MPC-HC section of the old registry hive, right-click it, and "Export" again. Save the exported data (which will make a much smaller file than your earlier gigantic export of the whole registry) as whateverfilenameyoulike.reg, and then have a look at it in a text editor. (Notepad is perfectly adequate.)

You'll see the text of all of the bookmark values, with at the top the version of Registry Editor that created the file, and then "[HKEY_USERS\\aaaaaa\\Software\\...", the address from which the data came.

If you double-click this file you'll get a warning asking if you really want to add that data to the registry, and actually you don't, yet, because all it'd do is write the data back to the same HKEY_USERS\\aaaaaa\\... location it came from, which is not where your current Media Player Classic will look.

All you have to do, though, is edit that square-bracketed address at the top, from HKEY_USERS\\aaaaaa\\... to the correct address for your current MPC, HKEY_CURRENT_USER\\Software\\MPC\\HC\\Favorites\\Files. (You can probably transplant the data between different MPC versions that keep their data in different places, too, but I'm making no absolute promises.)

If you're uncertain of the location of a program's data, you'll have to search by program-name or program-author-name again, to find it. In this case you could get there a bit

faster by making a bookmark in your current Media Player Classic and then searching the registry for the name of that video file. Somewhere among the hits in recently-opened-file lists and such there will be the location of the current MPC's bookmarks.

Other logical edits to the .reg file's text will also work, allowing you to, for instance, change the location of all of the files if your video drive used to be E but is now F, or whatever.

Once you've got the .reg file re-aimed at the right key, double-click it and tell Windows that this

time you *do* want to continue, and now the next time you run MPC, your old bookmarks should be back.

(Media Player Classic, like some other programs that default to storing stuff in the registry, has an option to store that stuff in a .ini file instead. Sometimes it even works!)

This is too much trouble to go to for data whose loss is only a slight nuisance, but it can really get you out of a tight spot - or save you some hefty tech-support fees - if the data locked up in an old registry is vitally important or valuable.

I/O OF THE MONTH

BETTER THAN A DIARY WITH A LOCK

I When I scanned through my son's chat history, checking to see if he was buying drugs or hiring prostitutes with my credit card (which I'd actually be pretty proud of, come to think of it, he's only nine), I found chunks of chat with some friends of his that all looked like this:

"yby ab qvqag qb vg z8 jung nobhg fro?" [this is one representative line from quite a lot submitted]

I don't think textspeak's gone quite that far yet, I presume this is a code. Do you know what kind of code it is?

[Name withheld, for security!]

O Yes: It's ROT13, a very simple "substitution cipher".

In ROT13, every letter of the message is "rotated" thirteen steps through the alphabet, wrapping around at the ends. ROT13 the text again and you get the original message. So your example of "yby ab qvqag qb vg..." ROT13s back into "lol no didnt do it m8 what about seb".

ROT13 is so simple that you can do it somewhat laboriously with pencil and paper, or automatically in various text editors, or indeed by applying the "awesome powa" of rot13.com. Because it's so simple, it provides no real cryptographic security - people use ROT13 more just to conveniently obscure non-secret text, like spoilers in a discussion of a movie.

It's often easy to spot ROT13 when you know that it exists, because common words like "the" and "and" rotate into strings that you can come to recognise ("gur" and "naq"). Work with it enough and you'll actually be able to read it directly, like a newsagent who's learned how to read upside-down. ROT13ed curse words are also highly recognisable and often even moderately pronounceable, which can be useful if you want to talk filthy in polite society.

I now suggest you make like the Allies in World War II and do *not* reveal to your enemy that you have broken his codes, lest he move on to better encryption when discussing un-done homework, unhealthy lunch foods and video games.



▼ Yep, that ought to do it.

Could you get by with Office Web Apps?

IT'S WORTH INVESTIGATING WHETHER YOUR BUSINESS COULD GET BY ON WEB APPS ALONE. AS **SIMON JONES** EXPLAINS, THERE COULD BE SIGNIFICANT SAVINGS

When we're advising companies on updating their software, one thing we have to consider is whether all their users need the full power of Microsoft Office, or whether some of them could make do with Office Web Apps, the cut-down online versions of Word, Excel, PowerPoint, OneNote and Outlook that are delivered through a browser. There are restrictions in Office Web Apps, but these generally only affect the creation of complex documents. If they're only viewing, printing or performing light editing on documents, these Web Apps can be good enough. Whether they're suitable for your company depends on your business processes, and how much you're willing to adapt these processes to match the reduced software ability.

The cost savings can be quite large: Office 365 Enterprise E3, which includes the full local Office suite, costs \$20 per user per month, but the E1 subscription, which only provides Office Web Apps, is only \$12.70 per user per month, a saving of \$87.60 per user per year. A good way to find out whether Web Apps could work for some of your users is to create a matrix of their requirements, as in the table on the next page.

List your staff members down the left-hand column, and the applications they currently use across the top, then put a number between zero and three in every cell to represent the degree of complexity of their usage of each application. This isn't so much a matter of how long they use the application for (in hours per day), but how many of the application's features they use (as a proportion of the available features). Zero means they don't use the application at all, while three means they use many of the more complex features of the application. Don't leave any cells blank - if in doubt, ask the user themselves what they actually do with each application.

