PC & TECH AUTHORITY

TECH ADVICE YOU CAN TRUST

WINDOWS 9
WHAT TO EXPECT
CAN MICROSOFT GET WINDOWS BACK ON TRACK?

23 SSDS TESTED
EXHAUSTIVE TESTING REVEALS BEST VALUE AND SPEED

ULTIMATE UPGRADE
A PC REBORN

WHAT TO KEEP AND WHAT TO REPLACE IN THE QUEST FOR PC PERFORMANCE

REVIEWS

LG ULTRA PC, DELL XPS 11, HP ELITEBOOK FOLIO, RAZOR BLACK WIDOW, LG G FLEX, ACER ICONIA W4, GALAXY NOTE 10.1, ADOBE CREATIVE CLOUD AND MORE!

HOW TO:

DVD & BLU-RAY MEDIA RIPPING GUIDE: TURN DISCS INTO FILES

CHERRY KEY COLOUR CODE: WHAT DOES IT ALL MEAN?

PLUS

IS GOOGLE EVIL?

ARMY ROBOTS AND A.I. WHAT IS GOOGLE UP TO?

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- We will always offer an honest and unbiased opinion for every review

TWEAKING IT A LITTLE

There's been a little gentle massaging of *PC & Tech Authority* this issue, attending to a couple of areas that warranted some attention as well as bringing in new regulars.

Our A-List section has been refreshed with several new products, ones we've been using and testing, stacking them up against the rest and concluding that the gear we're now recommending truly is the righteous good stuff.

The same goes for Kitlog, which sees new gear added in for almost every category, with the Perfect PC and Game Box representing a carefully balanced set of components ideally suited to their specification. We promise you that these important sections of the magazine will always feature products that are the best for their designated job, and if something's there, it carries our full recommendation based on testing and personal experience with it.

We've taken a bold step, adding to the hypothetical PCs in Kitlog with a real perfect PC in A-List – which is also the basis of our cover story (page 18). It's a high-end PC we use on a daily basis and will update when we feel the time is right. That replaces the High-End box in A-List, which was previously an off the shelf pre-built PC.

Given the importance of CPUs and GPUs, we've added a new Chip News section near the front of the magazine in each issue (page 12). Our silicon guru Mark Williams will, every month, bring you up to speed with what's new, what's coming and a rumour or two.

And with that, do please enjoy another issue of *PC & Tech Authority* packed with many more wonderful features, reviews and guides, all for the love of the PC.

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...

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There's no question about it, an AT-AT would utterly trounce a Titanfall bot. An AT-AT is like a futuristic Navy LCS.

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I just got married :) It was the most incredible day of my life, but also happy to be back at the office with my boys.

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All I am hearing about is Dark Souls II... Maybe it's time I put down my camera and diverted my free time to my Xbox instead.

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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.

LETTER OF THE MONTH

Your magazine is the only one I subscribe to, and Australian Personal Computer or APC, is the only other magazine I read. Their recent magazine celebrated its 400th edition (congrats, by the way! -Ed) which took me back to when I bought their first edition.
I am not here to talk about that magazine though. Back then, I owned a Dick Smith System 80 Blue Label. It had 4K (Yes, 4 Kilobytes of RAM) for the younger generation and all data was stored on the standard run-of-the-mill C60 or C90 cassette tape. I remember spending painstaking hours hoping the asterisks in the top right corner kept flashing, which meant the program was loading. Then there were the hours inputting hexadecimal code into your machine and hoping you did not go wrong as the program would not work, and you guessed it, as it was RAM, all it took was a power surge or blackout and all was lost. Now look at us; RAM goes by the gigabyte and cassettes are almost non-existent.

What does the standard person need though in the way of computing? I run a computer business as a hobby and always tell the customer that the major players out there are selling the customer equipment for which they will only use the tiniest portion of its ability. Yes I am pulling the rug out from underneath them, but providing a consulting service, setting up a computer to their needs and ultimately saving the customer money makes me feel better inside.
J. Howden

David Hollingworth says: We pretty much agree with you. While it's always great to have the latest and greatest hardware, the simple fact is that hardware requirements haven't really shifted much in the last couple of years. We know a lot of people with PCs a generation or more old, that are still operating at full capacity. So well done for letting people know.

BREAKING BAD

Finally the Gods have blessed thee, and shone the light!
Didn't think I'd see the day when on the front page, printed "Why Apple is ripping you off" - lol, love it.
Well, profanities aside; really enjoyed your article on Data Recovery in this month's issue. But one question remains unanswered: can one erase data remotely with a large electro-magnet, just like Heisenberg accomplished in the wonderful "Breaking Bad" series?
A. Philippov

David Hollingworth says: In theory, yes, a large magnet will scramble the platters in an HDD. However, it is a little touch and go, and if you're trying to do it through the chassis it may not work completely, and a proper forensic recovering process may be possible. Also, it's not really remote – you still need to be pretty close to the drive to make it work!

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

Windows is one of the best OSes out there, but the registry needs to be reworked so it doesn't leave things behind, the same as left over files.
FeliXinside wants to see Windows overhauled.
Web ID: 375276

Imagine a Windows rebuilt from the ground up, with no residual coding from Windows XP. Oh happy days...
And according to savvart, he's not alone.
Web ID: 375276

I just whacked out a couple of chapters of my biography while sitting on the potty...
IanMountjoy has some interesting ideas about Samsung's new AR keyboard.
Web ID: 374262

There is a god... and he watches Firefly
Ben Nekozawa Scott-Peters is a fan.
Web ID: 371048

I can't believe I was using the SnipIt tool to take a bunch of screenshot jpgs when the feature is built in!
James Maxx learns something new about Word.
Web ID: 374631

happy dance with limbs flailing
SadisTech's response to news that Dishonored 2 may be closer than we think.
Web ID: 373916

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

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LATEST TRENDS AND PRODUCTS IN THE WORLD OF TECHNOLOGY

PONOPLAYER SMASHES FUNDING TARGET

THE PONOPLAYER – AN "IPOD KILLER" THAT DELIVERS LOSSLESS AUDIO QUALITY – BURSTS PAST ITS KICKSTARTER TARGET ON DAY ONE

A new digital music player dubbed PonoPlayer - which promises to deliver music at the highest quality available - has smashed past its Kickstarter funding target on day one.

Backed by Neil Young and endorsed by a festival's worth of other music legends - including Sting, Elton John and Tom Petty - the PonoPlayer promises to reverse years of declining audio quality created by the compression of MP3 files.

The PonoMusic project had a Kickstarter funding target of US$800,000, but fewer than 48 hours after the fundraising began, its crowdfunding pot already stands at US$2.2 million, as of 8am on 13 March.

The PonoPlayer itself looks like a fairly unremarkable device. Shaped like a mini-Toblerone bar to accommodate "larger audio components" and a "large cylindrical battery" that the makers claimed will last for a mere eight hours, it would be unlikely to disrupt the iPod's market dominance on hardware design alone, especially with a price tag of US$399.

However, it's what's loaded onto the player that makes the difference. The PonoMusic.com store will only deliver albums in the lossless FLAC format, in bitrates ranging from "CD lossless quality" (1411kbits/sec - 44.1 kHz/16 bit) to "Ultra-high resolution" (9216kbits/sec - 192 kHz/24 bit).

By comparison, most MP3 music sold today on stores such as iTunes is delivered at 192kbits/sec or 256kbits/sec.

"The difference between a PonoMusic digital file and an MP3 is about 30 times more data from which your player reconstructs the song," the company has claimed, citing the player's quality.

Certainly, Pono has no shortage of stars willing to attest to the new device's audio quality. "This basically sounds like you've got a record player in your car," said Taylor Hawkins of the Foo Fighters in Pono's promotional video.

"It blew me away, it was like being in a recording studio," said Elton John. "Listening to Bob Dylan, you could hear him playing the harmonica right next to you. You could hear the drums and the backing vocals on 'Respect' by Aretha [Franklin]. I haven't heard a sound like that since vinyl."

HARDWARE SPEC AND RELEASE DATE

Details of the hardware spec are a little thin on the ground. The 5in x 2in x 1in device is certainly much larger than today's iPods, which the company claimed was a conscious design decision to allow it to choose audio components for their quality, not their size.

It has a colour touchscreen and only three buttons: power, and minus and plus for volume.

It has three connections: mini-USB for charging and syncing with a PC; a 3.5mm headphone jack; and a stereo mini-plug for connecting to a home hi-fi system or car audio system.

It has 64GB of internal memory, which will only hold around 800 of the "Ultra-high resolution" tracks, but it can be supplemented with up to 64GB more via the microSD card slot.

Pono aims to deliver players to their Kickstarter backers by October.

NSA BOTS MONITOR MILLIONS OF INTERNET USERS

FORMER CIA CONTRACTOR EDWARD SNOWDEN HAS ALLEGED THAT NSA'S SURVEILLANCE IS EVEN MORE WIDESPREAD THAN FIRST THOUGHT

The latest documents released by Snowden, first published on Glenn Greenwald's new Intercept website, suggest that the NSA's approach to monitoring targets' computers using eavesdropping malware has been on a near industrial scale, rather than carefully targeted.

Amongst the many tools used to carry out the targeted attacks – via compromised routers or Facebook – is an automated infection application known as 'TURBINE' that can scale to millions of infection attempts a day.

TURBINE is complemented, says Snowden, by a platform called 'QUANTUMHAND', which generates fake Facebook servers – presumably using DNS spoofing – which hapless users log into and so release their credentials.

Using these approaches, says Snowden, allows the NSA to take a highly automated approach to compromising the many elements of the Internet, even stretching to assuming control over cyber-criminal botnets, as well as creating their own botnet swarms.

Snowden's assertions add credence to reports last year that the NSA had Tier One ISP level access to various servers on the Internet, including backdoor – but direct – access to the systems of Facebook and Google.

The use of an automated approach to infection may help to explain why Facebook, Google and others have denied collusion with the US Government in allowing access to their servers.

Snowden's assertions continue to suggest that the UK's GCHQ has played a close role in working with NSA in its various activities. Last month, the intelligence agency was accused of harvesting Yahoo users' explicit Webcam images, and in January it was also accused of analysing Facebook likes and YouTube views.

BILL GATES: OFFICE "NEEDS MORE THAN A TUNE-UP"

MICROSOFT FOUNDER SUGGESTS OFFICE HAS FALLEN BEHIND THE TIMES

Microsoft founder Bill Gates has criticised one of the company's biggest cash cows, Microsoft Office – admitting the package needs "more than a tune-up".

Gates, who recently resigned as Microsoft chairman to become a technology adviser to new CEO Satya Nadella, signalled that the company was set to take even greater risks with its long-standing product lines, suggesting big changes were afoot for Office, and possibly Windows, too.

"Office and the other Microsoft assets that we built in the nineties and kept tuning up have lasted a long time," Gates said in an interview with Rolling Stone, conceivably referring to both Office and Windows.

"Now, they need more than a tune-up. But that's pretty exciting for the people inside who say, 'We need to take a little risk and do some new stuff'."

Gates didn't stipulate what that "new stuff" might be, although Microsoft is known to be working on a touch-oriented version of Office for iOS, which it's expected to release ahead of finger-friendly apps for its own OSes.

GOOGLE RIVALRY

Gates also admitted that Google was a "very strong company across a huge number of things right now", and said the search firm was now in a similar position to where Microsoft was in its 1990s heyday.

"The fact is search generates a lot of money," Gates said. "And when you have a lot of money, it allows you to go down a lot of dead ends.

"We had that luxury at Microsoft in the nineties. You can pursue things that are way out there. We did massive interactive TV stuff, we did digital wallet stuff. A lot of it was certainly ahead of its time, but we could afford it."

Now it seems rivals have greater spending power. In the same interview, Gates admits Microsoft would have bought WhatsApp, but not at the $19 billion price that Facebook paid last month.

OFFICE 365 GETS PERSONAL WITH $9/MONTH SINGLE SUBSCRIPTION

NEW LICENCING TIER AVAILABLE

Microsoft has unveiled another way to subscribe to Office 365, dubbing the new licencing tier "Personal".

Office 365 is Microsoft's subscription version of Office, and includes access to Word, Excel, PowerPoint, Outlook and other software in its popular productivity suite.

Office 365 Personal allows one computer and one tablet to use the suite for $89 a year or a monthly payment option of $9. That compares with $119 for Office 365 Home Premium, which can be used on up to five computers. Office 365 Home Premium will continue to be offered, but will be renamed Office 365 Home.

"We recognise that there are households of all shapes and sizes, and we're committed to delivering the right Office for everyone – whether that be one person or an entire household," said Microsoft marketing manager Chris Schneider in a post on the Office blog.

Both consumer packages include 60 minutes of Skype calls each month and 20GB of additional OneDrive (formerly SkyDrive) cloud storage.

Subscriptions will be available this Autumn; Microsoft hasn't given a more specific date, but states that further details will be released soon.

Microsoft reports that it has already signed up 3.5 million consumers to Office 365.

HOT... OR NOT

HOT

RADEON 290

And by 'hot' we really do mean 'not'. Now that bespoke cooling solutions are appearing en masse, along with tidy factory overclocks, graphics cards based on AMD's top GPU are highly desirable, finally running as cool and quiet as the competition from Nvidia – if you can pry one from the hands of a Bitcoin miner...

NOT

BITCOIN MINERS

The reason you may not be able to buy the Radeon card you want now – or at a price you think is fair – is because AMD's new cards are a whole lot better at mining virtual currency than Nvidia's GPUs. Matters are slowly stabilising as AMD pumps out more stock, but for a while there AMD cards were commanding up to 60% above RRP – if you could find one at all.

GOOGLE SUED OVER $66 IN-APP PURCHASE

GOOGLE SHOULD HAVE FIXED ITS IN-APP PURCHASING AFTER APPLE DID, LAWYER CONTENDS

A Californian law firm has filed a class-action suit against Google, after a five-year-old child spent US$66 on digital crystals in a game.

The suit follows pressure from regulators for developers and app stores to make it harder for children to rack up such bills, but so far much of the focus has been on Apple's App Store.

"Google has unfairly profited by marketing free or low-cost games to children and permitting them to easily rack up charges for worthless in-game currency, by failing to incorporate reasonable controls such as simply requiring the entry of a password," said Shanon J. Carson of Berger & Montague, one of the attorneys in the case.

"Google is certainly aware that its primary competitor, Apple, has taken steps to end this unfair practice, and Google should do the same," Carson added.

App stores are littered with free or cheap to play games and apps that make their money by offering in-app purchases, and are "engineered to be highly addictive," the lawyers said.

Google does require users to enter a password to make a purchase, but doesn't require it to be re-entered for 30 minutes for subsequent purchases. "This practice is designed to enable children to purchase in-game currency without parental permission and without having to enter a password," the lawyers said.

Google had not yet responded to request for comment when we went to print.

GAMING NEWS

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

WARLORDS OF DRAENOR PRE-ORDERS OPEN, WITH INSTANT LEVEL 90 BOOST!

NEED TO PLAY CATCH-UP FOR THE NEXT WORLD OF WARCRAFT EXPANSION? BOY ARE YOU IN LUCK...

Pre-orders for the next World of Warcraft expansion, Warlords of Draenor, have just opened, so that we can all pretend it's not an infinite resource made up of virtual data. But it does in fact come with one very handy, more or less tangible, upfront benefit.

If you pre-order now, you'll get access to an instant boost for one of your characters, taking it all the way to level 90, the highest in the game.

For the first time, too, Blizzard's announced that expansions and other digital items will be purchasable in Australian dollars – no more guessing at exchange rates!

Warlords of Draenor (which we're not all referring to around the office as Warlords of Drain-o, no-sir-ee) is available now for $59.95 for a physical copy, for the cave-men and women among us, and $54.95 for pure digital. You can upgrade that digital pre-purchase to the Digital Deluxe Edition, which delivers even more instant in-game bonuses – a Dread Raven mount and hatchling, Warchief portraits for StarCraft II (because surely you play ALL BLIZZARD GAMES), and Warsong Pennant for Diablo III (CONSUME ALL GAMES).

The level 90 character boost is a neat piece of functionality, but it is limited to one character. However, if you really must boost your entire roster of toons, you can do so for the low, low price of $66 – each.

Which will seem like value to some, and like a raging rip-off set to drastically unbalance the game to others.

WITCHER 3 NOT COMING UNTIL FEBRUARY 2015

DEAR GOD, WHEN ARE WE GOING TO SEE CYBERPUNK 2077?!?

CD Projekt RED announced overnight the release date for The Witcher 3: The Wild Hunt. And... it's kinda sad.

We won't be seeing the epic RPG until February next year.

"Ever since we started working on the third instalment in The Witcher franchise, it has been our aim to produce a title that would take our 11 years of experience in creating RPGs and distil them into a quintessence, into a game that would effectively crown those years. At the same time, we have wanted The Witcher 3: The Wild Hunt to expand creative boundaries, set new benchmarks, and develop the RPG genre as a whole."

So, according to CD Projekt RED's board, that focus on quality and player experience means a long dev time. Which, if it delivers on its promise, will ultimately be worth it.

In fact, RED has admitted that the game could have been released this year, but that it would not live up to their own expectations.

So does this mean Cyberpunk 2077 for 2017?

sigh

WATCH DOGS CLASSIFICATION CHANGED TO R18 IN AUSTRALIA

UBISOFT'S OPEN WORLD GAME OF HACKING AND REVENGE LOSES ITS MA15+ RATING. HERE'S WHY

Well, that's a hell of a thing – last September, Watch Dogs was classified with a typical MA15+ rating, but today the game's been reclassified as R18+, according to our own game ratings watchdog, @AusVGClassifications.

The reason would seem to be the addition of new scenes featuring sexual violence of some kind. The game previously was marked out for violence and sexual themes, but it appears more mature new content has upped the official consumer advice to "References to sexual violence and sex scenes".

Which is one of the big bugbears of our classification system.

In fact, it seems that nearly every aspect of the game has been subject to an increased impact, at least as far as the classification board is concerned. Violence has gone up from Strong to High Impact, Drug Use has gone from Mild all the way up to Strong Impact, and Sex has gone from Moderate to Strong. Themes, Language, and Nudity remain the same.

Certainly, the last trailer featured a lot more impactful violence and threats of violence, so possibly the game's delay last year was because someone at Ubi thought the game needed a little more kick.

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MSI recommends Windows 8.

MSI-Leading the game

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CHIP NEWS

WITH TWO NEW ARCHITECTURES RECENTLY LAUNCHED, **MARK WILLIAMS** INVESTIGATES AMD'S LATEST IN THE CPU TRENCHES AND WHY NVIDIA HAS GONE ALL MAXWELLIAN

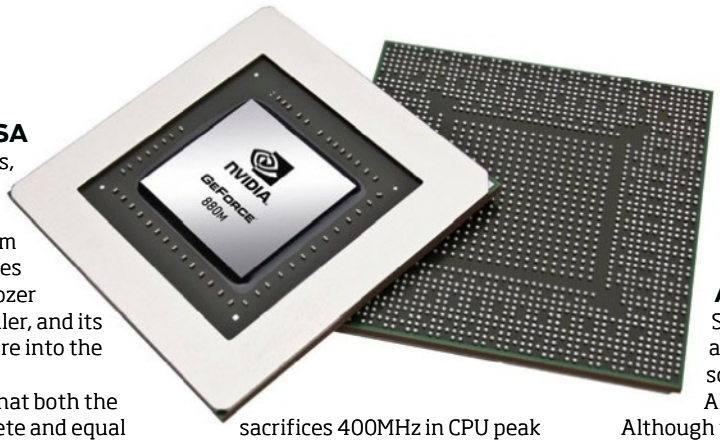
CPU

A10-7850K: FULL OF HSA

One of AMD's most recent CPUs, the A10-7850K, finally brings about the full realisation of its HSA (Heterogeneous System Architecture) vision. It combines its latest 3rd generation Bulldozer architecture, dubbed Steamroller, and its latest graphics GCN architecture into the one SoC, dubbed 'Kavari'.

HSA is realised by the fact that both the CPU and GPU now have complete and equal access to system memory, allowing both to be fully taken advantage of, especially in GPGPU intensive tasks.

It's built on a new half-node 28nm SHP (Super High Performance) process at Global Foundries, which provides a nice middle ground between what GPUs like, with die density, and frequencies, which CPUs prefer. Thanks to this, although the new design has some 1.1 billion transistors more (boosting the GPU unit count some 33%), it maintains the same SoC TDP and die area. It sacrifices 400MHz in CPU peak speed (with a still-respectable boost speed of 4.0GHz and a base frequency of 3.7GHz) however the deficit is recovered with the newer more efficient architecture.



These chips are aimed at 1080p@30fps gaming and include a new True Audio DSP, support for OpenCL 2.0 and improved UVD/VCE units.

The A10-7850K does extremely well in GPU intensive tasks like games besting the likes of the Intel i7 4770K; however in CPU intensive tasks even with the new architecture it's barely able to keep up with Intel's i3 4330.

Only hunt for these if a discrete video card is not an option, or if you prefer a build where APU graphics are sufficient.

AM1: SOCKETED KABINI

Some news has started to leak about AMD releasing a (FS1b) socketed version of its Kabini APUs dubbed the 'AM1 platform'. Although this class of chips has been around a while in laptops, AMD sees a market opportunity for these, placed opposite Intel's 'Bay Trail' based Pentiums.

With an upgradeable socket, higher memory speeds (1600 MT/s vs. 1333 MT/s), larger memory capacities (up to 16GB) and immediate support for 64-bit OSes, AMD sure looks to have an advantage over Intel's solutions in this space.

If you're building a small all-in-one system, media centre or SteamOS box, this platform should be high on your list.

GPU

GTX 750 TI: MAXWELL FOR DESKTOPS

With processing nodes still stuck at 28nm, Nvidia had to do something to keep the pressure on AMD. Welcome to its new 'Maxwell' architecture.

Nvidia has reworked much of its previous Kepler design to focus exclusively on power and die area savings, and is claiming that Maxwell outright doubles performance-per-watt over Kepler.

Maxwell still only officially supports DX11.0, however the video codec logic gets a 1.5-2x speed boost.

In terms of TDP the GTX 750 Ti replaces the GTX 650, and although it sports the same 128-bit memory interface, it doubles the VRAM to 2GB, L2 cache is multiplied 8x to 2MB, and shader cores are boosted by 60% from 384 up to 640. This puts the 750 Ti close to the upper market GTX 660 for performance, while sipping less than half of its power at 55W vs 140W.

When Nvidia ramps this new power-efficient design up to the higher performance brackets, AMD may well find itself on the back foot.

GTX 800M: MAXWELL FOR LAPTOPS

Nvidia has also launched its GTX 800M series line-up for laptops. The GTX 880M to GTX 860M are based on the older Kepler design but have more shader processors, while the GTX 860M (a second version) down to the (non GTX) 830M are based on the newer Maxwell.

The lower Maxwell GTX parts claim a solid 60% odd performance boost over the older 700M series, whereas the higher-end Kepler GTX parts gain around 30% extra.

The big new feature with this launch is its 'Battery Boost' technology. It's an addition to the driver software stack that limits frame rates in games to 30fps, thus saving power by not rendering unnecessary frames above that. It works best on easily rendered games; for example it can extend League of Legends play time by 2x, whereas Borderlands 2 gets 1.5x more. Users can alter the target frame rate and quality profiles to their liking, too. You can expect to play harder and longer with one of these under the hood, without the inconvenience of making manual adjustments.

Have a need for speed?

Looking for a wireless router that delivers super-fast speed? How does wireless speeds as fast as 1.3 gigabits per second sound? Well, hold onto your seats because Billion's new BiPAC 8800AXL wireless AC broadband router offers just that! Based on a Broadcom chipset, the BiPAC 8800AXL supports ADSL2+ and is fibre-ready, using an Ethernet Wide Area Network port to hook into the NBN as soon as it comes to your house. It also has four additional Gigabit Ethernet ports plus two USB 2.0 ports, allowing for 3G/4G modem connectivity, print serving or Network-Attached Storage. Aside from being blazingly fast, NBN-ready and backwards compatible, this amazing device is jam-packed with loads of other exciting features, including:

- 4-port gigabit switch
- 1-port gigabit Ethernet WAN (EWAN)
- 2 USB ports for print server, NAS, DLNA and 3G/4G LTE USB modem
- ultimate wireless speed 300+1300Mbps
- SNR adjustments to achieve highest sync speeds
- monitoring of individual LAN traffic
- QoS for traffic prioritisation and bandwidth management.

3 x faster than the current Wireless N protocol

Speeds up to 1.3 gigabits per second

For more information on the BiPAC 8800AXL or for a list of Billion stockists Australia-wide, visit billion.com.au.

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BILLION

MOST WANTED

THE THINGS WE CURRENTLY LOVE THE MOST THAT AREN'T NECESSARILY PCS.

NIKON COOLPIX A

Camera makers have battled the smartphone challenge by releasing compact shooters with too many pointless features, DSLRs that are ever-so-cheap, but still too big and heavy, and inventing an all-new class (interchangeable lens cameras). But we prefer the Nikon A. It's simply a big DSLR DX sensor (the same one Nikon use in the acclaimed D7000), packed into a compact body and with a lovely 18.5mm f/2.8 lens. There no zoom because most of the time you don't need one, and it lets the lens be of the highest quality. It just gets things done.

www.nikon.com.au

SONY W270S WALKMAN

It's waterproof. That's all you need to know. Laps can be swum while banging on to the Rocky soundtrack/Lose Yourself/insert you your favourite motivational track here. Its battery is good for about an hour and a half, which is about a marathon's worth, we reckon, if we had any idea about such things, which we don't. Or just wear it in the bath.

www.sony.com.au

TITANFALL COLLECTOR'S EDITION

The photo here cannot do proper justice to this object de geeky awesome. A model of a Titanfall bot, it's quite huge, at about 43 cm high, and every bit of it meticulously painted and detailed sci-fi perfection. The $400 box that it comes in includes a copy of the game, a couple of similarly detailed human figurines, a poster and a rather stupendously beautiful art book showing the hundreds of conceptual artworks that went into the creation of the game. It may well be sold out by the time you read this, but if you see one on eBay we have to say buy buy buy.

www.titanfall.com.au

PLEXTOR

Plextor Premium Grade SSD

M6e

Engineered for Elite Gamers

Fast loading, smooth, uninterrupted gaming becomes a reality as Plextor launches the M6e, a high-performance PCIe gaming SSD with driver-free ACHI support and selectable legacy BIOS/fast UEFI booting
Random read and write up to 105K /100K IOPS
Sequential read and write up to 770 / 625 MBs

128GB / 256GB / 512GB

M6S

Boot Up to Dominate

Low power consumption for extra battery life and environmental friendliness combine with high performance in Plextor's new M6S to give an efficient, responsive computing experience
Random read and write up to 94,000 /80,000 IOPS
Sequential read and write up to 520MB /440 MBs

128GB / 256GB / 512GB

M6M

Ultra Mini, Ultra Mobility

With its ultra mini size, light weight and low power consumption the M6M is especially suitable for ultra portable on-the-go computing devices.
Random read and write up to 94K /80K IOPS
Sequential read and write up to 520 / 440MBs

64GB / 128GB / 256GB / 512GB

True Speed
Sustained High Performance

True Protect
Unequalled Security And Data Accuracy

www.plextor.com

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Is SMS the simple money spinner?

ROSALYN PAGE EXAMINES THE DEGREE TO WHICH CONSUMERS ARE PRICE-GOUGED FOR SMS

The headlines screamed the revelations that consumers are being ripped off for SMS. The stories revealed that it can cost as little as 1 cent to send 100 SMS messages, while some consumers are charged up to 15 cents for a single message. The telco industry, the enfant terrible of consumer relations, in trouble again.

SMS costs are in the spotlight because the Australian Competition and Consumer Commission (ACCC) is looking at regulating the way telcos charge each other for SMS.

At the moment, there are controls around mobile calls through the mobile terminating access service (MTAS) regulation, but this doesn't apply to SMS. The MTAS applies a charge from one telco to another to use their network.

When a call is sent from someone's phone on one network it has to be passed to another network to the receiver's phone where it then terminates. (If calls are made on the same network, the MTAS charge obviously doesn't apply.)

Mobile termination is a wholesale service that one telco provides to another to carry the call on its network and it charges the originating telco for that termination service. But, in effect, the network operator is a monopoly owner of that network and can control the cost of its termination service without any competition.

If you've ever played Monopoly, you can understand how owning access to something, whether it be Mayfair or phone towers, can make it costly for people who land on it with the boot or a phone call.

Now, consumers don't necessarily pay this exact price for their calls, but it's one of the costs that telcos have to manage so it's understandable that it'll feed into consumer pricing in phone plans. The ACCC regulates the MTAS to keep a lid on what consumers pay for mobile phone services.

Understandably, it doesn't make the telcos happy that the ACCC can declare a cost for call termination services because this lowers the price and takes their profit margin down with it. Consumer groups such as the Australian Communications Consumer Action Network (ACCAN) want SMS termination services to be regulated to continue to bring down mobile costs.

"The telco industry, the enfant terrible of consumer relations, is in trouble again."

A bit of background will explain why this has come to the fore now. The MTAS was created in 1997 and regulated voice termination services over analogue and digital networks. In 2004 the ACCC regulated the mobile termination costs on 3G networks to promote competition. It was 21 cents per minute a decade ago and has lowered since then. The ACCC declared that it would be set at 9 cents in 2009 and that the service would be reviewed five years later.

This brings us to 2014. The ACCC has been looking into the MTAS once again. It's had a public inquiry, took submissions last year and released a discussion paper looking at the current state-of-play. The ACCC last year in its draft report proposed to declare SMS termination costs in the way that it does with phone termination costs. It wants to continue to promote competition and limit monopoly behaviour in the interests of consumers.

The big three carriers – Optus, Telstra and Vodafone – won't reveal the SMS prices they charge each other so we don't know the true cost. It's like the global roaming interchange fees that aren't declared. We're left to suspect that the price hikes are pretty big.

The telco landscape has changed considerably in a decade and it's a more complex market where many different types of services intersect. There are other services to consider in relation to costing – apps, VoIP, 4G and NBN.

The ACCC doesn't propose to regulate MMS services, for example, because of the relatively low usage compared to SMS. In relation to the NBN and 4G services, these are assumed to be included within the ongoing MTAS regulation. The ACCC is looking into including mobile calls to local numbers.

The MTAS is likely to be extended for a further five years, helping to lower phone and SMS costs, and hopefully this will flow on to consumers. The next battleground is global roaming. Expect to see headlines on bill shock until we get action on global roaming interchange fees. Watch this space for updates on the government's proposed trans-Tasman roaming bill that should empower the ACCC to put in place price caps for NZ.

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

HAD AN ISSUE AS A CONSUMER? INVESTIGATOR CAN HELP.

Email: investigator@pcandtechauthority.com.au

THE PERFECT PC

BUILD PROJECT

WHAT HAPPENS WHEN *PC & TECH AUTHORITY* EDITOR **BEN MANSILL** IS GIVEN FREE REIN TO BUILD A DREAM PC, TO USE DAILY AS HIS NEW WORK AND PLAY PC?

You know when it's time to upgrade. For me, that time is now. Following is the adventure in selecting the components, putting it all together, and experiencing the joys of a tremendous jump in performance, which, I hope, may illuminate the path ahead for many of you who may be considering a similar journey.

Shortly after coming onboard as editor of this wonderful magazine I was informed that one of my first tasks would be to undertake a long-planned feature story, one where an old PC underwent a significant upgrade, and that my own PC, which I use for work and play, would be the candidate. Furthermore, the brief gave me free rein to choose virtually any component. To say that this was a task I immediately relished and embraced enthusiastically is an understatement.

THE BUILD BRIEF

This is a build that's intended to be representative of a typical upgrade. It is not, for the most part, an exercise in cherry-picking the most powerful or most expensive components. Value, here, is just as important as performance.

The machine will be a daily workhorse, so must be able to run, as smoothly as possible, relatively demanding applications such as most of Adobe's publishing and design apps, and several of them at once. It is also a game box, so it needed headroom in particular with CPU power and graphics capabilities. All this mustn't be compromised by usability. The system mustn't be a mini-tornado of fan noise, and it must – absolutely must – be faultlessly reliable.

THE OLD BOX

It's a testament to the immense power of Intel's i7 CPU that this old machine had slugged along for a solid five years, and was still a perfectly capable gaming PC. Built in 2009, the heart of the system was an i7 870 CPU on a Gigabyte P55 motherboard. Its stock speed is 2.93GHz, but it's been running every day overclocked to 3.6GHz. However, in just the last month it began crashing, usually with a BSOD or spontaneous reboot. Clocking it back to stock didn't help, nor did many hours of troubleshooting. This machine had clearly reached the end of its impressive life.

It had recently been upgraded with a 7970 GHz Edition graphics card, as well as three new SanDisk SSDs. The year previously, an ASUS Xonar Essence sound card was also added. It all sat in a very stylish Lian Li V1000 case, so the initial question was which bits to keep, and what to replace?

Clearly the motherboard and CPU had to go, but the perfectly workable and very quick SSDs would stay, along with the sound card. The memory – 16GB of Kingston DDR3, which had been overclocked aggressively beyond its 1333MHz specification to 2000MHz, should also be replaced, as that may have been contributing to the crashing, despite testing as still being error-free. In the end I decided to put it all in a new case for no other reason than giving it a fresh look to do justice to the sense of newness it would all have.

THE CASE: COOLERMASTER COSMOS SE

I'm still in awe at how Coolermaster manages to sell these for just $179 (RRP). It has the looks of a premium case twice the price, comes equipped with two blue LED fans pulling air in through superb ventilation that takes up almost all the front panel; another two fans vent air out the top – which is also almost all grill, with another at the rear. A panel at the top provides mic and headphone plugs as well as 2 x USB 2 and 2 x USB 3 ports, very handy for the frequent connection of flash drives.

THE BUILD

Up to 18 drives can be installed using slide-out trays. But the front tray mounting racks block a significant amount of airflow so I removed all but the bottom two. There's provision for another two SSDs to mount flush with the back panel, which I utilised. Each tray can hold two SSDs, but fortuitously the old Lian Li dual-drive caddies fitted perfectly into a single-drive space in the Coolermaster trays, effectively doubling the number of drives I could install in that space, and allowing for vastly improved airflow.

Ample holes positioned well allowed for all of the system's cables to be kept well out of sight. I didn't encounter a single issue when assembling the system, with clear documentation, too. It was a joy to put it all together, and is a handsome beast emanating style and power befitting its role.

THE CPU: INTEL CORE I7 4770K

It was this, an i5 or perhaps a hex-core CPU, as options. In the end the price difference at the high end of the i7 range was minimal, and 6-cores was overkill for this machine, at least at this stage – perhaps later in the year once more demanding games are out – while the value of the extra hyperthreads in the apps I'll be running is genuine, so

▼ The black motherboard looks rather nice with the Cosmos SE case and red accents

that ruled out an i5.

The choice to go with the unlocked K variant was driven largely by the inclusion of the following item...

FRIPPERY: ASUS ROG FRONT PANEL

This lovely LED panel was completely unnecessary, but highly desirable. It allows not only quick control over fan speeds, but also one-touch overclocking. The i7 4770K's stock turbo speed of 3.9GHz can be instantly boosted to either 4.2 or 4.4GHz, with the gorgeous LED displaying the CPU temperature and CPU frequency.

It only works with ROG ('Republic Of Gamers') spec ASUS motherboards, and the motherboard I chose actually already included a panel with similar functionality, but with nowhere near the pretties. Yes, it was a bit of an indulgence, this bit, but it adds so much to the look that it was in.

THE BUILD

The panel takes up two 5.25-inch bays, and connects via a custom cable to the motherboard. It also supports ASUS' SupremeFX on-board audio via another cable, allowing one of several equaliser presets to be invoked via the panel. The Xonar Essence wasn't compatible with this function, but I've never found a product where eq pre-sets actually improve matters, so no loss there. It also needs a SATA power cable, which given its mounting position about as far away from any other component as could be, meant needing to use one of the few power cables available solely for this device.

CPU COOLING: COOLERMASTER NEPTON 140XL

The age of the heat sink fan is over. High quality All-In-One water cooling units are now hovering just over the $100-mark, and for any performance-driven system they are the only choice. The Nepton 140XL was selected for its low noise and high performance. As a single-radiator unit, it manages to almost equal the cooling prowess of double-radiator products.

THE BUILD

This was the trickiest bit of the entire build – not because it's difficult to install but because finding the right position for it was a lengthy process of trial and error. In a perfect world the radiator simply screws onto your chosen mounting area, with the cooling head

> "Finding the right position for it was a lengthy process of trial and error"

screwing onto the motherboard. Easy.

Initially I wanted to have both the push and pull 140mm fans mounted on the radiator, and measuring told me that would work, but once it was mounted it turned out that it stopped the motherboard from slotting into position by just a few agonising millimetres. Mounting it inside the case was something I wanted to avoid, as having it blast hot air into the case was undesirable, so in the end I had to use just the pull fan and mount that on the outside of the top grill.

As it turned out, the pull fan is more than enough to keep the radiator fed with air under load, and the amount of hot air coming through the other side was negligible, so it could have easily been mounted internally without affecting performance.

THE MEMORY: CORSAIR DOMINATOR PLATINUM

The only stipulation was for 16GB, that being the new minimum for high-end gaming. Yes, 8GB would be perfectly workable, but games with particularly sophisticated graphics engines are now shipping with 64-bit operation, allowing them to take full advantage of extra memory. Battlefield 4 is one such, and Star Citizen, which I'm very much going to latch onto, is another.

Corsair supplied 2 x 8GB modules of its top-end Dominator memory. These are built with cherry-picked memory chips which are not only excessively reliable, but also, in theory, have considerable overclocking headroom. 1600MHz RAM was supplied, which is a little slower than I would have liked but, as it turns out, is able to sit comfortably at 2000MHz without fuss.

3D SPEED	GOOD / PLAYABLE / UNPLAYABLE
VERY HIGH SETTINGS	54FPS
MEDIUM SETTINGS	92FPS
LOW SETTINGS	149FPS

SSD SPEED

One of the main drivers for this upgrade in the first place was to free the SSDs to run at full SATA 6 Gbit/sec speed. I expected close to double the performance, using the same drives, and with the exception of the old Intel X25, which isn't rated at SATA 6 Gbit/s speed, that's what I got.

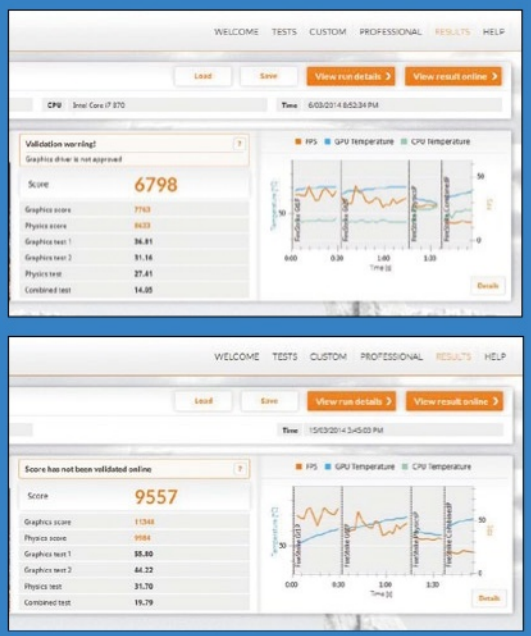
▲ While the SSDS were capable of close to 500MB/s, they needed a SATA 3 motherboard to unleash the potential

THE MOTHERBOARD: ASUS MAXIMUS VI EXTREME

Now this was certainly overkill, but gloriously so. Almost any Z87 motherboard would have done the job, or indeed an H87. But the choice was made for the Maximus VI because it's so ridiculously well engineered and feature-rich that it would serve well as a test bed for other components, being both faultlessly reliable thanks to its design being primarily able to handle the rigours of competitive sub-zero overclocking, and the UEFI BIOS in which ASUS has opened up every conceivable aspect of system control.

3D MARK

A 40.5% boost in 3D Mark shows what the pairing of the i7 4770K and the 290x is capable of delivering. The CPU is tested significantly in this benchmark, and while running at 3.5GHz, compared to 3.6GHz for the old system, a much higher boost frequency really helped it along.



▲ The combination of i4770K CPU and the Radeon R9 290x gave a massive leap in 3D Mark peformance. The new CPU, however, necessitated an all-new motherboard upgrade

THE BUILD

There were no issues with installation, although the SATA ports are positioned directly under the graphics card and so additional drives in the future will probably necessitate the removal of the card to gain access to the ports, but that's not a high drama. On the upside, there's an abundance of fan headers spread out in every area of the board, so all the fans could be connected directly, and not hung off PSU cables, thus allowing speed control via the fan bus or ASUS desktop software.

It's also a handsome-looking board, with its black PCB and red accents making the complete system particularly lovely to behold.

THE GRAPHICS CARD: ASUS RADEON R9 290X DIRECTCU II OC 4GB

Easily the most interesting part of the build and one I contemplated for a long time. ASUS were kind enough to let me select any of their graphics cards, and that meant some seriously high-end gear to consider, including the new water-cooled Poseidon 780 or the top-line 780Ti.

A few critical factors swung it towards the 290x, the big ones being 4GB of memory, and Mantle. I run a 30-inch Dell monitor, and at 2560 x 1600 native resolution graphics memory becomes very important in games with very large texture files. It's all too easy to fill up an Nvidia 780's 3GB of memory at that resolution with a modded version of Skyrim which included 4K textures and bumped-up object detail and draw distance. Star Citizen will also certainly push that envelope to a new extreme.

I also believe that Mantle will be adopted more widely than some of the sceptics may tell you. Again, Star Citizen will be a Mantle game, and the performance gains could be in the 20% or greater range. Yes, it's a largely speculative gamble, but it all makes AMD's card a far more interesting bit of gear to run than the simple brute-force appeal of the Nvidia 780. In any case, even in regular DX10/11 mode the 290x is generally equal to the 780Ti, making it the equal-fastest single-GPU option available now anyway.

I would not have chosen a 290/x card with reference cooling. It's true that they are too hot and too loud, and ASUS' DirectCU II cooling transforms it into a highly desirable component. It also allows for a nice little factory overclock, running at 1050GHz core and 1350GHz memory.

THE BUILD

Had I not done some careful pre-planning here I would have been in a bit of trouble, because the card (as with most new high-end cards) is just a smidge too long for the standard chassis space allowed for it. To fit this 26.7cm monster, the front drive bay mounting brackets needed to be removed, which was thankfully easy and didn't affect the plan for the rest of the build.

THE DRIVES: SANDISK EXTREME II 240GB SSD + 2 X SANDISK ULTRA PLUS 256GB SSD + WD BLACK 2 128GB SSD + 1TB HDD + INTEL X25 256GB SSD

These carried over from my old PC, with the exception of the WD Black 2, which is a new addition. SanDisk's Extreme II SSD offers high-end performance so serves as a C: and games drive. Quite a few dollars were saved here by not adding new drives, and I also opted to run with my ancient 1st-gen Intel X25 which is still amply quick, and has been heavily used over the years, so I am keen to keep it running as a long term test of SSDs over time.

The big radical decision here was to skip an optical drive altogether. Despite being a heavy gamer all my games come via digital distribution – usually Steam. I've used the DVD on average a couple of times a year lately, and have an external drive to use if ever needed.

3D SPEED GOOD PLAYABLE UNPLAYABLE

VERY HIGH SETTINGS	80FPS
MEDIUM SETTINGS	126FPS
LOW SETTINGS	194FPS

THE SOUND CARD: ASUS XONAR ESSENCE

I bought this a couple of years ago to replace an X-Fi which had died, and it's been one of the nicest additions to a PC I've ever enjoyed. Music is just incredible and gaming still good, though positional surround not as accurate or clear as an X-Fi.

THE FUTURE

As you'll see on page 76, where the A-List has been revamped, this build is now the basis for the High End PC. It doesn't include all the bells and whistles of the Performance PC in Kitlog, but is a little better than the Game PC in that same section.

In A-List, the specifications used here will be our standard for a quality PC with high-end components, but without going completely crazy and adding luxury items, like multiple video cards. In time, we'll revisit it, and add new components as warranted, but we expect it to last quite a few months, if not longer, before that's necessary. ◆

SYSTEM TUNING 101: OPTIMISE YOUR SYSTEM TO SUIT YOUR EVERY NEED

These days we can build desktop systems into various forms and shapes. However, despite the difference in size, specification and look, these systems may not have been optimised to their full capacity for any number of reasons. This guide will cover key tuning tricks to make an immediate improvement to the various aspects of your desktop; you will be amazed how much you can improve your system with some simple PC tweaks.

▲ ASUS Dual Intelligent Processors software allows precise monitoring.

MINIMISE FAN NOISE

Fan noise is the most irritating part of the desktop system usage experience. To minimise this effect, one has to first attempt to put all airflow to best use. Here are some principles to keep in mind.

1 Minimise anything blocking airflow. Some modern chassis feature cable holes along the top and sides of the motherboard. Make good use of these holes to route large cables to the back of the motherboard to prevent blocking your airflow. Consider dividing the system into various thermal zones, utilising thermal dividers such as TUF Thermal Armor, cooling components down separately if the blockage of airflow cannot be prevented.

2 All warm air must leave the system. Active airflow driven by additional fans can help to quickly remove the warm air inside the chassis.

3 Naturally, the warm airflow moves up, while the cold moves down.

4 Using intake fans to introduce cool airflow directly onto the heat critical components such as the water cooling radiator, CPU power module, CPU cooler, and chipsets can help to cool these locations down more effectively than interior circulation of air.

5 Utilise minimal airflow to achieve the above, in order to minimize fan noise. ASUS Fan Xpert 2 and TUF Thermal Radar 2 are unique software solutions that incorporate fan calibration capability, as well as taking into consideration the effect of different fan locations, or even turn some fans completely off when additional airflow is no longer needed.

MINIMISE SYSTEM BOOT UP TIME

The system boot up time is the time it takes from the moment the power button is pressed, to the very moment a user can begin to actually use the system. We can break this down into two key areas of concern, namely BIOS Load Up Time, and OS Load Up Time.

- The BIOS Load Time is dependent on the device initialisation time of all installed

▲ An attractive interface and complete control makes tweaking a joy.

devices, and the loading time of each BIOS module. While Option ROM, UEFI driver, and the backward compatible Legacy Compatibility Support Module enable a system to support various function and devices prior to driver load, they will also extend the BIOS Load Up Time as the tradeoff. One can consider disabling all Option ROM that the system will never attempt to boot from to minimise the system load up time. The CSM (Compatibility Support Module) can also be disabled if the system does not need to boot from any legacy device. Other device initialisation processes such as additional SATA devices, PS/2, onboard LAN, or even USB can also be bypassed during the POST stage to speed up BIOS Load Up Time; after all, they will still be initialised by the OS anyway. Finally, in a single storage device setup, one can consider upgrading to an SSD to save a couple more seconds of device initialisation time, as spindle-based HDDs have a relatively lengthy initialisation time compared to SSDs.

- The OS Load Up Time is dependent upon the device and driver initialisation time of all installed devices, the load time of all startup software (including AV software), and of course, the time it takes to load up the OS itself. That's why the OS loads quicker upon a fresh installation, and gets slower as you install more devices and software onto it. To speed up the OS Load Up Time, avoid installing unnecessary software, install no more than one Anti-Virus/Internet Protection software package in the same system, and conduct regular virus scans under Safe Mode to prevent the extension of OS Load Time. Microsoft Windows 8 or above features the advantage of needing less initialisation process during OS load stage as compared to previous Microsoft operating systems. One can consider upgrading to Windows 8 or above if OS upgrade is an option. If hardware upgrade is also an option, upgrading the OS drive from a spindle HDD to a SSD can easily improve the OS Load Time thanks having a relatively faster random access performance.

"Modern ASUS motherboards all feature the latest generation EPU design"

SCAN THE QR CODE FOR MAXIMUS VI EXTREME PERFORMANCE TUNING GUIDE

IMPROVE SOFTWARE LOAD TIME

This is the time it takes from the moment an application is clicked or double clicked, to the moment a user can begin to use the software. Modern Microsoft operating systems such as Windows 7 or above feature the ability to cache software into DRAM after each execution, provided DRAM space is sufficient, and such space does not need to be released anytime before the next execution. Software will execute extremely fast if it is loaded up for the second time upon entering the OS. However, if an immediate performance improvement is desired, one can consider upgrading the storage medium hosting the software to one with faster random access performance, such as an SSD, a SSD RAID, or even RAMDisk to improve the first-time software load up time.

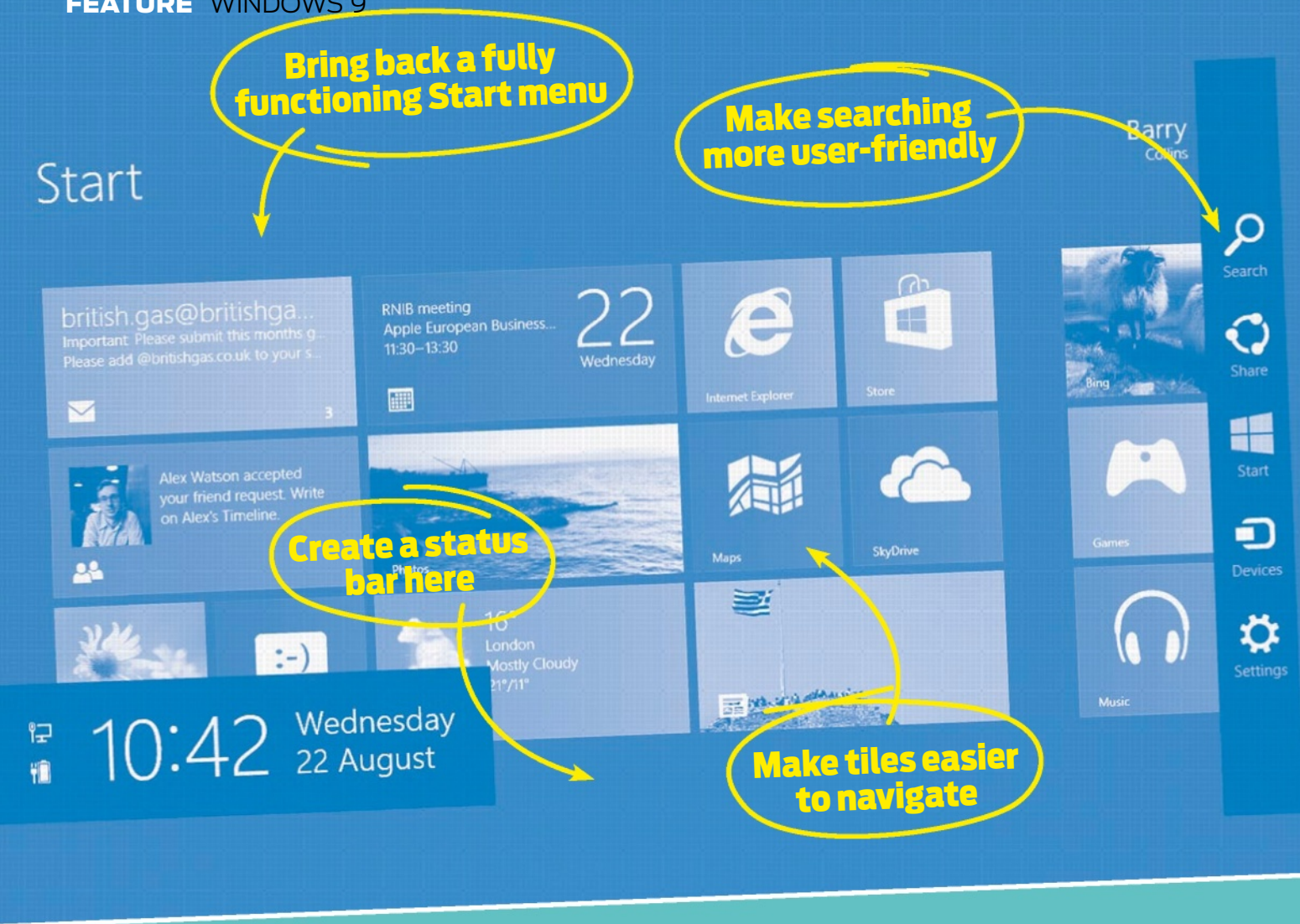
SCAN THE QR CODE FOR MAXIMUS VI POWER SAVING & POWER TUNING GUIDE

MAXIMISE DISK I/O PERFORMANCE

Though disk I/O performance can already be noticeably improved by upgrading to an SSD or even SSD RAID array, there's still room for further improvement with a few tweaks to the BIOS options. Go into BIOS setup screen, and disable options with the keyword "ASPM" (Active State Power Management), "LPM" (Link State Power Management), and configure "Package C State Support" to " C0/C1", for an instant I/O performance boost.

MINIMISE POWER DRAW

Modern ASUS motherboards all feature the latest generation EPU design, which divides the system power management into four separate usage models, namely the "High Performance" (maximise performance), "Auto" (balanced between performance and energy consumption), "Max Power Saving" (minimum power draw, with configurable CPU power draw in one watt increment), and "Away Mode" (ideal to leave the system to do background tasks while the user is away from the machine). Use these four modes wisely they can save you some power bills by the end of the year.



WINDOWS 9

TEN WAYS FOR MICROSOFT TO SAVE WINDOWS

AS THE MONTHS TICK DOWN TO THE LAUNCH OF WINDOWS 9, WE PUT TOGETHER OUR WISH LIST OF WHAT NEEDS TO BE IMPROVED FROM WINDOWS 8

Microsoft, we need to talk. The way you've been behaving lately, it has to stop – you're nothing but frustrating. We want things to go back to the way they were.

In Windows 8.1, the return of the Start button was functionally useless, but when you admitted it could have been improved many people took it as a step in the right direction. Windows 8.1 Update 1 is expected to further repair the damage to the desktop, making it easier to use Windows Store apps with a mouse and keyboard. And with Windows 9 rumoured to be arriving in 2015, you have an opportunity to listen to your users and make the operating system Windows 8 should have been.

Here are ten of our suggestions for how you can save Windows – plus a selection of the best ideas from *PC & Tech Authority* readers. We hope you're reading this, Microsoft, we'd love to see your OS shine again.

POWER STRUGGLE

Barry Collins, tech journalist: "The one thing that stops the Surface Pro from replacing my iPad 2 on a day-to-day basis is its power management. If I leave the Surface overnight, it takes 11.4 seconds for the Surface to reach the password screen after I press the power button; my iPad 2 is ready the moment I flip back its case.

"Even if the Surface hasn't gone into overnight hibernation, it still takes a second or two longer to resume than an iPad. These sound like petty complaints, but they affect usability. If I want to quickly check an email or send a tweet, I reach for the iPad every time.

"My other power-management gripe is that the Surface Pro will lose around 10-20% of its battery life sat in my bag overnight. The iPad barely loses anything. That means the iPad usually lasts a working week, while the Surface needs charging every two or three days.

"That just isn't good enough, especially for a device that's heavier than the iPad and twice as thick. If Microsoft wants Windows 9 to be a great OS for tablets and laptops, it needs to sort out the power management."

TAKING METRO TO TASK

Tim Anderson, Windows journalist and developer: "Microsoft went overboard with what it calls an 'immersive UI' in Windows 8. Apps run full-screen, and even to show a menu, you have to swipe or right-click. It's mad.

"I'd like to at least see a status bar in the Metro environment and have it show time, date, connection status and battery status, and be available for app developers, too. Live Tiles are designed for status updates, but you see those only if you go back to Start. In fact, I'd be happy about having the entire taskbar in Metro, which of course includes a notification area. Imagine switching to another app or to a desktop app with a single tap or click. Leaks suggest Microsoft is putting Metro app icons on the desktop taskbar, so it's moving in that direction. Here's hoping it goes all the way."

▲ An improved status bar might include the time, date, battery status and connection status

WINDOWS 7 MODE

Tim Danton, tech editor: "There's so much that's great about Windows 8 compared to Windows 7: the improved task manager; the integrated cloud storage via OneDrive, the fact Microsoft put so much effort into streamlining the OS to make it faster and more responsive. I've lost count of the number of people who look at those tiles in bewilderment and then simply give up."

WINDOWS 8.1 UPDATE 1: *WHAT MICROSOFT'S CHANGING*

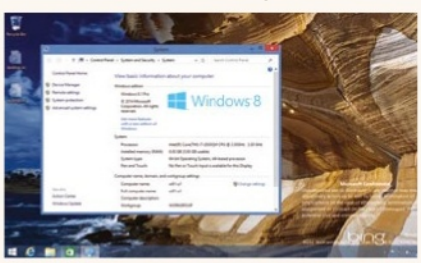
One major criticism of Windows 8.1 is that full-screen apps and desktop applications don't work well alongside one another. Happily, we don't need to wait for Windows 9 for some relief on that score. Windows 8.1 Update 1 is expected to arrive as a free download in March or April 2014; we've taken the pre-release code for a test drive and can reveal that it makes some very positive changes.

For starters, Metro apps can now appear on the taskbar next to desktop applications, making it much easier to see what's running and to switch between programs. Apps running full-screen gain title bars, so you can easily drag them around and close them – and if you hover at the bottom of the screen the taskbar pops up, again making it easier to manage and switch between your open apps.

The Start screen has received a few updates too: there are now friendly icons for Search and Power at the top right of the screen, which will be especially helpful for beginners. And when you right-click on a tile, the contextual menu opens in a regular dropdown rather than at the very bottom of the screen.

These changes make Windows 8.1 feel more intuitive and coherent, especially if you want to run desktop and Metro apps together. The original release of Windows 8 had some frustrating foibles, but with successive updates Microsoft is gradually turning its concept of a single OS for desktops and tablets into a usable reality.

▼ Store apps now appear on the taskbar, making them easier to view and manage



▼ The happy return of the title bar makes running multiple apps far simpler

▼ The improved Start screen is much more user-friendly and helpful for beginners

- Windows needs more, er... windows
- Making Window 9 free would win back some goodwill

BRING WINDOWS BACK TO WINDOWS

Nicole Kobie, technology journalist: "There's one aspect of Windows 8.1 that makes me want to cry out in frustration: when a Windows Store app opens in full-screen mode, yanking me away from my work. Whatever happened to multitasking? If Microsoft wants me to use the Facebook app rather than open Facebook in a browser tab, it must let such apps run in their own window on the desktop.

"Leaked builds of Update 1 suggest Microsoft's moving in this direction, making it easier to use apps with a mouse and placing app icons on the taskbar, for example. But it needs to go a step further: in Windows 9, they must run directly on the desktop. That will not only make Windows less frustrating on the desktop, but it will encourage us to use such apps – good news for both users and developers."

PLAY IN THE SANDBOX

Darien Graham-Smith, technology journalist: "One of the best things to come out of Windows 8 is a properly sandboxed approach to software. Tablet-style apps in the Windows Store are, by default, unable to access your hard disk (except for their own private data); nor can they directly access your hardware, interface with other programs or communicate over the network. Where a program needs permissions to work, these can be granted very narrowly – a music player, for example, can be given access to your music library, while remaining locked out of your Program Files folder. The presumption towards minimal access makes it difficult for a tablet app to mess up your system, or compromise your privacy.

"The interesting part is that the sandboxing mechanism (called AppContainers) isn't technically limited to tablet apps: it's perfectly possible to write desktop applications that run in a sandboxed mode. Microsoft has yet to push developers towards doing so, but I've high hopes that Windows 9 will see a major shift towards sandboxed desktop software. Perhaps the OS could default to a mode where sandboxed apps must be explicitly authorised to run. For individuals, a move towards sandboxed software would slash the risk of having your computer hijacked by a malicious or badly-written program. And in business, it could actually give employees more freedom: companies could safely allow users to download and install sandboxed software, while using a group policy to disallow unknown legacy applications."

LET US BUY A COPY WITHOUT A PC

Adam Banks, editor of MacUser: "As a long-time Mac user, I don't use Windows more than I have to, but I don't particularly mind if I do have to – and Macs can run it natively with a leg up from Apple's Boot Camp software. After I bought my latest Mac, I went shopping for a copy of Windows 8 to install as a second OS – and that brings me to what ought to be different with Windows 9.

"It seems there's an upgrade version of Windows 8, which is available only as an upgrade, and a full version – which is available only as an upgrade. It took me quite some time to get my head round this. After I finally stopped scrolling plaintively through version listings, I Googled and found a page buried in Microsoft's OEM Partner Center that told me I could legally use a 'Personal Use Licence' to install an 'OEM System Builder' version on 'a MAC' [sic]. With this faux acronym, Microsoft, you are really trolling us.

"Unfortunately, the page didn't actually offer to sell me anything. Clicking 'Can I purchase OEM System Builder software?' produced the single-word answer: 'yes'. I could download something called the 'Windows ADK', but I had to Google what that was.

"Eventually I found an OEM copy on Amazon for an only mildly eye-watering $170, which included no

WHAT YOU HAD TO SAY...

We asked *PC & Tech Authority* readers for their ideas to fix Windows 8; here are ten of the best suggestions. Listen up, Microsoft.

Paul started with a common complaint: "Remove the 'Metro' interface for non-touch devices. Full-screen apps only work on touch devices."

Ben agreed, suggesting the business version of the OS should be easier to customise. "As a small-business owner, I'm in the process of rebuilding 15 business PCs from Windows XP Professional to 8.1 Pro. I'm getting to know 8.1 pretty well, and I'm happy with it once up and running. What's annoying me is that all I want is a business desktop with Office and one piece of dictation software – I don't need the Metro interface and don't want to have to re-train staff to use it. A significant portion of my setup time involves removing all traces of Metro from the everyday user experience. There needs to be an 'Is this a work PC?' option in the control panel to give you the choice to turn it off if you want to."

Andrew Jones is tired of having to sign in. "It would be nice if it stopped nagging me to use a 'Microsoft Account' every time I use an app. I have my own Active Directory domain, I

support – because if you're a Mac user, or building your own PC, obviously you don't deserve any help. Fortunately, installation was a breeze. But why make it so difficult to buy a standalone copy, Microsoft? We're all friends here, after all."

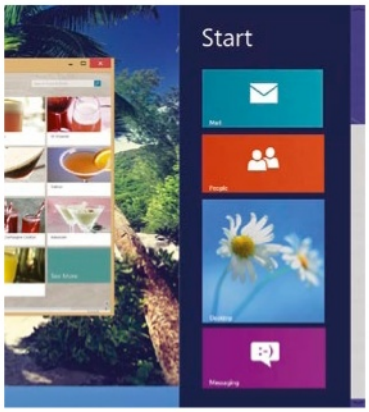
START SCREEN THAT SCROLLS... UP AND DOWN

Jack Schofield, journalist: "I'm very happy using the Start screen on a touch tablet such as the Surface Pro, and I appreciate that it scales well. However, I'm ergonomically welded to a desktop PC with a big screen and a mouse, and I'd like the option to use it in a more traditional way. First, I'd like to be able to open the Start screen in a window on the desktop. Please don't feel obliged to attach it to the Start button – that would be like bringing back the Start menu.

"Second, I'd like that window to have standard vertical scroll bars, so I can scroll up and down with the mouse wheel – just like any other program window, including DOS boxes. Tiles don't have to scroll sideways. The tiles in Windows Phone 8 have always scrolled up and down, and that's how I scroll."

SET IT FREE

Jon Honeyball, Real World Computing columnist: "Make Windows 9 free for home users. If Microsoft is going to get people to move from XP, then there needs to be a compelling upgrade path. If it's going to compete in the home environment with Android and iOS, then Windows has to be free.



A Start screen on the desktop, Microsoft?

"Companies will still pay for the licensing and the ability to have all the professional services, such as Active Directory domains, full remote management and so forth, and they'll keep paying through the rolling licensing plans. But it's time for the new CEO to bite the bullet and for Microsoft to put its money where its mouth is: Windows 9 Home should be free to download, free to install and free to use.

"But, here's the kicker: Microsoft should mandate upgrading and updating. Microsoft has to get Windows home users to follow the same upgrade path as iOS users if it's to have any hope of getting a platform that's rich and coherent. This requires the majority of users to move to the new platform when it arrives. This is easy to do – just make updating and free upgrading mandatory. Then Microsoft will avoid repeating the nightmare of a large XP population in the future.

"I dare Microsoft to do it. Best of all, it could do this within a month of now if it wanted to."

BUNDLE UP THE APPS

Sasha Muller, technology journalist: "If you've ever had to set up a new PC from scratch, or have a fleet of Windows devices, you'll remember the fun you had (re)installing your applications – it's painful at the best of times. Try the same on a Mac, however, and in most cases it's as simple as opening the Applications folder, selecting all the icons of the software you wish to copy, and dragging them onto an external disk. From there the apps generally just run with no further tweaking required.

"As applications are tucked into a 'bundle', all you see is a single icon: this means you can copy it wherever you please, or run it directly from an external drive, without having to tackle errors concerning missing dependencies. The only irritation is that apps from the App Store require you to input your Apple ID the first time they run on a new machine – which is still far less hassle than installing it from scratch.

"If Microsoft wants to make Windows 9 a more pleasant experience, and encourage users to use it on every device they own, pushing developers towards a bundled application structure would be a welcome step forwards."

BUY AN APP ONCE, RUN IT ANYWHERE

Jonathan Bray, technology editor: "When Microsoft moved its mobile OS from Windows Phone 7.5 to 8, one of the most interesting parts was the move to the NT kernel, which meant a lot of shared code with Windows 8. The reason behind this was to make it easier for developers to produce and release apps for both platforms. It was assumed at the time, by some commentators, that this might result in a bonus for users, too – but no tangible benefits have yet materialised. Wouldn't it be great if apps bought on your Windows phone were automatically available on the desktop, and vice versa? If Windows 9 could implement such a thing, it would give users more incentive to buy into the Microsoft ecosystem, an area where Apple currently holds the whip hand and Microsoft needs to grow." ■

don't want to sign in online, thanks."

Andy wants to keep using Metro, but in his own way: "To make Metro useful, it needs the option to permanently display the new Start menu on a second screen so you can keep an eye on apps."

Simon Ball says Microsoft needs better built-in support. "Why aren't the help files in one place so that the average user can find out how to use the software they have spent so much money on?"

Many readers – although not all – called for the return of a fully functioning Start menu. John Haynes had another idea: "The Stardock software [that installs a Start menu] costs less than $10 and makes me happy."

R Jones says Microsoft should "forget [the] charmless hidden daft 'charms' – they're so hard to find that I use the power switch for shutdowns."

Chimera Obscura would like to see "a compelling reason to upgrade", adding: "There really wasn't one with Windows 8, and I think that was a big part of its failure. People may have been more forgiving of the shortcomings if there had been a really good reason to upgrade. Windows 8.1 just seems too lame and plain, and for me, I fail to see any benefit."

Paul Bristow called for Microsoft to "sort out a proper backup system and make it easy and almost compulsory to set up. Everyone needs an image backup and a data backup."

And tech3475 had perhaps our favourite suggestion: "I know this may be minor, but restore Solitaire as a native desktop app. I play Solitaire when I'm waiting for something – for example, a long install – [and] I don't want to leave the desktop mode."

IS GOOGLE EVIL?

HOW IT WILL TAKE OVER THE WORLD

GOOGLE HAS ALREADY TAKEN OVER THE WEB AND SMARTPHONES; NOW IT'S TARGETING ARTIFICIAL INTELLIGENCE AND ROBOTICS. IS THIS THE BEGINNING OF SKYNET? **NICOLE KOBIE** INVESTIGATES

GOOGLE

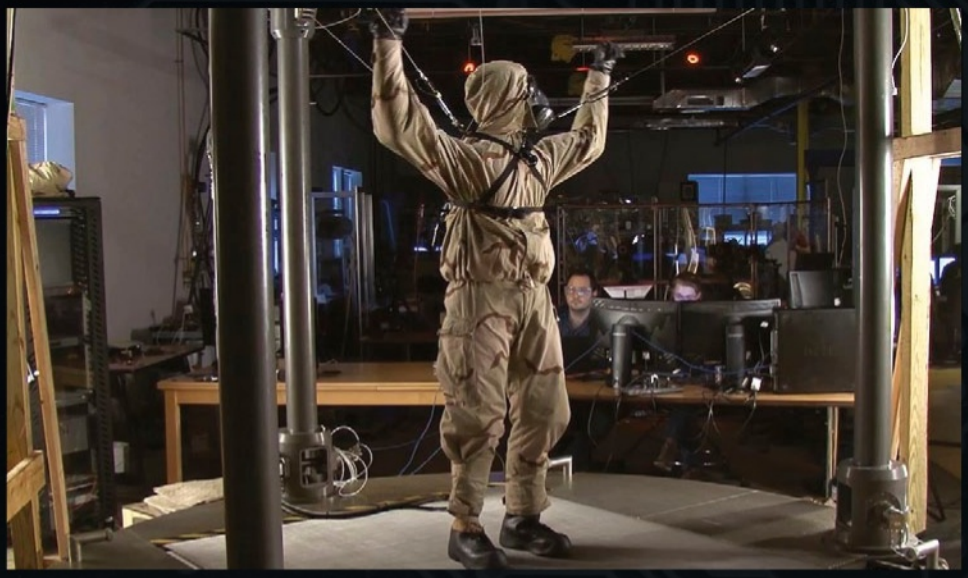
It's on your PC and your phone; it's always with you in pockets and bags. It will soon be embedded in watches and glasses, too, while partnerships with Audi, Honda and Hyundai mean that Android will be powering the dashboard in your car. Google is already stretching its tendrils into the offline world, with military-grade robots, healthcare and sensors dotted around people's homes.

So are we sleepwalking towards a dystopian future of corporate control, or an age of AI-powered convenience? Is it too late to stop Google taking over the world, even if we wanted to? Should we be just a tiny bit scared?

ANDROID ACQUISITIONS

Such questions have long followed Google, raised by its dominance of internet search - the gateway through which most of us access the web - and cemented by the success of its mobile OS, Android.

Long as we've asked these questions, Google - which wouldn't comment for this article - still has the ability to surprise, raising eyebrows with a succession of recent investments and acquisitions. Much of the billions of dollars it's spent on its "moon shots" - the futuristic research it conducts, without necessarily having plans for a product- have stayed out of the headlines. This all changed, however, with Google's ▶



purchase of Boston Dynamics in December: a robotics firm that works for the US military and is famous for its YouTube videos of impressive but creepy creations (**www.youtube.com/user/bostondynamics**).

Take the Cheetah, the world's fastest robot. It can hit speeds of more than 29mph thanks to an articulated spine, which gives it flexibility and lets it lengthen its stride in the same way as the big cat. So far, though, it's limited to running on the treadmill in Boston Dynamics' lab. The next version, WildCat, "is designed to operate untethered", a thought likely to send a shiver down anyone's articulated spine.

There's also the SandFlea, a small, flat device with four large wheels that looks like a toy – until you see it leap up and over a building. It can jump 10m in the air, land and reposition itself, and jump again, hopping up and over walls and homes. "That is high enough to jump over a compound wall, onto the roof of a house, up a set of stairs or into a second-storey window," Boston Dynamics says.

If robotic cheetahs and a gravity-defying hopper aren't enough to set your imagination spinning into sinister sci-fi scenarios, then consider Boston Dynamics' two anthropomorphic robots. The Petman simulates soldiers' movements in order to test protective clothing; watching the video of its movements is like viewing an odd, interpretive dance routine. This robot is limited to the lab, but the Atlas is a "high-mobility, humanoid robot" that covers rough ground on two legs, and can climb and use tools. "Atlas is strong and co-ordinated enough to climb using hands and feet, to pick its way through congested spaces," Boston Dynamics says.

The Legged Squad Support Systems (LS3) are even more impressive – these"rough-terrain" robots carry loads of up to 180kg, covering 32km in 24 hours. Computer-aided vision, terrain-sensing skills and GPS mean they can be sent on their own. The infamous BigDog is the size of "a small mule", and has much the same function: it carries heavy loads over varying terrain, such as snow, mud and rubble. The BigDog has four articulated legs that bend like an animal's, can run at 6.5kph, and climbs hills of up to 35 degrees.

And Google now owns all these creepy toys. Nervous yet?

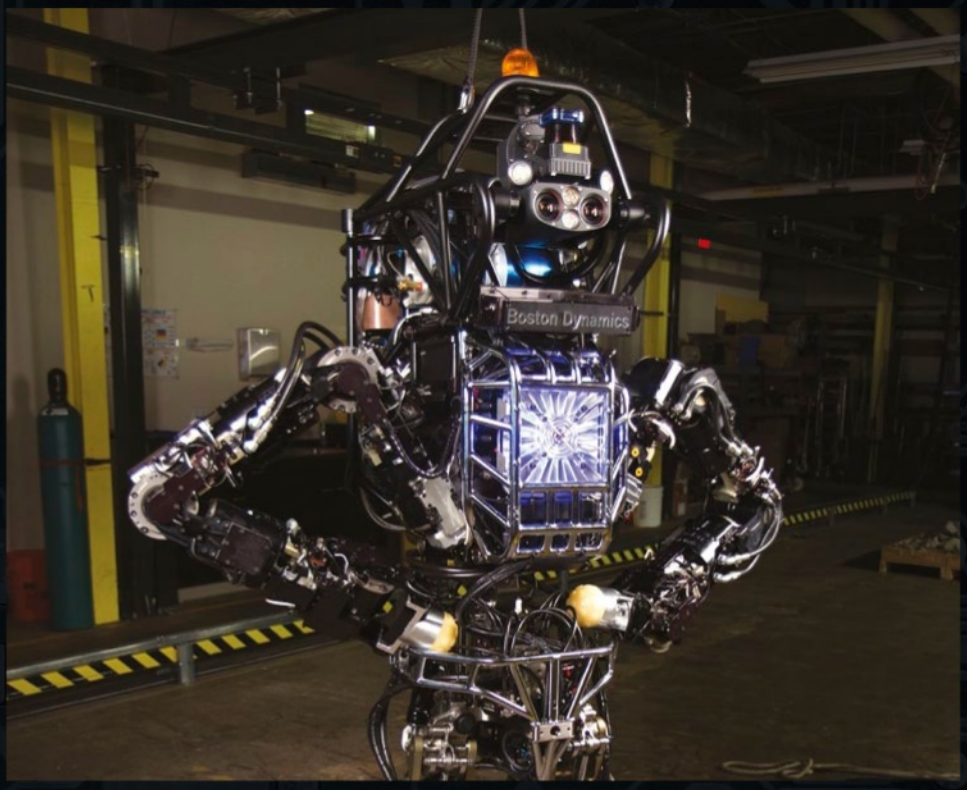
"...BUT THEY WERE DESIGNED TO SUPPORT SOLDIERS IN THE FIELD"

MILITARY MONEY

More alarming than robots that can hop their way into your bedroom or outrun Usain Bolt is the fact that they were developed with military money. Boston Dynamics' creations aren't actually killer robots, but they were designed to support soldiers in the field. The bulk of the company's money appears to come from DARPA and the US Navy, Army and Marines.

Noel Sharkey, professor of AI and robotics at the University of Sheffield, notes that the humanoid robot Atlas was funded by DARPA for its own robot competition. "This is ostensibly a challenge with a $2 million prize, to develop software to control the robot for a variety of tasks related to rescue," he says. "But this seems to be a PR exercise. When did DARPA ever concern itself with rescue? There's no doubt these developments are destined for the future battlefield."

Now that Google has bought Boston Dynamics, question marks hang over the military robots' future. While Google has said that it doesn't intend to be a military contractor, it will honour existing contracts. "We shall have to wait until the contracts expire in three to five years to find out if



the multimillion dollar contracts seduce Google further onto the dark side," says Sharkey.

However, signs suggest Google is happy to step away from military influence. The company recently bought another robotics firm called Schaft. Sharkey said "strong rumours" suggest Google removed Schaft's robots from the DARPA rescue challenge. "Given that the Schaft humanoid easily beat all the competition and won the last [challenge] hands down, it is giving up the opportunity for a lot of cash," he said. "We shall have to wait and see, but I don't think that Google will get into bed with the military to develop killer robots – it may well lose its slightly tarnished 'Do no evil' mantra."

ROBOTIC INVESTMENT

Boston Dynamics was Google's eighth purchase of a robotics firm in less than a year. Alongside Schaft, it picked up computer-vision firm Industrial Perception, camera-maker Bot & Dolly, robotic-wheel developer Holomni, and researchers Redwood Robotics, Meka and Autofuss.

Google then kicked off 2014 by acquiring DeepMind, a London-founded AI firm that uses learning algorithms for simulations, games and e-commerce. The purchase of such a firm makes sense for a search giant, which is always trying to improve how its systems understand what its users want. However, the DeepMind acquisition also fits into Google's robotic ambitions, and follows its launch of the Quantum Artificial Intelligence Lab last year, alongside the hiring of leading researcher Ray Kurzweil in 2012.

"The advancement in AI will allow for meaningful changes in how robotics can be used," explains IDC analyst Scott Strawn, pointing to existing robots such as the robot vacuum cleaner Roomba. "Their ability to manipulate their environment is limited, since we can't provide them with the means by which they can think in the ways that would be required to be more useful."

Google's other high-profile acquisition this year was Nest, for a tidy $3.2 billion. Nest makes smart-home devices, and is best known for its clever thermostat that learns when to turn on your heating. Such machine-learning abilities naturally have a role to play in robotics.

While the Boston Dynamics purchase raised eyebrows, the Nest investment resulted in a backlash against Google, with many wondering how the company planned to use their data. Google insisted it had no plans to collect user data for any reason other than improving the product, and initially intends to keep Nest operating as a separate company.

"The reaction comes down to a balance of convenience versus intrusion," says Strawn. "That's a balance that Google will have to work out. These privacy issues will continue to be in front of us for the foreseeable future, and the controversy it creates is likely to increase in importance."

TEN YEARS AWAY?

Not only has Google bought robotics researchers and other firms full of experts, it's put one of its best, most respected employees at the head of its robotics moon shot: Andy Rubin, formerly the head of Android, whose love of robots is reflected in the name of his mobile OS.

In an interview with The New York Times, Rubin suggested that Google robots could arrive in the next ten years. "Like any moon shot, you have to think of time as a factor," Rubin told the paper last year. "We need enough runway and a ten-year vision." He later added: "The automated car project was science fiction when it started... Now it's within reach."▶

One report in The New York Times cited anonymous sources that suggested hardware could be on the way within the next few years, but it's not clear if Google intends to create industrial robots or design products for consumers – or both.

Reports have suggested Google is already working with tech-hardware manufacturer Foxconn to trial robots in its factories, and Sharkey noted Google has been rumoured to be pushing into deliveries to counter Amazon's drone ambitions. "The idea of humanoid robots delivering parcels to your door is exciting. You could imagine a Google humanoid showing up in one of Google's autonomous cars."

ROBOT, GET ME A BEER

Improvements in AI could help robots become part of consumers' lives, says IDC's Strawn, and the company has always had more of a consumer focus. "If you improve the AI and have certain mechanical capabilities in place, which [Google] does through the acquisitions of these eight robotics companies, you can envision a point where you tell a machine 'clean my house'."

That's a vision that intrigues Gartner analyst Tom Austin, pointing to "assisted living" robots being developed at Cornell University. "These robots watch people and begin to recognise patterns in behaviour, and step in to help them," he says. "If I had one of those in my apartment here in Boston, it would notice that every time I turned on my TV to an American football game, I would then go to the refrigerator and get myself a beer. After watching this for several Sundays, the robot would – as soon as I turned on a football game – go to the fridge and get me a beer, without me asking."

But why does Google – a search and advertising firm – care about doing our chores or handing us a beer? "That's solving a meaningful problem that absorbs a lot of people's time, time that could be better spent – from Google's standpoint – online and searching," says Strawn. "It's a very similar argument to the one made for driverless cars – from Google's perspective, by making it so our cars drive themselves, it's increasing the number of hours in a day that you can spend online."

WHAT IT ALL MEANS

Looking at Google's varied projects, it's hard to understand exactly what it has planned. What do robotics, AI, smart glasses and driverless cars have in common?

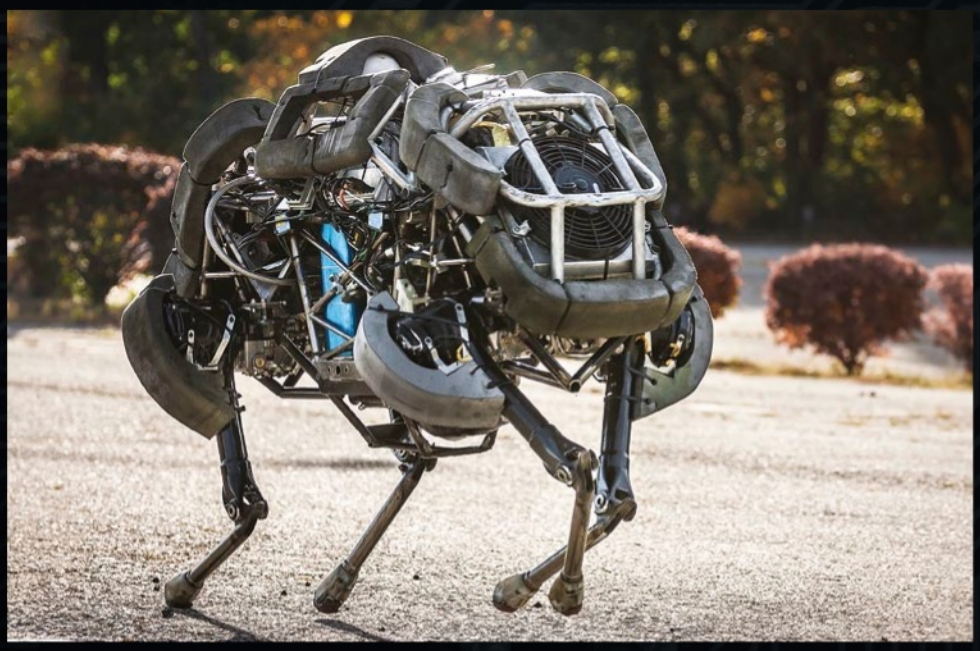
"There's a common thread, and I think the key is to understanding another of the company's ventures: Calico," says Strawn, referencing the California Life Company, created by Google with the aim of extending human life. "One of the things that is expanding or advancing at an exponential rate is our ability to manipulate DNA. The sequencing cost has dramatically dropped," he says, pointing to other investments in the area, including 23andMe, a company run by Sergey Brin's wife.

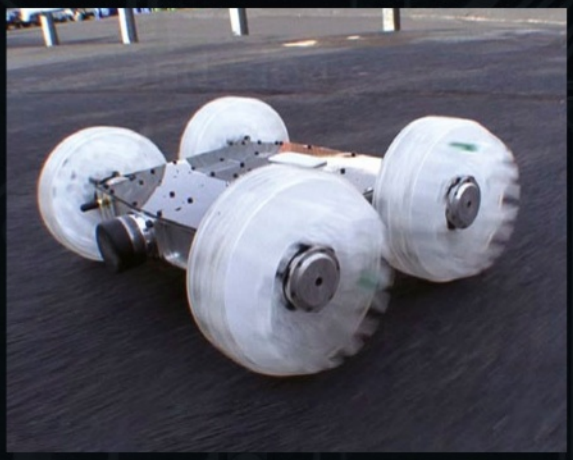
"WHY DOES GOOGLE CARE ABOUT DOING OUR CHORES...?"

Strawn's point isn't that robotics will necessarily come into play with Calico, but that Google is focusing on technologies with a "rapid pace" of change. He notes that the exponential curve of progress we're accustomed to in computing, with Moore's law, applies elsewhere, from the number of sites on the web to the falling price and improving performance of solar panels. "It's really in understanding the nature of those situations, where things are expanding at an exponential rate, that you can start to comprehend what it is that Google's doing," he says.

It's all indicative of Google's "world view", says Strawn. The company talks "an awful lot about '10x' technologies – not making incremental improvements, but substantial improvements or real leaps in technology. That's based on this thought process of exponential growth."

In other words, Google is investing in technologies that will see phenomenal growth, even if that requires planning for the longer term: ten years away, rather than next year. Google's plan isn't limited to robots. Its goal, as Gartner's Austin puts it, is to create technologies "that can shake up the world".





WATCH GOOGLE'S ROBOTS IN ACTION – GO TO ***WWW.YOUTUBE.COM/USER/BOSTONDYNAMICS***

DON'T BE EVIL

While such investments can be seen as a company following a sensible route to stay innovative, to those raised on sci-fi they could translate as the early planning stages of a dystopian corporate overlord bent on world domination.

Google's famous "Don't be evil" mantra comes with a promise to be a company "that does good things for the world, even if we forgo some short-term gains," as founders Larry Page and Sergey Brin wrote at the time of the firm's initial public offering in 2003. Of course, good and evil are subjective terms.

Speaking to NPR, executive chairman Eric Schmidt said the phrase was created directly by Google's two founders. "The idea was that we don't quite know what evil is, but if we have a rule that says don't be evil, then employees can say, I think that's evil. When I showed up, I thought this was the stupidest rule ever, because there's no book about evil except maybe, you know, the Bible or something.

"So what happens is, I'm sitting in this meeting, and we're having this debate about an advertising product. And one of the engineers pounds his fists on the table and says, that's evil. And then the whole conversation stops, everyone goes into conniptions, and eventually we stopped the project. So it did work."

However, it may not be down to Google or its engineers to decide what qualifies as "evil". Google already faces regulation in Europe around its search dominance, and pressure from national privacy watchdogs worldwide.

If Google continues in this vein, taking over more of our lives, would governments be forced to step in? "I don't see what the regulation would be," notes Strawn. "What are they going to do, go to Google and say 'stop innovating'?" He doesn't believe such an action could happen without resulting in mass public protest.

KITTENS ON ROOMBAS

So should we worry about Google? "I think the likelihood of Google actually doing evil is extremely low; I don't see the company fulfilling the negative dystopic fantasies that people have about Google," says Gartner's Austin.

That's also a view that is shared by Intel futurist Brian David Johnson, who also runs the 21st Century Robots project that aims to bring benign and personality-rich robots into homes (**www.robots21.com**). "It goes all the way back to Frankenstein," he says. "If we make something smart, it will do us harm. We're living in a time of science and technology, where the limit of what we build is constrained only by the limit of our imagination. What's holding us back is an inability to imagine a different future with robots."

Johnson points to the "baggage" derived from a science fiction preoccupation with menacing robots. "It's this nightmare we carry around with ourselves that the moment machine intelligence surpasses human intelligence, that for some reason the machines will rise up and do harm to us. It's kind of silly."

"Even with a technology that's making decisions for itself, you're the one who's programming it," he adds. "It's one of those things that's incredibly important: the technology that we build isn't separate from us, it's an extension of ourselves, and we bring our humanity into our robots," he says. "You don't feel like a Roomba that's there to clean the floor is going to rise up and take over – especially not with YouTube videos of kittens riding them. That isn't the face of the robot apocalypse. We need to imagine a different future."

IN THE LABS

YOU WON'T FIND BETTER REVIEWS ANYWHERE IN AUSTRALIA!

Cheery Cherry

DAVID HOLLINGWORTH PAYS WAY TOO MUCH ATTENTION TO HOW KEYBOARDS WORK – AND APPARENTLY IT'S WEIRD

So here's a true story from the office this month. Razer's latest keyboard came into the office amidst the usual 'ooh's and 'aah's that such new tech normally generates among the team. These keyboards have traditionally been very solid, and Razer's really gone out of its way to provide packaging that matches.

In this case that meant a little cut-out on the box where you can try out the supposed awesomeness of the new Razer designed switches.

It sounds like a great idea in theory, but in practice?

Well, you can read my review of the keyboard, but suffice to say I, and our old Editor John Gillooly, were not impressed. With a single key-press our opinion was formed, and we loudly proclaimed our disappointment.

Now, of course, we spend a bit more time than that on our reviews, but it's amazing sometimes just how quickly we form opinions. And, more often than not, those initial opinions are usually carried through in the full review process.

But what was really funny about our derision - sorry Razer! - was how baffled new Editor Ben was. John and I flew into a wild description of Cherry switches, actuation points, key weighting, and other deeply, arcanely nerdy keyboard terms.

Which, is also kind of what inspired this month's System Builder. It's always nice to know how every bit of PC hardware works, and so while's Ben's been putting together his new system and coming to grips with that, he can now learn about how his keyboard works.

And so can you.

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

WHAT OUR A-LIST MEANS

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.

WHAT OUR AWARDS MEANS

PC & Tech Authority's comprehensive Real World testing sorts out the best products from the pack. Any product recommended by *PC & Tech Authority* is well above average for features, value for money and performance.

WHAT OUR RATINGS MEAN

OUTSTANDING
VERY GOOD
GOOD
ORDINARY
POOR
VERY POOR

HOW WE TEST

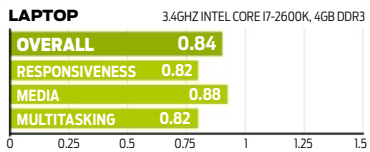
OUR BENCHMARKING TESTS ARE THE BEST IN THE BUSINESS. READ ON TO FIND HOW THEY WORK...

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 CS5 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.

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.

REVIEWED THIS ISSUE...

AMD MANTLE PERFORMANCE ANALYSIS

MATTHEW LAMBERT INVESTIGATES THE PERFORMANCE OF AMD'S NEW GRAPHICS API IN BATTLEFIELD 4 AND STAR SWARM

Marred by delays since its announcement in September 2013, AMD's Mantle API has finally made its debut. It's available to try now in Battlefield 4 and a demo called Star Swarm, which is freely available on Steam. It was due to be supported in Thief (*see p73*), but that too has been delayed to a post-launch patch. You'll need an AMD GCN GPU, the latest Catalyst beta drivers and Windows 64-bit to ensure compatibility. Mantle is in no way a final product – AMD is continuing to develop the technology, but there's enough now to run some tests and glimpse the direction in which it's heading.

MANTLE EXPLAINED

As a graphics API, Mantle is like Direct3D, the graphics component of DirectX. It's essentially a series of abstraction layers that grants developers access to the various execution units and functions within a GPU. However, APIs such as Direct3D and OpenGL have many layers of abstraction, allowing programs to function across numerous GPUs architectures from different manufacturers, which operate differently at the hardware level. Mantle, however, is only designed with the GCN architecture in mind, meaning fewer abstraction layers are needed, which theoretically results in fewer overheads and better performance.

CPU draw calls essentially tell the GPU what to render. Hundreds or thousands of calls can be needed to render even a single frame, which can be costly with current APIs, especially with lots of on-screen action. By thinning out the layers through which draw calls pass, and by improving the ability to queue them across multiple cores and threads, Mantle aims to significantly reduce draw calls as a bottleneck. Therefore, the biggest gains should be seen in CPU-limited scenarios, rather than GPU-limited ones, which are harder to combat at the API level, although optimisations have been made in this respect too.