Creating Word documents with a table of contents, cross-references, SmartArt, conditional formatting for Excel and so on, would definitely



count as a three. These features aren't available in Office Web Apps. (Web Apps may be able to display these features in documents that were produced in the full application, but you can't create or edit those features using Web Apps.) If they use or create any documents containing macros, that's automatically a three. Use a one to show simple usage - reading and creating emails, creating documents with simple formatting, and reading documents with simple or complex formatting. If their usage of the application is slightly more than simple, but you're not sure whether it counts as complex, give it a two.

When you've completed this matrix, look across each row in turn. Anyone with a three in their row will need the full version of that application. If they only have zeros and ones they can probably make do with Office Web Apps. If someone has a two, they may need the full version of the application. Open one of their more complicated documents in the full application and try to recreate it using Office Web Apps (you can do this for free by using SkyDrive or in a trial of Office 365).

When someone has a need for

complex features in only one or two of the applications, but is a light user of the others, you might consider giving them Office Web Apps plus the full version of the one or two applications they need, rather than the full Office suite. This may be cheaper than buying the full Office suite for that user. If they need complex features for more than two applications, it's usually cheaper to buy or rent the full suite.

You also need to consider whether adding the complexity of having to manage individual Office applications is worth the saving; there's a good argument to be made for simplifying your software management down to only two choices, Web Apps or the full Office suite. You can additionally gain a significant price reduction from Microsoft for licensing the same suite of applications across all of your users rather than mixing and matching applications. The Microsoft License Advisor website at <http://mla.microsoft.com> can help, or speak to your licence supplier or consultant.

One restriction that must be factored into your deliberations is from where your users open their documents. If they're kept in SkyDrive, SharePoint, SharePoint Online or email



SIMON JONES

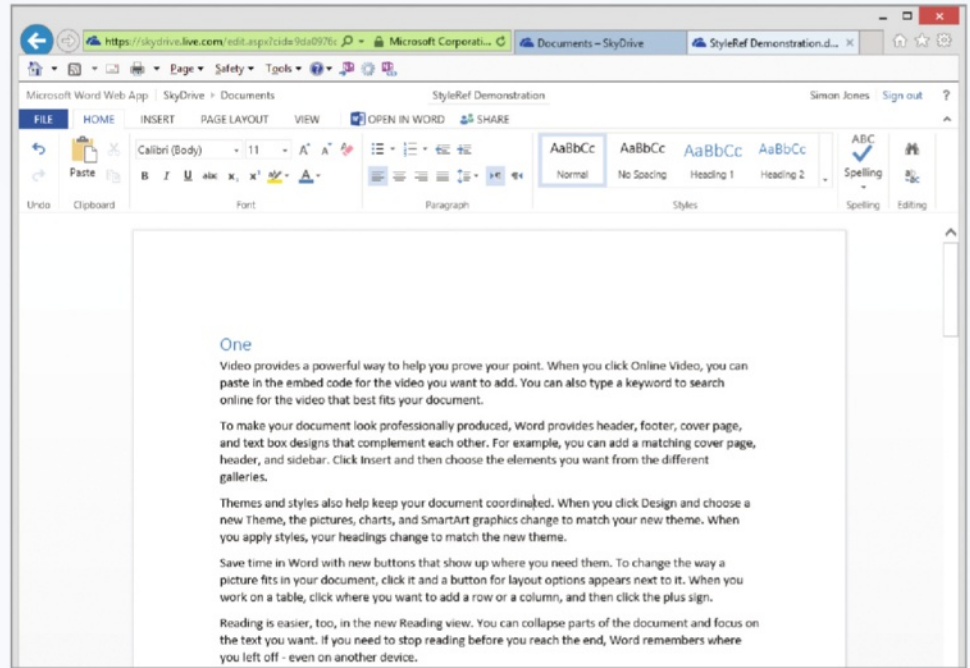
An independent IT consultant specialising in Office Automation, Visual Basic and SQL Server.

attachments, then Office Web Apps will be able to open them for viewing or light editing. If the files are kept in the local file systems of your PCs or network server, Office Web Apps won't be able to see them - you'll need to first copy or move the file to SkyDrive or SharePoint, or install the free Word, Excel, and PowerPoint viewer applications to be able to open them. These viewer applications can only view and print files, not edit them.

This is a good example of a place where you may want to change your business processes to fit with the restrictions of Web Apps. If you use in-house or third-party applications that expect to be able to access documents from standard network file shares, SharePoint document libraries can be made to appear as such by using the WebDAV interface. However, if such an application has been written so that it only tells the operating system to open the file, and passes it the file path and name, then you're going to need either the full Office application installed locally or the document-viewer application for view and print capabilities only. Rewriting in-house applications that previously expected all users to have the full Office suite installed can be quite challenging.

The alternative to moving all of your document storage from network file shares into SharePoint isn't something you'd want to do lightly, either. SharePoint and SharePoint Online (part of Office 365) give you plenty of extra file-storage features - such as check-in/check-out, document co-authoring, extensive search and security, file lists and custom properties - but there are some important restrictions that you need to be aware of.

First, no document stored can be larger than 2GB; SharePoint is built upon SQL Server, which has a hard limit of 2GB for storing any single piece of data. There are also limits on the characters you can use in filenames - no ampersands, hashes, or braces, for instance. Some file types can't be stored at all, since they're considered a security risk, including executable files, Access projects, Visual Basic scripts, and DLLs. Moving files en masse into SharePoint can lead to multiple failures, all of which have to be dealt with separately. Third-party tools can help,



but these cost anywhere from \$300 to \$2000, depending on the amount of data you have to move. If you have a very large collection of documents, SharePoint's performance can degrade, particularly if you put thousands of documents into the same folder. You may have to restructure your document collection, splitting them between different document libraries, to keep the numbers manageable in any one library.