BATTLEFIELD 4

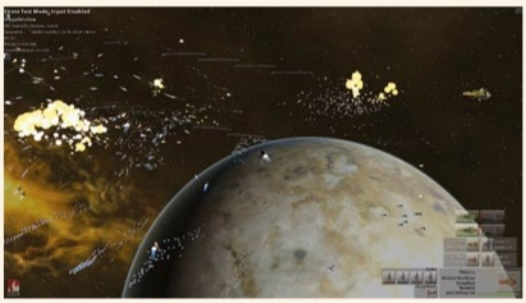
As FRAPS is incompatible with Mantle, we're reliant on Battlefield 4's built-in frame time recorder to test this game. Sadly, we're only able to accurately calculate and compare average frame rates from this data. We use our standard single-player benchmark to keep it consistent. It's a fast-paced scene with plenty going on, but multiplayer is still likely to be more CPU-bound.

With our overclocked Core-i5 3570K installed, there's little difference between D3D and Mantle. Even at Medium settings, the scene is still predominantly GPU-limited, although the R9 290X improved by 6 or 7 per cent in both tests when using Mantle.

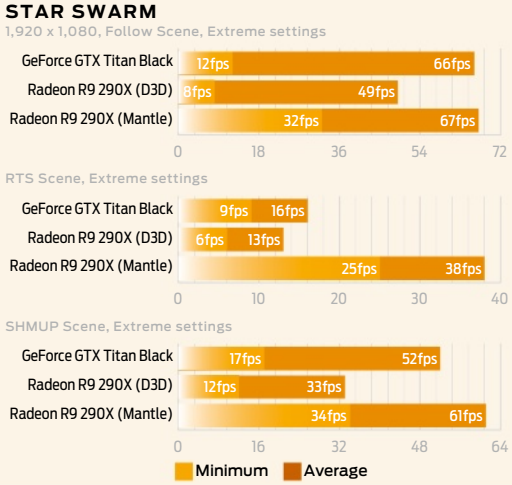
We then turned to a lower-end CPU, a stock-speed Core i3-3220. With the Ultra detail test, it was the same story – a small bump for the R9 290X and effectively equal results for the other cards.

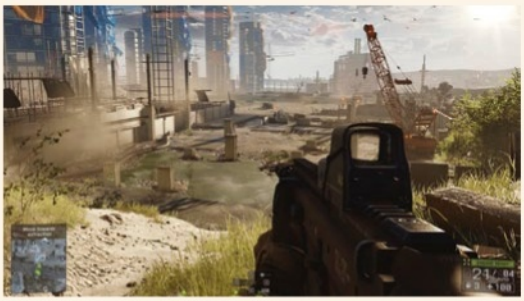
"The biggest gains should be seen in CPU-limited scenarios, rather than GPU-limited"

However, with Battlefield 4 at Medium settings, we finally see Mantle come into play. The similar results under D3D for the R9 290X and R9 280X here tell us that performance is CPU-limited, and this disappears with Mantle. The R9 290X's performance improves by a whopping 46 per cent, while the R9 280X and R7 260X see 16 and 6 per

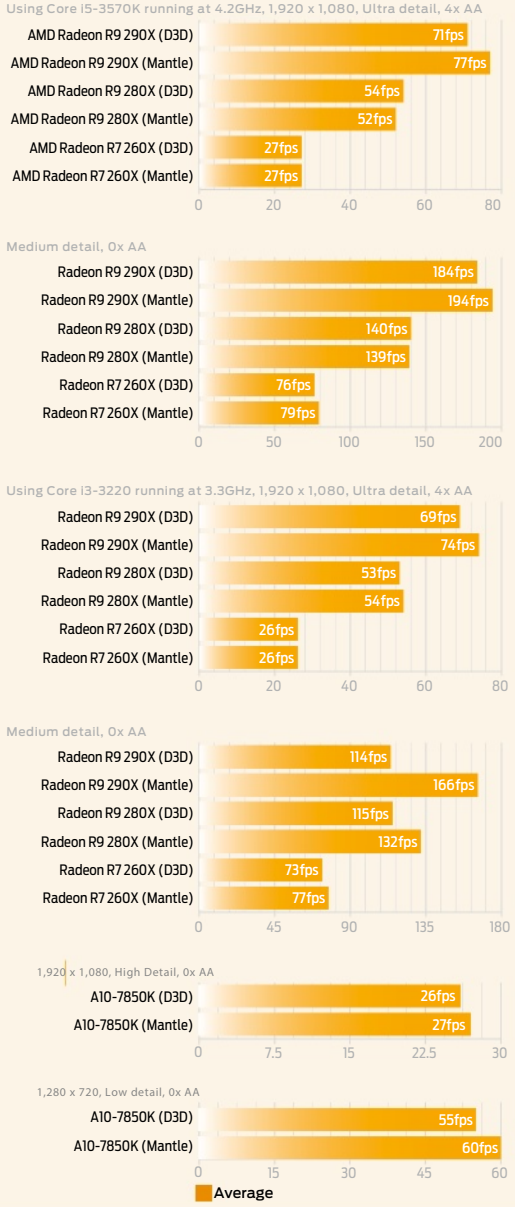


STAR SWARM RESULTS





BATTLEFIELD 4 RESULTS



cent gains. This also puts the AMD cards ahead of the competing Nvidia hardware at each performance point. However, the big drawback is that the gains are all but meaningless – with such high frame rates anyway, the unlocked performance doesn't result in any visible real-world differences.

We also tested the flagship Kaveri part in this game. At 1080p with Medium settings, the scene is hugely GPU-limited for integrated graphics, and the results are basically the same. At 720p with Low detail, however, we see a 10 per cent increase and a slightly smoother experience, as 60fps is hit much more frequently in the game.

STAR SWARM

Star Swarm is an Alpha demo of Oxide Games' Nitrous engine, which was built to exploit Mantle, and renders space battles with thousands of ships in real time. We run the four preset scenes (which survey battles from different viewpoints) three times each for two minutes, reporting the average results, which include minimum frame rates.

With D3D, frame rates are universally poor and unplayable, even with the top-end parts. Although frame rates can jump to beyond 100fps in less intensive sections, the more complex parts are very hard work. The RTS scene is the clearest example, as it maintains a wide view of the battle scene and constantly has thousands of ships in view.

With Mantle, the difference is massive. Although two of the scenes still dip below 30fps with the R9 290X, the experience is far smoother – in the RTS scene, its minimum frame rate effectively quadruples, while the average frame rate here goes up by 180 per cent.

CONCLUSION

In Battlefield 4, Mantle's real-world benefits are limited, and it works best with higher-end GPUs – we're unsure how many people will be pairing such cards with low-end CPUs. Still, free performance is free performance, and we encourage you to try it out. Star Swarm, on the other hand, is far more revealing.

Developers are currently used to designing games around API-based draw call limitations, but Mantle widens the potential to show more on screen at a time. Much remains to be seen, but this nonetheless has interesting ramifications for game development, and not only for RTS games and shoot 'em ups, but also as a whole. Any 3D game stands likely to benefit, should Mantle take off. That's the outstanding question and is one we're keen to see answered.

ASUS TRANSFORMER BOOK TRIO TX201LA

FUSING AN ANDROID TABLET WITH A WINDOWS 8 ULTRABOOK IS AN IMPRESSIVE FEAT OF ENGINEERING, BUT IT'S FAR FROM AN IDEAL PARTNERSHIP

PRICE $1599
SUPPLIER www.asus.com/au

While Asus has created countless Windows and Android devices, the Transformer Book Trio TX201LA is the first to unite the two platforms.

Part-tablet, part-laptop, this 11.6in device teams an Atom-powered Android tablet with the body of a Haswell-equipped laptop, and allows you to switch between the Microsoft and Google operating systems at the press of a button.

HARDWARE AND DESIGN

It's impossible to clock the Asus' unusual talents at a glance. It would be easy to mistake it for just another Windows hybrid. It must be said, however, that the Trio TX201LA feels nicely put together: brushed metal curls around the lid and base, interrupted only by the pin-prick speaker grilles, the lens for the 5-megapixel rear camera, and the power and volume buttons.

It works well as a convertible. The tablet feels stout and rigid, and there's barely any trace of give in the keyboard dock. Slot the tablet home and it wobbles a couple of millimetres back and forth, but two latches hold it securely in place. The weight is spread evenly, too, so it's possible to tilt the display all the way back without it toppling backwards. It's fantastically well built.

The downside is that the whole package weighs a hefty 1.7kg. The tablet makes up 710g of this, and the keyboard dock adds 990g to the figure – almost as much as many 11.6in Ultrabooks weigh on their own. It isn't a particularly slender pairing, either – together, the tablet and keyboard measure 23mm thick.

DOUBLING UP

There's good reason for the Asus' portly dimensions: the Trio TX201LA doubles up on more than only operating systems. Unlike the forthcoming Asus Book Transformer Duet TD300, which ingeniously powers both Android and Windows with the same Intel Core processor, the Trio TX201LA squeezes all the Windows hardware into the keyboard base – CPU, RAM, hard disk, wireless chipset and so forth – and has a different set of components in the tablet section, running Android on a discrete Intel Atom CPU.

The two parts are entirely independent. There's a power button on the tablet for the Android hardware, and a separate button for the Windows system in the base. Indeed, if you want to walk off with the Android

▼ Weighing 1.7kg, the Trio TX201LA is something of a bruiser

Photography: intro, Danny Bird; cutouts, Henry Carter; repro, Jan Cihak

tablet portion and leave the Windows keyboard base attached to an external monitor, you can.

This two-headed approach has its benefits. For one, switching between Windows 8 and Android 4.2 is impressively slick. With the Trio docked and powered up, a dab of a key on the top right of the keyboard swaps between the two almost instantaneously. If either half is powered down, then a dialog box pops up asking if you'd like to power up the other system.

Inevitably, this arrangement imposes some limitations. First, it's only possible to swap between Windows and Android with the tablet docked into the keyboard base; disconnect it and you're left with only the Android tablet.

Sharing data between the two operating systems isn't entirely seamless, either, although it isn't prohibitively awkward. In Windows 8, the Android tablet appears as if it were connected via USB, so it's possible to browse the tablet's 16GB of storage and the contents of its microSD card and copy files back and forth reasonably quickly.

Accessing data on the Windows disk from the Android OS is less speedy, however, since it's necessary to use Asus' PC Tool software, which transfers files over any existing Wi-Fi network. This means that both devices need to be on the same network, and transfer speeds will be limited to the capabilities of your network. We achieved around 2MB/sec on our local 2.4GHz network. Annoyingly, while the Android tablet's single-band 802.11n Wi-Fi worked without a hitch, the Realtek 802.11ac adapter in the Windows base refused to connect to our 5GHz network.

KEY SPECS

WINDOWS DOCK:
1.6GHz Intel Core i5-4200U CPU · 4GB DDR3 RAM · 500GB HDD · 2 x USB 3 · mini-DisplayPort · micro-HDMI · dual-band 802.11ac Wi-Fi · Bluetooth 4 · Windows 8.1 · 1yr RTB warranty · 305 x 194 x 13mm (WDH) · 990g

ANDROID TABLET:
1.6GHz Intel Atom Z2560 CPU · 2GB DDR2 RAM · 16GB storage · 11.6in 1920 x 1080 IPS touchscreen · single-band 802.11n Wi-Fi · Bluetooth 3 · Android 4.2 · 305 x 194 x 10mm (WDH) · 710g

THE TABLET

As a pairing, then, the two halves of the Trio TX201LA don't make the most comfortable bedfellows. But how does each part perform individually?

The tablet makes a good first impression, thanks largely to its fine 11.6in, Full HD display. It serves up bold, lively images and realistic-looking colours, and although it isn't the most intense display, nor blessed with an especially impressive contrast ratio, a maximum brightness of 364cd/m^2 is enough to keep the screen readable in most situations.

▶ The Asus is well designed and attractively finished

The 687:1 contrast ratio is wide enough to dredge up plenty of shadow and highlight detail, too. We put the panel through a full suite of tests with our X-Rite colorimeter and discovered that colour accuracy is strong, with an average Delta E of 2.6 placing it among the best Ultrabook and hybrid displays we've seen.

On the inside, Asus has opted for a dual-core 1.6GHz Intel Atom Z2560 CPU, 2GB of RAM and 16GB of storage. While it isn't the most generous specification, the Atom CPU is powerful enough to keep Android 4.2 feeling responsive. There's no lag while flicking between icon-filled homepages; web browsing is hiccup-free; and demanding gaming titles such as Despicable Me: Minion Rush are playable, if not 100% smooth.

The Atom CPU leaves the Asus lagging behind the best Android tablets in benchmarks, however. The Asus took 1075ms to complete the SunSpider browser test, and scored

ANDROID

TABLET: VIDEO RUNDOWN 5HRS 5MINS

WITH DOCK: VIDEO RUNDOWN 11HRS 5MINS

WINDOWS

WITH DOCK: LIGHT USE 7HRS 43MINS

only 684 in the HTML5 Peacekeeper benchmark. It was also off the pace for gaming power, stuttering to an average of 7.1fps in the GFXBench T-Rex HD test.

Battery life is decidedly average. On its own, the tablet lasted only 5hrs 5mins in our video-rundown test – a result that's less than half what we'd expect from an Android tablet. Leave the tablet connected to the keyboard base, however, and the tablet uses the second battery to extend runtime to 11hrs 5mins.

There's little else to set the pulse racing. Connectivity includes dual-band 802.11n and Bluetooth 3, and while the tablet charges via micro-USB (or the supplied PSU while docked into the keyboard base), the only other ports of note are a 3.5mm headset jack and microSD slot. The front- and rear-facing cameras are equally disappointing, with even the 5-megapixel snapper at the rear capturing smeary, overly compressed images.

THE WINDOWS LAPTOP

The Windows side of things is more successful, but still mixed. Asus has packed the Trio's keyboard base with an impressive-looking specification, including a 1.6GHz Core i5-4200U Haswell CPU, 4GB of RAM and a 500GB hard disk. There's an adequate selection of ports and connectivity, and around the edges is a pair of USB 3 ports, a mini-DisplayPort, micro-HDMI video outputs and a 3.5mm headset jack. Inside, Bluetooth 4 rubs shoulders with a Realtek 802.11ac Wi-Fi adapter.

In many regards, the Trio is an excellent 11.6in laptop. The Scrabble-tile keyboard has a sensible layout and a reasonable feel to every keystroke, and the top-quality touchscreen makes working in Windows 8 a pleasant experience. It's only a shame that the touchpad sours the moment; we found it jittery and unpredictable at times, and for the most part resorted to prodding the display instead. Hopefully a future driver update will rectify the issue.

The Core i5 CPU is a familiar face – and a capable performer – but the lack of solid-state storage takes its toll. Application-load and boot-up times were worst affected, and we were surprised at how sluggish the 5400rpm drive made Windows 8 feel at times, with multitasking causing applications to slouch reluctantly into view. Put to the test in the CrystalDiskMark benchmark, the Hitachi hard disk managed read and write speeds of no more than 75MB/sec – a poor result even by HDD standards, and positively glacial when compared with modern SSDs.

Throughout our testing, the Trio served up solid results. In the *PC & Tech Authority* Real World Benchmarks, the Asus scored a solid 0.65, which is what we'd expect. Battery life isn't sufficient to trouble the longest-lasting Haswell Ultrabooks, such as the Dell XPS 12, but it still managed to eke out an acceptable 7hrs 43mins from its 33Wh, 4430mAh battery. Unlike the Android tablet, however, the Trio's Windows hardware derives no benefit from the second battery – it's powered solely from the keyboard dock.

SECOND OPINION

I've long felt that Windows works best in laptop form, while a tablet needs a proper mobile operating system. So, to me, the Transformer Book Trio looked initially like the best of both worlds.

Sadly, the reality doesn't hang together. The idea of having different operating systems for laptop and tablet modes makes sense on paper, but the experience of switching between them is horribly jarring. When you detach the screen, the Windows applications and documents you had open vanish instantly, and you're thrust suddenly into a different operating system running different programs. Don't get me wrong, Android runs slickly on a Bay Trail Atom, but the discontinuity of the experience makes it feel unfriendly and inconvenient.

This is the fundamental problem with the Trio. The supposed advantage of a hybrid laptop is that you can use a single device in multiple formats according to your usage scenario. Changing the format of the Trio effectively turns it into a different device, which rather undermines the whole concept.

While the concept of the Transformer Book Trio TX201LA is nominally more convenient than carting around a Core i5 laptop and 11.6in tablet, its weight negates that advantage. There's no price saving either, even though the two parts are sharing a screen. I'd rather pick out a laptop to run Windows and a separate tablet for Android.

Darien Graham-Smith

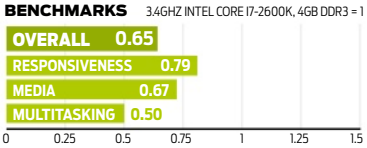
DOUBLE THE FUN?

As a concept, we can see some appeal. The hardware is well designed, the display is excellent, and the fact that the Android and Windows halves of the device work entirely independently raises some interesting possibilities.

We love that Asus is trying to do something new, but, at this price, we'd advise spending a similar amount of cash on an Ultrabook and a separate Android tablet instead.

Sasha Muller

BENCHMARKS 3.4GHZ INTEL CORE I7-2600K, 4GB DDR3 = 1



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

LG ULTRAPC

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PRICE $1898
SUPPLIER www.lg.com.au

The latest refresh of LG's UltraPC almost-ultrabook is as sleek as the previous iteration, but packs in a lot more power, while also being a general streamlining of the brand. So, basically, it takes an ultrabook design we already liked, and pretty much makes it a lot better.

Not quite perfect, mind, but still much better.

POWER BOOST

With a Core i7-4500U CPU under the hood, LG's new flagship laptop delivers flagship performance. Backed by 8GB of RAM and a 256GB SSD, it's a responsive unit, booting up in no time flat and able to handle all manner of tasks with alacrity. For everyday tasks it packs in all the power you could possibly need, though the performance does come with bit of a price – namely, battery life.

Away from a power point and with admittedly fairly heavy usage you'll be lucky to get four hours out of the UltraPC. The slim size of the unit is the main culprit here; its slim battery has to power the above hardware and the UltraPC's excellent HD IPS display, which is a big ask.

But as powerful as the UltraPC is, it's really not aimed at power users. For what it is, however, it is one of our favourite laptops to pass through the *PC&TA* labs.

STYLE APLENTY

Our love of speeds and feeds aside, the UltraPC remains a lovely blend pocket-conscious performance and elegant style – while still featuring a unique chassis. We rather like the fact that LG's eschewed the glossy and metallic finishes of many other laptop makers, in favour of a sturdy, unapologetically matte finish for its magnesium alloy chassis. It's once again available in stark white, though LG has also added a range of other colours for those who like to match their hardware to their own personal style.

The stark white unit we reviewed is striking, though it is prone to getting rather easily marked by day to day use. It easily picks up marks from being carried in our shoulder bag, and even managed to get a few rather impressive feline footprints during our at-home testing phase. It does clean relatively easy, but it is the one issue with the lighter coloured matte finish.

It's quite the looker, this ultrabook.

That matte chassis still delivers a pleasingly slim profile, too, while still fitting in an array of functionality. At only 17mm thick, the UltraPC also only weighs a shade over 970gm. With elegant curves on the underside flaring out to hold a USB3 port on either side, a mini-USB port, HDMI port, and a micro-SD card slot. Even the machine's balance is excellent, making it easy to use one-handed. It fits wonderfully into just about any bag, taking not much more space – or weight – than a heavy magazine.

The chiclet-style keyboard is fairly responsive, with good spacing between keys, though it does feature a very shallow travel distance. This wasn't an issue for us, and we were able to maintain a high rate of accurate typing. The touchpad is a little less inspiring; it features physical buttons under the pad which are responsive enough, but using the large pad for gesture-based control was a little hit and miss.

We should also note the feature that keeps the UltraPC from being a full ultrabook – its IPS display is not a touch display. For us, that's a definite plus, but if you're a fan of smearing your lovely, vibrant monitor with finger prints, it could be a dealbreaker.

Wi-FI connectively is handled by a dual-band 802.11a/b/g/n module that delivers solid speeds, though well short of the max-specced 433MBps. It's also Bluetooth enabled, which makes it a handy device for streaming content to other devices.

Which, in the case of music and video, is probably a good idea. The screen is great for video playback, but the onboard speakers are simply only functional and nothing amazing.

The Core i7 model we've reviewed here is priced pretty well, at $1898, but if you're willing to go for a little less grunt you can pick up the Core i5 version for $1298. Given that power really isn't the main go-to for the UltraPC (because it really does kill the battery), the Core i5 version is very likely the sweet spot, and it still has all the design and style features we love. But if money isn't a concern, this is one of our top choices for a truly slim, stylish notebook.

David Hollingworth

KEY SPECS

Intel 4th gen Core i7 4500U @ 1.8GHz • 8GB of RAM • Integrated Intel HD graphics • 13.3in 1920 x 1080 display • 256GB SSD • webcam • 2x USB3, 1x mini-USB, HDMI, audio ports; 971gm.

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

ACER ICONIA W4

THE ACER ICONIA W4 IS AN INEXPENSIVE AND REASONABLY NIPPY WINDOWS 8 COMPACT TABLET

PRICE $449
SUPPLIER www.acer.com.au

The Acer Iconia W4 is the company's second stab at a compact Windows 8.1 tablet, and hopes to make amends for last year's disappointing Iconia W3. On paper, it does everything right: it has a faster Atom Bay Trail processor, a free copy of Microsoft Office and an upgraded display with a gleaming IPS panel. The cost-free copy of Office is a significant inclusion. Many road warriors and other less deskbound types, as well as regular folks just wanting a quality tool to use for docs, spreadsheets and presentations, could find that this alone sways them in favour of the Acer Iconia W4. To a degree, too, it's also indicative of what's required to wean some tablet users off Android or iOS.

The IPS display is a significant improvement on the Iconia W3's washed-out TN panel. The 800 x 1280 resolution remains the same, but the wider viewing angles and vivacious colour reproduction are obvious from the start. If there's a negative, it's that the Acer's vibrant image quality comes at the expense of colour accuracy, and in the Labs it narrowly failed to produce the full sRGB colour gamut. Otherwise, it's a solid panel. We measured the Iconia W4's LED backlight peaking at a brightness of 312cd/m², and it delivered a contrast ratio of 1030:1.

Display aside, the Iconia W4 is physically very similar to its predecessor. Thankfully, though, it has abandoned the matte-white finish of the original model. The Iconia W4 looks better, thanks to a fake brushed-metal effect that covers the rear and softens into a matte grey around the edges and front. It still measures a chunky 11mm thick, but the rounded edges feel comfy in the hand and, at 415g, it's 85g lighter than the Iconia W3. Build quality is good, too, and apart from a little flex in the back panel, this is a solid compact tablet that certainly feels every bit the well-made device that it is, and with premium materials to impart a sense of pride to owners.

Unlike Asus' stylus-equipped VivoTab Note 8, the Iconia W4 relies on fingertips. Still, the touchscreen is responsive to flicking through web pages and navigating Windows. Some desktop applications can be fiddly to use, but it's here that the modest screen resolution and Windows 8.1 scaling settings work together to provide sensibly sized icons and menus. We were also pleased to see that Acer has located the physical Windows button on the lower bezel – Asus' VivoTab Note 8 has moved the Windows button to the tablet's edge, and we found it far too easy to press by mistake.

Under the hood there have been some major changes. Acer has replaced the Iconia W3's Intel Atom Z2760 with a 1.33GHz Atom Z3740 supported by 2GB of DDR3 RAM. The result is improved performance across the board and, when compared to Android and iOS tablets, Intel's Bay Trail Atom delivers a serious kick in the SunSpider browser benchmark. While the Iconia W3 soared past much of the competition with a SunSpider result of 670ms, the Iconia W4 sped to a score of 430ms – more than a third faster. By way of comparison, the Apple iPad mini with Retina display finished the test in 418ms.

Performance in Windows is surprisingly strong for such a tiny device. Despite using the same CPU as the VivoTab Note 8, the Iconia W4's Real World Benchmark score of 0.41 outstripped the VivoTab's result of 0.35, thanks to the Acer's nippier Samsung 32GB eMMC drive. In the CrystalDiskMark benchmark, the Acer achieved sequential read and write speeds of 161MB/sec and 53MB/sec, while the Asus' Hynix HGB4E eMMC drive fell behind with 75MB/sec and 35MB/sec in the same tests.

The Acer's battery is strong enough to keep it powering through a working day. In our looping video test with the screen set to 120cd/m^2, the W4 managed 10hrs 33mins. The W4's score in our light-use battery test was equally impressive. With the screen dimmed to 75cd/m^2, the W4 lasted 12hrs 5mins, a comfortable 36 minutes longer than the VivoTab's 11hrs 29mins.

The 32GB of eMMC storage is fairly cramped, but can be expanded via the microSD card slot on the tablet's right side. Acer has spread the ports around more effectively than on the Iconia W3, too. There's a micro-USB port and 3.5mm headset jack and a micro-HDMI output. A video output is a welcome addition and gives the option of using the Iconia W4 as a desktop PC, with monitor and Bluetooth keyboard and mouse. An optional Acer Crunch keyboard is forthcoming, too, which combines a lightweight Bluetooth keyboard with a foldable stand for the tablet.

The Acer Iconia W4 is a huge improvement on its predecessor, largely thanks to the inclusion of an IPS screen and faster processor. It also narrowly beats the VivoTab Note 8 thanks to eMMC storage, improved battery life and additional video output. It lacks the Note 8's stylus, but overall the Iconia W4 is one of the most persuasive Windows 8 tablets we've seen yet.

Bobby MacPherson

KEY SPECS

1.33GHz Intel Atom Z3740 · 2GB RAM · 32GB eMMC storage · 8in 800 x 1280 screen · dual-band 802.11n Wi-Fi · Bluetooth 4 · microSD · micro-HDMI · micro-USB · 5MP rear/2MP front cameras · Windows 8.1 · 210 x 11 x 130mm (WDH) · 415g

BATTERY: VIDEO RUNDOWN 10HRS 33MINS

BATTERY: LIGHT USE 12HRS 5MINS

PERFORMANCE	★★★★½
FEATURES&DESIGN	★★★★½
VALUE FOR MONEY	★★★★½
OVERALL	**★★★★½**

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SUPPLIER www.adobe.com/au

A subscription to Adobe's Creative Cloud includes regular updates, and the latest round of downloads brings some significant changes – starting with the arrival of 3D printing in Photoshop CC. It's an unexpected addition; although Photoshop has had basic 3D support since CS3, it's never provided a proper set of tools for sculpting and editing shapes. Rather, Adobe sees it as a finishing environment for models imported from modelling programs, or downloaded from online archives.

Objects can be imported in a variety of formats (OBJ, STL, 3DS, COLLADA and KMZ), and arranged as needed, with pannable previews offered in a variety of forms, from wireframes to fully rendered, custom-lit 3D scenes. Surfaces can be distorted with bump-map layers, and if you plan to output to a multicolour printer, you can either decorate your model with texture layers or paint directly onto its surface.

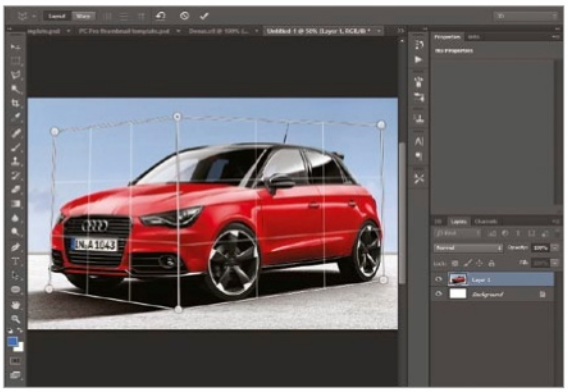
When you're ready to bring your model to reality, Photoshop automatically fixes any gaps in your meshes, and adds scaffolding to support the design while it's being printed. MakerBot, Mcor Iris and Solidoodle printers are supported natively, and third parties can add support for their own machines.

It remains to be seen how widely this new capability will be used. Creatives taking their first steps into 3D may appreciate the option of working in a familiar environment, but Photoshop doesn't do the whole job – and since finishing 3D models has little in common with a typical 2D workflow, most users will still face a steep learning curve.

Other updates to Photoshop target traditional 2D images. The new Perspective Warp tool lets you adjust the perspective of an image element by splitting it into two meshes, joined at the front corner. If you want to place a car onto a road, for example, you can set its wheels squarely onto the tarmac without distorting the bonnet. It's also now possible to link Smart Objects into your projects rather than embedding them – so when you update an Illustrator file that's linked as a Smart Object, your Photoshop file will be automatically updated, too.

Illustrator itself gets a few new tools. New handles can be dragged to round off the corners of shapes. Double-click a handle and the Round Corners dialog opens, allowing you to specify a rounding radius or set chamfering options.

The Pencil tool has been enhanced, too, now generating much cleaner curves by default. You can adjust a slider to control the balance between precision and smoothness, and after your shape is created, you can (as before) simply draw over a segment to refine it. The Direct Selection tool can also now be used to stretch line segments directly into the desired shape; switch to the Anchor Point tool and you can turn straight lines into Béziers by simply dragging out a curve. Together, these changes make it easier and more intuitive than before to work with curved paths.



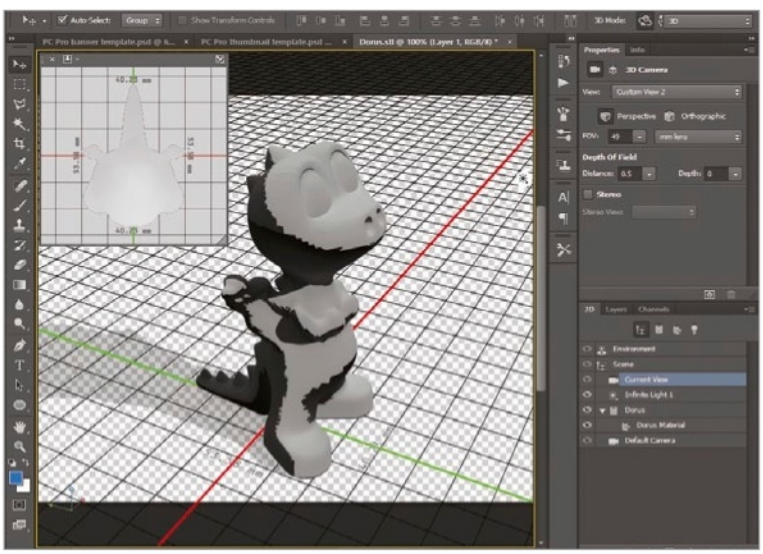
Perspective Warp helps you line up the elements in composite scenes

A final addition to Illustrator is integration with Adobe's online Typekit service; you can now jump directly from the Font menu into the browser to try out typefaces that aren't currently installed on your system, and install them for use at the click of a button. A similar feature has been added to InDesign CC, so if you open a document that uses a missing font, you can now install it from Typekit with a few clicks. For those using InDesign to create electronic documents, there's also improved hyperlink management and support for new EPUB 3 features.

It's impressive that Adobe continues to find ways to improve such well-established software. While not everyone will benefit from every update here, overall the Creative Cloud applications are starting to feel like a real step up from their CS6 incarnations.

Unfortunately, subscription-only pricing makes it impossible for us to give the package a wholehearted recommendation. If you're amenable to the licencing model, then Creative Cloud is a phenomenal set of tools that just keeps getting better. But for those who prefer to own their software, and who are already using a recent copy of Creative Suite, there's not enough here to justify switching.

Darien Graham-Smith



Photoshop's 3D features are intended to help artists finish and print their models

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

LG G FLEX

LG'S BOLD NEW CURVED G FLEX SMARTPHONE OFFERS MORE THAN JUST A NOVELTY SCREEN.

PRICE $1100
SUPPLIER www.lg.com.au

There's a good deal more to this intriguing 6 inch phablet than the curved screen, but let's talk about that, first, because if you're considering this phone it's likely the top drawcard. The same OLED process which is also yielding curved TV sets in the marketplace allows for its construction, and much like its curved TV brethren, the bend offers no actual benefit. The screen is no more readable, less reflective or somehow more immersive, and, because the curve actually adds to its overall depth it's no more comfortable in a jeans pocket. I also found that during calls the curve can make it a tad irritating because it means that the speaker end of the phone presses against your ear at a sharp enough angle to cause slight discomfort.

Expect to see many more devices with curved OLED screens, from wearable to other phones and more. The LG G Flex is a pioneer for a new form factor that has yet to find a legitimate use, and we look forward to seeing more innovation.

The screen, however, has much more going for it than its bend. Thanks again to OLED, it's lusciously vivid and bright, with perfect contrast and no discernible colour bleed – so text and icons against a black background do look rather spectacular. It's not quite perfect, though, as there's clearly visible noise in areas where the colour gradient blends. It's instantly noticeable with the wallpapers LG ships as default. Surprisingly, the large screen didn't prove to be too much of a power draw, with the Flex's extremely generous 3500mAh battery able to keep the phone going during average use for at least two days. Judicious use of the phone and dimming the brightness make this a handset that can go for long hauls between charges.

LG has taken a relatively restrained path with its implementation of Android 4.2.2 (Jelly Bean). There's little in the way of bloatware to slow things down, though the Qualcomm Snapdragon 800 CPU running at 2.26GHz was plenty powerful enough to make all tasks snappy and lag-free. The 2GB of RAM is what we would expect of a premium phone, and that helps it achieve premium performance, but we would have liked to expand the 32GB of storage – especially considering how well suited this device is as a media player. Unfortunately there's no SD expansion, which is debatably this handset's biggest weakness. On the upside, 802.11ac wireless is supported.

The extra adornments LG has added to the UI are well considered. We particularly liked the screen on/off mechanism, which is activated by a simple double tap on the screen. Another new addition is being able to access a media control centre by swiping outwards in opposite directions with two fingers. Q Slide, which started appearing on premium LG handsets last year, allows sizeable and moveable windows for apps and widgets, which can actually be quite handy given the large screen size and feasibility of running, say, a browser alongside a notepad.

LG has engineered the G Flex with a few clever touches. The power button (which also serves multi-functions) is on the rear of the phone, centre and near the top. A long press activates the camera and it flashes when face down if you receive an email or message. Next to it is an IR blaster, should you decide to use the G Flex to control your compatible devices.

Interestingly, the entire rear panel is built with a material which LG claims is self-healing. When scratches appear the plastic ever so slowly sort of melts back in to fill the crack, as long as it's not too deep. In the battle of features, where smartphone makers sometimes need to resort to gimmicks to stand out from the crowd, we'd rate this, and most other G Flex features, as actually quite useable and impressive.

A 13 megapixel camera is included. Panning and zooming is noticeably laggy, though a software patch may fix that. The actual business of shooting is quite good, with a very quick shutter response. There's also the ability to take a still photo in the middle of recording a video. Technically it's just saving a frame at the time the button is pressed, so will use whatever image quality settings you were using at the time for video, but it's still a time-saving convenience we appreciated.

This is LG's best smartphone to date, and is a serious contender among the top tier of the market. Street prices vary enormously, from around $600 to over $1000, and if you can pick one up at a decent price you aren't likely to be disappointed with it.

Ben Mansill

KEY SPECS

Snapdragon 800 2.26GHz quad-core CPU • 6 inch (1280 x 720) OLED screen • 2GB RAM • 32GB eMMC memory • 3500 mAh battery • 13 MP camera (front), 2.1 MP camera (rear) • 802.11 a/b/g/n/ac

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

CORE V71

not just a pretty case...

...it has the features to back it up too

Water Cooling Capability

Modular HDD Rack

Cable Management

Thermaltake
COOLall YOUR LIFE

LIKE US ON FACEBOOK

visit thermaltake.com.au for more info

SAMSUNG GALAXY NOTE 10.1 2014 EDITION

EXCELLENT IN ALL DEPARTMENTS – PRICEY, BUT THE BEST ANDROID SLATE ON THE MARKET RIGHT NOW

PRICE $685
SUPPLIER www.samsung.com/au

Samsung has a bewildering array of tablets and smartphones out at the moment, but there's nothing confusing about where the Galaxy Note 10.1 2014 Edition sits. It's the Korean firm's top-of-the-range consumer tablet, and it's designed to rival such products as the Nexus 10, Amazon Kindle Fire HDX 8.9in, Sony Xperia Tablet Z and Apple iPad Air.

It certainly has the price and specification to match those aspirations. It costs $685 and boasts a 10.1in, high-DPI, 2560 x 1600 screen; a 1.9GHz Samsung Exynos octa-core processor; an 8-megapixel rear camera; and a pressure-sensitive stylus, which slots neatly into the top-right corner of the tablet.

Other notable features include an infrared transmitter that turns the tablet into a universal remote control for your TV and set-top box, and 802.11ac Wi-Fi. Surprisingly, there's only 16GB of built-in storage, but there is a microSDXC slot for adding more.

The design is reasonably high-end, too, with a seamless strip of chrome-effect plastic surrounding the edge and a white plastic rear, imprinted with a leather-effect pattern. If this sounds cheesy, it doesn't come across that way. It's certainly a big improvement on the first Note 10.1.

Fire it up, and the good impressions continue. The screen – as is typical of Samsung's flagship devices – boasts a bright and fully saturated look, and with a pixel density of 299ppi, it matches the Nexus 10 and outdoes the iPad Air. It's a magnificently crisp display. Resolution isn't everything, however, and on the quality front, the Note 10.1 also scores highly. Measured with our colorimeter, the display hit a maximum brightness of 367cd/m² and a contrast level of 798:1.

With an eight-core SoC inside, it looks well up to the job of keeping Android 4.3 running smoothly, too. In fact, the Note's Samsung Exynos 5 Octa comprises a pair of quad-core processors: one clocked at 1.9GHz for demanding tasks such as games, and the other clocked at 1.3GHz, which kicks in when such high power isn't required. In addition, there's 3GB of RAM, and a powerful six-core Mali-T628 GPU.

In benchmarks, we found the Note 10.1 to be quick, but not quite as rapid as the iPad Air. In the GFXBench T-Rex HD test run at native resolution, the Note 10.1 gained an average of 14fps; the Air scored 21fps. Its SunSpider result was a touch more impressive at 612ms, but again it lagged behind the iPad Air's 391ms.

Things begin to look up when you start to compare it with its Android rivals. Overall, the Note 10.1 2014 Edition is on a par with the superb Kindle Fire HDX 8.9in, and faster than the Nexus 10 and Xperia Tablet Z.

The low-power cores seem to do the trick when it comes to conserving battery life, too, with the Note lasting a creditable 11hrs 10mins in our looping battery test. Technically, it's capable of lasting longer, but with 5% remaining on the gauge the Note dims its screen automatically to save power. Alas, it reduces the backlight intensity to such a level that the screen is unusable, and there's no way to change this behaviour in the settings, nor by adjusting brightness manually.

The Note's camera is an 8-megapixel snapper capable of grabbing 1080p video, and has a couple of key weaknesses: a tendency to underexpose when faced with scenes that have very bright and dark areas; and a problem with flare when shooting indoors, which reduced the contrast and overall quality of many of our test shots.

What does make the Note 10.1 2014 stand out from the crowd, however, is its pressure-sensitive stylus and, as usual with Samsung's Note devices, it's accompanied by plenty of stylus-specific apps and customisations. Pull the stylus out of its home in the edge of the tablet, for example, and a circular menu appears on the screen, offering a variety of options. You can grab onscreen elements, such as web pages and store them in the Scrapbook app; take quick notes; launch a choice of apps into pop-up windows; or grab a screenshot and scribble on it. There's also highly effective handwriting recognition built into the keyboard and the full version of SketchBook Pro is included.

This is all very useful, but we're less keen on Samsung's hefty Android overlay. Admittedly, it provides a lot of features out of the box, but it complicates things to an unnecessary degree – for example, requiring sign-up to Samsung's own Hub app store as well as Google Play to get the most out of it.

The Samsung Galaxy Note 10.1 2014 Edition is a top-quality tablet. It's as fast as a Kindle Fire HDX 8.9in, has a good screen, decent battery life, stylus support and expandable memory, along with infrared, universal remote control support.

It's expensive for an Android tablet, but it's more fully featured than both the Amazon Kindle HDX and the Nexus 10 and is the strongest all-round rival to the iPad Air. Our preference still lies with the iPad Air for its more appealing design, superior tablet-specific apps and faster performance, but Samsung is steadily closing the gap.

Jonathan Bray

PC & TECH AUTHORITY RECOMMENDED

KEY SPECS

Octa-core 1.9GHz Samsung Exynos 5 Octa CPU · six-core ARM Mali-T628 graphics · 3GB RAM · 16GB storage · 10.1in 2560 x 1600 IPS display · dual-band 802.11ac Wi-Fi · Bluetooth · 2MP front/8MP rear cameras · 1yr RTB warranty · Android 4.3 · 242 x 8.7 x 170mm (WDH) · 535g

BATTERY: VIDEO PLAYBACK 11HRS 10MINS

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

SEAGATE DESKTOP SSHD

AT JUST A FEW DOLLARS MORE THAN A STANDARD HDD, A HYBRID DEVICE IS A WORTHY INCLUSION

PRICE $115
SUPPLIER www.seagate.com/au

If you want to give any system a boost, the first piece of advice we usually give is to replace or supplement the mechanical HDD with an SSD. With no moving parts, no seek-time lag, and far quicker performance than a mechanical disk, you can give your system a real boost.

With an SSD, apps launch more quickly. Windows boots in double-quick time, and we've also found that in practice systems with an SSD tend not to suffer the dreaded long-term Windows slowdown. Take a look at our round-up starting on page 56 of this issue to get an idea of the variety in capacity, as well as price and performance on offer.

However, SSDs have always been much more expensive than mechanical disks. And although SSDs have been around for years, the price gap isn't shrinking. Thus, many system builders are often reluctant to include a dedicated SSD in off-the-shelf PCs, at least larger capacity drives.

As a result, when it comes to budget PCs, we've tended to see either very small SSDs designed to supplement a larger mechanical disk (for launching Windows and a handful of core apps or games), or none at all. The majority of complete systems we see even today still don't feature an SSD as standard, with many preferring to keep the system price down by listing an SSD in the options.

The solution, which is becoming increasingly common, is to include a hybrid drive. Seagate's 1TB Desktop SSHD is one such device which is already winning favour among many system builders. In addition to the usual 64MB buffer, this drive builds in 8GB of MLC SSD flash storage for caching frequently-used data – application executables, for example.

Algorithms built into the firmware of the drive can then analyse the data you use most frequently, and move them over to the SSD cache, thus accelerating the performance of your PC. This process is completely transparent to the user and the OS: there's nothing to configure or install to get it to work.

The key advantage of the Seagate SSHD, however, is a comparatively low price premium, even when stacked up against the smallest, slowest, cheapest standalone SSDs.

To add a half-decent, small SSD to your 1TB or 2TB spinning disk, for instance, you'll be paying around $80. The 1TB Seagate SSHD, on the other hand, adds a premium of around $15 to the retail price, and (it's worth bearing in mind) the extra cost will be even lower at street prices.

BENCHMARK RESULTS

So is it worth it for the performance gain? We haven't used one of these SSHDs long enough to be able to say categorically that it's as good as an SSD for maintaining long-term responsiveness. However, benchmark results do suggest it's an effective system.

▲ The Seagate SSHD is a classic hybrid drive, using flash memory as a buffer or cache

To test it, we repeatedly ran the portion of the *PC & Tech Authority* Real World Benchmarks that launches a series of applications (Microsoft Word, Sony Vegas Pro, Internet Explorer, Notepad and Adobe Reader), switches between them a number of times, then shuts them down. If the system is working correctly, we should see the time to complete this test fall as the drive "learns" the behaviour of the test and caches the necessary files.

It turns out this is indeed the case. The first time we ran the test it finished with a time of 1min 41secs. Over the following five runs, that time fell steadily to 1min 17secs, and then it flattened out. We ran the same test on two other PCs with hybrid drives and witnessed identical results.

By contrast, the standard 1TB 7200rpm Seagate Barracuda started off with a time of 1min 42secs, which fell to 1min 26secs on the second run and flattened out immediately.

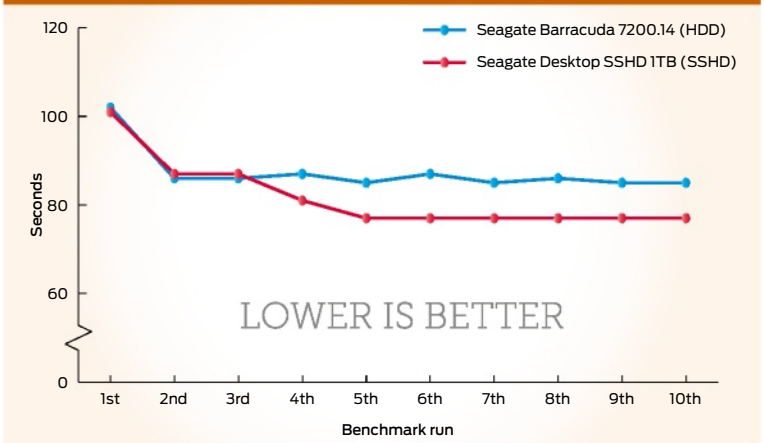
VERDICT

It's clear the Seagate SSHD system works, and works well, and even when compared to a pure SSD-based system, the results aren't too shabby.

The drives add a reasonably low premium over the price of a fast mechanical drive, so you can expect plenty of them to appear in moderately priced desktops – and also laptops (Seagate has a range of 2.5in SSHDs, too) – in the coming months.

Bobby MacPherson

SSHD vs HDD APPLICATION-LAUNCH SPEED



KEY SPECS

1TB HDD • 64MB buffer • 8GB MLC SSD

PERFORMANCE	★★★★★
FEATURES&DESIGN	★★★★★
VALUE FOR MONEY	★★★★★
OVERALL	★★★★½

DELL ULTRASHARP U2414H

DELL SERVES UP OODLES OF FEATURES AND STRONG IMAGE QUALITY FOR SENSIBLE MONEY

PRICE $409
SUPPLIER www.dell.com.au

Dell's UltraSharp monitors have long represented good value and respectable peformance and at first glance the latest 24in model, the UltraSharp U2414H, looks like a strong contender for the budget-monitor top spot. It offers a stylish design, a colour-calibrated sRGB mode and an array of features for only $409.

The U2414H looks different to Dell's previous monitors, thanks to a pleasingly curved rear. It hasn't lost anything in the way of utility, however: the solid-feeling silver stand rotates the display into portrait mode, provides 130mm of height adjustment and keeps the monitor firmly planted on the desk.

By far the most striking change concerns the bezel. Dell has banished the thick picture-frame surround of previous models, and the U2414H's matte, anti-glare finish now stretches almost all the way to the monitor's edges. This isn't just for show – it's perfect for multimonitor setups, which call for the smallest possible gap between displays. We hope this takes off and thin vertical bezels become commonplace for larger screens. If Dell chooses to, it will be the go-to brand for gamers and professionals running double or triple screens with just this seemingly minor feature. Since the U2414H's bezel measures 6mm thick along both its vertical and top horizontal edges, you can tile screens in either portrait or landscape orientation without issues.

The only retrograde step is taken by the panel resolution. Compared to its predecessor, the UltraSharp U2412M, the U2414H's Full HD, 1920 x 1080 display has disappointingly lost 120 pixels of vertical resolution.

▲ A 6mm bezel makes the U2414H perfect for multimonitor setups

Image quality remains competitive. Connected to our test PC via DisplayPort, the U2414H put in a solid performance. At default factory settings, the U2414H is set to 75% brightness, which we measured at 256cd/m^2; crank it to maximum and the W-LED backlight reaches a bright 323cd/m^2. The contrast ratio of 853:1 is excellent, and colour fidelity is good, with average and maximum Delta E scores of 2.7 and 6.4 respectively.

Select the U2414H's factory-calibrated sRGB profile and colour accuracy gets even better. The contrast ratio dips to 660:1, but the average Delta E improves to 2.1, and the maximum deviation drops to 4.3. The IPS panel is evenly lit, too: we measured no more than a 10% variation in brightness across the whole display. The Dell's only weakness is a tendency to crush the darkest greys into black.

At the rear, Dell has packed in a DisplayPort input, a mini-DisplayPort input, a full-sized DisplayPort throughput (which requires a DisplayPort 1.2-capable graphics card) and twin HDMI inputs, both of which support MHL connections. There's also a four-port USB 3 hub, with one port located at the centre of the back panel for easier access.

PC &TECH AUTHORITY RECOMMENDED

KEY SPECS

23.8in 1920 x 1080 IPS LCD · 130mm height-adjustable stand · portrait mode · DisplayPort · mini-DisplayPort · DisplayPort throughput · 2 x HDMI (MHL) · 4 x USB 3 · 3.5mm audio output · 539 x 486 x 185mm (WDH)

The Dell UltraSharp U2414H balances fine image quality with a great selection of features. Ultimately, we prefer the larger resolution of its predecessor, the UltraSharp U2412M – which is still on sale – but it's a close-run thing. If the Full HD resolution of the UltraSharp U2414H suits your needs – and for most media enjoyment as well as gaming, it should – then it's a steal at this price.

Sasha Muller

IMAGE QUALITY	★★★★★☆
FEATURES&DESIGN	★★★★★★
VALUE FOR MONEY	★★★★★☆
OVERALL	★★★★★☆

VIEWSONIC VP2772

A PROFESSIONAL-CLASS 27IN MONITOR WITH A 2560 X 1440 RESOLUTION THAT DOESN'T COST A FORTUNE

PRICE $1050
SUPPLIER www.viewsonic.com.au

ViewSonic's VP2772 promises high-end performance with its huge, 2560 x 1440 IPS panel lit by a wide-gamut GB-LED backlight. ViewSonic colour-calibrates each display to guarantee an average Delta E of 3.

Physically, the VP2772 looks almost identical to its predecessor, the VP2770-LED. The huge stand holds the monitor firmly in place – even when the 135mm height-adjustable stand is extended to its maximum – and it remains wobble-free in both landscape and portrait modes.

Connectivity has taken a leap forwards. In addition to DVI, HDMI, DisplayPort and mini-DisplayPort inputs, the VP2772 sports DisplayPort throughput for daisy-chaining a second monitor. The four-port USB hub has been upgraded to USB 3 as well.

The VP2772's IPS panel is an even greater improvement. The new GB-LED backlight allows the VP2772 to cover a claimed 99% of the Adobe RGB colour space. In practice, it serves up impressive colour fidelity. In Adobe RGB mode, we measured a contrast ratio of 715:1, an average Delta E of 1.5 and a maximum Delta E of 3.7. With the sRGB mode activated, the panel served up a contrast ratio of 714:1, and scored an average Delta E of 1.7 and a maximum Delta E of 4.1. The gently reflective finish helps to keep the picture vibrant and grain-free, but it isn't truly glossy.

Inexplicably, the sRGB mode locks the backlight at 218cd/m^2, which is far brighter than we'd recommend for professional use. The backlight is uneven, too, with dimmer patches noticeable in the top left and top right of the panel. We measured a brightness variation of 18% across the panel, which is disappointing.

Despite these flaws, the VP2772 provides professional-class colour fidelity for sensible money. If you can't afford a top-flight monitor such as Eizo's ColorEdge CG276, the VP2772 provides a taste of the high end at a fraction of the price.

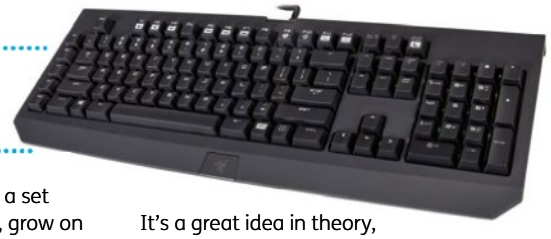
Sasha Muller

KEY SPECS

27in 2560 x 1440 IPS LCD · 135mm height-adjustable stand · portrait mode · DisplayPort · mini-DisplayPort · DVI · HDMI · DisplayPort throughput · 4 x USB 3 · 3.5mm audio output · 3yr swap-out warranty · 643 x 470 x 348mm (WDH)

IMAGE QUALITY	★★★★☆
FEATURES&DESIGN	★★★★★
VALUE FOR MONEY	★★★★★
OVERALL	★★★★½

RAZER BLACK WIDOW 2014



A GOOD EFFORT IN THEORY, BUT A PRETTY POOR RESULT IN PRACTICE.

PRICE TBX
SUPPLIER www.razerzone.com

When Razer released its Black Widow keyboard range a few years ago, it pretty much started a gaming keyboard cold war. Not only were its peripherals competitors hopping onto the mechanical keyboard bandwagon (including folks like Corsair, who'd never even been in that space before) to try and catch up, sparking a design war, but just getting hold of the mechanical switches themselves was a challenge. Both Razer and Corsair have boasted to us in the past of their efforts to buy up entire batches of the prized Cherry-made switches that power their keyboards, while companies like ThermalTake, under its Tt eSports brand, continue to produce boards featuring every possibility of switch.

And all the while, Cherry itself can only manufacture switches at a set pace. They do not, apparently, grow on trees. Which is the situation that brings us to Razer's latest attempt to steal a march on its competition.

Razer's latest iteration of the Black Widow, available in vanilla and Ultimate editions, features an all-new Razer-designed 'Green' switch (complimenting Cherry's own Red, Blue, Black and Browns, natch). It might be Razer-designed, but it's likely not Razer-built, however; which does beg the all important question -- would it have been a better-designed switch were that the case?

The Black Widow remains a fine keyboard in terms of build and extras, but the new Razer switches really are quite terrible, at least for our preferred methods of keying and gaming. The Green switches feature a relatively light actuation, good travel, and a very definable 'click' upon hitting the actuation point -- all good so far, but there's also a second 'click' that you can feel when the key travels back to its position.

It's a great idea in theory, delivering discrete feedback to key presses and the return to a ready-state, but in action the second click has a tendency to stick, especially if -- like us -- you rest your fingers on your keys during gameplay. In that case, the pressure of your fingers is enough to settle the key before it springs back into position, in such a way that it doesn't register further key-presses.

Just about the worst thing you could want when you're in the middle of a tense game, in other words. Even for day-to-day typing the Green switch just doesn't feel comfortable. There's a second, Razer Orange switch that we're very curious to try, but for now, we'll be avoiding further use of this particular keyboard.

David Hollingworth

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

MIONIX NAOS 7000

MIONIX DELIVERS A SMOOTH MOUSING EXPERIENCE THAT'S AS SLICK AS IT IS COMFORTABLE.

PRICE $79
SUPPLIER www.mionix.com

There's a lot to like about Mionix range of gaming peripherals. In the past we've found them well built and really quite comfortable. However, we've also found them a bit hit and miss – when we looked at the Naos 8200, it looked the part, but in practice delivered rather jittery performance. The new Naos 7000 has now come along to try and convince me of Mionix's superiority in the field.

And it makes a pretty compelling argument.

Externally, it's very similar. An unapologetically right-handed design will leave ten per cent of the gaming population out in the cold, but for right-handers like me, it's one of the most comfortable mice on the market. With moulded curves on either side for every one of your fingers to rest on, you can maintain an easy grip without exerting a tonne of pressure. It's also good for those who like grab their mouse between thumb and pinky – no matter your grip, the 7000 can accommodate it in style.

It also features one of the slickest set of mice feet we've ever encountered, fairly gliding across our mouse mat with almost no applied exertion. There's no sense of grind or friction, making it mouse movements sweeping and unobstructed. Of course, if you like a bit of friction, to track your movements, it may not appeal. Mionix's similarly new Avior, has a much rougher surface play.

Of course, it's performance in game and on the desktop that will make or break a mouse, and, impressively, the new 7000 does not disappoint. A very clicky mouse wheel provides solid tactile feedback to scrolling, while the range of buttons feature similarly good feedback and performance. Most impressively, though, the new ADNS -3310 sensor is amazing. It does not accelerate the cursor at all – what you see on screen is what you'll feel under your hand. And our old bugbear, of the 8200's rather poor pick-up performance, is completely gone, making the 7000 not only comfortable but very accurate in-game.

David Hollingworth

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

Speedy and easy to set up, the Linksys offers plenty for the price

LINKSYS EA6900

A QUICK, FLEXIBLE AND SUPREMELY EASY-TO-USE ROUTER, AND THE PRICE IS VERY REASONABLE

PRICE $240
SUPPLIER www.linksys.com

Now that 802.11ac is making its way into more phones, tablets and laptops, choosing an AC router such as Linksys' EA6900, is becoming an increasingly tempting option. The new wireless networking standard has been somewhat slow to catch on – certainly slower than the 802.11n standard, which many manufacturers were keen to roll out before the final details of that standard were actually ratified. Increasingly, consumer electronic devices – at least at the high end, or with premium models – are including 802.11ac as a standard. We're starting to see it in premium TV sets, too, which makes good sense as media streaming (across multiple sources) is becoming popular and ac offers far superior performance to 802.11n for that. And if you're going to opt for 802.11ac, you might as well go for broke and choose a top-end model. The Linksys EA6900 is the firm's new flagship router – the first under new owner Belkin – and it's packed full of appealing features.

As with the Asus RT-AC68U, the EA6900 is an "AC1900" device. That doesn't mean its top speed is 1900Mbits/sec. Instead, the 1900 figure is a totting up of the router's maximum possible link speed across each of its wireless frequency bands: over 2.4GHz the EA6900 can connect at up to 600Mbits/sec, while over 5GHz it can connect at up to 1300Mbits/sec. That 600Mbits/sec speed – 150Mbits/sec faster than standard 2.4GHz connections – is enabled by using a proprietary Broadcom technology, TurboQAM, so not every device will get the benefit. Like most top-specification routers, the EA6900 also lacks an integrated modem, so you'll need a separate modem (cable or ADSL) to feed it an internet signal.

There's plenty of features to get your teeth into, however. The router uses its three external antennae as a beamforming array, to help strengthen the wireless signal, and there are four Gigabit Ethernet ports at the rear. In addition, there's a pair of USB ports (one USB 2, one USB 3) for sharing storage devices and USB printers.

Linksys' Smart Wi-Fi admin interface is one of the best when it comes to installation and setup, and once it's up and running, the widget-based UI makes accessing the router's various settings a doddle. Parental controls make it possible to block and allow internet access based on the time and day of the week, and there are Android and iOS apps that allow you to take control remotely, set up guest access, and monitor your network from a smartphone or tablet. A selection of in-app extensions allow you to expand what you can do with these apps, and although there's decidedly more choice for iOS devices than Android at this stage, we expect that to even-out.

KEY SPECS

3x3 stream 802.11ac wireless router • rated at 1300Mbits/sec for 802.11ac and 600Mbits/sec for 802.11n • 4 x Gigabit Ethernet • 1 x USB 3 • 1 x USB 2 • 1yr RTB warranty • 255 x 206 x 105mm (WDH)

Testing with a 3x3-stream Asus PCE-AC68 PCI Express x1 card, and using iPerf to measure maximum bandwidth, the router hit 72.4MB/sec over 5GHz at close range – faster than the Asus RT-AC68U – but 23.8MB/sec in our long-range test, which is slightly down on the Asus' performance. Over 2.4GHz, we measured close-range speed at 19.2MB/sec and long range at 6.3MB/sec. On balance, we prefer the Asus' results – it's a better all-rounder.

We also tested the speed of shared storage over Gigabit Ethernet and found performance to be rapid, but again slower than the Asus. Still, there isn't much wrong with sequential read and write speeds of 28.6MB/sec and 19MB/sec – they're not far behind – and such results make it possible to employ the EA6900 as an occasional NAS drive.

The EA6900 is an excellent 802.11ac router. It's speedy, easy to set up and manage, flexible and, most importantly, reasonably priced for everything you get. We prefer the Asus RT-AC68U, which delivers more balanced all-round performance, but this Linksys isn't far behind and is still a top choice.

Jonathan Bray

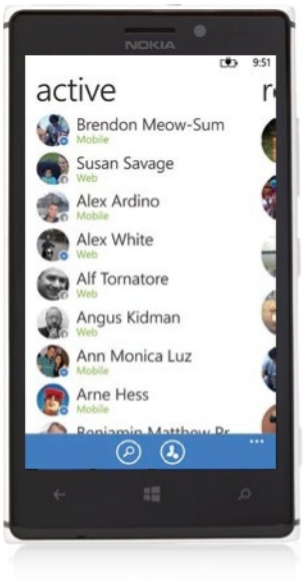
PERFORMANCE	★★★★★☆
FEATURES&DESIGN	★★★★★★
VALUE FOR MONEY	★★★★★☆
OVERALL	★★★★★☆

APPS ROUND-UP

JENNETH ORANTIA TESTS AND RATES ESSENTIAL APPS FOR A BETTER MOBILE EXPERIENCE

FACEBOOK MESSENGER

PRICE FREE **DEVELOPER** FACEBOOK
PLATFORM WINDOWS PHONE 8



One of the unique features of Windows Phone has always been the Facebook chat function built into the Messaging app, making it near seamless to switch between regular and online texting. The only downside is that it lacked functionality compared to the dedicated Facebook Messenger client, such as location stamping, group chatting, built-in emoticons and read receipts. Further, it lacked the all-important ability to send photos via the stock Messaging app, which has long been disappointing.

Now Windows Phone users can have the best of both worlds: integrated Facebook chat via the stock Messaging app and the full Facebook Messenger experience courtesy of the new standalone Facebook Messenger app. Unlike the Facebook app for Windows Phone 8, it has been designed by Facebook itself, and as such looks and works just like the clients for iOS and Android.

Naturally, it uses the standard Windows Phone UI of large text and sideways scrolling to move between screens. From the main screen, you can see your most recent conversations and create new ones. Swiping to the next screen shows a list of all of your friends in alphabetical order, with your favourite friends at the top, and you can jump to a particular letter of the alphabet quickly by tapping on the star and tapping on the relevant letter. You can also scroll over to the 'active' page to see friends that are currently online, and it distinguishes between friends that are connected via the web and a mobile device.

Despite its looks, however, Facebook Messenger for Windows Phone 8 isn't quite as functional as its iOS and Android counterparts. The chat heads feature, which displays floating thumbnails of people you're currently chatting with, isn't available, nor is the ability to send recorded voice messages or initiate voice calls. It also lacks integration with the Facebook app for Windows Phone – if you tap on the Messaging icon in the Facebook app, it opens the messaging function within the app rather than launching the dedicated Facebook Messenger app.

EASE OF USE	★★★★★★
FEATURES	★★★★★☆
VALUE FOR MONEY	★★★★★★
OVERALL	★★★★★★

PUSH BULLET

PRICE FREE **DEVELOPER** PUSHBULLET
PLATFORM WEB, IPHONE, ANDROID

Push Bullet is an online web service that lets you 'push' files, links, photos, checklists, notes and addresses directly to mobile devices and friends that you've added, saving you from the rigmarole of having to email or message attachments. While it isn't a new service per se, it has recently added the option to push content to iPhone devices in addition to Android.

Setting the service up is simple. Once you visit the Push Bullet webpage and sign up with your Google account, any mobile devices you install the app on are added to your list of devices. The name of your device appears on the left-hand side of the webpage, and clicking on it displays the various content pushing options. As soon as you push something to your mobile device from your desktop, you'll get an instant notification from Push Bullet.

The iPhone app has a built-in viewer for things like Word documents and photos, but you can tap the button in the top right-hand corner to open the file in a compatible app. For addresses, however, it will automatically open them in Apple Maps – there's no option to specify that these open in Google Maps if that's your navigation app of choice.

Push Bullet also comes with Chrome for Firefox extensions to make it easier to send content directly from your web browser. If you right-click on any webpage, you'll see a Push Bullet icon that lets you either send a link or a screenshot of the page to any of your registered devices. If you want to send files, however, you can only do so from the Push Bullet web page.

Push Bullet for iPhones makes transferring files from your desktop computer more of a drag and drop experience. Push Bullet for Android kicks it up a notch with its real-time notification mirroring feature. If you have the Chrome extension installed and turn 'notification mirroring' on in the Android app, you'll see all of the notifications from your Android phone appear in Chrome.

EASE OF USE	★★★★★★
FEATURES	★★★★★★
VALUE FOR MONEY	★★★★★★
OVERALL	★★★★★★

GRAVITY SCREEN

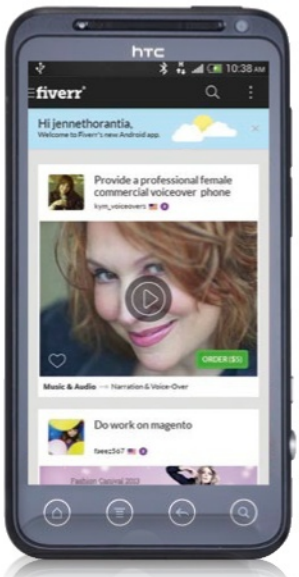
PRICE: FREE
DEVELOPER PLEXNOR
PLATFORM ANDROID

The concept behind Gravity Screen is simple yet effective. Rather than rely on the power button to turn your smartphone on and off, this app will automatically perform those functions by taking advantage of the built-in sensors. Using the proximity sensor and accelerometer, it's clever enough to turn the screen off when you put your phone in your pocket or put it face down on a table. Conversely, it will turn the screen on when you take it out of your pocket or detects motion near the screen. The Pro and Unlocked versions of the app, available through in-app purchases, add features like additional control over the sensors, widgets and an app exclusion list.

OVERALL ★★★★½

FIVERR

PRICE: FREE
DEVELOPER DROIDSTER
PLATFORM ANDROID



Originally available for iOS only, a native client for Fiverr has finally come to Android. In case you aren't familiar with Fiverr yet, it's an online global marketplace for services that start from $5. You can create your own 'gigs' for other people to buy or browse through the millions that are already available, including 'recording a personal video using a furry monster puppet', 'do a press release' and 'professionally master your song in 24 hours', as just a few examples of the sometimes amazing range of things you can do, or have done for you here. As with the iOS version, however, the Android client is a little limited. You can't create gigs from the app, and the management tools for buyers and sellers are somewhat limited.

OVERALL ★★★½☆

WETRANSFER

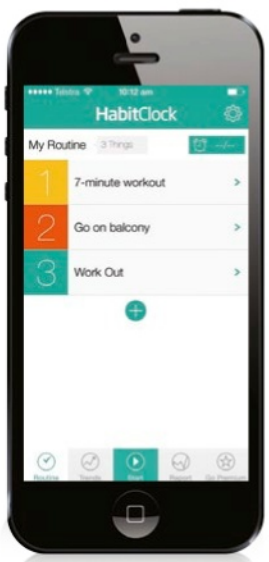
PRICE FREE
DEVELOPER WETRANSFER
PLATFORM IPHONE

The popular file sharing service for the desktop has arrived on the iOS platform, but it's not without its limitations. Ostensibly, it's just as easy to use as the web service: you don't actually need to create an account to send files (instead the same objectives can be accomplished if you simply plug in the email address of the recipient). Still, when using the app there are advantages, mostly in terms of using its features – particularly so on a small-screen smartphone. The user interface is refreshingly clean and simple, and you can transfer up to 10GB of files in one go. However, the API restrictions in iOS mean the only files you can send are photos and videos. Further, you can't sort through your photos and videos by album, and it doesn't support any of the WeTransfer Pro features.

OVERALL ★★★★½

HABITCLOCK

PRICE FREE
DEVELOPER LIFESETTER
PLATFORM IPHONE



HabitClock is an alarm clock app with a difference. Rather than stick to simply waking you up in the morning, HabitClock goes a step further by reminding you to go through your entire morning routine. You can add whatever you like to your routine, such as drinking a glass of water, brushing your teeth, and taking a shower, and it will remind you to do each one sequentially. If you're looking for inspiration, you can browse through the 'trends' tab to see what other people are doing in their mornings worldwide or in your area. There are also ready-made lists you can download if you're really stuck for ideas. We think it's all a rather silly idea for an app considering that we usually remember to put on our pants, but it works very well as a reminder service for more important tasks, so that's why we suggest giving it a try.

OVERALL ★★★★½

LABS BRIEFS

CM STORM REAPER

PRICE $119
WEBSITE www.cmstorm.com

Built around the quality Avago 8200 DPI laser sensor, this is ostensibly pitched as a gaming device, and is a fine tool for everyday computing, with tastefully austere styling – at least compared to some of the more outrageously designed game mice out there. The chunky metal wheel is a particularly nice bit, as is the aluminium cover which generally remains cool under the hand.

Other quality features which we appreciated in testing include Teflon strips running the entire length of the base, making this a particularly greasy slider, as well as a braided cord. Notch up another plus for the outstanding software, which is elegant and packs in a wealth of control. Presets can also be stored in the onboard memory, which is handy for pro gamers who move from PC to PC. The best feature is the large 'sniper' button just ahead of your thumb which switches the DPI to a slower preset for precision work – another press brings it back to normal. That's handy for artists and designers, too.

Ben Mansill

OVERALL ★★★☆☆☆

DELL XPS 11

PRICE $2498
WEBSITE www.dell.com.au

We have been puzzling over this machine for the last week, as it sat on our desk in front of us. It's an undeniably beautiful machine, sleek, black, light and very cool-looking. But what to do with it? As a laptop it's left flailing because its keyboard is well-nigh impossible to use with any speed. The keys don't move, at all, and are barely raised bumps on the surface. There's no tactile feedback, so instead of watching the screen to touch-type, instead we stared at the keys, wondering if we'd pressed them properly. However, flip the keyboard up and over and it 'becomes' a tablet. A very powerful, and somewhat expensive, tablet. The HDMI port technically makes this a media machine, but still, it's a half-way functional device whatever you try to use it for.

Our review machine was high-spec, with a 1.9GHz i5 and a 128GB SSD. While nicely powerful, at the price it's difficult to justify since it's a lot to pay for a machine that's mostly for entertainment. Grab the cheaper one at $1498 and it could be a rather nice utility device.

Ben Mansill

OVERALL ★★☆☆☆☆

SANDISK DUAL USB DRIVE

PRICE $80
WEBSITE www.sandisk.com.au

There are a great many ways to transfer files from a smartphone or tablet to a PC, and vice-versa. Here is another option, which is appealing for its simplicity and versatility. The adaptor has a micro-USB plug on one end, and a regular USB 2 plug on the other. It is intended to store files via its onboard memory (there are 16, 32 and 64GB variants) while attached to one device, and shift them to another. The device is tiny, and thankfully there's a hole for a lanyard, or to attach it to a keychain.

As you would imagine, transferring from one device to another is as simple as dragging and dropping, but SanDisk has taken it all a step further with the inclusion of the SanDisk Memory Zone app. This gem is just a memory and file manager – but it's a very good one. When used with the drive attached, a long press on any file gives you the option of copying it to the drive (or cloud). It can also run a backup, copying selected files or folders to the drive.

Ben Mansill

OVERALL ★★★★☆☆

SANDISK WIRELESS MEDIA & FLASH DRIVES

PRICE $99 (FLASH); $268 (MEDIA)
WEBSITE www.sandisk.com.au

SanDisk appear to be on a roll, with a string of innovative products lately. This one is intended for file sharing wirelessly, or for streaming HD media. It's not the first product to do either, but in its compact and battery-poowered form it is quite appealing. The physically smaller 'Flash Drive' model comes in 16, 32 and 64GB versions and can stream HD content out to up to three simultaneous users, and supports up to eight wireless connections for regular data transfer. Fully powered, it's good for around four hours before needing a recharge.

The slightly larger Media Drive (about the size of a pack of playing cards) can do five HD streams or, like the Flash version, eight data connections. A larger battery doubles endurance to eight hours. It also features SD expandability, which the Flash version does not. All connections are secured, so this could be handy for road warriors who need to share files, as well as various media sharing scenarios.

Ben Mansill

OVERALL ★★★★☆☆

HP ELITEBOOK FOLIO 1040 G1

PRICE $2499
WEBSITE www.hp.com/au

There's no mucking around with this HP ultrabook. Designed for enterprise use, it's built to last and to keep your data secure. A spill-proof backlit keyboard, fingerprint reader and integrated Smart Card reader give it solid protection against the rigours of living in the modern world. While onboard data encryption, a full suite of HP's enterprise-class data recovery software and services, plus a BIOS that will resume normal operation after corruption add to its rugged appeal.

We called it in for a test based more on its handsome good looks. Too often, today, ultrabooks skimp on durability, and the Folio 1040 G1 caught our eye with its attention to both substance and style. It's a wonderful machine to work on, its sharp yet thin 14-inch screen being available in either HD or FHS (which adds 2mm to the screen's depth). An i5-4300U at 1.9GHz and a 128 SSD are standard, as is a 6-cell battery. It's also got a generous 3-year onsite warranty.

Ben Mansill

PC &TECH AUTHORITY RECOMMENDED

OVERALL ★★★★★☆

TP-LINK AV500 NANO POWERLINE ADAPTOR

PRICE $69
WEBSITE www.tp-link.com.au

It's the way many used to network, before wireless performance became fast and reliable, but the good old-fashioned powerline adaptor still has a place in homes that are especially large or where Wi-Fi has trouble penetrating thick concrete or other materials. The TP-LINK AV500s were used to test HD media throughput, which is still something many Wi-Fi networks struggle with. The adaptors connected as easily as we'd expect using the simple pairing button system. These too, we're told, support many devices in a home network so adding more later shouldn't be a problem.

Once connected, performance in the region of 500Mbps in a perfect environment can be expected, which is enough for several HD streams.

Importantly, the TP-LINK AV500 NANO goes into a standby mode when not in use, with the manufacturer claiming up to 85% reduction in power consumption as a result.

Ben Mansill

OVERALL ★★★☆☆☆

GROUP TEST

Solid state showdown

A SOLID STATE DRIVE IS ONE OF THE BEST UPGRADES YOU CAN GIVE YOUR PC. WE'VE TESTED 23 OF THEM TO DISCOVER WHICH ONES DESERVE YOUR CASH

Virtually every PC should have a solid state drive, as they make a huge difference to your computing experience. With no moving parts, the data throughput of NAND is leagues ahead of the fastest hard drives. System boot times, game and software loading times, as well as general responsiveness, all receive a dramatic upgrade as a result. SSDs also draw less power, produce less heat, and are silent and much smaller too.

The downside, of course, is cost – mechanical disks are cheaper per gigabyte than SSDs, and are thus still the better choice for high-capacity storage. That said, price as a barrier to entry continues to fall, as some drives are now dipping below $1 per gigabyte.

Almost any modern SSD will be a significant upgrade from a hard disk, but that doesn't mean you should rush out and buy the cheapest one. There are numerous other factors to consider. NAND flash comes in different flavours, and the wide array of controller types confuses matters further, especially if you're an early adopter looking to upgrade to a superior model. Thankfully, we've rounded up 23 of the latest SSDs, ranging in capacity from 240GB to a whopping 1TB, with a number of different controllers too.

This is the definitive guide to purchasing an SSD, today. There is no better upgrade option, and we know you'll enjoy all their benefits.

Matthew Lambert and Mike Jennings

FEATURED THIS ISSUE

How we test

Our battery of SSD tests comprises synthetic benchmarks, PCMark 7's trace-based storage benchmark, a boot time measurement and Iometer's I/O workload generator.

Prior to testing, we issue an ATA Secure Erase command to each drive with the Parted Magic (*www.partedmagic.com*) Linux build. This tells the controller to release all stored electrons within every NAND module, erasing all data and resetting the SSD to factory performance.

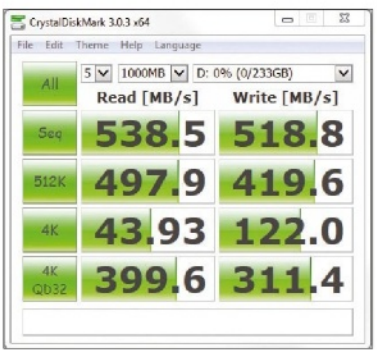
For synthetic tests, we use AS SSD (*http://tinyurl.com/ASSSDCPC*) and CrystalDiskMark (*http://tinyurl.com/CPCCDM*). With these free benchmarks, you can easily compare your own PC's storage performance with that of the drives on test. Both benchmarks perform a theoretical test of a drive's sequential read and write performance, as well as its 4KB random read and write performance, both at single and high queue-depths (64-queue-depth in AS SSD, and 32-queue-depth in CrystalDiskMark). Queue depth refers to the number of pending I/O operations for a volume of storage – and more demanding software uses greater queue depths.

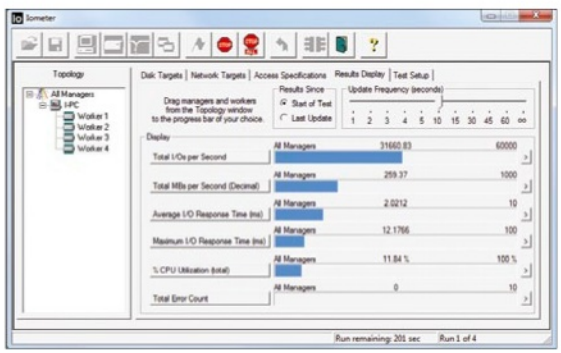
While the two tests are similar, they use slightly different data patterns, so performance between them can vary. AS SSD automatically performs multiple runs and reports the average, while with CrystalDiskMark, we use the 1000MB file size set to five runs, with the average again reported. Sadly, though, SSD performance isn't static and can degrade as the NAND cells are filled. Nowadays, widespread TRIM support helps to minimise this issue, but nevertheless, we perform a full fill of each drive, delete the data and then retest it in AS SSD to ensure that performance integrity is maintained.

For real-world testing, we use PCMark 7's Secondary Storage benchmark, which loops three times and reports an average. It uses recorded SATA traces (the exact traffic over the SATA bus at the time of recording) to simulate performance under a wide range of circumstances. We're most interested in the application and gaming tests, as these will have the most pronounced impact on everyday use. We take the raw performance results from each, which eliminate trace idle times and make differences between drive performance more obvious. The AS SSD, CrystalDiskMark and PCMark 7 tests are performed on an Asus Maximus V Extreme's SATA 6Gbps ports, using an Intel Core i5-3570K and 8GB of 2400MHz Corsair Dominator RAM.

We also test how long each drive takes to boot a clean installation of Windows 7 64-bit using the freely available BootRacer (*www.greatis.com/bootracer*), which measures boot times down to a thousandth of a second. This test is conducted using an SATA 6Gbps port on an Asus Maximus V Formula using an Intel Core i7-2600K and 4GB of 1600MHz Crucial Ballistix DDR3 RAM. The system also uses an AMD Radeon HD 5870 graphics card. We install the 13.12 Catalyst drivers and reboot the system five times to allow Windows to get its caching in order, before taking the average of the five subsequent boot times.

Our final test uses Iometer (*http://tinyurl.com/CPCIometer)* to generate four 64-queue-depth workload patterns (Database, File Server, Workstation and Web Server), simulating heavy use with different file sizes and write to read ratios. We run each test for five minutes using fully random data, which is easily enough to stress test a modern SSD controller. The number reported is the average IOPS (input/output operations per second) of all four tests. This test is performed on the drives as raw, unformatted volumes, using a SATA 6Gbps port on an Asus P9X79 Pro with an Intel Core i7-3960X and 16GB of 1600MHz G.Skill RipjawsX RAM.





THE SCORES

The speed score is taken from a weighted breakdown of the performance tests. AS SSD and CrystalDiskMark account for 25 per cent each, while 40 per cent is allocated to the PCMark 7 and BootRacer real-world tests, which are the most relevant for everyday use. The final 10 per cent comes from Iometer, as the sustained high queue-depth workloads are only applicable to the most hardcore users. The cost per gigabyte is based on the pricing at the time of writing over the accessible formatted capacity, while the bang per buck score is a ratio of the speed and cost per gigabyte.

CRUCIAL M500 240GB, 480GB AND 960GB

SOME OF THE LOWEST COSTS PER GIGABYTE ON TEST

PRICES
- Crucial M500 240GB - $179
- Crucial M500 480GB - $389
- Crucial M500 960GB - $649

Crucial's M500 drives are handled by Marvell's 88SS9187 controller, for which Crucial develops its own firmware, while IMFT 128Gb (16GB) 20nm MLC NAND dies are used throughout.

The controller is connected to 16 NAND packages in each drive (one 128Gb die per package for the 240GB, two for the 480GB and four for the 960GB). Such high-density NAND keeps down production costs; the 960GB works out at an incredible 67c per gigabyte, while the others are below the 81c mark. Only Samsung's SSD 840 EVO 1TB and Transcend's cheap and cheerful SSD340 manage the same feat.

The M500's DDR3 cache scales with capacity, from 256MB in the 240GB model to 512MB in the 480GB drive and 1GB for the 960GB model. It's used mainly for page mapping: if there's a power failure, a series of capacitors allows any user data in the cache to be quickly flushed to permanent storage.

The M500 is also compatible with the TGC Opal 2.0 and IEEE-1667 specs, enabling hardware-accelerated encryption such as that in BitLocker. This is more secure than ATA password encryption and has a smaller overhead than software encryption. Finally, RAIN (Redundant Array of Independent NAND) sets aside the extra inaccessible area of the NAND for data redundancy, providing some protection against NAND cell failures.

Sequential read speeds are comparatively low, capping out at 500MB/sec and leaving the drives at or near the bottom of the charts in both tests. Write speeds don't fare much better, but the two larger-capacity models have a clear advantage, hitting around 430MB/sec in AS SSD and 15MB/sec more in CrystalDiskMark, while the 240GB drive is limited to sub-300MB/sec speeds and comes last in CrystalDiskMark. This limit is due to the controller only being populated with two NAND dies per channel.

Single-queue-depth random speeds are essentially identical throughout the range. With a maximum read speed of 28.7MB/sec in CrystalDiskMark, the drives are relatively poor performers here, but they have excellent write performance. The peak of 125.4MB/sec loses out only to OCZ's Barefoot 3 drives.

Again, there's little separating the three drives with high queue-depth read speeds, although the other Marvel 9187 SSDs outperform them. As for writes, the higher-capacity drives hit around 300MB/sec in AS SSD and 340MB/sec in CrystalDiskMark, leaving them mid-league, while the 240GB model comes in rather lower, with write and read speeds of 238.9MB/sec and 276.3MB/sec respectively.

> "128Gb 20nm MLC NAND dies are used throughout"

The drives struggle in real-world tests, although they're bunched tightly together in PCMark 7. In the Starting Applications test, they're particularly low in the charts, failing to break the 90MB/sec bar. Booting up Windows tends to favour smaller capacities – we saw that the 240GB drive has a respectable 12.03-second boot speed, but the larger 960GB takes 14.4 seconds to boot. While only a small difference, it's certainly something to bear in mind. Iometer speed is also respectable. The higher capacities are better here, but even the 240GB model averages 34,975 IOPS – higher than the Samsung SSD 840 Pro 256GB, but not as good as the Plextor drives.

CRUCIAL M500 240GB

SPEED	$/GB	BANG/BUCK	OVERALL SCORE
38/50	18/20	23/30	79%

CRUCIAL M500 480GB

SPEED	$/GB	BANG/BUCK	OVERALL SCORE
40/50	18/20	24/30	82%

CRUCIAL M500 960GB

SPEED	$/GB	BANG/BUCK	OVERALL SCORE
39/50	19/20	25/30	83%

CONCLUSION

At under 81c per gigabyte, the M500 drives are very reasonably priced (the 960GB model is even cheaper than the OCZ Vector 150 480GB). Performance throughout could be better, and Samsung's victory here is clear. Still, the 240GB drive is much better than the cheaper Transcend one and would make an excellent primary drive for a budget SSD-based system. Meanwhile, the 480GB and 960GB models would make great laptop upgrades by bringing both speed and capacity to a single 2.5in slot, and the encryption, redundancy and power loss protection features are added bonuses too.

VERDICT

Some nifty features and acceptable performance, but the low cost per gigabyte is the real highlight of the M500 series.

OCZ VECTOR 150 240GB AND 480GB, AND VERTEX 460 240GB

OCZ PAIRS THE INDILINX BAREFOOT 3 WITH TOSHIBA NAND

PRICES
- OCZ Vector 150 240GB - $310
- OCZ Vector 150 480GB - $650
- OCZ Vertex 460 240GB - $230

OCZ's enthusiast-aimed Vector 150 and mainstream Vertex 460 drives, despite their different target users, use very similar hardware. The difference is that the Vertex 460's Barefoot 3 controller is clocked slightly lower. This particular controller is an 8-channel model that uses an ARM Cortex core and an OCZ Aragon coprocessor.

Another difference is that the Toshiba 19nm NAND modules in the Vector 150 series are more heavily validated. As such, those drives are rated for higher endurance – five years of 50GB/day host writes (even more than Samsung's SSD 840 Pro), compared to three years of 20GB/day on the Vertex 460. All of the drives include a bundled copy of Acronis True Image HD.

Sadly, though, none is compatible with the Opal 2.0 and IEEE-1667 specifications, so hardware-accelerated encryption, such as that in BitLocker, is off the cards.

Of the three drives, sequential read performance is best on the Vector 150 240GB, which hits 519.8MB/sec in AS SSD and 537.4MB/sec in CrystalDiskMark. This latter benchmark sees more middling performance from the other two drives, but sequential write performance is more convincing. In both tests, the trio is clustered closely together, with speeds just below 500MB/sec in AS SSD and around 520MB/sec in CrystalDiskMark – only Samsung drives ever overtake them in either case.

Single-queue-depth random reads are the weakest aspect of the Barefoot controller. While the 480GB Vector 150 manages to maintain mid-league status with 29.6MB/sec (AS SSD) and 32MB/sec (CrystalDiskMark), the two others only manage speeds of around 25MB/sec and 27MB/sec. By comparison, Samsung's SSD 840 Evo drives can hit over 40MB/sec in both tests. Thankfully, single-queue-depth random write speeds are simply outstanding. In both AS SSD and CrystalDiskMark, the Barefoot 3 drives top the chart in these tests.

> "These drives aren't the best choice for the majority of home users"

In the higher queue-depth tests, we again see better write performance than read speed, although read speeds still see some dramatic improvements, with the 480GB Vector 150 having the best result of 381.2MB/sec in AS SSD's 64-queue-depth read test. Samsung's SSD 840 Evo and SSD 840 Pro drives give the OCZ drives a run for their money with high queue-depth writes, but in both benchmarks, a Vector 150 drive secures the top spot.

Despite five chart-topping synthetic figures from the Vector 150s, though, real-world performance is fairly mediocre. The three OCZ drives are clustered around the middle of PCMark 7's Starting Applications test – all of the Samsung, Toshiba and Plextor drives are ahead. The Gaming test is the biggest letdown, however. Even the Vector 150 480GB only manages 115.9MB/sec here, while the Vertex 460, with 112.6MB/sec, is in second to last place. The Vector 150 drives are also only average at best with Windows booting, while the Vertex 460 is much better with its 13-second boot time.

As a saving grace, all three drives come out on top in the Iometer tests. The Barefoot 3 controller comes into its own under this sustained battery of high queue-depth mixed workloads, where even the down-clocked Vertex 460 fends off all other competition.

OCZ VECTOR 150 240GB

SPEED	$/GB	BANG/BUCK	OVERALL SCORE
43/50	16/20	21/30	80%

OCZ VECTOR 150 480GB

SPEED	$/GB	BANG/BUCK	OVERALL SCORE
45/50	14/20	19/30	78%

OCZ VERTEX 460 240GB

SPEED	$/GB	BANG/BUCK	OVERALL SCORE
42/50	16/20	21/30	79%

CONCLUSION

The poor to average performance observed in PCMark, BootRacer and single-queue-depth random shows that these drives aren't the best choice for the majority of home users and enthusiasts. They're also costly – the 480GB Vector 150 has the joint highest cost per GB at $1.35, while even the $230 Vertex 460 240GB is above average. Nevertheless, the excellent high queue-depth and mixed workload performance makes the Vector 150 drives fine candidates for heavy-use scenarios, such as workstations or file servers.

VERDICT

These drives have some outstanding performance, but they're less impressive in the most critical areas for home users.

INTEL 530 240GB AND TRANSCEND SSD 340 256GB

THESE TWO DRIVES LOCK AND LOAD AN OLDER SANDFORCE CONTROLLER

PRICES
- Intel 530 Series 240GB - $230
- Transcend 340 256GB - $190

SandForce has spent years supplying controllers to prominent SSD manufacturers, with its SF-2281 chip leading the way, but it's more recently come under pressure from firms such as Samsung, Toshiba and OCZ, who have either developed their own controllers or switched allegiances.

Intel's 530 Series relies on the SF-2281 controller, although Intel has optimised its firmware to eke out a little more performance from SandForce's venerable silicon. The 530 also sees Intel move from 25nm to 20nm MLC NAND. These new Micron-made flash chips are more efficient than their predecessors, bringing this drive into line with the NAND used by most of its rivals.

It's a good-looking 7mm drive, finished with brushed metal, and with a shiny Intel logo and a neat chip graphic in one corner. Plus, Intel is generous with its box contents; there's a 9.5mm spacer, a 3.5in adaptor, a SATA cable and a Molex-to-SATA power adaptor. The five-year warranty is good too, matching the best of the other drives on test.

Transcend's drive makes use of the SandForce SF-2281 controller too, and it has a slimmer 7mm form factor, so it will fit inside tiny ultrabooks as well as desktop PCs. Meanwhile, the three-year warranty is a standard offering that isn't as generous as the five-year deal provided by several of this month's drives. It is also one of the cheapest SSDs in this month's Labs, at $190 – which is close to the cheapest, from Crucial, at $179.

However, while Intel might have tweaked its controller and used new 20nm NAND chips, neither of these modifications helped the 530 perform well in our benchmarks. In AS SSD, the 530 was always in the bottom half of the results tables, and in four of the six tests, it was in the bottom five – in the sequential write benchmark, that meant a result of 322MB/sec, which is a long way behind the Samsung 840 Evo 250GB's 503MB/sec. Likewise, in AS SSD's 64-queue-depth random read test,

> "It was in the bottom half of the results table in every AS SSD test"

the Intel SSD managed 210MB/sec, compared to 347.2MB/sec from the OCZ Vector 150 240GB.

The situation was similar in CrystalDiskMark, where the only glimmer of hope came in the 4KB random read and write tests – the 530 was towards the top in the former benchmark, and mid-table in the latter. The Intel drive returned mixed results in real-world tests too. Its mid-table scores in the two PCMark 7 benchmarks were bolstered by one of the best boot times in the Labs. However, its Iometer result of 26,989 was in the bottom half of the results table, showing that you can get better drives for more intensive storage workloads.

Transcend's drive, reliant on the same controller, fared no better.

It was in the bottom half of the results tables in every AS SSD and CrystalDiskMark test, and its AS SSD sequential write pace of 259.9MB/sec was the worst on test – almost half the speed of the top drive. The Transcend's performance was underlined in real-world tests. It propped up both PCMark 7 tables, had an average boot time and sat towards the bottom of the Iometer rankings too.

CONCLUSION

Both these drives struggle to compete in terms of speed, and the Intel 530 is also hamstrung by one of the most expensive dollar-per-gigabyte figures on test. And, while Transcend's drive offers superb value at 74c per gigabyte, that doesn't justify its benchmark results – it's just too slow compared to good-value competition.