If you're considering using SharePoint Online - part of Office 365 - you'll need a fat pipe to and from the internet: saving and opening all your documents to and from cloud storage will be slower than from folders on your local network. An internet connection at 2-20Mbps/sec can't compare to an office LAN running at 100-1000Mbps/sec. If you're on an ADSL connection, that "A" for Asynchronous means that you'll receive only a fraction of the download speed when uploading. ADSL, fibre and wireless broadband connections do reduce this performance gap, but their costs are usually higher. This problem is mitigated by Office Web Apps to some extent; when people are viewing and editing their documents, only the pages each user actually views or edits are in fact transported - so they don't have to download the whole document to view

Office Web Apps let you create documents with simple formatting through a browser

You may want to change your business processes to fit with the restrictions of Web Apps

only its first page.

It's safe to say that - in any well-established business with lots of files and entrenched business practices - moving everyone from using the full Office suite to having some of them use only Office Web Apps won't be easy, but it can achieve a very significant saving.

WORD PARAGRAPH FORMATTING

When people first start using Microsoft Word, they often play with the font formatting of their documents - applying bold, italic and different font sizes, for example. However, they often shy away from the paragraph-formatting options, which are seen as more of a dark art. The Paragraph Formatting buttons on the ribbon (Home | Paragraph) show only a few of the things you can do with your text, as well as some of the things you shouldn't do.

The most-used buttons in this group have to be the ones for text alignment - Left, Centre, Right and Justify - which have the shortcuts Ctrl+L, Ctrl+E, Ctrl+R, and Ctrl+J respectively. These alignment options have their uses, but please don't overuse the centre and right alignments. Right alignment can be useful for headers and footers - although using tab stops may be preferable - or for formatting a small amount of text, such as the "from" address at the top of a letter. You'd usually apply this in association with the "No Spacing" style to remove any extra spaces from such paragraphs. Centred text is sometimes used for

Name	Department	Outlook	Word	Excel	PowerPoint	OneNote
Alan Acorn	Finance	2	3	3	1	1
Barry Brown	Finance	2	1	3	0	0
Cheri Chatsworth	Sales	1	2	1	0	1

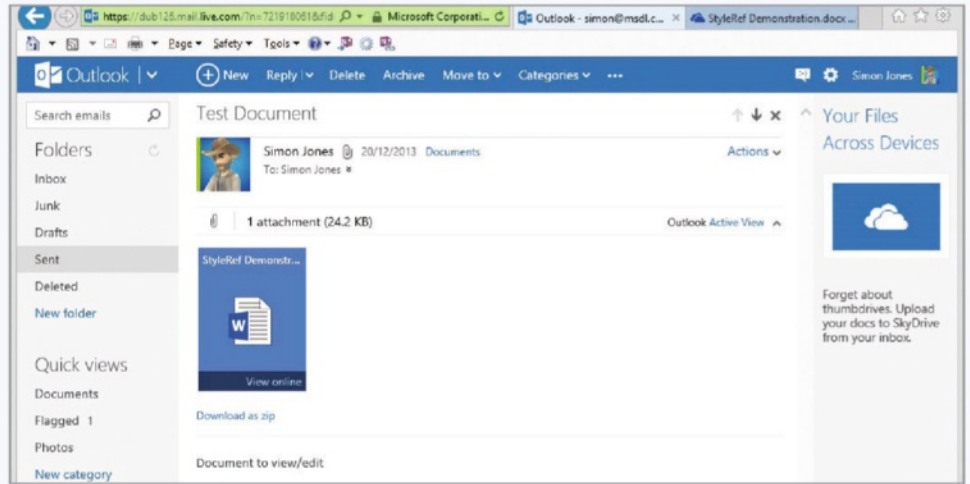
titles and headings, but it's falling out of fashion, and can make your document look dated. Left alignment is simplest and best for headings. I make sure all my heading styles have left alignment, but I always use justified alignment for the main body text, since this gives a much cleaner, more professional appearance overall.

Another pair of straightforward buttons are Increase Indent and Decrease Indent. These move the left edge of the selected paragraphs further away from or closer to the left margin. Each click moves the text by half an inch, unless you put one or more tab stops into your text, in which case the indent will jump to those in addition to the standard half-inch increment. If you don't like these half-inch defaults, there's little you can do: they were baked into Word's program code way back in the mists of time, and can't be changed to more metric standards such as 10mm (half an inch is 12.7mm).

Shading and Borders are useful for highlighting and separating text, and can be applied to a few words or a whole paragraph. If you're marking a whole paragraph like this, you may consider using a textbox instead, which will give you the flexibility to pull the paragraph out of the main flow of text and make it look more like an illustration. Shading gives you access to all of the Theme colours or any other colour you want, but it shouldn't be confused with Highlight (under Home | Font), which has only a limited range of bright or muddy colours. Highlight acts like a highlighter pen on paper: you can toggle the highlight on and off by repeatedly applying it to text. You can find all text marked with the highlighter (Alt+H, FD, A) and display or print a document without any highlights - File | Options | Display | Show Highlighter Marks - without having to manually remove them.