The Samsung 840 Pro 256GB is a better mid-sized drive than both these products in terms of speed and bang per buck, while the Crucial M500 240GB is a better drive if you're on a tight budget. SandForce's SF-2281 controller is clearly now past its best.

VERDICT

The SandForce SF-2281 controller is now past its best – you can get better performance and value for money.

INTEL 530 SERIES 240GB

SPEED	$/GB	BANG/BUCK	OVERALL SCORE
39/50	15/20	18/30	72%

TRANSCEND SSD 340 256GB

SPEED	$/GB	BANG/BUCK	OVERALL SCORE
34/50	19/20	21/30	74%

PNY XLR8 240GB AND XLR8 PRO 240GB

HOW DOES PNY'S HIGH-END XLR8 BRAND TRANSLATE TO SSDS?

PRICES
- PNY XLR8 240GB - $160
- PNY XLR8 PRO 240GB - $155

The XLR8 brand is more often seen on PNY's top-end, overclocked graphics cards, but it also adorns several of the firm's mainstream and high-end SSDs.

This month's Labs has seen 240GB versions of the XLR8 and XLR8 Pro drives arrive and, like the Intel and Transcend SSDs, they both rely on SandForce controllers. The chip in question is the SF-2281, which has already demonstrated its age on the opposite page. Both PNY drives also use 25nm Micron-made MLC synchronous NAND too.

Both PNY drives look the part, with dark metal and a stylish logo emblazoned across one panel, but they both also use the older 9.5mm form factor, which means they won't fit inside some slimline ultrabooks, although they'll be perfectly fine for use in most desktops and standard-sized laptops.

The two drives are mainly differentiated by the NAND used, with the Pro drive's NAND flash rated at 3000 P/E (program / erase) cycles. This in turn has an effect on warranties: the standard model includes a three-year deal, while the Pro drive serves up five years' worth of support.

On the plus side, these drives look great, and both have reasonable warranties. However, both will also put a sizeable dent in your wallet. The standard XLR8 drive costs $160, which makes it one of the most expensive mid-sized SSDs in the Labs. The Pro model is a little cheaper, at $155, but it's still in the top tier when it comes to price per gigabyte.

Both PNY drives have middling, dated specifications too, so it's no surprise that their performance was comparatively uncompetitive. The two drives spent much of their time towards the bottom of our synthetic benchmarks.

Interestingly, across most of the AS SSD and CrystalDiskMark tests, the standard XLR8 drive was faster than the Pro model too. The Pro drive was particularly disappointing in several small file reading tests, as its 18MB/sec and 171MB/sec results in AS SSD's 4KB random read and 64-queue-depth random read benchmarks results illustrate.

There was a glimmer of hope for the standard XLR8 drive in a handful of tests. It was one of the top drives in AS SSD's sequential read test, thanks to its 521MB/sec result, although this behaviour wasn't replicated in CrystalDiskMark, and the XLR8 crept into the top half of the results table in CrystalDiskMark's 4KB random write run.

However, both PNY drives had good showings in the boot time test, with the standard XLR8 drive just outpacing the more expensive Pro SSD – its 11.54-second boot was the second-best in the Labs.

The PNY SSDs faltered in the rest of the real-world benchmarks though. The standard XLR8 was slightly faster than the Pro model in the application boot test, with these positions reversed in the gaming benchmark – but, in both tests, the PNY drives sat towards the bottom of our results tables.

> "The Pro drive's NAND flash is rated to handle 3000 program / erase cycles"

Our final test, Iometer, saw neither drive impress – while neither was the worst on test, they were both in the bottom third of our results table.

CONCLUSION

Like the Intel and Transcend models, these PNY drives rely on the old SandForce SF-2281 controller, and the use of 25nm NAND also makes them outdated compared to the 19nm and 20nm NAND used in drives elsewhere.

This outdated hardware results in predictably uncompetitive performance, although both of these drives impress at the checkout – the slower Pro drive's 64c-per-gigabyte figure is extremely competitive, and the standard XLR8's 66c-per-gigabyte price is not far behind.

If you need a mid-sized drive, the Samsung 840 Pro 256GB is a much better option in our opinion – which the benchmarks show; it's consistently far quicker and it's much better value for money too, thanks to its modern, efficient components. Meanwhile, if you're after professional-level performance and endurance, OCZ's new Vector 150 240GB is cheaper and faster than the XLR8 Pro, leaving this SSD in a no-man's land where it fails to impress for either performance or value, however if you happen across this SSD at a bargain price, we still believe it's a worthwhile option to add to your desktop system, or an older laptop in desperate need of a speed boost.

PNY XLR8 240GB

SPEED	$/GB	OVERALL SCORE
37/50	14/20	67%
BANG/BUCK		
16/30		

PNY XLR8 PRO 240BG

SPEED	$/GB	OVERALL SCORE
36/50	15/20	67%
BANG/BUCK		
16/30		

VERDICT

These XLR8 drives don't live up to their name, with uncompetitive performance but very affordable prices.

SANDISK EXTREME II 480GB; PLEXTOR M5 PRO EXTREME 256GB AND 512GB

HOW DOES MARVELL'S 088SS9187 CONTROLLER FARE?

PRICES
- SanDisk Extreme II 480GB - $420
- Plextor M5 Pro Extreme 256GB - $250
- Plextor M5 Pro Extreme 512GB - $640

Marvell's name is seen in all the SanDisk and Plextor drives on this page. SanDisk's Extreme II moves from a SandForce controller to the Marvell 88SS9187, although it's been given a boost with SanDisk's own firmware.

The SanDisk drive's 19nm MLC NAND chips also have a twist up their sleeves. Around 14 per cent of each chip operates in a simulated SLC mode, which SanDisk calls nCache. It's designed to work as a write buffer to improve small file performance, and it's doubled in size since its introduction in the SanDisk Ultra Plus too. It's all packaged inside a good-looking 7mm enclosure, and the five-year warranty is generous too.

Plextor's M5 Pro Extreme SSDs were the first drives to make use of the Marvell chip, back in 2012, but the firm has now countered the older controller by loading its 256GB and 512GB models with Toshiba 19nm Toggle Mode NAND. That sounds potentially potent, and both drives look good too, with bright metal enclosures and 7mm form factors.

Like the SanDisk drive, a five-year warranty is included too.

The SanDisk Extreme II only slipped from mid-table in our AS SSD results in a single test, and in the sequential read benchmark, it was only 4MB/sec behind the chart-topping Samsung 840 Pro. The SanDisk's CrystalDiskMark results were similarly mid-table in most tests, and its sequential read result was, again, impressive – only the two Samsung Pro drives were quicker. However, nCache doesn't seem to do much; the Extreme II remained mid-table in most of our small file write benchmarks.

In our real-world tests, the Extreme II remained resolutely mid-table too. In PCMark's pair of tests, it was beaten by a host of Samsung and Toshiba drives, and its 11.99-second boot time was half a second behind the fastest drive.

> "The 4KB random write performance remained largely uncompetitive..."

Meanwhile, Plextor's Marvell-based drives returned mixed performance in AS SSD. The two drives hit the top five when reading sequential files, outpacing strong competition from Samsung and Toshiba, and the 256GB version excelled in the 64-queue-depth random read test, with a second-best pace of 368MB/sec. They languished when tasked with 4KB random writes, though, and did little to stand out elsewhere.

The 4KB random write performance remained largely uncompetitive in CrystalDiskMark but, in the rest of these tests, the two M5 Pros didn't stray from the mid-field. The 256GB M5 Pro was also the third-fastest booting SSD on test, and its 11.55-second start time easily bested the 512GB model's 12.47-second result. The M5 Pros were some of the best performers in PCMark 7's application boot test too, but headed back to the mid-table in PCMark's gaming benchmark.

CONCLUSION

Plextor's M5 Pro drives are among the quickest and most consistent drives on test, but they're hampered by poor pricing: the 256GB and 512GB models cost 97c and $1.25 per gigabyte. The SanDisk was better value – its 87c-per-gigabyte price being average. Even with NAND tweaks, the aging Marvell 88SS9187 controller can't compete with Samsung's latest tech.

VERDICT

All these Marvell-controlled drives are rapid performers, but they're expensive too.

OCZ VECTOR 150 240GB

SPEED	$/GB	OVERALL SCORE
42/50	15/20	77%
BANG/BUCK		
20/30		

OCZ VECTOR 150 480GB

SPEED	$/GB	OVERALL SCORE
45/50	16/20	83%
BANG/BUCK		
22/30		

OCZ VERTEX 460 240GB

SPEED	$/GB	OVERALL SCORE
44/50	16/20	82%
BANG/BUCK		
22/30		

SANDISK ULTRA PLUS 256GB AND X110 256GB

LOW COST PER GIGABYTE, AND MARVELL SS889175 CONTROLLERS

PRICES
- SanDisk Ultra Plus 256GB - $170
- SanDisk X110 256GB - $180

SanDisk is clearly a fan of Marvell controllers, with the SS889187 chip used in the firm's Extreme II drive, but for its Ultra Plus and X110 models, the firm has turned to the Marvell SS889175.

This controller is the sequel to the 9174, which was a big hit in older SSDs such as the Plextor M3 and Intel 510 Series, and it's designed to improve on its predecessor with lower power consumption, thanks to a quartet of independent NAND channels. It also allows direct access to the firmware, so SanDisk has been able to craft its own firmware for the Ultra Plus 256GB.

Like the Extreme II, SanDisk has deployed 19nm MLC NAND inside this drive, and it also has the nCache system that we saw in the Extreme II. This feature is designed to replicate SLC (single level cell) performance across a small section of the SSD's NAND and, in theory, improve small file write speeds. As with other SanDisk drives, the Ultra Plus uses the slimmer 7mm form factor, and there's a three-year warranty too, although plenty of other drives have five-year deals in place now.

The third SanDisk drive in this Labs, the X110, has recently made the move from the business market to the consumer side, and it also relies on the Marvell SS889175 controller. It uses the same 19nm NAND too, and the same nCache system. However, the X110 has the added benefit of read error protection that can repair faults with no performance overhead, as well as thermal throttling to prevent overheating, although admittedly, this isn't an issue we've ever encountered with SSDs – it's only ever likely to be an issue in crowded server racks where this enterprise-class drive was designed to operate. Like the Ultra Plus, the X110 also has a three-year warranty.

It's no surprise that two drives with similar specifications weren't too far away from each other in benchmarks – throughout our theoretical tests they were often next to each other in the results tables.

However, while nCache may be designed to improve small file write performance, these two drives sat towards the bottom of our results tables in both of AS SSD's applicable tests; they managed 96MB/sec in the 4KB random write test, which is almost 20MB/sec behind the leading drive, and they were around 125MB/sec behind the best drives in the 64-queue-depth random write test too. The Ultra Plus and X110 were consistently better when reading small files, though, and were mid-table in the overall sequential benchmarks.

> **"SanDisk has been able to craft its own firmware for the Ultra Plus 256GBs"**

We spotted the same pattern in CrystalDiskMark; these drives might have a system designed to impact small file writes, but in these benchmarks, both drives performed disappointingly. In the 32-queue-depth random write benchmark, they were bottom of the pile. Conversely, sequential and 4KB random reads were a little better.

Meanwhile, the X110 returned a boot time of 11.85 seconds, which is one of the best on test, but neither drive impressed in the rest of our real-world benchmarks. They were both in the bottom three in PCMark 7's application boot run, and stayed in the bottom third of this month's drives in the gaming test. The situation didn't improve in Iometer, where these drives were bottom – and scores of around 16,400 were a long way behind the 22,621 scored by the Samsung 840 Evo 250GB, which was the next-best drive.

CONCLUSION

Both these drives offer good value for money, with the Ultra Plus costing 66c per gigabyte and the X110 costing 4c more. That's in the top half of our results table, but that's the only area where these drives impress. There's plenty of competition around the 256GB mark, and the Samsung 840 Evo is much faster and only a few cents per gigabyte more expensive.

SANDISK ULTRA PLUS 256GB

SPEED	$/GB	BANG/BUCK	OVERALL SCORE
38/50	18/20	22/30	78%

SANDISK X110 256GB

SPEED	$/GB	BANG/BUCK	OVERALL SCORE
38/50	17/20	21/30	76%

VERDICT

Reasonable all-rounders, but that isn't enough to cut it in the SSD market any more.

SAMSUNG SSD 840 EVO 250GB, 500GB AND 1TB

DO SAMSUNG'S MAINSTREAM SSDS FARE AS WELL AS ITS PROFESSIONAL DRIVES?

PRICES
- Samsung SSD 840 Evo 250GB - $189
- Samsung SSD 840 Evo 500GB - $379
- Samsung SSD 840 Evo 1TB - $669

The SSD 840 Evo range is the only one on test to use TLC NAND, which stores 3-bits per cell. Specifically, it's Samsung's 19nm Toggle 2 NAND. The increased density compared to MLC NAND decreases cost, hence the drives' attractive prices, but it typically lowers performance and endurance too.

Nevertheless, Samsung has a few tricks up its sleeve. The MEX controller, for example, is Samsung's latest and greatest, using the same three ARM cores used in the SSD 840 Pro's MDX controller, but running at 400MHz (100MHz faster). It's supported by Samsung's LPDDR2-1066 cache – 512MB in the lower capacities and 1GB in the 1TB model.

To combat slow TLC write speeds, the Evo drives use TurboWrite. This treats a portion of the NAND as SLC memory, which is much faster. The size of the portion used increases with capacity – 3GB, 6GB and 12GB in these three drives. If a write process exceeds this buffer, performance will drop to normal TLC levels.

Another trick is RAPID Mode, enabled through the excellent Magician software. It utilises system RAM and resources for caching and buffering to offer potentially massive performance gains, although results depend on the workload. All the drives also ship with a typical three-year warranty, although some drives offer five years.

The Evo's sequential reads aren't top of the pack, but we saw 512-518MB/sec in AS SSD and 534-541MB/sec in CrystalDiskMark, so there's little to be concerned about. Sequential writes are fantastic, though, and TurboWrite's impact is obvious. The Evo drives secure the top three spots in AS SSD, and beat the competing similar-capacity Vector 150 drives in CrystalDiskMark too.

For random reads, it's an outstanding victory for the Evos, with the faster controller giving them the edge over the more expensive Pro drives. They take first, second and third place in both tests, and they're the only drives to hit over 40MB/sec. Random writes, meanwhile, are on a par with the 840 Pro series.

The 64-queue-depth random reads in AS SSD aren't great, especially for the 250GB drive, but 32-queue-depth performance in CrystalDiskMark is much better, with the 1TB drive coming second overall with 405.9MB/sec, and the 250GB not far behind with 401.1MB/sec.

Such queue-depths are mostly unrealistic for the Evo's intended audience, but even so, the 1TB and 500GB drives are strong performers for high queue-depth writes, losing only to the Vector 150s.

The 250GB drive, meanwhile, falls down the charts, probably suffering from having less overall NAND dies for each channel.

Performance is also good in PCMark 7, although they can't match the 840 Pro drives here. We saw 110-114MB/sec in the application start test, with Plextor and Toshiba both ahead. Tasty speeds of 146-151MB/sec in the gaming test are enough to surpass Plextor and pull level with the Toshiba Q Series, however.

The BootRacer results are nothing too impressive though – the 1TB drive has the slowest boot time, but higher capacitive drives typically suffer in this respect, and it's to be expected.

Iometer is the Evo's weakest point, although again, such workloads are irrelevant to the vast majority of consumers. The 1TB drive manages a respectable 32,986 IOPS, but the 250GB achieved just 22,621 IOPS. In this case, the relentless writes would have quickly surpassed the drive's TurboWrite buffer and passed into the slow TLC NAND.

> "For random reads it's an outstanding victory for the Samsung EVOs"

SAMSUNG SSD 840 EVO 250GB

SPEED	$/GB	BANG/BUCK	OVERALL SCORE
44/50	17/20	24/30	85%

SAMSUNG SSD 840 EVO 500GB

SPEED	$/GB	BANG/BUCK	OVERALL SCORE
45/50	18/20	26/30	89%

SAMSUNG SSD 840 EVO 1TB

SPEED	$/GB	BANG/BUCK	OVERALL SCORE
44/50	19/20	27/30	90%

CONCLUSION

The SSD 840 Evo drives have their limits, but for the majority of home PC users, including hardware enthusiasts, they're fantastic all-rounders.

The Samsung SSD 840 Evo 250GB comes out a little slower and more expensive than its bigger siblings, but equally, its price of 75c per gigabyte is still very reasonable, making it one of the best drives available at this popular capacity.

VERDICT

Fast, attractively priced and backed by great software, the Evo range is a deserving winner of this month's Labs.

SAPPHIRE Tri-X™ series

Cooler than any of the games you'll play.

Tri-X
R9 290

Tri-X
R9 290X

AMD GCN ARCHITECTURE | AMD HD3D TECHNOLOGY | AMD CROSSFIRE TECHNOLOGY | AMD APP ACCELERATION TECHNOLOGY

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4GB GDDR5 | OC overclocked | Tri-X TRIPLE FAN

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SAMSUNG SSD 840 PRO 256GB AND 512GB

THE TOP END OF SAMSUNG'S SSD LINE-UP

PRICES
- Samsung SSD 840 Pro 256GB - $249
- Samsung SSD 840 Pro 512G B - $479

The SSD 840 Pro is Samsung's flagship SSD range, but its triple-core Samsung MDX controller is older than the Evo's MEX, and at 300MHz it's 100MHz slower. Elsewhere, there's 512MB of Samsung's own LPDDR2-1066 RAM for caching, and eight NAND packages, although the Pro drives' Samsung 21nm Toggle 2 MLC NAND has a higher endurance than the Evo's TLC flash memory. As such, the 840 Pro has a five-year warranty, although this only covers 40GB/day of host writes, compared to 50GB/day with OCZ's Vector 150.

They're also supported by Samsung's Magician software, which is the best SSD software we've seen. It provides tools for rapid and simple firmware upgrades (some drives still rely on DOS interfaces), as well as performance optimisation and over-provisioning options. Samsung's RAPID Mode, which harnesses RAM and other system resources to boost performance, now also supports the SSD 840 Pro series. Meanwhile, AES-256-bit encryption comes as standard on the Pro drives, but the newer hardware-encryption specifications that the Evo supports aren't present.

In terms of performance, the SSD 840 Pro drives have the best sequential read results on test, with the 256GB hitting 523.9MB/sec in AS SSD and the 512GB model achieving 544.6MB/sec in CrystalDiskMark.

It's a similar story for sequential writes – the Evo drives are better, but the Pros are faster than drives from other manufacturers, and they don't rely on a capacity-limited TurboWrite buffer for their speeds in the same way as the Evo drives, either.

With its slower controller, the SSD 840 Pro drives lose to the Evo drives when it comes to 4KB random reads (the Intel SSD 530 also nudges ahead in CrystalDiskMark), with speeds of around 35MB/sec in AS SSD and 38MB/sec in CrystalDiskMark. Meanwhile, write speeds are a little weaker, with the chart-topping OCZ Vector 150 drives ahead of this Samsung by 10-15MB/sec in both tests.

> "The SSD 840 Pro drives have the best sequential read results on test"

In the multi-threaded random read tests, the 256GB Pro drive had an abnormally low (but repeatable) result of 282.2MB/sec in AS SSD that places it sixth from bottom, but it shoots right back to near the top with 403.4MB/sec in CrystalDiskMark, where the 512GB drive takes top place with 406MB/sec. Random writes improve at high queue-depths, with strong results of 325-330MB/sec in AS SSD and just under 370MB/sec in CrystalDiskMark, although these aren't enough to catch the Vector 150 range.

Fantastic PCMark 7 performance sees the Pro drives take the two top spots for both tests, with the 512GB drive achieving 139.2MB/sec in the application starting test, and 156.7MB/sec in the gaming test. The Toshiba Q Series Pro drive comes close, but almost every other drive is left trailing by a fair margin.

Compared to drives of similar sizes, BootRacer performance for both capacities is only average, but with a boot time of 11.89 seconds, the 256GB version is still only 0.4 seconds slower than the best.

Finally, in Iometer's strenuous mixed workloads, the SSD 840 Pro drives hold up well compared to some drives, but they aren't the best. The 512GB drive achieved 38,888 on average, while the 256GB model hit 33,475. This leaves Plextor and Toshiba both ahead, while the winning OCZ drives are 17-18 per cent faster.

CONCLUSION

The SSD 840 Pro drives aren't the fastest in every benchmark, but they hit hardest where it counts the most, and on balance have the best performance on test. Costing 93-97c per gigabyte, they command a small premium compared to most drives, leaving the cheaper Evo drives as the best deal overall. Still, they make a fantastic purchase if you have the money, although hardcore users who will be hammering drives with mixed workloads will want to look to the OCZ Vector 150 range instead, which copes better with intensive workloads and has a higher endurance rating, but is also more expensive. Samsung has surged ahead of specialist storage companies in the mind of many informed shoppers, and it's not hard to see why. We have no hesitation in recommending these SSDs for almost any kind of home use.

SAMSUNG SSD 840 PRO 256GB

SPEED	$/GB	OVERALL SCORE
47/50	16/20	87%

BANG/BUCK 24/30

SAMSUNG SSD 840 PRO 512GB

SPEED	$/GB	OVERALL SCORE
48/50	16/20	87%

BANG/BUCK 23/30

VERDICT

Beaten to the top spot in some of the benchmarks, but overall, these are still the quickest SSDs available.

TOSHIBA Q SERIES 256GB AND 512GB; TOSHIBA Q SERIES PRO 256GB

TOSHIBA'S TRIO OF CONTENDERS FEATURE HOMEMADE HARDWARE

PRICES
- Toshiba Q Series 256GB - $249
- Toshiba Q Series 512GB - $530
- Toshiba Q Series Pro 256GB - $200

Toshiba's previous drives had incomprehensible names, but that's changed with the new Q and Q Pro drives. The former range is designed for mainstream use, and it's here in its 256GB and 521GB guises. The latter is an enthusiast product, and we've reviewed the 256GB version. One factor that hasn't changed, though, is the firm's reticence when it comes to providing details about the insides. Both ranges include Toshiba-made controllers, and the Pro drive's chip is labelled TC358790XBG, but that's all we know about it.

Both ranges also employ 19nm MLC Toggle Mode NAND, which is made by Toshiba. Neither drive is especially good-looking, though, with plain metal enclosures and dull stickers. The standard Q Series drives also use the portly 9.5mm form factor, while the Pro drives are 7mm tall and include a 9.5mm spacer in the box.

Both of Toshiba's 256GB drives return 238.47GB of formatted capacity and, strangely, the Pro model is the cheaper of the pair – it costs $200 compared to the standard drive's price of $249. Meanwhile, the 512GB Q Series drive weighs in at $530. Warranties differ between the two drive brands, however: standard Q Series drives have three-year deals, and while the Pro drives are only shipped with two years' worth of covered support.

> "The Q Pro had the fastest boot time on test, with a rapid result of 11.49 seconds"

There's little difference between the make-up of the Q and Q Pro series drives, which explains why the three were often grouped together in our benchmark tables.

The standard Q Series 256GB was the best of the three Toshiba drives in four of the six AS SSD benchmarks, but all three Toshiba were inconsistent in these tests. The drives sat in mid-table for sequential reads and writes, with scores north of 500MB/sec not far behind the victorious Samsungs. They were also among the best performers in the random 64-queue-depth tests, but fell behind in the rest of AS SSD's small file benchmarks – in the 4KB random read test, the three Toshibas managed around 20MB/sec, which can't compete with the 40MB/sec of the table-topping Samsung silicon.

We spotted the same trends in CrystalDiskMark, with the standard 256GB Q Series drive leading the way, and inconsistent performance throughout. Sequential reads and writes were reasonable, but small file performance was uncompetitive – these drives were bottom in the 4KB random read results, and occupied three out of the bottom five positions when writing 4KB random files. Throughout all our testing, the Q Series Pro was fastest when dealing with 32- and 64-queue-depth tasks.

The three Toshiba drives stabilised in real-world tests, all returning good scores in PCMark 7 – only Samsung drives could beat them in these tests, and it was Toshiba's Q Pro SSD that was the best performer out of these three, albeit by only a handful of points. The Q Pro was also the best drive on test when it came to boot times, with a rapid result of 11.49 seconds, and it was the fastest Toshiba drive in Iometer with its 44,009 IOPS result too.

CONCLUSION

All three Toshiba drives had mixed starts, with good sequential performance tempered by poor small file pace, but real-world use proved that these SSDs still have enough pace to rival most of the drives on test. They all offer reasonable value for money too, with prices between 97c and $1.03 per gigabyte. The best deal is the Q Pro 256GB, though, which just creeps ahead in performance and has a good price too.

TOSHIBA Q 256GB

SPEED	$/GB	BANG/BUCK	OVERALL SCORE
44/50	17/20	23/30	84%

TOSHIBA Q 512GB

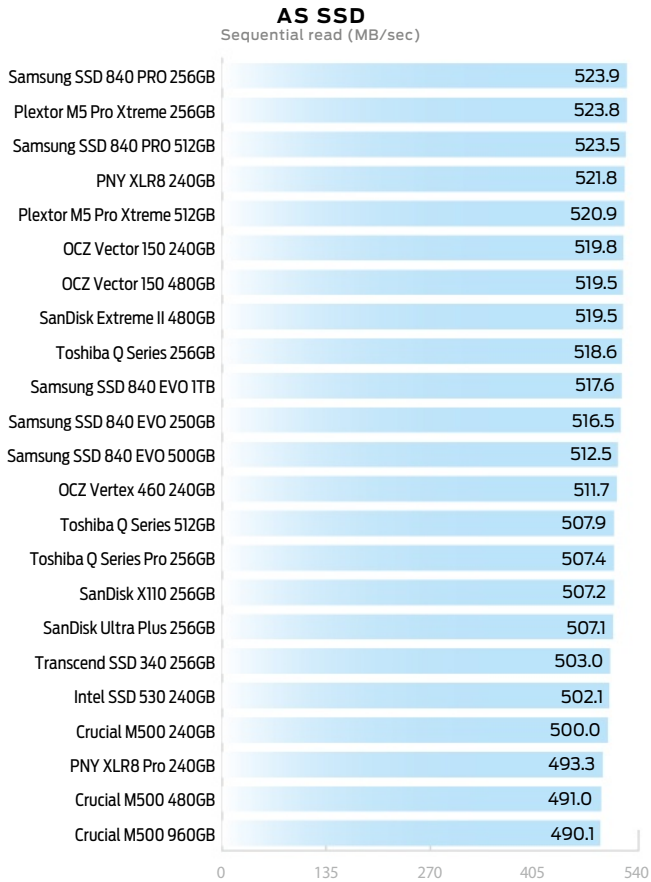
SPEED	$/GB	BANG/BUCK	OVERALL SCORE
42/50	16/20	21/30	79%

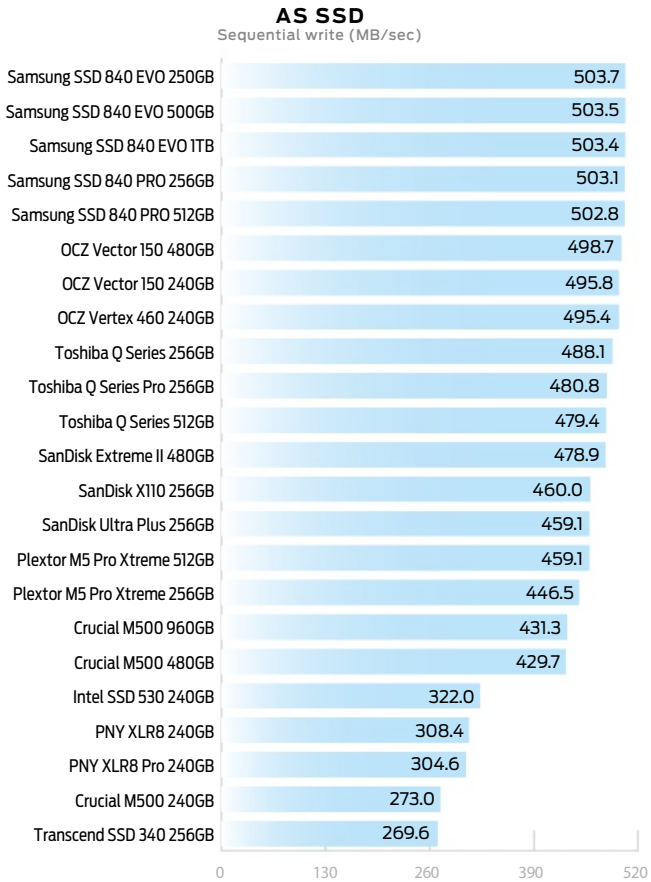
TOSHIBA Q PRO 256GB

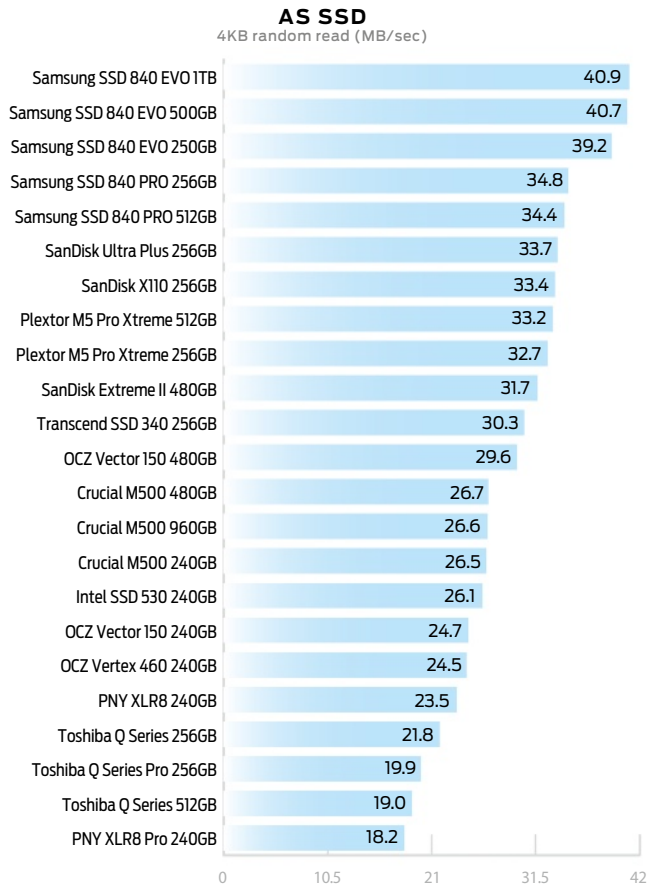
SPEED	$/GB	BANG/BUCK	OVERALL SCORE
44/50	17/20	24/30	85%

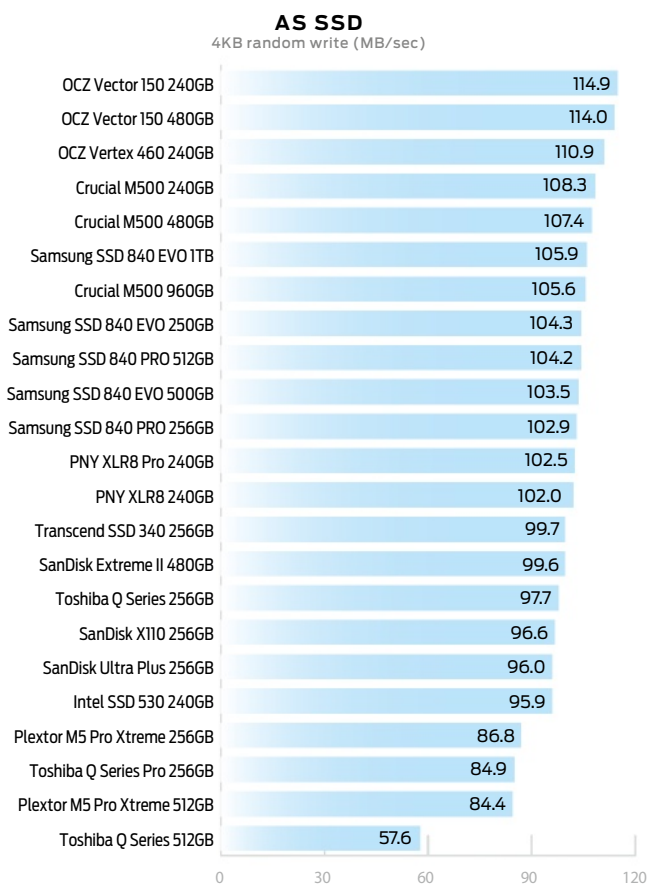
VERDICT

All three drives impress in real-world tests, but it's the Q Pro 256GB that takes home an award.

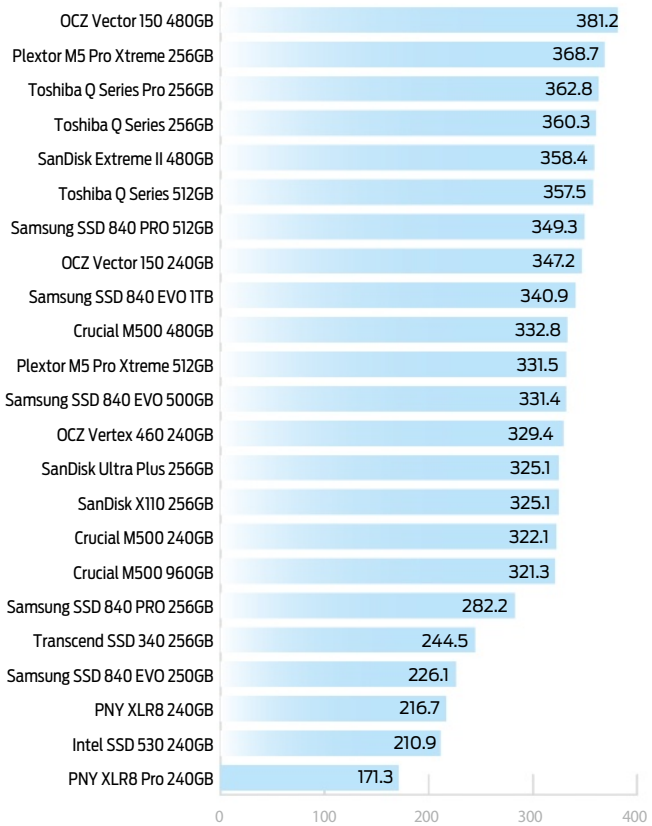

AS SSD
Sequential read (MB/sec)
Samsung SSD 840 PRO 256GB 523.9
Plextor M5 Pro Xtreme 256GB 523.8
Samsung SSD 840 PRO 512GB 523.5
PNY XLR8 240GB 521.8
Plextor M5 Pro Xtreme 512GB 520.9
OCZ Vector 150 240GB 519.8
OCZ Vector 150 480GB 519.5
SanDisk Extreme II 480GB 519.5
Toshiba Q Series 256GB 518.6
Samsung SSD 840 EVO 1TB 517.6
Samsung SSD 840 EVO 250GB 516.5
Samsung SSD 840 EVO 500GB 512.5
OCZ Vertex 460 240GB 511.7
Toshiba Q Series 512GB 507.9
Toshiba Q Series Pro 256GB 507.4
SanDisk X110 256GB 507.2
SanDisk Ultra Plus 256GB 507.1
Transcend SSD 340 256GB 503.0
Intel SSD 530 240GB 502.1
Crucial M500 240GB 500.0
PNY XLR8 Pro 240GB 493.3
Crucial M500 480GB 491.0
Crucial M500 960GB 490.1
0 135 270 405 540


AS SSD
Sequential write (MB/sec)
Samsung SSD 840 EVO 250GB 503.7
Samsung SSD 840 EVO 500GB 503.5
Samsung SSD 840 EVO 1TB 503.4
Samsung SSD 840 PRO 256GB 503.1
Samsung SSD 840 PRO 512GB 502.8
OCZ Vector 150 480GB 498.7
OCZ Vector 150 240GB 495.8
OCZ Vertex 460 240GB 495.4
Toshiba Q Series 256GB 488.1
Toshiba Q Series Pro 256GB 480.8
Toshiba Q Series 512GB 479.4
SanDisk Extreme II 480GB 478.9
SanDisk X110 256GB 460.0
SanDisk Ultra Plus 256GB 459.1
Plextor M5 Pro Xtreme 512GB 459.1
Plextor M5 Pro Xtreme 256GB 446.5
Crucial M500 960GB 431.3
Crucial M500 480GB 429.7
Intel SSD 530 240GB 322.0
PNY XLR8 240GB 308.4
PNY XLR8 Pro 240GB 304.6
Crucial M500 240GB 273.0
Transcend SSD 340 256GB 269.6
0 130 260 390 520

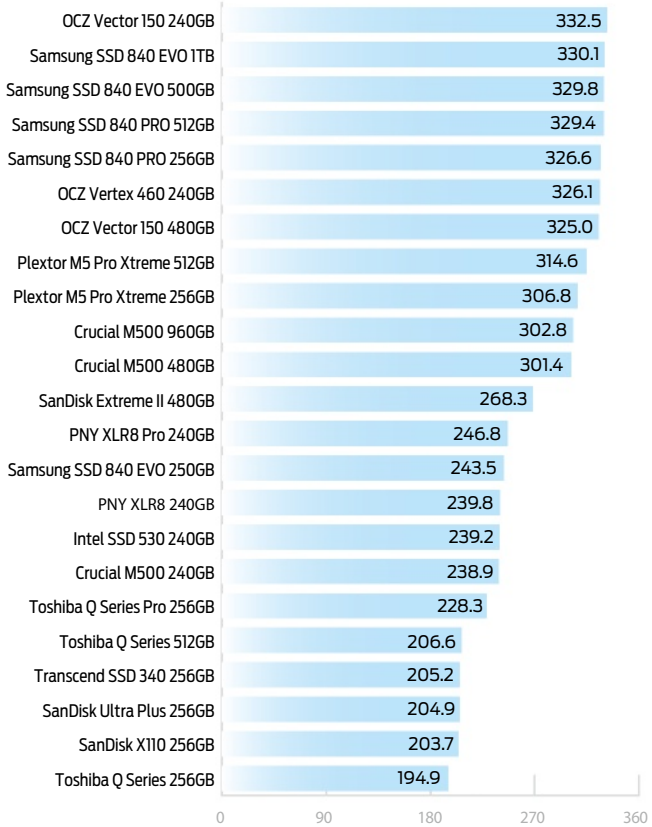

AS SSD
4KB random read (MB/sec)
Samsung SSD 840 EVO 1TB 40.9
Samsung SSD 840 EVO 500GB 40.7
Samsung SSD 840 EVO 250GB 39.2
Samsung SSD 840 PRO 256GB 34.8
Samsung SSD 840 PRO 512GB 34.4
SanDisk Ultra Plus 256GB 33.7
SanDisk X110 256GB 33.4
Plextor M5 Pro Xtreme 512GB 33.2
Plextor M5 Pro Xtreme 256GB 32.7
SanDisk Extreme II 480GB 31.7
Transcend SSD 340 256GB 30.3
OCZ Vector 150 480GB 29.6
Crucial M500 480GB 26.7
Crucial M500 960GB 26.6
Crucial M500 240GB 26.5
Intel SSD 530 240GB 26.1
OCZ Vector 150 240GB 24.7
OCZ Vertex 460 240GB 24.5
PNY XLR8 240GB 23.5
Toshiba Q Series 256GB 21.8
Toshiba Q Series Pro 256GB 19.9
Toshiba Q Series 512GB 19.0
PNY XLR8 Pro 240GB 18.2
0 10.5 21 31.5 42


AS SSD
4KB random write (MB/sec)
OCZ Vector 150 240GB 114.9
OCZ Vector 150 480GB 114.0
OCZ Vertex 460 240GB 110.9
Crucial M500 240GB 108.3
Crucial M500 480GB 107.4
Samsung SSD 840 EVO 1TB 105.9
Crucial M500 960GB 105.6
Samsung SSD 840 EVO 250GB 104.3
Samsung SSD 840 PRO 512GB 104.2
Samsung SSD 840 EVO 500GB 103.5
Samsung SSD 840 PRO 256GB 102.9
PNY XLR8 Pro 240GB 102.5
PNY XLR8 240GB 102.0
Transcend SSD 340 256GB 99.7
SanDisk Extreme II 480GB 99.6
Toshiba Q Series 256GB 97.7
SanDisk X110 256GB 96.6
SanDisk Ultra Plus 256GB 96.0
Intel SSD 530 240GB 95.9
Plextor M5 Pro Xtreme 256GB 86.8
Toshiba Q Series Pro 256GB 84.9
Plextor M5 Pro Xtreme 512GB 84.4
Toshiba Q Series 512GB 57.6
0 30 60 90 120

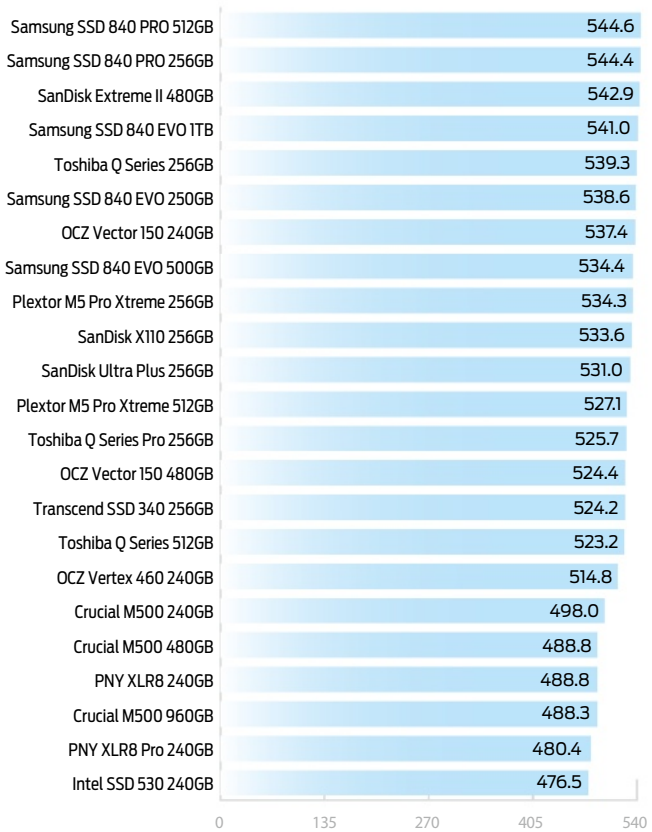
AS SSD
64-queue-depth random read (MB/sec)



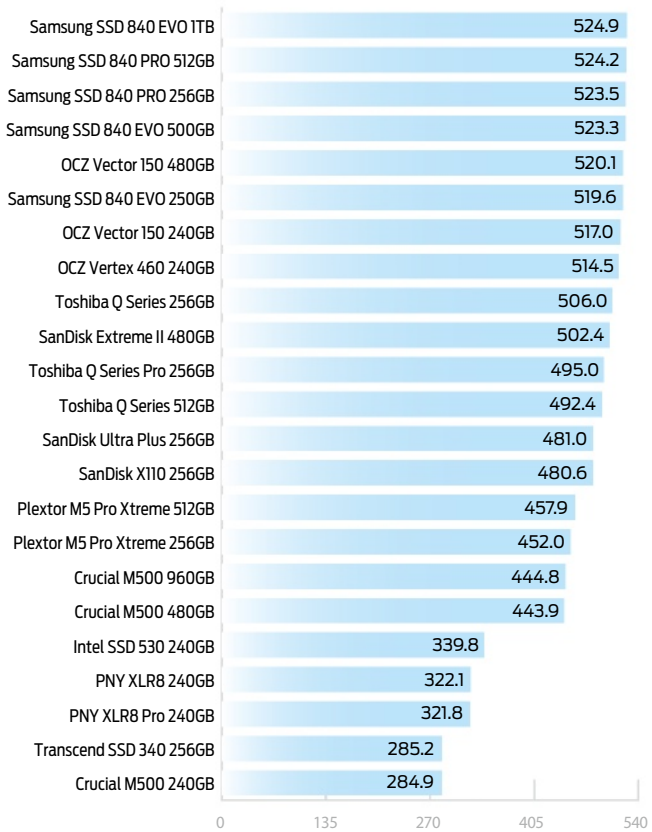
AS SSD
64-queue-depth random write (MB/sec)



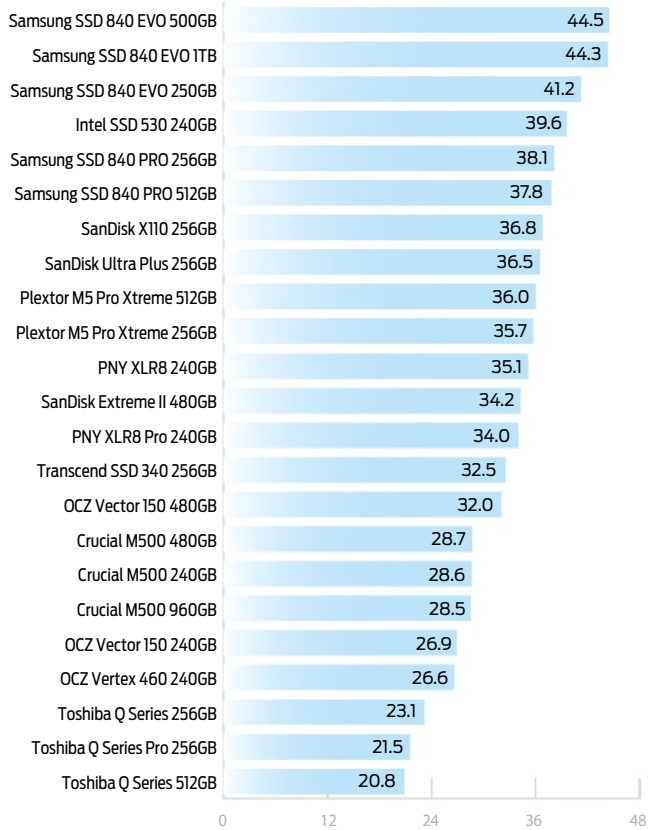
CRYSTALDISKMARK
Sequential read (MB/sec)