The Line And Paragraph Spacing button gives you a menu of the most-used spacing options. Standard line spacing from Word 2007 onwards is 1.15 times the font height; Word 2003 and earlier used single-line spacing - one times the font height - and some people still prefer that, but the extra space makes it easier to read the text. Double- and triple-line spacing is sometimes employed for specialist purposes, such as book manuscripts, screenplays and legal documents, where the person reading may need to make notes directly onto the page.

Word usually puts a short white space after a paragraph to separate it from the next one, which means



that you don't need to press Enter twice between paragraphs. Headings normally have extra space before them to make an even bigger gap from the previous text, so it's obvious to the reader that there's a change from one part of the document to the next. You can control these paragraph-spacing options relatively easily using the "Add/Remove space before/after paragraph" options at the bottom of the Line And Paragraph Spacing menu. If you want more control, you have to use the full Paragraph Settings dialog. You can get to this from Line And Paragraph Spacing | Line Spacing Options... or by using the dialog launcher in the bottom-right corner of the Home | Paragraph group (Alt+H, PG).

This Paragraph Settings dialog lets you set all the options to do with paragraphs in fine detail: indentation can be set precisely in inches, centimetres or millimetres, and you can set special indentation schemes such as First Line or Hanging Indents, which you can otherwise set only by using the ruler. Spacing options can similarly be set precisely, including extra options such as "At Least" and "Exactly" for line spacing, which let you set the line

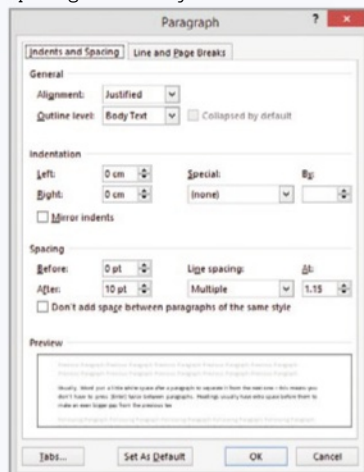
▲ Set indents and spacing using the Paragraph Settings dialog

“People often shy away from paragraph-formatting options, which are seen as a dark art”

”

spacing in points. You can also have 12-point text on 14-point lines. The second tab of the Paragraph Settings dialog controls line and page breaks. Widow/Orphan Control is the setting that prevents pages from starting with a single line left over from the last paragraph of the previous page (a widow), or pages from ending with the first line of the next paragraph (an orphan). Word shunts these odd lines across the page break so that you never have less than two lines of a paragraph before or after a page break.

The "Keep with next", "Keep lines together" and "Page break before" options do exactly what they say. The first command sticks the selected paragraph to the next one so that they both appear on the same page if at all possible. The second command tries to keep all of this paragraph on the same page, while the third forces a page break before this paragraph without you having to insert one manually using Ctrl+Enter. This is most often used with styles, where you might create a chapter or heading style that throws a page break, so that all of your chapters start on a new page. Heading styles also often have "Keep with next" enabled so that if the first paragraph under a heading slips over to a new page, the heading will automatically follow it over. ■



▲ Access integrates with OneDrive and Office Web Apps

RULERS AND TABS

I've mentioned the ruler and tab stops a couple of times during this whistle-stop tour of paragraph formatting in Word. They provide the key to many of the more complex formatting controls, including bullets and numbering. However, they need far more space to explain, so they'll have to wait for a future column in PC & Tech Authority.

Wolfram-and-Raspberry Pie

JON HONEYBALL IS AMAZED BY THE FUNCTIONALITY THAT WOLFRAM BRINGS TO THE RASPBERRY PI, BUT IS LESS IMPRESSED WITH SO-CALLED "SMART" TVS

A few columns ago, I said that I'd seen the future and I can now reveal what that was: if you have the Raspberry Pi single-board computer, you can now download the free Wolfram Language runtime – and even a full copy of Mathematica – to run on it.

Wolfram is a curious company. Those who "get it" become passionate believers, whereas those who think that the world of calculation starts and ends with Excel generally shrug, utter a "meh!" and walk on by. Probably because they never took maths at school or university, and preferred history of art or philosophy to anything useful. Their loss. Some people are put off by the almost irrepressible enthusiasm of Stephen Wolfram, the founder, and say that his ego appears to have no finite bounds. I shrug and say "so what?" He's clearly built an incredibly successful product and platform that employs hundreds of people around the world. His product is hugely influential and used in all kinds of unexpected places (did I mention history of art and philosophy?).

Some years ago, I wrote about Wolfram's Alpha scientific search engine in this column, and how I thought it would become huge. It has: you may not use it every day; you may not even know that you're using it; but it's there, and I challenge you to find anything comparable from any other software company. The world is a better place for it.