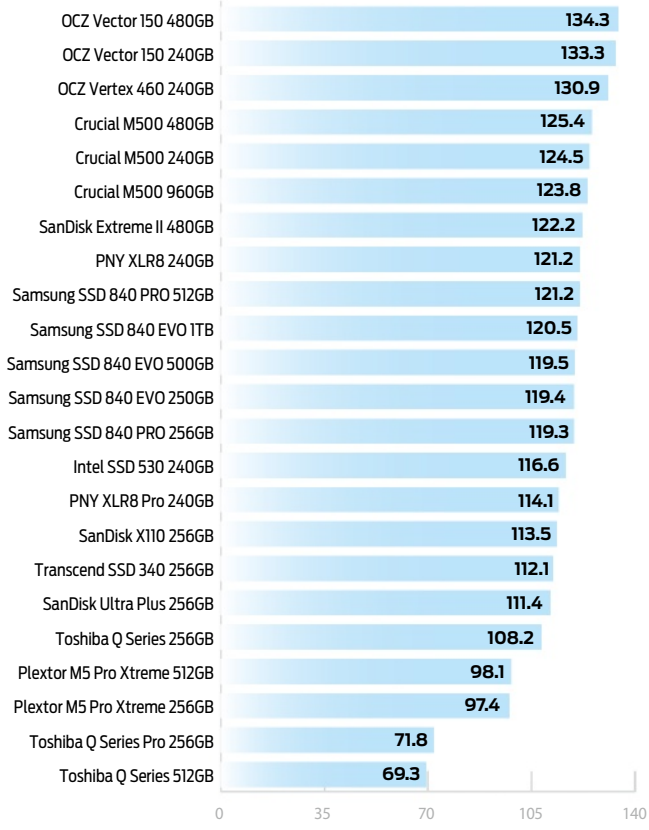
CRYSTALDISKMARK
Sequential write (MB/sec)



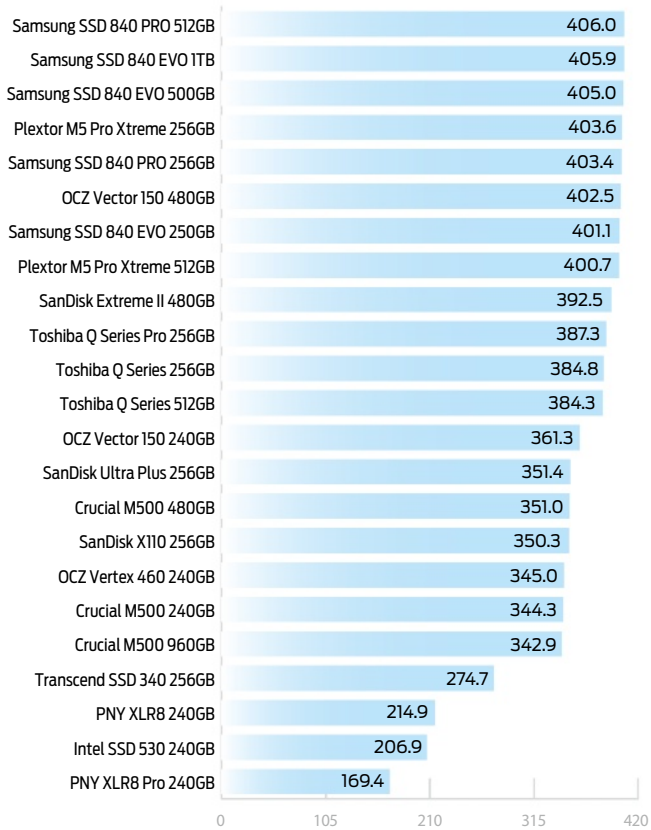
CRYSTALDISKMARK
4KB random read (MB/sec)



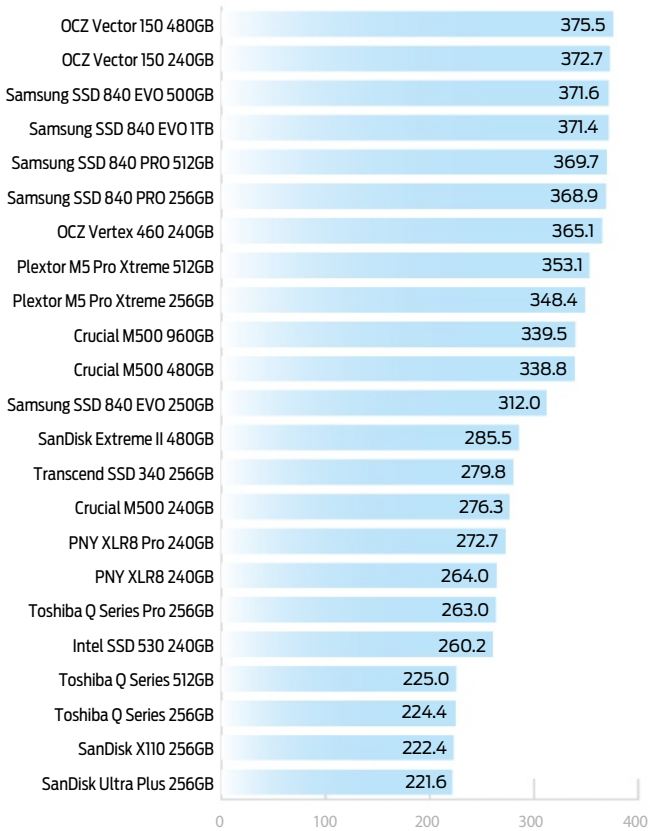
CRYSTALDISKMARK
4KB random write (MB/sec)



CRYSTALDISKMARK
32-queue-depth random read (MB/sec)

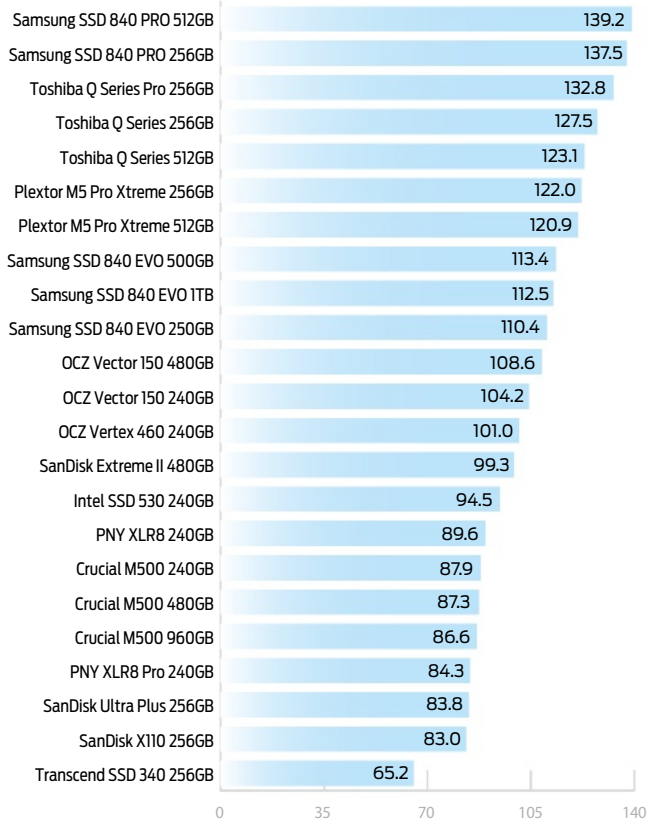


CRYSTALDISKMARK
32-queue-depth random write (MB/sec)



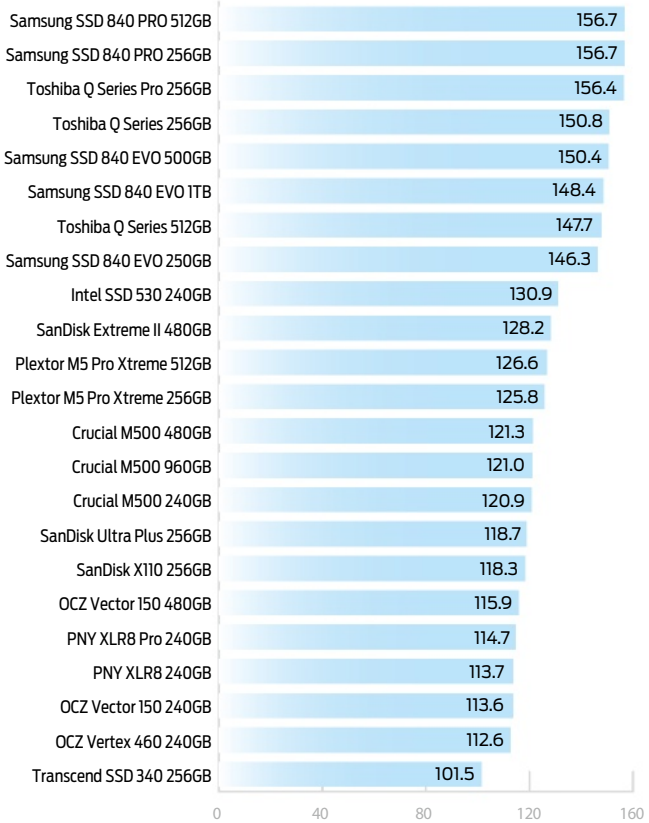
PCMARK 7

Starting Applications test raw result (MB/sec)



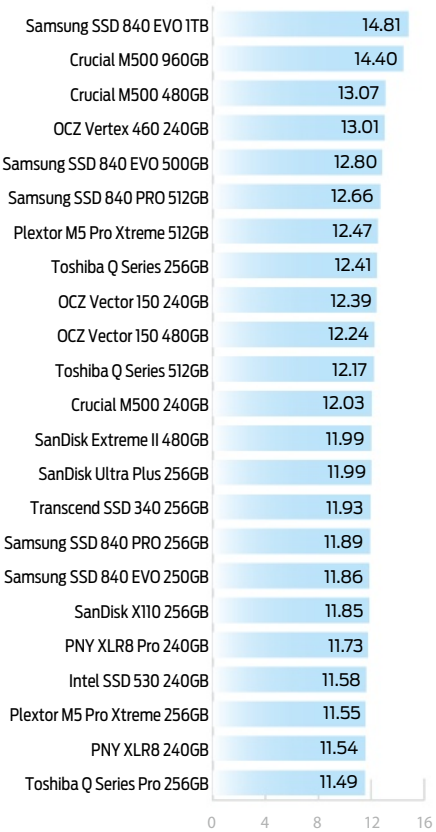
PCMARK 7

Gaming test raw result (MB/sec)



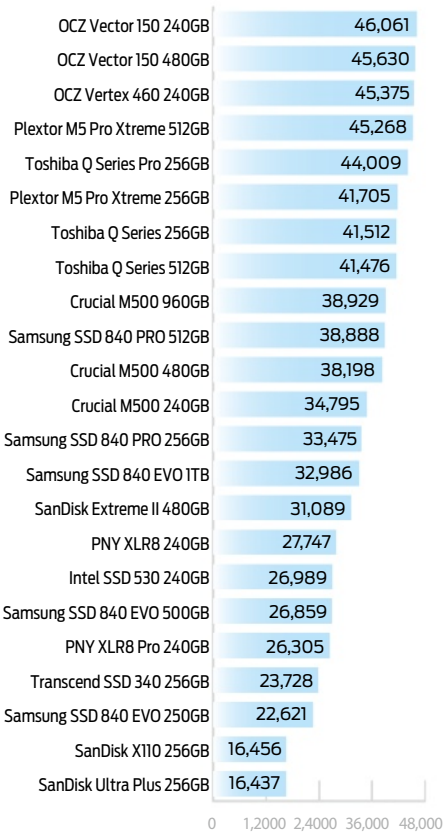
BOOTRACER

Windows 7 64-bit boot time (seconds)



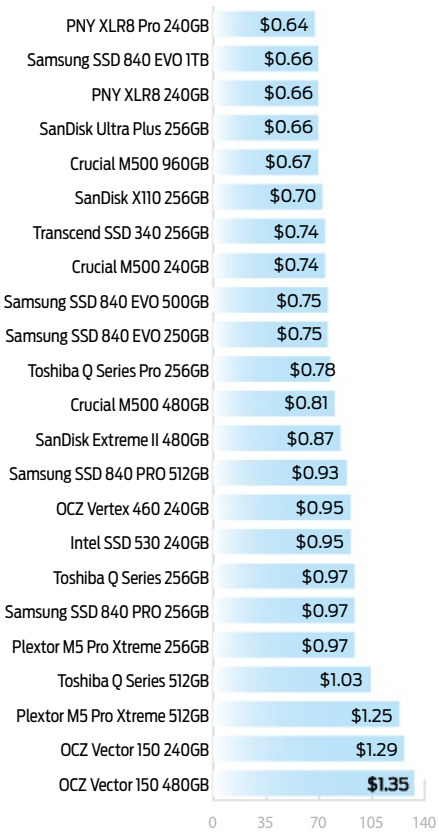
IOMETER

Mixed workloads overall score (IOPS)



COST/GB

Retail price over formatted capacity



TITANFALL

RESPAWN GAMES IMAGINES A WORLD DOMINATED BY GIANT ROBOTS, AND THE COD GAME THAT COULD NEVER BE...

DEVELOPER Respawn Entertainment
PUBLISHER Electronic Arts
WEBSITE www.titanfall.com/au

Titanfall wears its legacy rather proudly on its sleeve. The game's developer, Respawn, is the brainchild of a gaggle of ex Infinity Ward staff – the same guys, in fact, responsible for the massive hype-train that is the Call of Duty franchise. So, in a number of ways, Titanfall, while heralded as one of THE big next-gen games of the latest console generation, is both very fresh on the one hand, and very similar, on the other.

In fact, there's a reason we're calling it CoD:Bots around the office – it's pretty much the game that Activision and Infinity Ward SHOULD be making. It takes tried and true gameplay mechanics into a gritty, science fiction future, adds a whole new layer of giant-robot-related gameplay, and pares down the online multiplayer experience into a laser-focused six-on-six shoot-fest.

PREPARE FOR...

Which is not to say the game's perfect – far from it, in fact. It's heavily tied to online competitive play; so much so that even the game's 'campaign' is a multiplayer-focused, simply using the same maps and objective-based gameplay as the 'Classic', or multiplayer, mode, with some half-arsed narrative tacked on to each fight. Even if you lose a match, the story still progresses, making it all seem particularly meaningless.

It also means that if you're without a connection, or can't find other players, you cannot play Titanfall at all. EA's made no bones about this, but considering the game's frequent use of AI-controlled bots and soldiers even in multiplayer, some kind of true campaign mode would be handy.

Titanfall also seems to have much the same attitude to shooter mechanics as its Call of Duty predecessors. It is fast and relentless, played out on tight, well-designed maps that focus on close-in, reflexive gameplay. If you prefer more... thoughtful shooters, then perhaps Titanfall isn't your game.

But it must be said – what Titanfall does well, it does very well indeed.

TITANFALL!

With a couple of exceptions, each map starts off with players – referred to in the game's lore as pilots – on foot. There's a countdown to your Titan dropping in from orbit, though you can speed this up by achieving objectives and racking up kills, or by the use of Titanfall's equivalent of CoD's perks – one-shot burn cards that can boost gear or shave 40 seconds off Titanfall.

This means the feel of the game can change on a dime – close infantry action one second, and sudden giant robot mayhem the next. Most players will get access to Titans at the same time, but if one comes in early it can really dominate. And if they all come in at once, it's like switching from a standard shooter to a Mechwarrior game in the blink of an eye.

However, the balance is astounding. Even on the ground, players have access to anti-Titan weaponry, so you'll often find yourself lurking on rooftops or in buildings, trying to avoid getting stomped or blown up with ease, so you can take your shot. The addition of infantry jump jets is an advantage, and you can even cloak yourself to avoid being spotted. But if one of those giant bots can see you... chances are you'll be dead in no time flat.

The Titans that make up so much of the game's lore feel vastly different. For one thing, they cannot jump at all, meaning that the verticality of the infantry side of the game is completely missing. However, you have so much more killing power, and you can wipe out entire squads on the AI grunts that join you in each map. Against other Titans things are obviously more drawn out, but the range of weaponry on offer, from slow cycling plasma guns to homing missiles and more, means the slug-fests are at least fun to watch. Sadly, while critical hits are possible, the lack of real locational damage is missed – it would be great to be able to damage legs or blow off limbs. That said, when you do take one down, the resulting explosion can be devastating.

The spread of maps and game modes, from classics like Capture the Flag to the tense Last Titan Standing, offer a fair amount of variety, but the game is so fast-paced that you're really not taking in the sights of each exotic locale. It's possible, like Call of Duty, to play through a half dozen maps inside of twenty minutes, so it always feels a little too breathless. Which is a shame because the game does look amazing, and there's always fascinating stuff on each map (in campaign and classic modes) happening in the background – you just don't have time to spot it.

Titanfall doesn't quite seem as next-gen as it promises, but it is nonetheless a highly polished shooter experience. But one that can, at times, feel a little hollow and soulless.

David Hollingworth

PLATFORMS
Xbox 360 · XboxOne · PC · Tested on PC

atomic
Not quite the next great shooter revolution, but fun nonetheless

RATING ★★★★½

THIEF

IT'S A GREAT LOOKING GAME, BUT ULTIMATELY AN UNSATISFYING REMAKE WITH BETTER, MORE MODERN COMPETITION

DEVELOPER Eidos Montreal
PUBLISHER Bandai Namco
WEBSITE www.thiefgame.com

Despite the ditching of the series' number progression, Thief is not a reboot of the famed stealth/action series, but rather a redefining of the game's goals, and a refinement of its mechanisms in a modern, apparently 'next-gen' gaming world. It advances Garrett's urban kleptomaniac playground even further towards a steampunk setting, and gives the eponymous anti-hero a new range of supernatural powers, while still trying to instil in players the idea that stealth and secrecy will always trump bold action and getting into fights.

As such, it's very easy to compare the game to last year's Dishonored, and – unfortunately – it's not a great comparison.

TIPPY TOE...

The City – great naming there, Eidos – has seen better times. There's a nasty plague ravaging the population, which is ruled over by a 'cruel tyrant' straight out of Central Casting. Amongst all this angst and misery, Garrett just wants to steal stuff and be left alone, but he gets caught up in a job-gone-wrong which sees his thieving partner lost to some strange, arcane ritual, while he ends up with the ability to see beyond normal reality.

There's a strong plot running through the game, but most of the time it seems at total odds with the way the game drives you to steal all the things. You might, for instance, be in a hurry to get from dingy alley A to misty bridge B, but you'll be given any number of incidental premises and shops to rob on the way – and the game will definitely judge you based on your success at ignoring the main plot in order to walk away with untold riches from more or less innocent people minding their own business.

The thieving, however, is at least a fun challenge. You'll need to negotiate the shadows, time the rounds of guards, and be careful making noise. The game slowly gives you more and more tools, too, that turn each set piece level into a careful puzzle to solve, such as water arrows to extinguish torches. However, the sense of free discovery that made Dishonored – a very similar game in this regard - such a joy to tackle here feels much more cramped, in part by the decision to actively hamper Garrett in hand to hand combat. It's a tense, deadly affair, fighting guards, and one the game discourages. At the same time, some levels will auto-fail if you even so much as get seen – it's very much a stealth game, and if the idea of being pushed to play that kind of game is not for you, you've been warned.

The various AI's controlling the movement of guards is competent, however relatively easy to trick, and remarkably forgetful. Within second of alerting a guard, they'll forget anything ever happened if you can just stay out of sight for long enough. With a system of freerunning now added to the game, it's clear that the game is meant to

PLATFORMS
PC · Xbox 360 · PS3 · Xbox One · PS4

played with a sense of speed – if you move through each section quickly and quietly, you won't notice the tricks the developers have employed to create the world around you. Linger too long, though, and you run the risk of being seen behind the curtain.

Nowhere is this more felt than in the way some surfaces are highlighted as climbable, while others – of similar, or even lesser height – taunt you as being impassable. All of the game's challenge is built on locked systems, rather than emergent exploration. Again, Thief compares poorly to Dishonored in this regard, as the latter game gave you tools that unlocked levels in seemingly unexpected ways. By contrast, Thief gives you limited tools, and limited ways in which to access them and the environment.

Which would be moderately passable if the game's overarching plot were more gripping, or the voice-acting a little less hardboiled.

For those desperate for some challenging stealth mechanics and a love of steampunk, Thief undoubtedly delivers, though not perfectly. However, if you're at all put off by being rail-roaded into sneaking over fighting, or looking for a more satisfactory story and setting to explore, there are better games.

David Hollingworth

atomic

A very pretty game, but ultimately a hollow experience compared to both its forebears and more recent games

RATING ★★★☆☆☆

BANISHED

WOOD FOR THE HOUSES, WHEAT FOR THE BAKER, TREES FOR THE LOPPING. GO TO IT, LITTLE PEOPLE

DEVELOPER Shining Rock Software
PUBLISHER Steam
WEBSITE www.shiningrocksoftware.com

PLATFORMS
PC Only

One day, a couple of weeks ago, I noticed that a good half of my many online Steam friends were playing this. Soon after, so too was I. A combination of lovely looking screenshots showing villages and villagers amidst mountains and forests had a charming lure – one that I think was also fuelled by a chronic lack of choice recently in the 'make a happy and prosperous town for starving and unhappy little people' genre. Perhaps, too, gamers with a hankering for meticulous micro-management that isn't overdone, or just silly, were drawn to Banished. Sim City let us all down, and there hasn't been an Anno game for a while – and Anno is most like what Banished is.

Banished strips away almost all of the frivolous encumbrances which usually adorn this style of game. Most developers would call the finished game here a template, one which they'd ruin with occasional volcanos or invading barbarians. Perhaps the small team at indy devs Shining Rock just didn't have the time or resources to mess with it much more, but the game is all the better for that.

Things kick off when a small group of little people arrive in your randomly generated map. They've been tossed out of whatever town they once belonged to, hence 'banished', but that's about all the story you're going to get – or need.

There aren't many of them, just a couple of dozen adults and a few kids and infants. They are your most important resource, and it's the people that the entire game mechanic hinges upon. While the usual business of plonking down houses, buildings that do stuff and some roads is a mouse click away, for a very long time there just aren't enough people to get it all done in the time you'd like, or are used to in this sort of game. As such, your initial phase must be managed most carefully. It can take a long time for the villagers to get anything done, at least playing in real time. Add too many items to the build queue and you'll just end up waiting in frustration for that critical warehouse when there's half a dozen houses in the line before it, and no wood to build it from, because the scant few townsfolk are running back and forth ebbing away at each building in turn and never really getting much done at all.

This all makes for a slow game at first, and one which must be planned carefully. It's best to try and do just one or two things at a time for the first couple of years of game time, and monitor carefully how efficiently your townsfolk are attacking their tasks. Provided the basics of food and shelter are your top priorities, everything starts to fall into place fairly smoothly after that, and you can set about creating a basic resource-gathering infrastructure – a lumberjack here, a fisherperson or four there.

But in Banished, things don't ever accelerate to the point where you can chuck buildings or farms down without much thought. It's all about the people. Your tiny handful of overworked people. You see, the population only ever increases in size via natural means (you know what I'm talking about) but it seems that a hard day of wood chopping or rock carrying puts a damper on their enthusiasm for breeding. They aren't bunnies in love, these folks. It can take many years of game-time for just a few more kiddies to be added to the population – and another dozen years before any of them are old enough to be put to work. Very occasionally a couple of 'wandering nomads' will join your gang, but for the most part the number of available workers falls well short of what you need to meet your grand ambitions, and that's the cool thing that makes playing Banished such a joy.

Another thing to watch is shifting people around between tasks too much. Over time they get better at the job they're doing, so the gods of efficiency demand that you keep them doing the same thing. Forty years in the quarries for you, little man.

Eventually you'll have a healthy economy and happy citizens galore. The late-phase game has you a bit busy with trade, but by then the main satisfaction comes simply from having gotten that far. Unfortunately, after only a couple of plays you'll have it all figured out, and no real desire to do it all over again. It's a keeper for the hard drive, though, for rainy days when making hay and babies and a bit of village building is just the thing.

Ben Mansill

atomic
A no-frills villagers sim that's soothingly satisfying but too easy to master.

RATING ★★★☆☆☆

THE MIGHTY QUEST FOR EPIC LOOT PREVIEW

DEVELOPER Ubisoft Montreal
PUBLISHER Ubisoft
WEBSITE www.themightyquest.com

When it comes to game names, Ubisoft Montreal's free-to-play dungeon builder/crawler does exactly what it says on the tin. You build an increasingly complex dungeon designed to protect your treasures, while raiding other dungeons to steal the loot of others.

Effectively this is two games mashed together. The dungeon building is done from an overhead strategic view, in which you can build and rearrange areas of the dungeon itself, as well as place traps and monsters designed to hinder other players. As you level up and build your riches you can buy upgrades, which make it even more difficult for others to plunder your loot. This is perhaps the weakest part of the game at the moment, especially early on where you have little in your arsenal to mount a serious challenge to invading players.

PLATFORMS
PC

On the attacking front, the game plays out as an Action RPG. You have a limited set of abilities, only four health potions at a time, and are set a series of goals to achieve. If you can fight your way through the various traps and monsters, looting gold and beating the time limit set by the game, you'll earn gold stars. Earn all three and you'll gain the maximum riches, which can then be funnelled back into your dungeon.

The Mighty Quest For Epic Loot recently went into open beta, and at the moment you can quite happily play a single character without needing to spend any cash. If you want to, you can drop cash to boost XP, Loot and Cash intake, as well as new bag slots and the like. It is well worth looking into, especially if your idea of multiplayer is more about challenging others than shooting at them.

John Gillooly

THE INCREDIBLE ADVENTURES OF VAN HELSING II PREVIEW

DEVELOPER Neocore Games
PUBLISHER Neocore Games
WEBSITE www.neocoregames.com

When the first game launched last year, The Incredible Adventures of Van Helsing took us by surprise as a truly charming, enjoyable indie Action RPG that worked in spite of being limited to one class and with a somewhat limited scope.

The sequel has come along quickly, and feels like a real step up from the original. It now has multiple classes to play, with unique abilities. Alongside the main Gunslinging and Melee skills of the original are now two spellcaster classes as well as two engineer-styled ones. Impressively, the missions feel like a step away from the legacy of Diablo that pervades most ARPGs.

Our preview of the game involved a mission where you were tasked with leading the defence of an area against invasion. This meant several optional missions that you could undertake in order to make the area easier to defend, whittling down the opposition forces and cutting off avenues of attack. Then the invaders began arriving, with the ensuing quests playing out like tower defence as your defenders helped ward off the invading armies.

PLATFORMS
PC

While it's still in limited beta, this looks and feels like a significantly more rounded game than the first. The new characters look and feel unique, and play out very differently. While there are quite a few action RPGs currently on the horizon, The Incredible Adventures of Van Helsing II is definitely going to be worth a look, and if priced under $20 like the original it will be an absolute bargain to boot.

John Gillooly

THE A-LIST

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

Some big changes in the A-List this issue! First of all, we've changed the recommended PC which was previously a select off-the-shelf high-end system, along with a gaming PC system, to instead be a recommended build we're calling the Editor's Choice.

There are two Editor's Choice builds, one high-end and one media box. We're debuting the high-end machine in this issue, and you can read all about it in the feature story starting on page 18. Next month we'll be covering the building and specification of the Media PC.

We're making this change because there are so many retail PC systems which offer similar components and performance, so we have decided instead to go ahead and actually build a PC based on what we'd want to use on a daily basis. These machines will be used regularly by the editorial team, so they really are exactly the sort of machines we would choose – and recommend to you. Unlike the hypothetical Kitlog machines on the following page, these are PCs we have built and will be using for both work and play. We will only upgrade them when doing so will bring a significant performance boost yet represent sound value for money.

Elsewhere in A-List we've re-jigged the laptop categories to reflect changes in design, use and relevance. We've eliminated the Gaming category, and have replaced it with a new Performance category, which encompasses components suitable for gaming as well as meeting the needs of power users. A new Professional category has been added, which reflects our thoughts on the best laptop for getting things done, whether on the desk or on the road. The Value and Ultra Portable categories remain, and these have been updated with new recommendations.

PCS DESKTOPS

HIGH-END PC&TA EDITOR'S CHOICE

★★★★★★

PRICE $3414

An extreme PC able to deliver perfect gaming performance, but also be equipped to handle the most demanding desktop apps. See page 18!

SPECIFICATIONS i7 4770K CPU; ASUS Radeon R9 290x DirectCU II OC 4GB graphics; Corsair Dominator Platinum DDR3 16GB; ASUS Maximum VI Extreme motherboard; ASUS ROG Front Panel; Coolermaster Cosmos SE case; Coolermaster V1000 PSU; Sandisk Extreme 2 240GB SSD; 2 x SanDisk Ultra Plus 256GB SSD; WD Black 2 SSD + 1TB HDD

MEDIA TO BE REVEALED NEXT ISSUE!

In next month's issue of *PC & Tech Authority* the team will be building a dream media box, able to store, play and stream a complete media collection. Join us as we carefully specify components that will be up to the task, but no more than necessary for the task at hand.

ALL-IN-ONE APPLE IMAC 27IN

★★★★½

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.

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

★★★★½

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 1536x2560 widescreen Multi-Touch display; 1GHz 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 × 8.7 × 166 mm, 2GB memory, 10-day battery life . WEB ID 279534

PCS LAPTOPS

VALUE ASUS T100

★★★★½

PRICE $550 **SUPPLIER** www.asus.com.au

Thanks to Intel's new Atom CPU, the Transformer Book T100 delivers full Windows 8.1 in a tiny, affordable package – the netbook is back. The T100 delivers everything you could ask for, and it's ludicrously affordable.

SPECIFICATIONS Quad-core 1.33GHz Intel Atom; 2GB DDR3; 64GB eMMC; 10.1in 1366x768 Touch LCD; Wi-Fi; Ethernet; HDMI.

PROFESSIONAL APPLE MAC BOOK RETINA

★★★★½

PRICE $3199 **SUPPLIER** www.apple.com/au

The machine that does everything right, and looks the part, too. We've chosen the top-end 2.3GHz i7 model with 16GB of RAM and a 512GB SSD plus GT 750M graphics.

SPECIFICATIONS 2.3GHz Intel Core i7; 16GB RAM; 512GB SSD; 15in 2880 x 1800 LCD; 1 x USB 3; 2 x USB 3; 2 x Thunderbolt 2; dual-band 802.11abgn Wi-Fi; Bluetooth 4; 3G

PERFORMANCE VENOM BLACKBOOK 17 G00502

★★★★½

PRICE $2399 **SUPPLIER** venomcomputers.com.au

Powerful and with a GPU able to handle intensive gaming. Corsair Vengeance RAM – upgrade to 16GB RAM if required. Built-in subwoofer and X-Fi surround audio.

SPECIFICATIONS 2.4GHz Core i7-4700MQ; 4GB Nvidia GTX 765M, 8GB DDR3; 1920 x 1080 17.3in screen; 1GB HDD + 120 GB SSD; 802.11a/g/n; USB 3.

ULTRA PORTABLE LENOVO CARBON X1

★★★★½

PRICE $2499 **SUPPLIER** www.lenovo.com/au

Lenovo inherited – and built upon – IBM's legendary ThinkPad build quality, and added a much-needed dose of style to this highly capable machine.

SPECIFICATIONS 2.1GHz Intel Core i7-4600U; 14in touchscreen (2560 x 1440); 8GB RAM; 256GB SSD; 802.11ac/abgn; Bluetooth 4

PERIPHERALS

WIRELESS ROUTER ASUS DSL-N55U

★★★★½

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; PPTP; 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.

SPECIFICATIONS 2TB external hard disk with NTFS; USB 3.0, with other docks available as optional; 44 x 124 x 158mm 894g.

NAS SYNOLOGY DISKSTATION DS214PLAY

★★★★★★

SUPPLIER www.synology.com

The fastest NAS in our grouptest (*PC&TA 197*), with excellent media streaming capabilities.

SPECIFICATIONS 2.1GHz Intel Atom; 2GB RAM; 2 x USB 3 + 1 x USB 2; iOS and Androidmobile apps; RAID 0, 1, 5, 10; JBOD.

ALL-IN-ONE PRINTER CANON PIXMA MG5460

★★★★½

SUPPLIER www.canon.com.au

The winner of our most recent printer grouptest, this combines excellent print quality with decent costs and is just as good at printing photos as it is documents.

SPECIFICATIONS 9600 x 2400dpi print; 2400 x 4800ppi 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 grouptest, 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 grouptest, a big improvement over recent years, and a good solution for beginners and more advanced users. Kaspersky AV software runs well on even low-end machines, and operates relatively seamlessly and with a small memory and OS footprint.

BACK UP ACRONIS TRUE IMAGE 2013

★★★★½

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 365 HOME PREMIUM

★★★★½

SUPPLIER www.microsoft.com.au

The easiest to use Office to date.

WEB DEV ADOBE DREAMWEAVER CS5

★★★★½

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

★★★★½

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 11

★★★★½

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 5

★★★★½

SUPPLIER www.adobe.com.au

An excellent tool for photo management and light editing, as used by the pros and now available at a very reasonable price.

KITLOG

In this month's issue we've overhauled the Kitlog systems to the right. While many of the components used previously were still perfectly workable, it was certainly time to give this important section of the magazine a refresh. We'll also be reviewing this section every issue in *PC & Tech Authority*, and upgrading components whenever we believe there's a better option, so, in future if a component carries over from the previous issue it's because we still believe it's the best choice.

We've chosen each component carefully, and our choices are based on performance, suitability to the task, and – even in the case of the Perfect PC – value. Sometimes the most expensive item isn't necessarily the best choice.

It's also worth noting that in the case of graphics cards, the brand we are recommending isn't necessarily the one to go with for perfect performance. Another manufacturer's card which uses the same chipset as the one we recommend will serve you equally well – provided the amount of memory onboard and the cooling is at least equal to what we've suggested here. The brand and model we've recommended is the one we've tested or used ourselves, and have compared it to others of a similar specification.

We place great importance, too, on the peripherals. We're particularly finicky about our mice and keyboards, and because we generally get to test every new product that's released you can be sure our suggestions here have sound thinking and experience behind them, along with a not inconsiderable amount of game-testing.

You'll also notice that for the first time in a long time a dedicated sound card has been thrown back into the mix. While most onboard sound processors do an adequate job for music and gaming, our specifications for these systems call for outstanding audio quality for the Perfect PC, and for the Game Box, accurate positional decoding at maximum fidelity and with minimal CPU impact.

For music it's hard to beat the ASUS Xonar ST/X. While its signal to noise ratio is extremely high at 124dB, what matters most is the combination of the AV100 DSP and the TI Bur-Brown DAC that delivers music that's just magical. For our Game Box we've gone with a Sound Blaster X-Fi. At just $80 it adds impeccable clarity to any game.

Lastly, the systems we have specified are designed to work harmoniously. Each part of the build is considered in relation to how it will function with the rest of the system. For those of you who choose to match our recommendations to the letter, you won't be disappointed, but if you are simply looking at upgrading part of your system, you can be sure that each item offers great performance, and in most cases, good value.

THE GAME BOX

CPU

INTEL CORE I5 4670K
PRICE $275
Gamers can do without Hyperthreading and save $100 or more, compared to an i7. The K version is unlocked for easier overclocking.

MOTHERBOARD

ASROCK H87PERFORMANCE
PRICE $129
All the gaming mobo you need and at a bargain price. Includes decent onboard audio if you want to save a few $$ and skip the Xi-Fi.

MEMORY

KINGSTON HYPERX KHX1600C9D3B1K2/8GX 8GB X2
PRICE $220
Reliability and value are all you need in a gaming rig. Spending more will yield very little and is better invested elsewhere.

VIDEOCARD

GIGABYTE GTX 760 OC 4GB
PRICE $360
An excellent price/performance balance, and with 4GB of memory to handle high resolutions or games with large textures.

THE PERFECT PC

CPU

INTEL CORE I7 4770K
PRICE $400
Intel's top-of-the-line quad-core i7 delivers huge performance and can overclock easily to around 4.4GHz with the K version.

MOTHERBOARD

GIGABYTE G1 SNIPER M5
PRICE $275
We've upgraded this from the Sniper 3 to the newest model, which happens to also be $100 cheaper! Fully featured and fast!

MEMORY

CORSAIR DOMINATOR PLATINUM CMD32GX3M4A2133C9 32GB
PRICE $619
These memory chips are hand selected and tested, and 32GB of fast RAM will keep things smooth and fast in intensive tasks.

VIDEOCARD

MSI GTX 780TI
PRICE $800
This single-GPU powerhouse is cool and quiet yet has the power to push though anything effortlessly. Mature drivers and good cooling help.

SUBTOTAL: $2592 RIG ONLY: $1973

COOLER

COOLERMASTER NEPTON 140XL
PRICE $140
Easy to install AIO CPU cooling, relative quiet and performance to rival twin-radiator units.

CASE

BITFENIX RONIN
PRICE $99
Bitfenix continues to deliver great budget cases that look terrific and are easy to build in.

SYSTEMDRIVES

SAMSUNG 840 EVO 250GB
PRICE $190
Super-fast, cheap and space for the OS and your games.

WD BLACK 2
PRICE $340
An extra 128GB of SSD storage plus another 1TB of HDD space, all in a tiny 2.5in size.

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

TT SPORTS VOLOS
PRICE $89
The easy first choice at *PC&TA* HQ where we play hard and test every mouse. Also superb value.

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.

SOUND BLASTER X-FI XTREME
PRICE $80
The best positional game audio and pretty good music quality, too.

POWER SUPPLY

CORSAIR CS650M
PRICE $140
It's quiet, reliable, and at 650W is more than we need for this build, but has the headroom for additional graphics.

SUBTOTAL: $5192 RIG ONLY: $4198

COOLER

CORSAIR H105 WATER COOLER
PRICE $160
Best-of-breed cooling plus nice and quiet equals a happy CPU.

CASE

COOLER MASTER COSMOS II
PRICE $400
The only case you'll ever need. Premium luxurious bliss.

SYSTEMDRIVES

SAMSUNG 840 EVO 1TB SSD
PRICE $680
Samsung has conquered the market with its 840 EVO, so fill up with 1TB of incredible speed and storage.

WD BLACK 2
PRICE $340
Supplement the EVO with this hybrid drive and 128GB of SSD + 1TB of HDD space.

KEYBOARD

CORSAIR VENGEANCE K95
PRICE $179
The perfect keyboard. Lovely Cherry Red mechanical switches, a slick and attractive aluminium body and customisable backlighting make this The One.

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 $125
An excellent performer and highly configurable mouse that suits both left- and right-handers.

AUDIO

ASUS XONAR ESSENCE ST/X
PRICE $175
The go-to card for perfect music quality, though the motherboard's onboard sound is fine if this isn't so important to you.

POWER SUPPLY

CORSAIR AX1200
PRICE $349
Reasonable value for this mighty power unit, delivering stable power and able to handle quad-graphics.

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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.

SYSTEM BUILDER: Understanding mechanical keyboard switches

DAVID HOLLINGWORTH LOOKS INTO WHAT MAKES CHERRY KEYBOARD SWITCHES THE PICK FOR GAMERS AND SERIOUS TYPISTS

While mechanical keyboard switches are very much the in-thing when it comes to gaming keyboards, they're all based on a technology that has been around since the 80s. And it's one that in-the-know typists and keyboard aficionados (these people do exist), have been using for years.

SORTA GERMAN ENGINEERING

The Cherry Corporation began producing keyboards in 1967, when the company was already 14 years old. They moved to Germany in 1967, and were bought out by the slightly less cheery sounding ZF Friedrichshafen AG in 2008. Cherry started manufacturing Cherry-brand switches in 1985, and those switches - and others - are still in production today.

Whereas your average run-of-the-mill keyboard might use a rubber-domed-membrane to regulate key presses, or a slightly more effective scissor-switch design, Cherry MX switches are made of up to seven moving and non-moving parts to deliver a range of different actuation forces and tactile feedback. Each MX switch is denoted by the colour of the actual part - you won't see this, as it's actually the part underneath the letter-stamped key itself, but it's this important design that gives each switch its unique character.

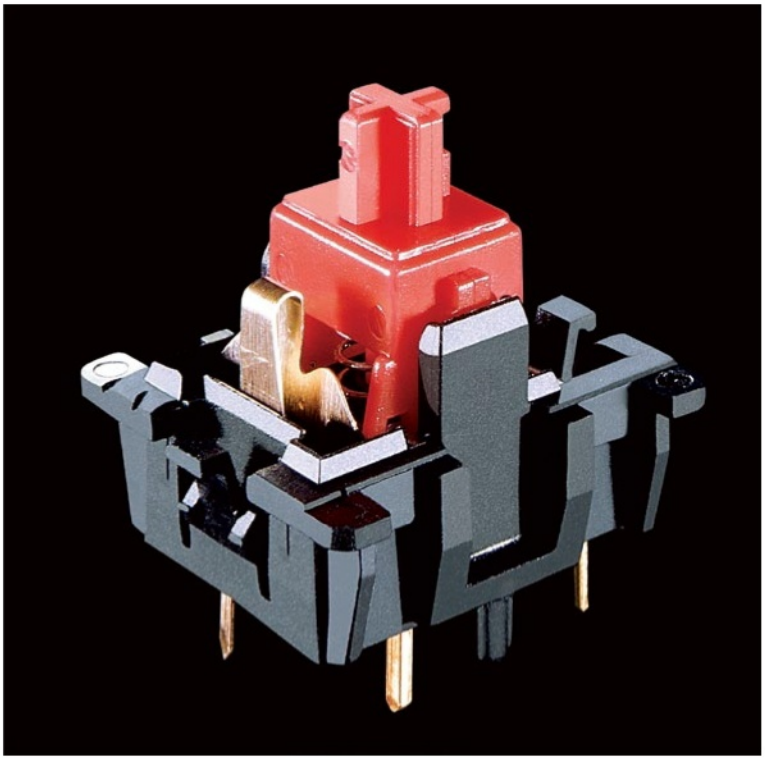
> "Actuation feedback is a real boon to gamers where clicks-per-minute are the key"

There are schools of thought for the usefulness of each major kind of switch, and a few of the lesser-known ones. Some gamers swear by Blue switches, for instance, while others look down upon anyone who doesn't use a Brown switch. This has in fact caused more than argument here in the Labs, but we'll lay out the particulars of each so you can get an idea of what might be the right switch for you.

CHERRY MX BLUE

The Blue switches are a relatively recent innovation, and were the switches of choice in the first generation of Razer BlackWidow keyboards, as well as Filco keyboards. The internals of this switch deliver a definite bump and audible click upon actuation, in turn delivering excellent feedback for typists. Razer was convinced that this combination of tactility and heavy weighting - they need more pressure to actuate - made it a perfect choice for pro gamers who needed definitive feedback on in-game actions, much the same as it provided to touch typists.

However, it is quite a noisy system. Having experienced these keyboards in closed office environments, they can be a little



▶ This is why Cherry switches feel so good – more than a rubber membrane

hard on the hearing - and the nerves - of those nearby.

CHERRY MX BROWN

Brown switches are very similar to Blues, but deliver only the tactile bump of definitive actuation, without the annoying clicky sound. Browns therefore make excellent keyboards for dedicated office workers, and gamers that don't need to sound like they're murdering a field of crickets to feel like they're winning at Starcraft.

Incidentally, real-time strategy games like Starcraft are the perfect example of cases where actuation feedback is a real boon to gamers. It's a game where clicks-per-minute are the key to victory, keeping build queues running, and giving clear, concise move and attack orders to your troops.

CHERRY MX RED

Cherry Reds deliver the lightest actuation force of all the Cherry switches, and that light-weight is combined with a truly linear motion - there is no feedback to clear actuation other than the key bottoming out.

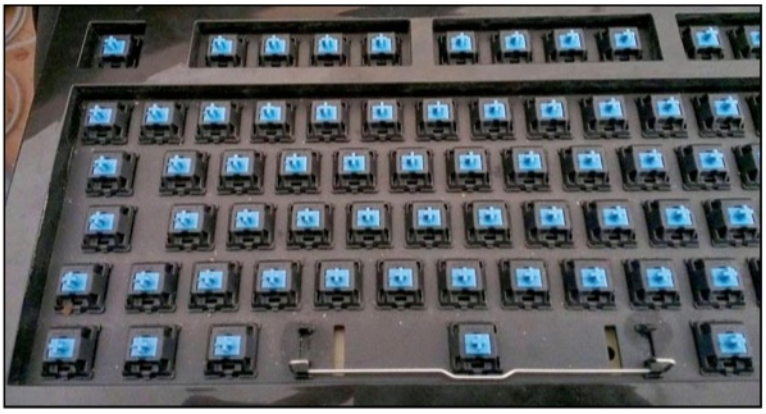
Being lightweight - in comparison - they are also ideal for gamers, as each keypress takes less force, allowing for rapid double-clicking.

CHERRY MX BLACK

Blacks deliver a similar linear, tactile-free action as the Reds, but do so with a far stiffer actuation weight. In fact, blacks require more pressure than all the other Cherry switches - so much so that fatigue can be an issue.

Commonly used in point of sale situations where accidental presses are a problem, an argument has also been made for Blacks as also ideal for RTS gaming, for much the same reasons. Mistakenly entering the wrong cash amount is almost as bad as mis-keying your build cue when the Zerg are at the gates, apparently.

▲ The Cherry phenomenon has driven keyboard innovation in general.



▲ One beautiful gaming keyboard

◀ Behind the scenes – colour coding in action

AND THE REST

There's a mess of other, less well known and less used switches in the Cherry MX range. We all know Lock switches, commonly used on Caps Lock keys in the good old days. Dark Grey switches are seen in spacebars on keyboards that use MX Black switches, since it has an even heavier actuation force, and Super Black switches do what they say on the tin, with a super-heavy actuation force. Green switches are a stiffer version of Blues, while White switches are similar, but quieter.

But we have a few more mechanical varieties incoming. Not only is Razer now producing its own (*see our review on page 50*), but Corsair has been working with Cherry to deliver classic MX switches with built in RGB LEDs. These will be coming in the next generation of Corsair keyboards, delivering classic Blue, Brown, Red and Black switches, all with the capability to light up in 16.7 million colours. You'll even be able to light up different keys in different colours, making for handy in-app macros, or highlighting the all important WASD keys if you're a FPS gamer.

THE 'RIGHT' KEY

It's hard to recommend a particular switch to someone, so we'd really recommend trying the entire range of switches before you get yourself a mechanical keyboard. The fact that everyone on our team has a different preference is proof enough of that.

HOW TO:

DVD and Blu-ray ripping

YOUR MOVIE LIBRARY DOESN'T NEED TO STAY LOCKED AWAY IN A PILE OF SHINY DISCS. **ADAM TURNER** SHOWS HOW HANDBRAKE IS THE RIGHT TOOL FOR CONVERTING YOUR MEDIA COLLECTION

Optical discs offer a handy way to get high-quality video into your lounge room, but discs are less convenient once you want to stream those movies around your home or slip them in your pocket as you walk out the front door. Thankfully it's not too hard to rip your favourite movies to your computer and then watch them on your gadgets of choice.

Unfortunately Australia's copyright rules don't permit ripping your DVD and Blu-ray movies to your computer. The recent copyright law review is unlikely to change this, although it's worth remembering that we were ripping our music CDs for many years before Australian law caught up with the times. You'll need to draw your own moral line in the sand when it comes to copying content which you've legally purchased on disc. These days some discs come with a digital download, but it might not be in a format which suits you.

THE RIGHT TOOLS FOR THE JOB

There are several applications designed specifically for ripping movies, but let's stick with the highly-respected HandBrake video transcoder <handbrake.fr>. It's available for Windows, Mac and Ubuntu, and because it's open source, it's completely free.

HandBrake removed its DVD decoding features several years ago, but you can get around this by installing the VLC media player <videolan.org>.

Together these two free applications should happily convert your DVD library to MP4 video files which will play on a wide range of gadgets. You can also opt for MKV, but HandBrake ditched support for DivX and XviD several years ago.

Nothing separates MP4 and MKV in terms of picture quality, because technically they're only container files. By default, HandBrake uses the H.264 video format inside both MP4 and MKV files. MKV is a little more flexible but, when in doubt, stick with MP4 because it's compatible with a much wider range of devices. If you're catering to Apple gadgets then definitely stick with MP4, ensuring you use the .M4V file extension so files play nicely with iTunes.

AnyDVD HD <slysoft.com>,

> "Occasionally you'll run into a particularly stubborn disc which these can't rip"

DVDFab <dvdfab.cn> and DVD Decrypter can make a bit-perfect copy of your movies and save them on your computer as hefty VOB, M2TS or ISO files.

Occasionally you'll run into a particularly stubborn disc which these applications can't rip due to damage or aggressive copyright protection. Try ripping the disc to your computer first as one large ISO file and then point your conversion software at that ISO rather than the original disc. If your conversion software insists on a physical disc then use software like CloneDVD <slysoft.com> to mount the ISO so it appears to be a real disc in the drive.

THINK ABOUT THE BIG PICTURE

Before you rip anything, consider how you'll watch your movie files.

You need to cater to the fussiest devices in your ecosystem, which will most likely be Apple gadgets, Smart TVs or perhaps games consoles. Also consider how you'll deliver files – perhaps you'll copy them to the internal drive or a USB stick, perhaps you'll stream them over your home network or the internet. Try to keep transcoding to a minimum.

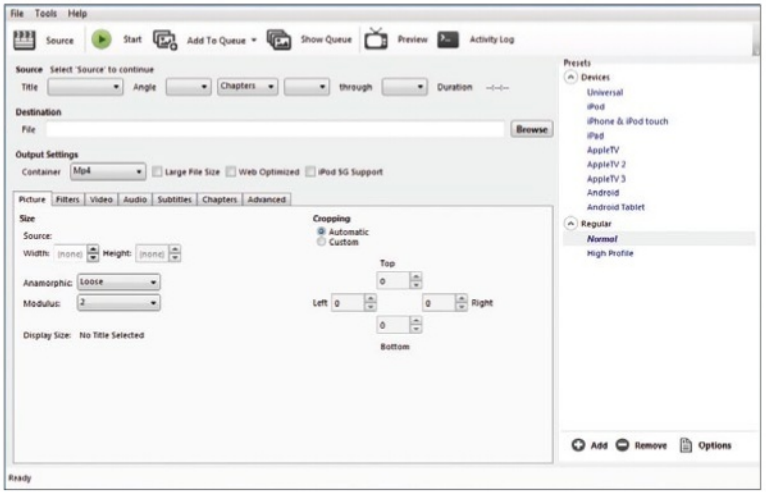
In a perfect world the idea is to rip once, store in a central location and watch everywhere. This means finding resolutions and quality rates which look good on your large screens but don't create files too large for your portable devices. Create test files before you go on a ripping frenzy.

LET IT RIP

Ripping DVDs with HandBrake and VLC is very straightforward but it's best to master the basics of converting DVDs before tackling your Blu-ray collection.

Click HandBrake's Source button and point it at the DVD in the optical drive. It takes a minute to examine the disc and identify its list of titles. Even if you've got VLC installed, HandBrake might ask for the libdvdcss file in order to handle the encryption – although you should be presented a link for downloading it.

HandBrake selects the largest title and assumes it is the main movie. If



▶ The austere and functional UI used by Handbrake allows for quick processing and intuitive operation

the disc contains several TV episodes HandBrake will only choose one, but make sure it's an individual episode rather than the Play All playlist. Sometimes you'll see more than one title which looks like it could be the

> "It's a good idea to rip a few minutes of your movie as a test... watch for blur & pixelation"

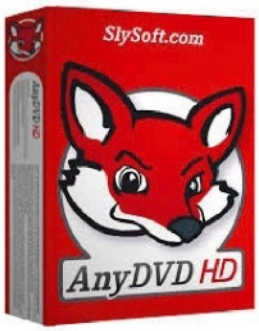
main movie. Some movie houses make life difficult by creating 99 titles, most of them dummies.

HandBrake has a knack for choosing the right title, but to be sure you can play the DVD in VLC. Go to the disc's main menu and press Play on the movie or episode you want to rip. Don't press Play All. Once it's playing, click the Playback dropdown menu and look under Title to see which title number you're watching.

HandBrake might take forever or even crash when scanning the disc. Or it might not see the title number you need. Once you know the title number, click Source, Title Specific Scan, Open Folder and then select the VIDEO_TS folder on the disc. Enter the title number and press Open Title. If you're still stuck, try ripping the disc as an ISO first. Just having AnyDVD HD running in the background might be enough for HandBrake to read the disc correctly.

At this point you can keep things simple by choosing a device preset from the list on the right, such as iPhone, Apple TV or Android tablet. Now go to the destination bar, click browse and specify a folder along with a file name. Press Start and go make yourself a coffee. If there's a string of TV episodes on the disc you should enable the auto-naming option in the preferences. Press Add to Queue and repeat for each title before you click Start and rip them as a batch.

DVDFab and AnyDVD are also good options for creating VOB, M2TS or ISO files.

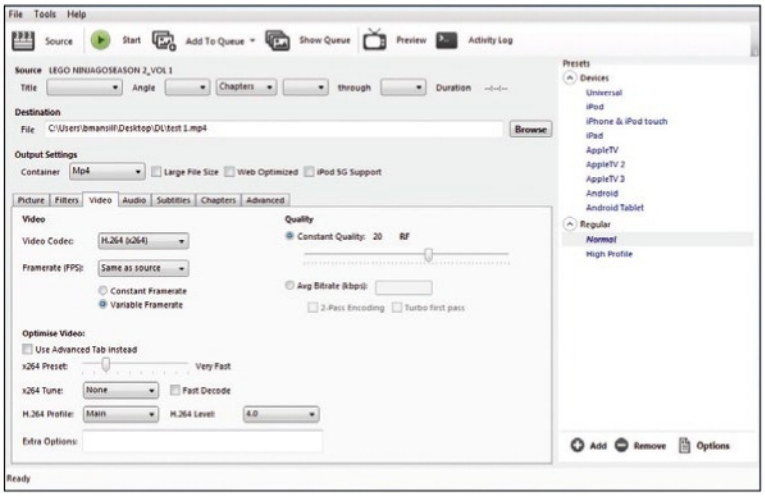


GET CRACKING

It's a simple enough process, but you may want to dip into HandBrake's Video settings to tweak the file size and picture quality. It's a good idea to rip a few minutes of your movie as a test. Look for a scene with fast-moving action, dark shadows, skin tones and panning shots so you can watch for blur, pixelation and jitter when testing the different video quality settings on your devices.

For a quick settings check use the Preview button to generate a 30-second clip (although it can be flaky at times). When you're ready to test on your various devices, choose a title but only scan chapters 1 through 1. Play this short test clip on every server and device you're trying to cater for. Some devices can be very fussy even with files that they're supposedly compatible with.

If the result looks terribly distorted and blocky then the DVD's copyright protection probably hasn't been bypassed. It's also possible that VLC isn't supplying the correct version of libdvdcss.dll and you'll then need to download it. Go to download.videolan.org/pub/libdvdcss/1.2.12 and grab the 32 or 64-bit version of libdvdcss-2.dll (if you're running a 64-bit version of Windows then make sure you're also running a 64-bit version of HandBrake). Now rename it libdvdcss.dll and move it into the HandBrake folder inside the Program Files folder.

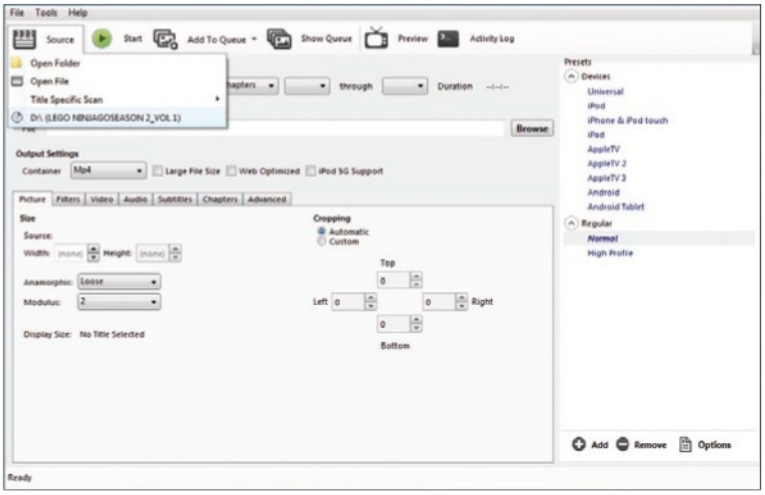


Handbrake's video options screen

LOOK YOUR BEST

If you're catering to multiple devices then start with HandBrake's Universal preset, which is Apple-friendly. Some presets raise the H.264 level/profile past 3.0, as high as 4.1, which can improve the picture quality but this comes at the expense of backwards compatibility with older devices.

The most significant problem you're likely to encounter with picture quality is interlacing. It



Select the source disk here

creates jagged edges on moving objects, as if they're a slight ghost. You're more likely to see it on content more than 20 years old – that's when the movie or TV show was first made, not when the disc was made. It's not something you want to discover after you've ripped hours and hours of video.

If you notice the tell-tale signs of interlacing on moving objects, go back to the HandBrake home screen and click on the Filters tab. Rather than Deinterlace, which impacts on the overall picture quality, set Decomb to Default. Decomb only kicks in when required and doesn't impact on the overall picture quality, so it's really easier to leave it on rather than checking if every disc is interlaced. Detelecine works a similar way, so it's also worth setting it to Default and leaving it there.

If you notice slight stuttering in panning shots, try switching from variable to constant frame rate over on the Video tab. Specifying a frame rate, rather than "Same as source", could also help. Stuttering can vary between devices and playback software, so make sure you test your clips in the environment you intend to watch them in. The same with overall picture quality – don't be deterred if it looks disappointing on your computer but you'll only watch it on your phone.

Once you're happy with your settings, click Add at the bottom right of the HandBrake interface and save them as a custom preset. Tick "Use Picture Filters" to make sure you save all your changes.

MADE TO FIT

If you're willing to trade file size for picture quality then it's worth taking a closer look at the Video tab.

The aim of the game is to obtain the best picture possible at a file size you can cope with using in a format all your devices can handle. Stick with the H.264 video codec and Constant Quality rather than Average Bit Rate. Tick Web Optimised to move the container header to the start of the file so it can begin streaming quickly. Ticking "Large file size" enables 64-bit support and removes the 4GB file size limitation, but some playback devices might not be happy with these files.

> "Surround sound goes to waste if you're only watching on handheld devices"

On the Constant Quality slider, RF:20 makes a good starting point for DVDs. The lower the number the higher the picture quality but don't go to extremes. You might experiment shifting it a few points either way.

There's a myriad video settings you can tweak on the Video and Advanced tabs but most are best left alone by mere mortals. If you've an eye for detail you might try changing the x264 Tune to film, animation, or grain, depending on the content you're ripping.

LISTEN UP

Surround sound goes to waste if you're only watching on handheld devices, so you might stick with 2-channel stereo sound to keep down file sizes.

By default the Audio tab should take the English "Dolby Digital" AC-3 5.1-channel track and convert from Dolby Pro Logic II to 2-channel AAC at 160 Kbps. If you've golden ears, you might try bumping it up to 192 Kbps.

The Apple-friendly presets also add the AC3 track to the file, with the codec marked as AC3 passthrough. This gives iGadgets access to the 2-channel track while offering 5.1-channel surround sound when you're watching on something like an Apple TV with an optical or coax digital audio output. If you're confident that you don't need a surround sound track, set that second audio track to None to produce a smaller file.

READ MY LIPS

Subtitles crop up in movies more often than you'd expect, so change your presets to allow for them.

Unless you're after English (Closed Caption) or foreign language subtitles then you won't need to regularly touch the Subtitles tab. You do, however, run into the occasional character who requires subtitles, like Jabba the Hut. You might find the disc relies on the DVD player's subtitles features rather than burning the subtitles into the picture.

To play it safe you should enable Foreign Audio Search in your preset, with Forced Only and Burned In ticked. This automatically scans for occasional subtitles, rather than movie length subtitles, and burns them into the image so they'll appear on every playback device.

If you rely on the non-English soundtrack found on some discs, you can add it to the file using the Audio tab. If your playback device doesn't allow you to switch language then you might need to stick with one.

GO LARGE

Once you've mastered the art of ripping DVDs it only takes a few tweaks to rip Blu-rays, but the movie houses like to make life difficult.

You can use AnyDVD HD to create a Blu-ray ISO with copy protection stripped away, but with AnyDVD HD running you should be able to point HandBrake straight at the disc in the computer's Blu-ray drive. Another option is to use MakeMKV to rip the disk and then point HandBrake at that file.

More often than not HandBrake selects the correct MPLS title number for the main feature but some Blu-ray discs throw in scrambled bogus MPLS titles. You might discover at least two which look like full-length movies.

Choosing the right one isn't an exact science. Even if you've used MakeMKV to rip the movie first, you still can't be absolutely sure it chose the correct MPLS. You might start with a Google search – there's a long

list on AVS Forums (**bit.ly/1eUG74i**) – but it's made difficult by the fact the correct MPLS number can vary between regions.

Applications like BDInfo (**cinemasquid.com**) help by analysing the disc to reveal exactly which M2TS video files are included in each MPLS playlist. Sometimes it's as simple as looking for the MPLS with exactly the same running time as the movie. When comparing MPLS playlists, look for M2TS files which differ. Find them in the BDMV/ STREAM folder on the disc and play them using VLC. Look for little changes, like the language used in writing on street signs, to reveal which is the true MPLS playlist and which are the imposters.

Media Player Classic – Home Cinema (**mpc-hc.org**) is handy because it plays MPLS playlists – from the disc's BDMV/ PLAYLIST folder – rather than just playing individual M2TS video files. If you find MPC-HC freezes when shifting between M2TS files on the disc, try ripping the disc using AnyDVD HD and playing the movie from the hard drive. Some stubborn discs will present you with two MPLS files containing identical M2TS lists and playlengths. At this point you might just have to choose one and hope for the best.

Once you've found the correct MPLS you'll need to tweak a few HandBrake settings in your custom DVD preset and create a Blu-ray preset. Start by bumping the Constant Quality slider up to RF:22. You can bringing it down later if you're unhappy with the picture. You could also experiment with basing your Blu-ray custom profile on High Profile rather than Universal, but expect to pass the 4GB mark. Once again create a few small test clips to try on all your devices – with fast-moving action, dark shadows and panning shots – before you commit to launching into ripping your entire Blu-ray library.

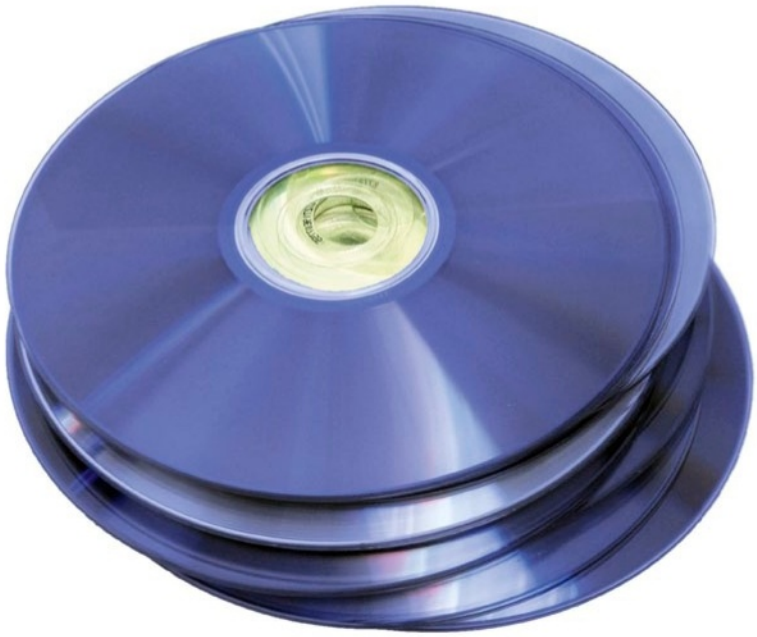
▲ Our exaggerated example (above) shows how interlacing works. By eliminating the need to process (and display) every second horizontal line, processing time and file size can be reduced, and on small screens the effect is barely noticeable

"There's some trial and error involved in finding the best settings for your devices"

Before you rip you should also consider the video resolution. It sounds like sacrilege, but do you really need a massive 1080p file if you're only watching it on a small screen? By running a lower screen resolution in the file you are ripping you will speed up the ripping process, and the end result will also be a much smaller file size, which can prove to be quite useful as your collection grows. By default the Universal preset will rip a Blu-ray movie at DVD resolution. Rather than changing the image width all the way up to 1920 on the Picture tab, for a 1080p file, consider setting it to 1280 to produce 720p. This almost halves the file size without a major drop in picture quality on a small screen. It might be a reasonable compromise for kids' movies and romantic comedies, if not sci-fi blockbusters with lavish special effects you will want to enjoy at better fidelity.

When it comes to audio, HandBrake should take the English DTS 6.1-channel track and convert it from Dolby Pro Logic II to 2-channel AAC at 160 Kbps. You can create a second track to add surround sound, converting the DTS soundtrack to Dolby Digital AC-3. If you want to retain the DTS or DTS-HD soundtrack then look to MKV instead of MP4, if your playback device supports it. Or you can ditch surround sound completely to reduce the file size.

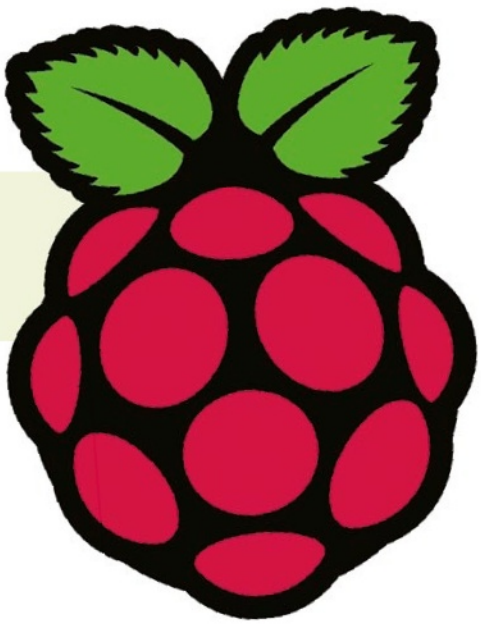
There's some trial and error involved in finding the best settings for your devices, so make sure you perform plenty of tests with short clips and then single movies before you take the plunge and rip your entire Blu-ray library. With a little patience and practice you can carry around your favourite movies in your pocket and have them ready to go across your devices as well as sharing via the home network. ■



HOW TO:

Create a Raspberry Pi weather station: Part 2

KEVIN PARTNER SHOWS YOU HOW TO SET UP YOUR RASPBERRY PI WEATHER STATION FOR REMOTE CONTROL, AND TO UPLOAD WEATHER DATA VIA DROPBOX



This is part two of a feature adapted from the Raspberry Pi for beginners MagBook, available now in newsagents and from online bookshops. The book guides you through your first steps in setting up the Raspberry Pi and beginning to program in Python. The project assumes a certain degree of familiarity with Raspbian and the principles of creating programs in Python, but advanced skills are not required to get this project up and running.

Last month we created the main code to control our Raspberry Pi weather station (if you missed part 1, you can download it from Web ID: 374620). Now it's time to look at setting it up for remote access, to upload weather data wirelessly and allow control over the internet.

THE DROPBOX API

To handle the uploading side of things, we'll use Dropbox. This cloud storage service works, essentially, by providing a special folder on the Dropbox server that's accessible only to you. When you install the client software on a computer or mobile device, the contents of that folder are automatically copied up to the cloud. Install the software on additional devices and they'll all be kept synchronised as files are added, edited and deleted. For example, if you create a document on your PC and save it to your Dropbox folder, you can then access the same document on your iPad without taking any other action. There's also a web application for managing your content.

Alongside these regular modes of use, Dropbox offers an extensive API that allows you to access your files via a program. Since there is no official Dropbox client for the Raspberry Pi, we have no choice but to use this API if we want to base our upload system on Dropbox – but this is a convenient way to proceed anyway as it enables us to build the features we need into our code without user intervention.

What's more, Dropbox and Python work particularly well together, not least because the Dropbox client is written in Python. As with most APIs, Dropbox includes its own library that makes connecting with its services possible, in much the same way as Tinkerforge's library makes connecting with its sensors possible.

Before you can do anything useful with Dropbox, you need to create an account. (A free account is fine.) You can then go to **www.dropbox.com/developers/apps/create** and, once you've agreed to the terms and conditions, click the "Create an app" button. This is a necessary step because every program that wants to connect to Dropbox needs its own unique ID to identify it to the service.

Give your app a name and leave the "Access setting" value set to Folder. This means that any Dropbox user connecting to your climate-measuring app will see a new folder created in their Dropbox account called apps (if one doesn't already exist); and, within that, a subfolder with the same name as your app. In our case, we've called the app RPi_Lab.

On the "General information" page for your new app you'll see values for "App key" and "App secret" – you'll need both of these values for your Python code. Make sure to keep these private since they give the code access to individual user data. You're now set up on the Dropbox server.

The final step before we can start integrating the weather station app with Dropbox is to download the Dropbox Software Development Kit (SDK), which is analogous to the Tinkerforge bindings. Go to **www.dropbox.com/developers/core/sdks/python** on your Pi and click the Python heading under Download SDK.

After downloading the SDK, right-click the file and select Xarchiver from the context menu. Extract the files to home/pi/dropbox and type the following into the terminal:

```
cd /dropbox/dropbox-python-sdk-1.5.1
```

Bear in mind that the folder name could be slightly different if the SDK's version number has been updated since publication; if the above command doesn't work, adjust your syntax accordingly. Finally, type this into the terminal:

```
sudo python setup.py install –f
```

This uses the Setup Tools library we installed last month to configure the necessary Dropbox files. We'll now be able to access all the API functionality through a simple import statement.

CODE FOR UPLOADING TO DROPBOX

To handle Dropbox operations, let's create a new module called upload.py with two functions: auth_dropbox and save_to_dropbox. You'll see the complete code for this module in the box opposite, and it's included in the code bundle that you can

download from **http://tinyurl.com/mxw8omx**.

Having installed the Dropbox SDK, our script starts by importing the relevant parts using the from keyword (*see Uploading to Dropbox, line 2*). We're also going to use the pickle and os standard libraries.

To understand what happens next, you need to know that Dropbox works using sessions; you can think of these as one-off attempts to use the service. For each session you need to supply the application key, its Secret key and the access type (app_folder in almost every case). Dropbox uses these to establish that your application is registered with it and you, as the coder, are connecting legitimately (only you should know the Secret key).

You won't be surprised to learn that before we can connect to a Dropbox user's account and start uploading data, we also need the user's authorisation, which means Dropbox needs to know which user's account you want to connect to, and that you're authorised to do so. For this it requires an access token and secret token: these are different for each user and each session, and can be generated only when you're actually running the code. If you don't want the user to have to go through the rigmarole of authorising your app every time they run the program, you need to store these tokens to use again later.

To handle this, the first step is to save the access information into properly named variables and create an object (sess) that's an instance of the Dropbox session class (*see Uploading to Dropbox, lines 4-7*). We'll be using this to connect. We use os.path.exists to check whether or not config.dat exists – this being the name we've chosen for the file in which we'll save the tokens (*see Uploading to Dropbox, line 10*). If it does exist then the program must have been run at least once before, and tokens must have been generated already and saved here. If so, we don't need to do anything further at this point.

If the file doesn't exist then we need to get the user's authorisation. Since this is a program for personal use, we can take a fairly basic approach to this; if you were creating a commercial app that connects to Dropbox accounts, you'd want to polish it up a bit. It's also worth noting that, since this isn't a publicly distributed app, only a limited number of specified Dropbox accounts can be used – but that's no problem here. All we need to do is create a request token that identifies us to the Dropbox server; then, using

this, we build a URL and prompt the user to visit it and authorise our app to access their account. The raw_input() statement at line 7 halts execution until this has been done.

Once it has, the access token will be a property of the sess object and we can set a variable to its value. This variable is actually a dictionary containing two tokens – the access token key and the access token secret

> "Dropbox includes its own library that makes connecting with its services possible"

– and we can then use pickle to save them to the CONFIG.DAT file. Having done this, we can reuse these tokens in future sessions. To connect with a different Dropbox account, simply delete config.dat: the authorisation process will trigger again next time you run the program.

SAVING TO DROPBOX

Now we have our access credentials and are linked to a user's account, we're ready to save our data to their Dropbox folder on a regular basis. This is handled by the second function in our new module, named save_to_dropbox, starting at line 27.

We've written this function to take into account the fact that Dropbox relies on a working network connection to upload the latest data. If a network error should prevent Dropbox from connecting to the internet, Python's default response is ordinarily to exit the program with an error code, causing monitoring to stop. This is a potential stumbling block, since we want our weather station to run automatically, without a keyboard, monitor or mouse. Rebooting it can be awkward, and if we don't manage to do it quickly we may miss a lot of measurements.

Fortunately, Python has a built-in mechanism for handling errors using the try statement – and its best friend except. When Python encounters the try statement, it knows that if any of the following code produces errors, it shouldn't abort the program but should skip to the except statement later on to handle it. In our case, we're instructing Python to try to upload the data (*see Uploading to Dropbox, line 35-49*).

If there's a problem with the network connection, an IOError will be generated and the first except block will run. In this case, it simply prints a message; any other error prints some information to help us diagnose the problem. Crucially, in neither case does the program stop, so your data needn't be lost. As a rule of thumb, you should always use this technique when conditions you can't control directly (such as an internet connection's availability at any specific moment) would otherwise cause the program to crash.

Let's walk through the code within our try block. First, we create a new Dropbox session. We then open the CONFIG.DAT file and use pickle to load in the access token and secret token we saved earlier. We then assign these to the session object, giving it all the information it needs to connect to the correct account.

At line 42, we're now able to create an object based on Dropbox's core class – DropboxClient – which takes our session variable as its argument, and we have the Dropbox API at our command. In this scenario, all we want to do is upload a specific file to a particular folder, but you can build additional functionality into your application (for example, file browsing). We open the file and pass it to the put_file function of the client object (*see Uploading to Dropbox, line 44*):

```
response=client.put_
file('/'+thefile,f,True)
```

The first parameter tells Dropbox to upload the file; "f" is a reference to the file itself (established in the previous line of code) and the True switch

ensures that Dropbox overwrites the file in the user's account. If we didn't use this (it's set to False by default) then Dropbox would create a new file each time.

The response variable contains various data about the file once it's been uploaded. Then we print it so we can see, by looking at the interpreter output, that it's working (*see Uploading to Dropbox, line 45*).

The code is now almost complete: all we have to do is add a few lines to main.py to trigger the Dropbox uploads. You can see the updated code in the box opposite, and download it from **http://tinyurl.com/mxw8omx**.

At the top of the code you'll see that we've added import upload to make our new module available. Then we've made a few additions to the main loop: first, we call the Dropbox authorisation function at line 71. We've decided to upload the data to Dropbox every 30 minutes (in other words, after every second measurement), so this is set up by line 70; this creates a new event that will be triggered every half-hour, at which point line 77 calls the new send_dropbox function, which we've defined at line 55. This in turn calls our save_to_dropbox function from the upload module; placing this within its own function isn't strictly necessary, but it makes things easier should if we wish to expand what we do with Dropbox in the future.

We've added line 43 at the end of the save_summary function, which uploads our daily summaries. Every 15 minutes, measurements are taken and saved to the SD card; every 30 minutes the latest version of this CSV file is uploaded to Dropbox; and then, at midnight, we calculate the daily averages, minimums and maximums, add them to the summary CSV file, save this locally and upload it.

UPLOADING TO DROPBOX

```
1  def auth_dropbox():
2          from dropbox import client, rest, session
3          import pickle,os
4          APP_KEY = 'kmnd8m0dmm30rlk'
5          APP_SECRET = '1p0d50gh83h6wnr'
6          ACCESS_TYPE = 'app_folder'
7          sess = session.DropboxSession(APP_KEY, APP_SECRET, ACCESS_TYPE)
8
9          #has an access token been saved already?
10         if os.path.exists('config.dat')==False:
11                 request_token = sess.obtain_request_token()
12                 url = sess.build_authorize_url(request_token)
13
14                 # Make the user sign in and authorize this token
15                 print "", url
16                 print "Please visit this website and press the 'Allow'
   button, then hit 'Enter' here."
17                 raw_input()
18
19                 # This will fail if the user didn't visit the above URL
   and hit 'Allow'
20                 access_token = sess.obtain_access_token(request_token)
21                 if access_token:
22                         save_data={'access_token':access_token.
   key,'secret_token':access_token.secret}
23                         save_file=open('config.dat','wb')
24                         pickle.dump(save_data,save_file)
25                         print "success"
26
27 def save_to_dropbox(thefile):
28         # Include the Dropbox SDK libraries
29         from dropbox import client, rest, session
30         import pickle,os,sys
31
32         APP_KEY = 'kmnd8m0dmm30rlk'
33         APP_SECRET = '1p0d50gh83h6wnr'
34         ACCESS_TYPE = 'app_folder'
35         try:
36                 sess = session.DropboxSession(APP_KEY, APP_SECRET,
   ACCESS_TYPE)
37                 token_file=open('config.dat')
38                 token_data=pickle.load(token_file)
39                 access_token=token_data['access_token']
40                 access_secret=token_data['secret_token']
41                 sess.set_token(access_token,access_secret)
42                 client = client.DropboxClient(sess)
43                 f=open(thefile)
44                 response=client.put_file('/'+thefile,f,True)
45                 print response['client_mtime']
46         except IOError as e:
47                 print "I/O error"
48         except:
49                 print "Unexpected error:",sys.exc_info()[0]
```

DIALLING INTO YOUR RASPBERRY PI

Our weather station is almost ready to deploy in its final position. The last thing to do is set up a remote connection to it so we can control it over the network – so we don't need a monitor, keyboard or mouse connected to the Pi. We need the Raspberry Pi's network IP address. To find this, type this in LXTerminal:

```
ip a
```

This will cause a lot of information to appear, but we're interested in only the final line, beginning inet: write down the numbers that follow it. In most cases, the first three sets of numbers will be 192.168.1, so look for these and add the final one-, two- or three-digit number. Finally, we need to install the software the Raspberry Pi will run to accept and manage connections. In LXTerminal, enter the following lines:

```
sudo apt-get update
sudo apt-get install
tightvncserver
vncserver :1
```

You'll be prompted to create a password: this is the password you'll use when you connect to the Pi from a different computer. Note that the password you choose will be automatically truncated to eight characters. You'll be asked whether or not you would like to add a "view only" password; in most cases, you won't

THE FINISHED MAIN MODULE

```
#!/usr/bin/env python

import pygame, csv,os
from pygame.locals import *
from datetime import datetime
import pytz
import upload
from Today import *

HOST="localhost"
PORT=4223

AMBIENT_UID="am9"
TEMP_UID="bPb"
BARO_UID="bMW"
OUTPUT_FILE="climate_data.csv"
today=Today()

from tinkerforge.ip_connection import IPConnection
from tinkerforge.bricklet_barometer import Barometer
from tinkerforge.bricklet_temperature import Temperature
from tinkerforge.bricklet_ambient_light import AmbientLight

def save_csv(line):
        csv_file=open(OUTPUT_FILE,'a+')
        writer=csv.writer(csv_file)
        writer.writerow(line)
        csv_file.close()

def save_summary(thedata):
        summary_file="climate_summary"+".csv"

        if os.path.exists(summary_file)==False:
                csv_file=open(summary_file,'w')
                writer=csv.writer(csv_file)
                writer.writerow(('Date','MaxTemp','MinTemp','AvgTemp','MaxPressure','MinPressure','AvgPressure','Max Light'))
                writer.writerow(thedata)
        else:
                csv_file=open(summary_file,'a+')
                writer=csv.writer(csv_file)
                writer.writerow(thedata)
        csv_file.close()
        upload.save_to_dropbox(summary_file)

def get_formatted_time():
        GMT=pytz.timezone('Europe/London')
        utc_time=datetime.now()
        the_time={}
        gmt_time=GMT.localize(utc_time)
        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

def send_dropbox():
        upload.save_to_dropbox(OUTPUT_FILE)

def main():
        print "alive and kicking!"
        thistime=get_formatted_time()
        today.set_day(thistime['date'])
        ipcon=IPConnection()
        barometer=Barometer(BARO_UID,ipcon)
        temp_sensor=Temperature(TEMP_UID, ipcon)
        light_sensor=AmbientLight(AMBIENT_UID,ipcon)
        ipcon.connect(HOST,PORT) #connect to the master brick

        pygame.init()
        clock=pygame.time.Clock()
        pygame.time.set_timer(USEREVENT+1,1800000) #upload every 30 minutes
        upload.auth_dropbox()

        end_prog=False
        while end_prog==False:
                for event in pygame.event.get():
                        if event.type==USEREVENT+1:
                                send_dropbox()
                        if event.type==pygame.KEYDOWN:
                                if event.key==pygame.K_ESCAPE:
                                        end_prog=True

                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'],time_info['zone'],temperature,air_pressure,light_level)
                newday=today.update(time_info['date'],this_row)
                if newday<>False:
                        save_summary(newday)
                save_csv(this_row)
                pygame.time.wait(900000)#pause for 15 minutes before taking the next reading

if __name__=="__main__":
        main()
```

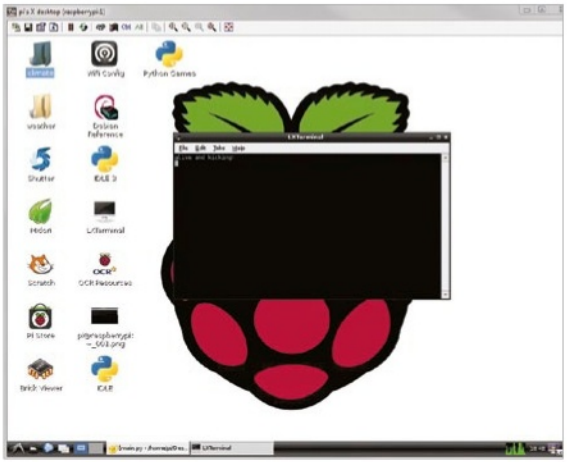
need one.

We now need to set this server to run automatically when the Raspberry Pi is rebooted in its new location. To do this, launch the File Manager from the Raspbian desktop. Click View and then tick the Show Hidden option. You should now see a folder called .config in the Pi folder. Inside this folder, you should see an autostart directory (if it isn't there, click File | Create New | Folder and create it). Right-click and select Create New | Blank File and name it TIGHTVNC.DESKTOP.

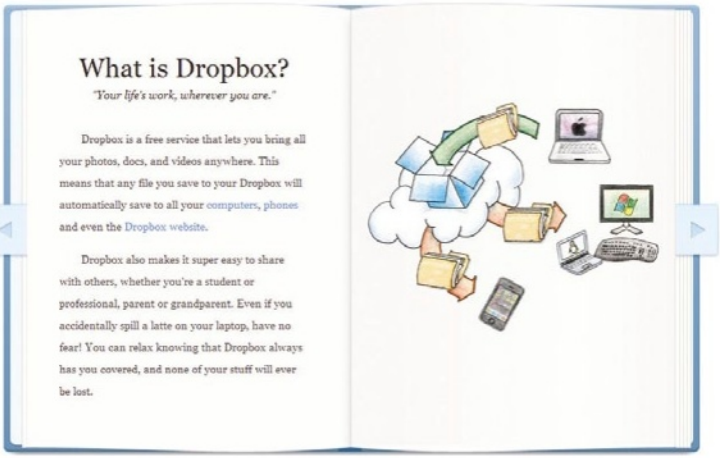
Now, right-click TIGHTVNC.DESKTOP and open it in Geany. You need to add the following text to the file (be careful to include the space before the colon on the fourth line):

```
[Desktop Entry]
Type=Application
Name=TightVNC
Exec=vncserver :1
StartupNotify=false
```


GAMDIAS
GAMING ART IN MOTION
HERMES
Be Legendary by Domination
ZEUS
Feel the Authority and Supremacyof God of all Gods
HEPHAESTUS
Be As devastating As the Weaponry Designed by the God of Fire
EPSILON
ESPORTS
CoD GHOSTS
calls on
HEPHAESTUS, ZEUS and HERMES,
the ultimate dream team.
ALTECH
COMPUTERS
1300 131 660
altechcomputers.com



▲ You can set up the TightVNC software to enable remote access to your Raspberry Pi



▲ Dropbox's service provides a folder on the server, accessible only to specified users

The TightVNC software that allows you to log in remotely should now run automatically every time your Raspberry Pi starts up. To test this from your desktop PC, go to **www.tightvnc.com/download.php** and select the "Installer for Windows" entry appropriate for your setup (this assumes you're using Windows, of course; Mac and Linux users can use a built-in remote client or the Java version of TightVNC available from the downloads page). Download the installer, choose the "custom" option and deselect TightVNC Server – we only need the Viewer software to control our weather station.

Now launch the TightVNC Viewer and type the IP address of the Pi into the "Remote Host" box, following it with :1, and click Connect. You'll be prompted for the password you chose and, once that's been entered, you should see a large window appear with a view of the Raspbian desktop. Congratulations – you have now connected your computers together.

Shut down your Raspberry Pi, remove the keyboard, mouse and monitor, and install it in its location, henceforth using TightVNC Viewer to control it remotely. If TightVNC Viewer reports that it can't make the connection, it's possible the Pi's IP address has changed: the best solution is to log into your router and examine the list of connected devices to find the Raspberry Pi's IP address, and mark it as reserved for this device so it won't change. If for any reason this isn't an option, you can guess the address by starting at 192.168.1.2 (or 192.168.0.2 if your network is set up that way) and moving up until you connect.

When you're ready to begin monitoring the climate, load your `main.py` file into Geany and run it. The first set of readings should appear quite quickly, confirming that the program is working properly.

VALIDATING AND PLOTTING THE DATA

You should now start receiving updates to your Dropbox folder every 30 minutes. The update will appear as a CSV file in your application folder. Make a copy and open it in your spreadsheet – you should see your initial readings listed. Remember to check the following morning for the summary CSV file. If that's there too, you know everything is working as intended.

> "Now that we are linked to a user's account, we're ready to save data on a regular basis"

Now the back-end is working, it's a good idea to check your readings against those of your local weather station. The Bureau of Meteorology's observations page at **www.bom.gov.au** will help you find the station nearest to you. If your value for current temperature differs from the "official" value by more than a degree, investigate whether your box is being overheated by direct sunlight, or cooled by the wind. You can check for this by waiting for a sunny day, then plot your temperature data as a graph. You should see a fairly smooth, bell-shaped curve as the temperature rises and falls. If you see big jumps in temperature, it suggests the box is warming up too much. If this is the case, try moving the box, shading it or covering it in aluminium foil to reflect the heat away. Otherwise, your readings won't be valid.

If all's well, your weather station will start generating useful data very quickly, so it makes sense to decide on some short-term objectives, so that you can start drawing conclusions and really start enjoying your new device. Let's say that you're interested in the relationship between air pressure and temperature. Once you have a week's worth of data, you can plot graphs to see how they interrelate. Here's how to generate your chart in LibreOffice/OpenOffice Calc:

1. Make a copy of the CSV file and open it in LibreOffice.

2. Select the date column first, then hold down Ctrl and select the AvgTemp and AvgPressure columns – you should have three selected.

3. Click Insert | Chart choosing the Points and Lines chart type. Click in the Smooth Lines checkbox and click Finish.

As you begin to collect the observations using your new Raspberry Pi weather station, you'll notice an immediate problem with the chart: the temperature values vary over a much smaller range than the air pressure values do. To fix this, right-click over the chart and then choose Insert | Delete Axes. Now, under Secondary Axes click next to Y axis – this adds another vertical axis on the right-hand side.

Right-click over the temperature line (in blue, at the bottom) and select Format Data Series. Under "Align data series to", select Secondary Y axis. The temperature readings will now be plotted against a smaller scale.

To draw firm conclusions you might want to wait until you have a larger dataset, so you can compare results, such as when plotting weather patterns across different seasons, for example. Ultimately, it's up to you what you do with your data – that's what spreadsheets are for, after all. ■

Disclosure difficulties and PR pitfalls

ANY ORGANISATION COULD SUFFER A SECURITY BREACH, SAYS **DAVEY WINDER**, SO ALL SHOULD LEARN HOW TO KEEP CUSTOMERS INFORMED – ACCURATELY AND LEGALLY

Disclosure is a doubled-edged weapon: get it right and everyone benefits; get it wrong and everyone loses. Let me illustrate this with some recent incidents.

In most states in the US, companies are legally obliged to disclose any security breach that could affect their customer data. But when retail giant Target admitted it had suffered a breach – after being prompted into action by well-known security reporter Brian Krebs – the firm made a number of mistakes, not least being both too early and too late with its disclosure. Timing is never easy, but Target got it spectacularly wrong.

The attack against Target's stores – all 1700-plus of them – occurred between 27 November and 15 December 2013, and Krebs published a story about it on 18 December. One day later – only four days after the incident had been uncovered and the breach halted – Target issued a public confirmation that an attack had happened and was being investigated. So far, so good: this confirmation statement clearly outlined that a breach had occurred, that it had been resolved and that an investigation was underway. A quote from the CEO assured customers that they could continue to "shop with confidence" and expressed regret for any inconvenience. This is the kind of reputation control and damage mitigation that you'd expect from any business that fell victim to such a breach.

Then came the line: "Approximately 40 million credit- and debit-card accounts may have been impacted." This is where things went pear-shaped. Target had ignored the golden rule of disclosure: stick to the facts. The language used – "approximately" and "may have" – is the telltale sign. If you don't know the numbers, don't mention them. It's better to say "an unknown number of transactions have been compromised" until you're sure of the figure.

Things became worse the following day, 20 December, when Target set its PR department loose to try and mitigate any damage this by-now-hot story might be causing to its brand. Quotes from Target appeared saying that few reports of credit-card fraud had been received as a result of the breach, and that it would be offering 10% off in-store purchases as a gesture of goodwill.

However, on 10 January 2014, Target finally admitted that the transactional data of 70 million customers had been compromised, and that the stolen information included names, postal addresses, telephone numbers and emails, as well as debit-card and credit-card data. Target only started to notify customers by email about the breach in January, so almost an entire month had passed since the official admission and damage-mitigation statements were made. Target should have notified its customers as soon as the breach had been confirmed, which would have enabled them to contact their banks and check for any misuse of their cards.