Now the company has started talking publicly about the Wolfram Language, the underlying platform for all of its engines from Alpha to Mathematica. Wolfram has been

“

Pi shows what can be done for next to nothing, and Wolfram takes it to the next level

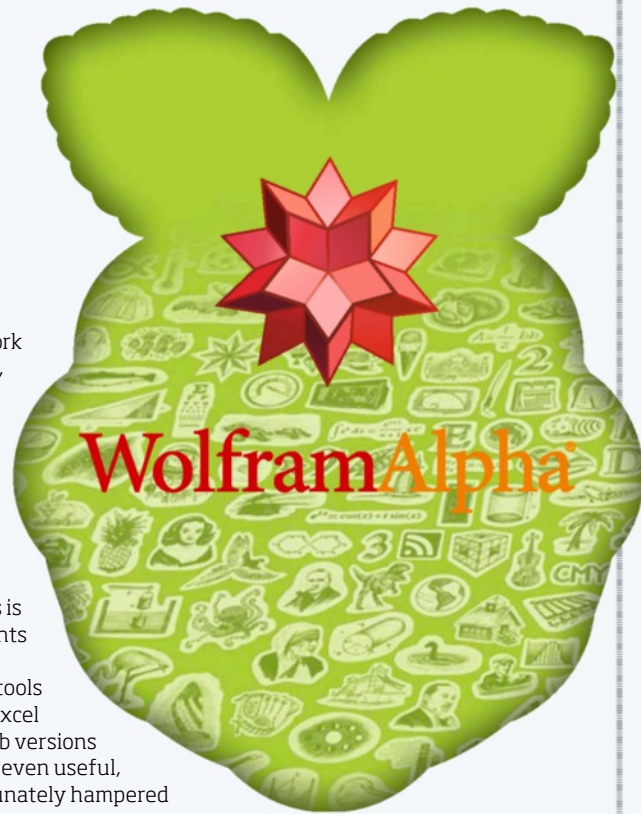
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With Wolfram Mathematica now available for the Raspberry Pi, it has become possible to create effective, knowledge-driven computational devices for peanuts

doing incredible work with this language, even offering a fully web-based HTML5 version of Mathematica. If ever proof were required that you can build rich applications inside a web browser, this is it. It cruelly highlights the poor quality of the HTML ports of tools such as Microsoft Excel and Word (their web versions may be okay, often even useful, but they're unfortunately hampered by their history).

Wolfram Language runs on any hardware, from Raspberry Pi to supercomputer cluster, either locally or in the cloud – you choose. On the Pi, you can do this for free, on a computer board the size of a playing card, for less than \$35. Alright, so you need to add a mains power supply, and maybe a case, but this is commodity computing of a size, cheapness and power we have never witnessed before. No wonder it's becoming hugely influential and is selling like hot cakes.

Getting my Pi up and running was simple, and within a few minutes I had a full GUI running on my lounge TV set. A few minutes more and I had a full Mathematica workbook displayed on there, too. Performance isn't exactly scorching, reminiscent of a computer from the late 1990s, but – and this is most important – it's fast enough. Actually, Wolfram claims its performance on the Pi is comparable to – maybe even faster than – the



NeXT cubes on which Mathematica first shipped. However, the NeXT was a multi-thousand-dollar workstation, while the Raspberry Pi fits in your pocket (almost in your wallet), and costs less than a decent round of drinks down the pub.

The Pi deserves to be huge, and it should be mandatory for every schoolchild to have one. Looking back at the history of UK educational computing, it started when I was at school with feeble 8-bit micros and painful programming languages; it then moved on to the hugely influential wave of the BBC Micro; and thereafter into the world of Wintel PCs. After a while, the educational focus shifted toward acquiring Microsoft Office skills. Now, everyone can do that: everyone has a smartphone.

The Pi takes computing back to the hobbyist level. With Mathematica and the Wolfram Language, it lets you build ridiculously effective knowledge-driven computational devices for peanuts. This is what we should be teaching our children today. I can't praise this enough. What's galling, of course, is that there's nothing here that couldn't have been delivered by Microsoft Research. However, Ballmer would have demanded it be an expensive licence, a billion-dollar division, and that we buy it from a favoured



hardware partner. Pi shows what can be done for next to nothing, and Wolfram takes it to the next level. Buy one, and make learning to use it your New Year's resolution.

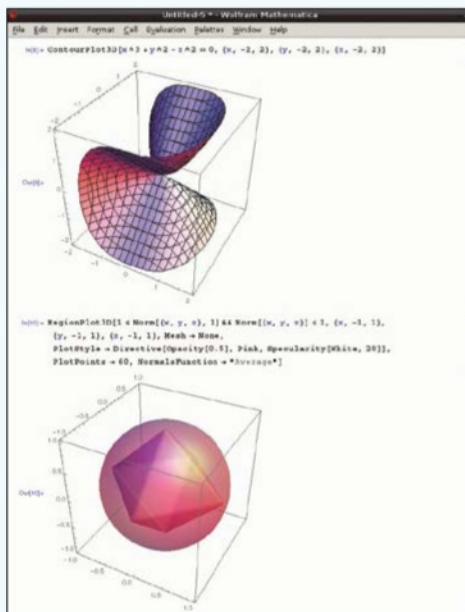
NOT-SO-SMART TVs

One of the first things I needed to buy for my Raspberry Pi was a nice wireless keyboard-and-mouse combo. Well, perhaps not a mouse, because that wouldn't work very well on my lap while lounging on the sofa – more like a trackpad. Ideally, a device that combined the two into one battery-powered unit. Oh, and I didn't need it to be Bluetooth: a simple radio connection would do.

I found just the thing at my local hardware emporium: the Logitech Wireless Keyboard K400. For less than \$50, this device gives you a proper keyboard and a touchpad with two mouse-click buttons. It supports multitouch, is lightweight, and works at up to 10m from the tiny USB wireless plug that comes with it. It's just about ideal for lounge operation of a Pi. I then bought a second one to go with my "smart" TV. I've been looking around at this new generation of internet-connected TVs, and have to admit they're a truly miserable bunch. "Smart" isn't the word I'd use to describe them – "dumb, awkward and pitiful" would be closer to the mark.

My Samsung TV's UI is simplistic, and trying to get it to see security-camera video recordings on a DLNA-networked NAS box was an exercise in frustration: huge blocky icons, no customisation of the UI, and a painfully difficult experience altogether. When looking at these video files held on a Buffalo NAS server elsewhere on my network, this "smart" TV decided that all of the video files created over the past few days were actually created in 2036. How it came to such a time-travelling conclusion isn't clear, but somewhere something is getting very confused. Worse still, web browsing is best left to the truly desperate.

Things aren't much better in the land of LG, either. I played with one at my local shop that had a gyroscopically sensitive remote control, which moved a mouse pointer on the screen; however, it was truly grotesque in every way. To make these TVs useful, their vendors need to wake up and realise they need to supply either a real keyboard/trackpad combination (for which the Logitech



▲ With Wolfram Mathematica now available for the Raspberry Pi, it has become possible to create effective, knowledge-driven computational devices for peanuts

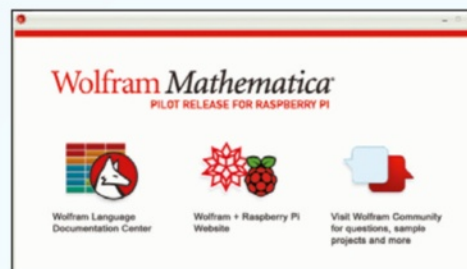
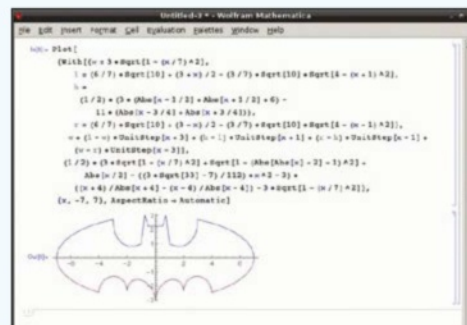
device might be the ideal blueprint) or find a way of using the viewer's smartphone or tablet as a UI device in a properly coupled and effective way. The current methods of clicking around an onscreen keyboard, shouting at or waving towards the screen simply aren't efficient or reliable enough – bundling a \$50 keyboard/trackpad can't be an impossible consideration when customers are spending thousands on the screen itself.

Is this current nonsense really the best the TV manufacturers can do? Smart TVs are set to become the "big screen" end of a continuous spread of technologies that starts with 65in screens at the top; descending through desktops, Ultrabooks and tablets in the middle; down through smartphones; and finally to wearable devices such as smartwatches or Google Glass. Providing a seamless, easy experience at all of these different display sizes

will be critical to persuading the public this vision is worth buying into. (If my experience of the current wearables such as the Pebble and Samsung watches is anything to go by, just as much work is required at that end of the scale, too.)

MATROX DSI

My main desktop 27in iMac in the lab is finally getting on a bit, and although I'll admit that it's exceptionally well-stuffed – 16GB of RAM, around 32TB of Thunderbolt storage and a second 27in Thunderbolt display – I'm still waiting impatiently for the new Mac Pro.



One major limitation of my mid-2011 iMac is that it has no USB 3 sockets. Everything is resolutely USB 2. This is fine, except for those times when I need to transfer data at speed onto a USB 3 stick, or to transfer some high-resolution photos off an SD card reasonably quickly. What to do? Well, there is a solution out there, from Matrox, called the DSI1.

DSI1 is really designed for laptops, but it works for my purposes, too. It's a Thunderbolt-connected, book-sized box that adds one USB 3 port, two more USB 2 ports and a Gigabit Ethernet port to your computer, along with some audio in and out. It's somewhat overkill for my iMac, which isn't short of either Gigabit Ethernet or USB 2 ports, but that single USB 3 port is a godsend for my needs, and justifies the purchase. Just plug it in and away you go: it's great when you need it, and a good demonstration of how Thunderbolt offers capabilities far beyond mere USB.

BLACKMAGIC TV STUDIO IN A BOX

It's astonishing how the prices of devices that were previously unimaginably expensive continue to plummet. If you want a good example of this trend, trundle over to the Blackmagic Design website (www.blackmagicdesign.com), where you'll find devices such as the ATEM1 Production Studio 4K, a fully specified 4K production TV studio switch. The ATEM1 comes with ten 6G-SDI inputs, three 6G-SDI outputs, HDMI, audio and the rest, all nicely wrapped into one small rack-mount box.



JON HONEYBALL
Computer journalist and consultant specialising in both client/server and office automation applications.

Not so long ago, such functionality would have cost tens of thousands of dollars – even hundreds of thousands – but today, you pay just over \$3000 for this capability. Once you've added some real control surfaces to do live TV production, the cost of your system will be less than \$20,000 (and you won't need such control surfaces for lightweight use: everything can be done from your computer). This is amazing.

Take a look at the company's other offerings: Thunderbolt-based 4K video recorders to SSD costing hundreds of dollars; a 2.5K digital cinema camera body for \$2475; and its forthcoming 4K camera for only \$3659. Okay, that won't do everything that a Red Epic can do, but its price is almost one-tenth of that. This is truly a company to keep an eye on if you want to work in professional-specification video, or even if you're a committed consumer-level movie-maker. These prices are now affordable for clubs and small groups, or for solo power users.

ASUSTOR AS-608T

On the strength of our glowing *PC & Tech Authority* review, I bought an Asustor AS-608T NAS RAID box kitted out with 24TB of disks. This unit offers a huge amount of capability, and would fit well into a SoHo or almost any small-business computing environment.

Getting it up and running was simple, although accepting all the defaults in the setup wizard resulted in a straightforward eight-disk stripe. This isn't a particularly wise choice, since a single disk failure would break the entire store. Reformatting it as RAID5 wasn't hard, but it took more than 24 hours for the formatting operation to complete, and there was no obvious "go at max speed please" button that might have helped. I understand why the default is to offer a simple stripe – because it gets you up and running in a few seconds – but the risk just isn't worth it, not when you're playing with upwards of 24TB of data.

Then I decided to start up the AFP (Apple Filing Protocol) support and Time Machine server capabilities, and added this NAS box as a Time Machine target. I hadn't realised until recently that you can have

multiple targets set up in your Time Machine configuration, and that it will automatically round-robin around them all. Unfortunately, there's no easy or obvious way to migrate from a local Time Machine store to a remote one, and you can end up in a twisting maze of packages and spare image bundles if you're not careful. Much simpler is to add in the new store and tell it to back up the local machine.

This would have been fine, except that I have around 8TB of local storage to back up. Just as with the NAS itself, there's no obvious "please go at max speed" button for Time Machine. So, at only 1TB per 24 hours, this initial backup is going to take more than a week to complete, which is certainly food for thought. It's been running for only one day so far, and has backed up 1.18TB of the required 8.46TB. I expect that in a few days time I may suffer a total sense of humour failure, and just start manually copying everything over by hand...

I bought this NAS because I wanted to take the Time Machine role away from one of my Thunderbolt-connected Promise RAID arrays. It seems somewhat daft to use such an expensive and high-speed array for archival storage, but moving terabytes of data around is still somewhat boring. Maybe I need to take a long, hard look at my Gigabit switch setups, too, to make sure that nothing there is blocking and contributing to a traffic jam. At that point, I can say I think I've already over-committed my Christmas holiday period.

LOW-POWER BLUETOOTH

I've said it before, but low-power Bluetooth 4 is going to be huge in 2014. There's an entirely new wave of products coming along that use this protocol, which enables battery-powered devices to run for months on small battery packs. As expected, there's been a rush of devices that promise to solve those eternal questions, "where are my keys?" and "did I leave my bag in the restaurant/back seat of the cab/wherever?"

Some of these gadgets are more successful than others. I've tried the Proximo system from Kensington, a firm famous for security cables

“Smart isn't the word I'd use to describe these TVs – 'dumb' would be closer to the mark”

that tie computers irremovably to desks. It was working quite well, right up to the point where my iPhone managed to lose all connection with both devices, despite their being within range. This may have been an iOS 7 issue, but it was no less disappointing for that.

I've also just had Atama's Sesame arrive, and I hope this will work better. This device connects to your desktop or laptop device and automatically locks the screen whenever you move away from the computer. Again, this employs Bluetooth 4, so it isn't much good with my 2011 iMac that doesn't have this interface. My MacBook Pro does, though, and it's arguably more useful for that purpose. I'll report back once I've tried it.

Obviously 100% reliability is absolutely vital for this sort of solution, since there's no point setting up such a device if it doesn't work properly all of the time. That's the real problem with this sort of technology – trust is everything, especially for a security-related product.

OPENDNS

My final tip this month is to start using OpenDNS on your internet connection. This excellent DNS service provides a wealth of DNS-based security features for free. If you move up to a paid-for account, you'll gain access to a whole heap more useful stuff offering enterprise-level security. I consider OpenDNS to be mandatory, especially for the small-business user. It's possible that some of the more militant ADSL services may impose DNS blocking that stops you from actually using a third-party DNS service, but it's worth trying the free version to see. ■

IE11 ARRIVES

Internet Explorer 11 has been released for Windows 7, but it isn't a mandatory installation. Sensibly, Microsoft has decided to let you decide when you want to upgrade from IE10. My experience has been good so far, so you may want to look into it, especially if you're a home user.

▼ Professional-grade video equipment – such as the 4K Blackmagic UltraStudio – is now becoming affordable



Social media – why it should be your friend

FIONA TEAKLE THINKS YOU CAN GET A LOT OUT OF SOCIAL MEDIA - IF YOU'RE CLEVER ABOUT IT!

In 2004 you haven't even heard the word Facebook, now most of us are guilty of logging in and checking our account at least once a day. Whether we are at work or at home we are logging in, it also allows you to reach customers you never thought possible from the comfort of their home.

The main goal of social media is to provide an avenue for your existing or potential customers to have access to you, 24/7. But what should you be aiming to do with your presence? At the end of the day the key is to evoke an emotional response, be it one of the following:

- Informing
- Provoking
- Asking a question
- Or Inspiring

What does that actually mean? This means that someone will have looked at your post or tweet and have one of these reactions and therefore want to respond or pass it onto their network, which then increases your reach and according to the Social Media Marketing Industry Report 2013, more than half of marketers who have used social media marketing for over 3 years reported an increase in sales over that period.

So what can you actually do with effective use of social media other than increasing sales? More than anything you can establish authority. This means that potential or existing customers can see that you know and understand the product you are selling.

People are now flooded with choice and more importantly we can find out more about someone via their social networking sites then you may uncover on a first date! With this in mind, not being part of the social media sites then has the ability to harm your brand. People will be potentially talking about your product or company whether



Social media allows us to actively engage customers



you realise it or not. Being part of the conversation ensures that you can monitor what is being said, this doesn't mean censor, but more an opportunity to respond to negative feedback. When deciding on what new car to buy or what company will deliver a solution better people will do their own research. This is basically word of mouth marketing, but potentially without opening their mouths! The other side of it is, if you aren't online yet your competitors are and the customers can interact with them and not yet, who are they likely to choose?

While social media is not always good and when something goes wrong (like your website crashing during a peak period), it provides an avenue for your customers to directly point their anger to you, it also provides you with another avenue to talk and interact with them in a tough time! Technology fails at times, we all

know and have seen that, but being able to proactively respond can turn a bad situation into a positive one. The other aspect is that as soon as someone is having a negative experience with you they can and do turn to social media. Being able to respond proactively and try and save the brand and experience that the person is having can be invaluable.

Social media, at the crust of it, enables us to actively engage with our customers daily and is fast becoming a non-negotiable decision. More and more people are turning to social media for good or bad reasons, so not getting involved could only harm your brand. The ACS has its own social media channels to promote not only the positive things the society is doing, but also to explore and provide insight into the industry as a whole. I encourage you to follow/like us at [facebook.com/australiancomputersociety](https://www.facebook.com/australiancomputersociety) and twitter.com/acsnewsfeed. ■



FIONA TEAKLE is Director of the ACS Young IT Board. You can contact her at fionateakle@acsmail.net.au

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JON HONEYBALL suffers from post-Vegas blues as he mourns the loss of Microsoft

“The International Consumer Electronics Show, or CES as it's known to just about everybody, is a very weird affair indeed. For a start, it's set in the odd location of Las Vegas (who would build such a place in the middle of a desert?). What's more, it takes place only a handful of days after Christmas, when right-minded people should be getting back to work and failing to keep their New Year's resolutions.

The Las Vegas Convention Center, where most of the event takes place, is huge; it makes the Darling Harbour Convention Centre look like a village hall. About 150,000 people turn up - and that's only the visitors, never mind all the show people and representatives. It's so big it spills over into several hotels on the Strip.

My working day at CES seems to run from 7am to midnight every day for a week. The work ranges from on-stand product introductions to private back-room meetings covered by lengthy non-disclosure agreements and overseen by suitably beefy security guards. Then there are the working dinners, where you try to discuss strategy in a dark room over the din of a disco while eating overpriced food. Is it any surprise I came home and promptly went to bed for nine days with man flu?

Was it worth it? Yes - but there were two companies missing, unless you count private skirmishes in hidden hotel rooms. However, their reasons for absence couldn't possibly have been any more different.

Apple wasn't there, but it hasn't done CES for years. It doesn't care: it has a network of Apple stores around

the world. In any case, one of the aircraft hangar-sized halls was filled with vendors selling nothing but Apple

“I could go to various stands and find things that run on Windows, but there was no underlying need for Microsoft”

accessories. Talk to a few people and you soon discover the going rate for a licensed Lightning connector on a third-party device is a few dollars, even when bought in the hundreds of thousands. Apple had nothing to launch and nothing to say, and the show doesn't fit its global message.

Microsoft wasn't there, either. No keynote from a missing-in-action CEO. No stand. And a remarkable lack of Windows-based devices. There were myriad smart TVs running at 4K with mind-bending screen capabilities; loads of low-power Bluetooth 4 devices that chatter for hours; embedded smart devices for the home; and plenty of Android devices. But there was almost nothing running Windows - or Windows Phone. It was as if Microsoft had fallen off the planet.

Of course, the Consumer Electronics Show is about just that - consumers. Not corporates, not the large internetworks that keep the global economy running, not cloud services.

In that guise, it was just tumbleweed city for Microsoft. It felt strange, to be honest. Yes, I could go to various stands and find things that run on Windows or connect to Windows hardware. But there was no underlying need

for Microsoft. “Oh yes, our new tool runs on iOS and Android.” “Windows Phone?” “Well, not at the moment.” “Any timescale for that?” “Not really - we're just following the market.”

Maybe I'm being too sensitive. Maybe there's a hidden, fundamental need for Microsoft technologies that will remain relevant to the home and SoHo user as we approach the second half of the decade. But based on my week spent trudging the halls, hotels and private briefings of CES, I must conclude that the market has gone cold for Microsoft. Too many promises of jam tomorrow haven't delivered.

Microsoft's answer seems to be to leak tidbits about Windows 9 to the more excitable members of the press. This will help, won't it? Erm, no. If the figures are right, 30% of daily web users are still using XP, and they've fought off several attempts to get them to part with their money to upgrade to Windows 7, never mind Windows 8. And what will the story be in a few years' time when the firm stops supporting Windows 7? That's when the chickens will truly have come home to roost.

I find it deeply upsetting. We need the genius of Microsoft's developers to deliver, because we'll be poorer for it if the company is squeezed out of the market. But change comes from the top, and Microsoft is coasting without a leader.

I'm not sounding the death knell yet. But Microsoft needs to change tack at next year's CES if it's going to pull itself out of this hole. At least, that's what I think. As do all the people who have come back from CES with flu.



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