I've already said that "too soon" is no better than "too late", and I'll admit that there's no template regarding the number of days to wait before disclosure. However, as soon as a company is sure that a breach has taken place and customer data has been accessed, those customers have a right to be made aware of this fact – as well as the potential risk they're being exposed to, and the recommended course of action to prevent loss. More cynical readers might suggest that a large retailer such as Target wouldn't want to undermine the busiest shopping week of the year, and that waiting until after Christmas may have maximised its profits. Of course, I have no way of knowing if this is what happened. What I do know, however, is that handling breach disclosure in this way isn't popular with the public.

On the one hand, part of me feels sorry for Target: those who argue that breach confirmation should have come when the attack was first noticed say the company went for disclosure too late; however, those who noted that the details within the disclosure weren't accurate say that it went too early. On the other hand, no company – especially one the size of Target – can be forgiven for failing to implement a workable and effective incident-response plan.

DAVEY WINDER
Award-winning journalist and small-business consultant specialising in privacy and security issues.

SCRAPING SNAPCHAT

Another recent case, involving the social network Snapchat, demonstrates a slightly different take on disclosure. This incident didn't involve financial data, but rather the exploitation of a vulnerability to enable automated "scraping" of otherwise freely available data. Unless you're a teenager, or a parent to one, the chances are that the Snapchat phenomenon hasn't appeared on your radar. Essentially, it's a photo-messaging application that pushes the notion of "brief attention span" to the max. Its users post images and videos to each other, and to groups of contacts, on a strictly time-limited basis; these messages self-destruct after ten seconds and are deleted from Snapchat's servers. Not surprisingly – so I'm told – this means a lot of rather "intimate" images are posted, and the service has become almost de rigueur for online flirting of the more explicit kind, particularly among adolescents.

So that's what Snapchat is used for, but where does it fit into my discussion of the rights and wrongs of breach disclosure? Well, while posted messages are deleted from the Snapchat servers after a few seconds, the user information – such as usernames and telephone numbers – isn't. The "breach" involved someone uploading the details of 4.6 million Snapchat users to an online database that was searchable by anyone who knew where to find it. It appears the group that published this database, which went by the name of SnapchatDB, was firing a warning shot across the bows of a company that doesn't take warnings of privacy vulnerabilities seriously enough for their liking. I can deduce this because all the telephone numbers in the database were missing their last two digits – a deliberate act of redaction by the posters – and the database was withdrawn entirely before long.

Gibson Security, an Australian IT security site that has been around for

> Target finally admitted that the data of 70 million customers had been compromised"

as long as I can recall, was the first to highlight the potential for automated scraping by third parties, namely a vulnerability within the Find Friends function of the Snapchat app. It did so in August, a good four months before the incident took place.

On Christmas Eve, Gibson Security posted details of how the vulnerability might be exploited. Snapchat responded in a blog post on 27 December, dismissing the threat as not possible. "Theoretically, if someone were able to upload a huge set of phone numbers, like every number in an area code, or every possible number in the US, they could create a database of the results and match usernames to phone numbers that way," the response read. "Over the past year, we've implemented various safeguards to make it more difficult to do. We recently added additional countermeasures and continue to make improvements to combat spam and abuse."

Within days, the SnapchatDB hackers stated that they'd employed a modified version of this published methodology. So, there are two parts to this disclosure problem: first, there was the initial response, which was very defensive and used the word "theoretical", a red rag to any bullish hackers. Second, when the "additional countermeasures" proved insufficient, the full disclosure statement posted on 2 January didn't put things right. I'd advise any client of mine to adopt a "we got that wrong, but now we're putting it right" approach.

Instead, Snapchat responded with a less-than-apologetic statement. "A security group first published a report about potential Find Friends abuse in August 2013," it read. "Shortly thereafter, we implemented practices like rate limiting aimed at addressing these concerns. On Christmas Eve, that same group publicly documented our API, making it easier for individuals to abuse our service and violate our Terms of Use."

This sounds like passing the buck to me, and to many IT security industry colleagues with whom I've discussed the wording. Rather than accepting that it had failed to prevent this privacy lapse, Snapchat chose to deflect the blame onto Gibson Security. The statement never used the words "sorry" or "apologise". Instead, there was news that a new version of the app would be released that will allow users to opt out of the vulnerable Find Friends feature, and that some "improved" rate-limiting measures and "other restrictions" were being added to address future abuse attempts.

This certainly isn't the way to do it. Sure, no financial data was exposed here, nor was it a major security breach. However, with a community such as this, whose members value privacy highly – why would they want to send self-destructing messages in the first place if they didn't? – anything that affects this privacy must not only be taken seriously, but, critically, must also be seen by the community to have been taken seriously.

Interestingly, the tone changed when a further posting was made a week later, on 9 January, announcing the Snapchat client app update. "Our team continues to make improvements to the Snapchat service to prevent future attempts to abuse our API," it stated. "We are sorry for any problems this issue may have caused you and we really appreciate your patience and support." This was cool, but far too late. Timing and honesty are key to successful disclosure: get either wrong and you're onto a loser.

The lesson to take away from this should be that getting it right is something your business will have to confront sooner rather than later. My advice is not to wait until an incident occurs, and then develop an ad-hoc response as the first hours and days pass, but instead to start revising your incident-response procedures now. No matter the size of your business, you need to have a plan in place to deal with a security breach. This needs to include the who, how, what and when of disclosure. Ensure that a named individual is responsible for organising and signing off the disclosure statement. Detail how that disclosure process should fit into the investigation and forensic side of incident response. Determine what information should be included in any disclosure statement and what should not. Finally, have a schedule for the release of your disclosure statement based on all of the above, and make sure it covers publication to regulatory bodies, stakeholders, law enforcement and customers alike.

HIDDEN DANGERS OF DISCLOSURE

It should come as no surprise that the bad guys have latched onto the fact that people are scared by data-breach-notification emails, and that such fear may lead them to perform whatever's being suggested by the breached company to protect passwords and other data.

For example, it didn't take the scammers long to start leveraging the Target breach by sending out fake disclosure notifications that purported to come from Target's security department. These emails attempted to trick the recipients into clicking on a link that eventually redirected them to an online survey offering a cash prize. Completing this survey then took them to others in an endless loop, with each iteration acquiring more personal data along the way in order to build a user profile for the criminals. The key, of course, is not to fall victim to any knee-jerk reaction – any recipient pausing to think for a moment would have noticed that it was sent from a Yahoo email address, which is a bit of a giveaway.

AND TALKING OF SCAMS...

If you use the trendy social-networking-meets-micro-blogging site Tumblr, then watch out for a scam that's been doing the rounds. The two scam methodologies that have caught out the most social network users are "discount voucher" and "cheat the system". The Tumblr scam is a fine example of the latter. In general, if it looks too good to be true it probably is, and caution should be exercised – particularly if younger users who may not be quite so discerning are involved.

We all love to tweak the software we use, and social networks never seem to work quite the way we'd like them to. But more often than not, when someone tells you they can add the missing functionality, it won't happen. There are exceptions, and my advice is to research any promised enhancement app before installing it. That way, you can avoid scams such as the one in which power users are offered the chance to post more than 250 items a day. The browser extensions will install a keylogger that harvests all your login data, and random screenshots of your desktop for good measure. ■

CISCO 2014

The 2014 Cisco Security Report is one of the more interesting snapshots of the threat landscape. It states that the overall number of reported vulnerabilities and threats has reached its highest level since it started tracking in 2000. The cumulative alert totals are up 14% from 2012. Cisco also reveals there's a global shortage of more than one million security professionals. The bad guys are simply outpacing and outspending the ability of IT security professionals to address their threats.

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've included tools and utilities to help you dust the cobwebs from your PC. Inevitably, over time, PCs do slow down as more and more apps are installed, and then uninstalled. A quick clean through the registry is usually in order, but the tools on this month's DVD do so much more, so get to it, then, and restore your machine to its full potential.

ABELSSOFT BACKUP 2014

CREATE A BACKUP
Select the files to backup, and a title for the backup jop. The most common file types are already available in a pre-selection.

AUTOMATION
You determine when an automatic backup should occur. Which can e.g. be a specific time interval or when Abelssoft Backup automatically detects when you connect a USB drive.

PASSWORD PROTECTION
You can prevent unauthorized access to your backups with a password.

EASY RESTORE
Restore easily your backups if you need it. Choose which version of your backed up files you want to restore and go for it. That's it.

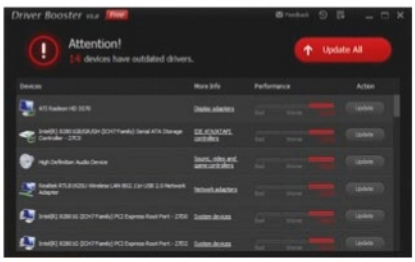
BACKUP ALL FILES
Abelssoft Backup can also backup locked files.

EMERGENCY BACKUP
Abelssoft Backup supports the 1:1 drive images backups ("Images". With these Images, you can restore your entire PC)

FAST
Abelssoft Backup has a high-speed solution for backups: With up to 90MB per seconds.

IObit Driver Booster PRO

Updating drivers is usually an initial step to avoid hardware failure and system instability. To update drivers regularly is also an effective way to enhance your overall PC performance. While this process could be risky and frustrating if done manually, Driver Booster PRO is introduced to download and update drivers for you automatically with just one click. Based on cloud library, Driver Booster PRO can always be the first to identify outdated drivers, and download and update driver at an unrivaled speed. With the backup feature, it is an easy, effective and risk free solution to keep your computer's drivers up-to-date.



WinOptimizer 2014

Like any other machine, computers require maintenance at regular intervals to ensure smooth operation. Relying on built-in facilities alone, though possible, is a daunting task that requires intricate knowledge as well as constant efforts to keep up to speed with technical developments.

Don't let background tasks take time away from you! Let Ashampoo WinOptimizer 10 handle system complexity while you focus on what computers were made for - to get your work done!

Xara Photo & Graphic Designer 7 Drivers

Xara Photo & Graphic Designer is the perfect software choice for all your photo and graphic design work, with powerful photo editing and enhancement features, and truly flexible illustration and design tools.

PUPPY LINUX

This time for sure! We're very sorry about the lack of Puppy Linux a couple of issues ago – we've had our DVD designer taken out back and firmly shot for his lack of attention to detail! Seriously, we're very sorry for any confusion caused.

But this month we've got that, and Linux Mint as well.

Linux is a free operating system, and Puppy Linux is a special build of Linux meant to make computing easy and fast.

Puppy Linux enables you to save money while doing more work, even allowing you to do magic by recovering data from destroyed PCs or by removing malware from Windows. See these example articles: recovering files from Windows and safe Internet banking with Puppy Linux.

With Puppy Linux, you can carry your programs and data anywhere.

Easy - Just use a CD or USB flash to boot a PC. Puppy Linux is downloadable as ISO, an image that can be burned to CD or DVD.

Fast - Because Puppy is small, it can live in your PC's memory and be ready to quickly execute your commands, whereas in other systems, programs are first read from drive storage before being executed.

Save Money - Even if your PC has no hard disk (ex, broken hard disk), you can still boot Puppy via CD or USB and continue working. Old PCs that no longer work with new systems will still work good-as-new with Puppy.

Do More - Puppy boots in less than a minute, even in old PCs, and it does not require antivirus software. Administering Puppy is quick and minimal. With Puppy, you just have to take care of your data, which you can easily save to USB flash (Then forget about your operating system!). Your data can be read by other computers.

Do Magic -Help your friends suffering from computer malware by booting Puppy and removing malware from their PC (use antivirus that is built-in or can be installed in Puppy). Example - bad Autorun.inf is easily removed by Puppy (Just delete it as well as its companion exe program). If your friend thinks that she has lost data from her corrupted hard disk, boot Puppy and try saving her data!

Carry Anywhere (Portable) - Because Puppy is able to live in CD/DVD or USB flash, as well as save data to these same devices, you can carry your programs and data with you.

PC & TECH AUTHORITY

DVD CONTENTS

No 198 / MAY 2014

WINDOWS: · Malwarebytes' A/M · VLC Media Player · Apple iTunes · CCleaner · CutePDF · Defraggler · DeepBurner · Foxit Reader · Sandboxie · Spybot S&D · WinRAR · WinZip · 7Zip **INTERNET** · AOL Instant Messenger · Vuze · Dropbox · Google Chrome · FileZilla · M/S Security Essentials · Mozilla Firefox · Mozilla Thunderbird · Skype · Steam · ZoneAlarm **TROUBLESHOOTING** · Serial Codes · Blank Registration Website · Can't find a file? · Installation Error **HELP:** Disclaimer · Damaged or faulty DVDs · Using this DVD · Installing software **EDITORIAL:** · Burning an ISO image · PC&TA Editorials **LINUX:** Puppy Linux · Linux Mint **FEATURES:** Abelssoft Backup 2014 · IObit Driver Booster PRO · WinOptimizer 2014 · Xara Photo & Graphic Designer 7 **DRIVERS:** ATI Catalyst · NVIDIA Forceware

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, Level 5, Building A, 207 Pacific Highway, St Leonards NSW 2065

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 HAS A FEEL FOR THESE THINGS.

FOLDER, I DUB THEE E:

I Can you map a network drive on... your own drive? What I'd like to do is bind a drive letter to a folder or other drive on my computer, so I can run a program that expects all its stuff to be on e:\programname from a folder called c:\programname, but to be able to actually do all this without changing any configuration stuff for the actual program? So yes, I'm looking for the easy way, but I think this would be a handy trick to help out with similar situations.

I ask this because I dumped my ancient Eudora e-mail program to this almost as ancient WinXP laptop so I can use it while my proper computer's being fixed, but now the program isn't in e:\Eudora any more so when I run it, it complains and it seems to work, but I'm worried I'm messing something up there or elsewhere. I suppose I could edit the setup files, but it strikes me that binding E: to C: somehow would be a useful thing to be able to do anyway. Is it possible?

Peppin

O Yes, using the good old SUBST command, which became part of MS-DOS getting on for thirty years ago now.

If you open a DOS prompt (just run "cmd" in the Start-menu box in Windows versions pre-8, or sacrifice a rabbit and then type "cmd" in the Start screen of Win8), and type...

subst e: c:\somedirectory

...then that folder on C will now be e: as far as the system is concerned.

You can't actually SUBST a drive letter to another drive letter, only to a folder *on* a drive. So if you want Eudora to think c:\eudora is e:\eudora, "subst e: c:" won't work. But if you move the Eudora folder into a subfolder, let's call it foo, then "subst e: c:\foo" *will* work.

You'll have to re-run the command every time you reboot, but that's probably the way you want it for a temporary setup like this. You can just put the command in a batch file in the Startup folder if you want it to be automated.

THINKING VERY HARD ABOUT NOTHING

I You recently had a letter from someone who wanted a way to tell what Chrome tab was using tons of CPU time, and you told them to press shift-Escape to get the Chrome Task Manager. I've got the same problem and can use the same technique to spot the pages that do it. Usually it's an eBay page.

My question is: what is it about eBay, and rarely some other random site, that does this? Few to no other people seem to have this problem. I want to fix it, not just have a fast way to tell exactly where it is and have to close a tab to make it go away. So what's the next step?

Pat Roane

O When a popular site does something weird in a popular Web browser for not-very-many people, if the culprit isn't malware of some sort, it's likely to be a browser extension (or "add-on").

Finding a badly-behaved extension is pretty easy. Just disable *all* extensions (in Chrome, you do this via Settings -> Extensions), and see if the problem persists. If it doesn't, re-enable your extensions one at a time and see which one brings the problem back. It'll almost always be one extension, not some confusing combination.

This technique identified Pat's problem quickly enough: It was the relatively unpopular "FVD Downloader", for downloading streaming video files. I don't know why FVD particularly freaks out on eBay pages, but switching from FVD to the more popular "Video Downloader Professional" cured it.

BEEPY KEYS

I Every time I press shift or alt or control there's a beep, and that key - they're called "modifier" keys, right? - is stuck on for the next letter. Like, if I want to write Dave I can press in sequence shift-d-a-v-e. I'm running Windows 7.

What the heck is going on?

D. Pfaff

There is no special hotkey combination which a cat cannot press. They will not tell you what they did.

O What you have, is "Sticky Keys" turned on.

In various recent Windows versions, a box to turn on Sticky Keys pops up if you press either Shift key five times. Five Shifts plus an Enter will turn it on, and this can happen by accident if a kid, cat or person in an altered mental state gets at your keyboard. You would be surprised, it can happen to any of us. Sticky Keys is really useful for people who for whatever reason cannot easily press two keys at once; for everybody else, it's a nuisance.

Sticky Keys and several of its relatives can be found in the keyboard section of the Control Panel "Ease of Access Center", which sounds like a government office where you can get on a three-year waiting list for a wheelchair. There is, for instance, "Mouse Keys", for controlling the pointer with the keyboard, and "Toggle Keys" (which you can activate by holding Num Lock down for a while) to beep when you press Caps-, Num- or Scroll-Lock. "Filter Keys" blocks accidental brief or repeated keystrokes; you can turn it on by holding down right-Shift. That's good for people with tremors, or trying to type while riding a horse.

(The Ease of Access Center contains numerous other disability-support sorts of features, best among which for practical-joke purposes is the screen-reading "Narrator".)

I/O OF THE MONTH

HOW BAD IS TEA FOR ELECTRONICS?

I'm not asking for myself, you understand. But if, hypothetically, someone had spilled a half-cup of tea (white, no sugar) into their laptop (ThinkPad X200) and then frantically pulled the battery and shook as much liquid out of the thing as they could, what are the odds the laptop will survive? Hypothetically.

Bakar Korgay

O There are three basic ways in which spilled liquids kill computers.

The first way is by physically interfering with moving parts. While there is liquid in a hard drive, that drive will not be happy. When the liquid dries up, whatever solids it leaves behind can also interfere by, for instance, clouding the lens in an optical drive, which is pretty easy to clean. Or by filling the fantastically tiny gap between a hard-drive's heads and its platters, which is conceivably somewhat fixable by washing with distilled water and then powering the drive back up only long enough to recover data from it, but I wouldn't make any bets.

Fortunately, hard drives are pretty close to completely sealed. They have a little breather hole with a fibre filter over it to allow the air pressure inside the drive to equalise with the outside pressure, but that vent is so tiny that it usually keeps even catastrophic spills from getting into the drive. If a drive isn't actually immersed in liquid, it'll probably stay dry inside.

(If your computer has an SSD instead of a moving-parts hard drive, of course, then even immersion probably won't kill the drive. I presume your little ThinkPad X200 also has no optical drive, so you don't have to worry about that either.)

The second way liquids kill computers is by corrosion. If a liquid is acidic and left on electronics for a while, it can damage circuit-board traces and some other components. Even clean water can cause corrosion if you leave it sitting there.

The third way is by conductivity. Many beverages are electrically conductive enough to completely screw up the functionality of any circuits they're sitting on. The goo left by an evaporated beverage may also be conductive enough to be a problem.

The worst liquid that commonly gets spilled on computers is non-diet cola. Cola is quite acidic (a pH of two-point-something), it's highly conductive, it foams into every tiny cranny, and it contains huge amounts of sugar - Coke's about ten per cent sugar by weight. So it leaves plenty of horrible

▼ Better rinse it out thoroughly

goo when the water evaporates.

The best liquid that commonly gets spilled on computers is plain tap water. Water is not acidic, it's only very slightly conductive, and it leaves no evaporation residue worth worrying about on anything short of a hard-drive platter. If you dry a water-splashed computer out smartly so corrosion can't get going, it'll probably be fine.

Tea with no milk or sugar in it is chemically pretty close to water. If that's what you... hypothetically... spilled, then your computer would have an excellent prognosis, provided you can get it apart and dry it out.

Tea with milk and sugar would be significantly worse (Earl Grey might be acidic enough to do some damage!), but still not nearly as awful as cola.

With milk and no sugar? I reckon you'll be OK, provided you can take the laptop apart, clean it carefully (rinse with deionised water if you want to be fancy), dry it out, and reassemble. Even if you've never done this before, taking a modern laptop apart (and then having it work when you put it back together...) is usually quite easy. Most manufacturers have downloadable service manuals, and all you need are the right screwdrivers.

I would definitely opt for doing this myself if you don't have a computer-repair person who can look at it right now. Leaving the wet laptop on the shelf for a day while someone gets around to fixing it is not a good idea.

The part of a laptop that retains spilled liquid best is the keyboard, but cleaning that is pretty easy. Just detach the keyboard module, run plenty of water over and through it, and leave it to dry out in the sun for quite a lot longer than you'd think it'd need. This is to make sure there's no water lurking in the little rubber domes or between the layers of the key-matrix sandwich.

(You can clean a PC keyboard by putting it in the top rack of a dishwasher, and it'll probably work afterwards. I don't recommend you try this with an expensive keyboard, however.)

In days of yore I once discovered an Amiga 3000 (I told you it was days of yore) that'd been sitting under a roof leak and had dirty water literally sloshing around inside the case.

I poured the water out, gave everything a wipe, pointed a halogen floodlight at it for a few hours, and it was fine.

How long can you last?

PAUL OCKENDEN FINDS OUT HOW TO MAKE HIS MOBILE LAST LONGER BETWEEN CHARGES, IN AN ATTEMPT TO ESCAPE FROM THE DAILY PHONE-CHARGING ROUTINE

Ask any smartphone owner to list three things they don't like about their phone, and chances are one will be its battery draining far too quickly. I spotted a joke on this very subject on Facebook the other day, along the lines of: "This morning, I put on a pair of trousers I'd last worn at a wedding back in 2001 and found a Nokia 3210 in the back pocket – it was still showing two bars of battery." Not exactly Edinburgh Fringe material, but it made me chuckle. Many people seem to be resigned to charging their smartphone every day, plugging it in overnight so it's ready with a full charge the following morning. Some will even get through their battery before the day is through, which can be a pain.

Of course, we'll never get back to that "last-all-week" stamina of pre-smart mobiles, but battery life has become quite miserable nowadays. I could once recommend BlackBerry phones, which often lasted for three or four days between charges, but in a failed attempt to ape Apple and Android, a recent BlackBerry is no better than the rest of the herd.

When choosing a new phone, there are a few things you should consider in an aim to get as much runtime as possible. The first, pretty obviously, is to pick the phone with the biggest battery. Most manufacturers seem to be in a race to produce the slimmest units possible – for example, each new iPhone is always a little slimmer than the previous one – but as the phone becomes slimmer, so does the battery inside. A few manufacturers have tried to buck this trend, such as Motorola with its various Maxx handsets, which eschew svelteness for stamina; for example, the recent Droid Maxx has a 3500mAh battery beneath its back cover. Unlike some of the earlier Maxx phones, the Droid Maxx isn't particularly porky at 8.5mm – thicker than the ever-popular Samsung Galaxy S4 (7.9mm). This ability to fit bigger batteries into more recent phones is also partly due to larger screens – as they become bigger, there's more space behind them for a battery. HTC's One max, which has a whopping 5.9in screen width, packs a 3300mAh battery.

Of course, there's a trade-off for having a bigger screen – more pixels require more battery juice to switch on and off, and the bigger GPU needed to keep those pixels updated also uses more power. A bigger screen will also need a bigger backlight, making it tricky for handset manufacturers to achieve the right balance.

> If there's a particular phone you're after but it doesn't have a huge battery, all is not lost

Using JuiceDefender, my Nexus 5 can easily last me for three days

If there's a particular phone you're after that doesn't have a huge battery, all is not yet lost. So long as that phone's battery is replaceable, there's always a chance that an enterprising manufacturer will have produced an extended replacement. Usually these will be physically larger than the original, so they'll ship with a replacement back cover for the phone housing a bulge to accommodate the extra bulk.

An alternative solution is to carry a rechargeable battery pack, so you can top up your phone if it gets low and you're nowhere near a charger. I've written about several of these in this column over the years, but a favourite remains the Innergie PocketCell, because it's relatively light, has a great form factor (like one of those disposable cigarette lighters), carries a healthy 3000mAh of charge, and can pump it out at up to 2.1A. When heading out of my house or office for more than a few hours, I always make sure I've packed a fully charged PocketCell.

WHEN THE CHIPS ARE DOWN

Your phone's CPU can also have a significant effect on how quickly it consumes a fully charged battery. Faster CPUs use more power, although that will be offset slightly by spending less time performing the tasks, but aside from its clock speed, the type of CPU is also important. Intel's smartphone chips will often beat the equivalent ARM-based units – especially in standby time, since these CPUs are particularly good at switching into low-power mode. As yet, we've seen only Medfield phones. The earlier Atom Z2460 devices weren't too great, but Z2480-driven phones such as Motorola's Razr i have been brilliant, and outperform ARM-based phones with similarly sized batteries. They usually achieve respectable results in benchmark tests, too. This 32nm Medfield fabrication technology is only the start; hopefully, we'll start to see 22nm Merrifield devices soon, and then perhaps 14nm Moorefield phones sometime next year.

Intel's phone CPUs are already frugal, but the move to 14nm fab ought to take things to a whole new level. The only thing to be aware of when choosing an Intel-powered handset (and we're talking only Android here) is that there's a very small number of apps that won't run on it. The best-known example is probably TomTom, which steadfastly refuses to run on anything other than an ARM-based Android smartphone.

While talking about Android phones, there's one other trick you could try that may give you a bit of extra runtime: a change to that other meaning of "runtime" – that is to say, the core of the operating system, which is its process VM. The original Android runtime system was called Dalvik, named after the Icelandic fishing village where the ancestors of Google's Danfuzz – more properly named Dan Bornstein – once lived. Dan led the team that created Dalvik and, being a hands-on kind of guy, also

PAUL OCKENDEN
Owner of one of the UK's oldest web agencies, Paul works on award-winning sites for many blue-chip clients.

contributed much of the code for the project. (If you have an hour to spare, I'd urge you to watch **www.youtube.com/watch?v=ptjedOZEXPM**, where Dan provides an insight into the code that lies at the heart of most current Android devices.)

However, Dalvik is getting a little long in the tooth so, for Android 4.4 KitKat, Google has provided an experimental alternative called ART (for Android RunTime). Dalvik is a just-in-time (JIT) runtime, which means that apps are converted into machine code afresh every time they run – albeit with some help from caching. By contrast, ART is an ahead-of-time (AOT) runtime, which means that the app code is precompiled when the software is first installed on a phone.

There are two main benefits to ART: first, the phone will feel much faster, and so will apps as a result; and second – and the reason for mentioning ART here – that since apps are executed as native code without compilation, CPU loading is reduced, so the phone's battery will last longer. I reckon that flipping a handset to use ART instead of Dalvik should typically give you around 20% extra time before it needs another charge.

Before you perform this trick, I must raise a few caveats. First, app installation will take a little longer, perhaps 30-50% more time, although unless you're a developer you probably won't even notice this. Second, and perhaps more seriously, there are a few apps that won't run properly on ART, although most popular software has by now been updated to cope with the new runtime, so it's only likely to affect fairly obscure apps (especially ones that have been abandoned by their developers). Finally, your phone will use more storage space when running ART, since the compiled app code takes up more room.

The Innergie PocketCell is one of my favourite travelling companions

If you're happy to accept these caveats and have a phone running KitKat (and I wouldn't advise this on anything earlier than 4.4.2), then how do you switch from Dalvik to ART? First, you'll need to enable Developer Mode on the device. Go to Settings | About Phone, which you'll find at the bottom of the list, and tap the build number several times. If you do this correctly, you'll see a message saying, "You are now a developer". Who knew a change of career could be so easy?

Now go back to the previous screen. Just above About Phone, you'll see a new menu entry called Developer Options. Tap into it and you'll see a lot of new settings, some of which can be a bit dangerous, so it's best not to poke around too much here unless you really know what you're doing. Partway down this page, you should see an entry that says Select Runtime: tap it and you'll be offered a choice between Dalvik and ART. Select ART and your phone will reboot automatically, because this switch makes a fairly fundamental change to the way the device works. As part of this reboot process, it will go through all of your apps, building the native machine code versions needed for the AOT runtime. This can take a few minutes, depending on how many apps you have installed. When it's finished, everything should be back to normal on your phone, except that it will probably feel more sprightly and – the primary reason for doing this – its battery should last a little longer.

There's no equivalent change available for the other mobile operating systems, such as iOS and Windows Phone. One thing you'll usually find across all platforms, however, is that each major OS update tends to decrease battery life (because they often introduce new features or pretty-but-battery-draining visual effects). Minor OS updates can sometimes have the opposite effect, since bug fixes and new optimisations to the code work together to decrease power wastage. This is one reason why discussions about how long any particular phone model lasts between charges are typically so fruitless, because not only does it depend on each individual's usage patterns, but it's also profoundly affected by the updates that have been applied to each handset over time.

Any type of handset can benefit from the tips shared here

SCREENING

Your usage pattern is a critical factor affecting the time between battery charges, no matter which mobile OS you're using. The biggest transient power drain on any handset is normally its CPU, but few tasks keep the processor fully loaded for any length of time. The second biggest power-hog is more problematic, and that's the screen. Keeping the screen lit for long periods is a surefire way to drain your battery more quickly – even more so if you've cranked up the brightness or left your phone set to auto-brightness (especially if you're

It may have been last updated in early 2012, but JuiceDefender works brilliantly

using it outdoors), because a brighter backlight obviously consumes more battery power.

More activity on the screen will consume the battery more quickly, since the GPU will be working harder – this is particularly true for fast-moving games, which exercise all of those special GPU geometry features that are left untouched in everyday phone use.

There's one exception to this rule, and that's watching videos. Most modern phones have chipsets with special circuitry designed to decode and display video highly efficiently without stressing the CPU or GPU particularly hard. So, if you see a phone review that says it lasts so many hours when watching movies, don't assume you'll achieve the same hours playing Modern Combat 4, because I can assure you that this won't be the case.

As a rule of thumb, the less you use the screen the longer your battery charge will last. Hardly rocket science, is it? There are a couple of things you can do to keep the screen turned off unless you're looking at it. First, set the screen time-out appropriately: there's no point in having the screen blazing away for five minutes after you've stopped using it. However, if you set it to time out too quickly, the screen will darken while you're reading a web page or looking at a photo. Everyone will have a different setting that suits them best, and the way they use their device, but chances are it will still be shorter than the default setting.

The second tip is to make use of your phone's notification LED. Many people will keep dabbing at their phone because they're expecting an important email, or to see if someone has replied to a social media conversation. There's usually no need to do this, because if you have notifications set up correctly on your handset, then that email and that social media reply will both cause the notification LED to blink. Depending on your phone, mobile OS and/or third-party apps that you have installed, email and social media conversations may even each cause the LED to blink in a different colour and/or at a different flash rate. Once you get into the habit of checking this LED, you'll find yourself waking up the screen far less frequently, and seeing a big improvement in battery life immediately.

IF YOU'RE APPY AND YOU KNOW IT...

There's one final thing you can do to improve your battery stamina, and that's to install a power-saving app. Frankly, I'd recommend this only if you have an Android phone; on iOS and Windows Phone, the opportunities for an app to increase battery life are somewhat limited. You'll find a lot of battery-saving apps in the Google Play store – some of them work well, and others not so much.

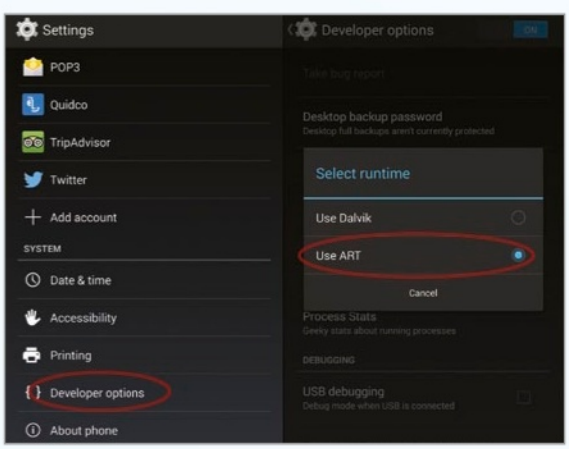
I've tried out quite a few, and one of my favourites is Smartactions. It's particularly easy to set up and use, but it was created by Motorola and so works only on that company's phones. In close second place, though, comes JuiceDefender. If you judge by its entry in the Google Play catalogue, you might think it's "abandonware", and dismiss it: the product was last updated in early 2012, and you'd expect it to be pretty broken by now given the number of major Android updates that have taken place since. But you'd be wrong to reject it, because JuiceDefender works – and it works well.

It is available in three versions: Free, Plus and Ultimate. Even the free version is worth a try, while Plus gives you a few more things to tweak and the Ultimate version provides a few more still, although it requires a rooted phone to access them.

In my case, I have it set up to disable Wi-Fi, except when I'm at home or my office (but I manually enable it at other times if I need to) and to throttle back connectivity when the battery gets low. I also deploy the option to sync background data only every 15 minutes rather than continuously, except when the screen is on, which means that I get full access to data. Oh, and the data is further scaled back at night (although, again, it would be re-enabled if I start to use the phone).

I could use other options, such as throttling back the phone's CPU speed when not in use, and taking automatic control of Bluetooth as well as Wi-Fi, but I haven't found a need to go that far yet. It's still very much worth throttling back your CPU and seeing how well it still runs your favourite apps, as well as doing the things you like, as many handsets work very well on a lower CPU setting.

Just by using the options described above, I find myself able to get about three days of use from a Nexus 5; without using JuiceDefender, I'd still have to charge it every day. I can't recommend it highly enough, although I suggest that you try the free version first just to make sure it works with your phone. ■



With recent Android versions, you can switch to ART runtime via the phone's developer settings

IOS BATTERY TWEAKS

Although battery-saving apps can't achieve much on Apple devices, you can make a few manual tweaks that help: turn on Reduce Motion in the Accessibility settings; turn off background app refresh; turn off automatic updates (you can then download updates via the App Store as and when needed); and within the Privacy settings, turn off Location Services, except for those few apps that really need to know where you are.

The Mac Pro arrives

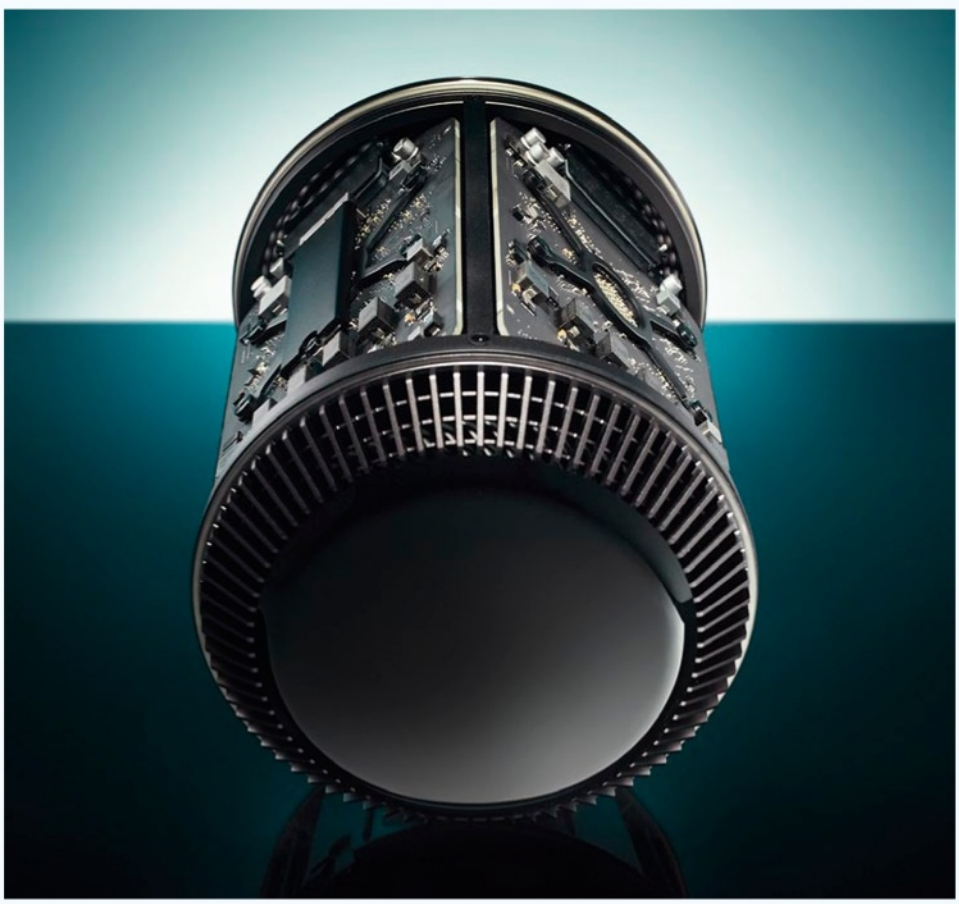
JON HONEYBALL IS DELIGHTED THAT THE NEW APPLE MAC PRO IS FINALLY HERE – AND WITH SIGNIFICANTLY IMPROVED CONNECTIVITY

It's here. The hardware combination I've been waiting for is finally sat on my desk. In fact, I'm using it now to write these words. What is it? The new Mac Pro.

Let's start with the Mac Pro. I'll make no bones about it – I like OS X. I also like Windows 8.1, which is shaping up nicely after the somewhat dreadful start of Windows 8. I really like Windows 7 64-bit, this being my corporate desktop of choice. Want to roll out 5000 desktop computers in a fully managed corporate environment? Windows 7 64-bit gets my vote every time. It's easy to control in a full Active Directory environment, along with Microsoft's excellent server-side management tools. But for my own personal use in the lab, I go with OS X.

The hardware is top-notch (with a top-shelf price tag, too) and the OS just works. I love being able to migrate all of my data and applications to a new machine within a few minutes, using the remote-transfer technologies that move all user settings, apps, licences – everything. Try doing that on a Windows desktop in a home/SoHo environment. I find OS X nicer to use than Windows 8.1, but I move back and forth between the two over the course of a day without much trouble.

However, it's the Big Macs that hold a special place in my heart. My previous Mac Pro was from 2007, a behemoth of a box with eight cores, 32GB of RAM, twin 30in monitors and four internal hard drives. A hugely productive device, it paid for itself many times over, despite its initial cost. It never glitched, spat out its dummy or fell over. What else could you ask of a workstation? Indeed, it's still working today, running as a Time Machine server alongside other roles. Two years ago, I moved up to an iMac 27in, stuffed to full "Honeyball spec" with an i7 processor, 16GB of RAM and an SSD. This box has also delivered great service by enabling me to start looking at Thunderbolt, first via a single Promise 12TB RAID array box and then a second (and a few more devices, too).



The Mac Pro is designed to be admired on a desktop, rather than hidden under a desk

The Mac Pro can run six Thunderbolt 2 interfaces simultaneously

For high-end media-production nutters, though, neither the iMac nor the old Mac Pro have come up to the mark in recent times. The old Mac Pro had no Thunderbolt support, while the iMac had limited expansion capabilities, despite being able to put things onto its Thunderbolt bus. A new Mac Pro was required, and when Apple unveiled it, the world gasped – a small, mirror-finished, cylindrical case containing massive computational power. Up to 64GB of RAM with six Thunderbolt 2 interfaces running at 20Gbits/sec. Two GPUs with shedloads of RAM. And PCI Express-speed solid-state storage of up to 1TB capacity, running at around 1GB/sec read-and-write speed.

My order was duly placed through the Apple Store. Clearly the base model wasn't going to be anywhere near big enough, not for a machine with an expected six-year lifespan of work ahead of it. The CPU choices

> The hardware combination I've been waiting for is finally here on my desk

came down to 3.5GHz six-core with 12MB of L3 cache, 3GHz eight-core with 25MB of L3 cache, or the 2.7GHz 12-core with 30MB of L3 cache. Normally, I'd have ticked the 12-core option automatically, but closer investigation showed that the 3GHz eight-core option was the best for me. I don't often max all the cores, so the Turbo Boost options on the eight-core version were going to be better for me than the absolute core count of the 12-way.

For RAM, the answer was easy enough: 64GB. This is a machine that's going to process lots of 4K and 5K video, and will also run VMware Fusion. You can't have too much RAM for these applications. For graphics, I could have stayed with the default Dual AMD FirePro D500 GPUs with 3GB of VRAM each, but I decided instead on the Dual AMD FirePro D700 GPUs with 6GB of VRAM each.

Now for a small digression. If you do as much flying as I do, you'll probably have your favourite airline and loyalty scheme. I choose to fly with British Airways (BA) and find it offers excellent service. I fly often enough to be a Gold member and am fortunate to travel Club or First. Now, I could have just gone to the Apple website, entered the configuration for my Mac Pro and pressed Buy, but instead I went to the BA website, logged in with my BA account number and went to its e-shopping pages. This directed me back to the Apple website now carrying over an ID token, where I made my purchase in exactly the same way. By taking this route, however, I'll receive two BA miles for every pound spent at the Apple Store, totalling a lovely 13,556 miles.

I paid using my American Express BA card, which awards 1.5 miles for each pound spent, so that was another 10,167 miles. Total mileage count comes to 23,723 miles – almost enough for a free upgrade from Premier Economy to Club on a round-trip flight from London to Los Angeles. That's for free, just by employing a different purchase route. When making such big purchases online, it's worth carefully considering how you'll pay for the item: there are many benefits to be had by choosing a slightly different route.

So, yesterday the Mac Pro arrived. It's tiny. It looks like something from *Star Trek*, and it's beautifully built. I quickly attached a spare 27in Thunderbolt monitor to it, connected it to the network and pressed the power button. This box is silent, even when working hard. It's designed to sit on your desktop and be admired, not hidden away at floor level. Setup was a simple affair as usual, and I quickly had Final Cut Pro X installed. I transferred over about 100GB of raw Red camera footage, shot at 5K, and imported it into the program. Watching the CPU meters showed all 16 CPUs going at maximum (16 because the eight physical CPUs all have Hyper-Threading, and so look like two cores each). After a few moments, the files had been imported into optimised H.264 format, and I then dragged and dropped the material onto the timeline and pressed play.

A standard-resolution Thunderbolt display barely stretches the Mac Pro's legs

This is a huge data and computational load, and yet the Mac Pro just gobbled it up and spat it out. This is down to a number of factors: the high-powered CPU performance; the raw speed of the internal storage and power of those GPUs; and a piece of software that's tightly optimised for this hardware. With any high-power solution, it's imperative that you have a properly tuned setup designed to make the best use of what's there, otherwise the performance will be merely adequate rather than exceptional. There's no point having high-power GPUs if you're using software that can't make use of them, which is why there's absolutely no point buying a Mac Pro if you want to spend all day in Excel, a web browser and a Twitter client.

That would simply be a grotesque waste of money and give you nothing you couldn't do on an iMac or any mainstream Ultrabook. Give it optimised software, however – whether that's in the field of video editing and processing, audio analysis or CAD/CAM engineering – which has been designed explicitly for the new platform, and the Mac Pro will pay for itself very quickly. I tried some picture-in-picture compositing at HD resolution, which is a task we have to carry out regularly for one particular client. This is the sort of workload that can make even a MacBook Pro struggle, but the new Mac Pro had no problems. I can see that each work set we get will be chopped in time quite dramatically.

Obviously, plugging in standard-resolution monitors – even very nice ones such as the 30in calibrated Eizo or the 27in Thunderbolt – isn't really stretching the legs of the Mac Pro. That's because it can support three 4K monitors simultaneously, or six Thunderbolt monitors. At CES in January, I saw some rather gorgeous 4K monitors from Samsung and LG that used their leading-edge technologies. I don't know what these are going to cost, but they're offering top-notch capabilities – including full hardware calibration – so I'm waiting for a few months, first for the wallet to recover and then for these new 2014 monitors to arrive. They'll definitely be worth looking at when they get here, and a pair of 4K monitors on the Mac Pro would be just the ticket.

THUNDERBOLT 2

One of the new features of the Mac Pro is Thunderbolt 2, the 20Gbits/sec interconnect that I discussed when it was first announced in April 2013. I wasn't expecting Thunderbolt 2 to be available so

JON HONEYBALL
Computer journalist and consultant specialising in both client/server and office automation applications.

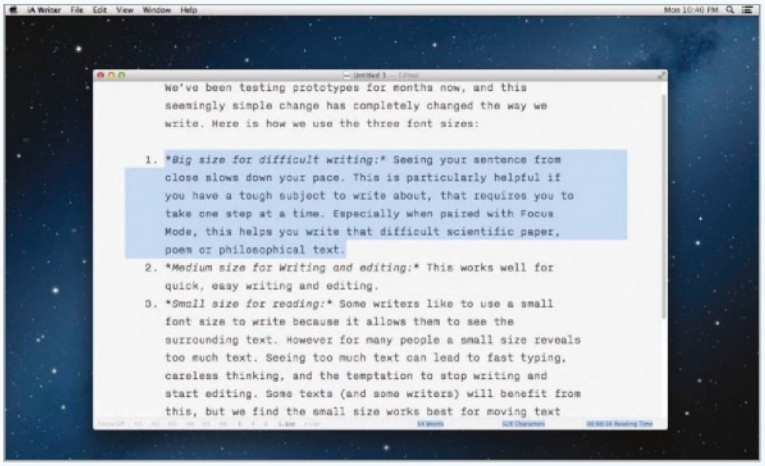
quickly, but it's backwards-compatible with Thunderbolt 1, which has doubtless helped. But the product that has remained most tantalisingly just around the corner has been Thunderbolt over fibre-optic cable. I thought we were almost there earlier in 2013, when Corning demonstrated its cabling and told me that it was almost ready to ship.

Where the intervening eight months disappeared isn't clear, but I can finally report that it does exist and that you really can buy it – I ordered one 10m cable just before Christmas through a friend in the US, and bought two more while in Las Vegas. The local Apple Stores don't stock it, but I had it delivered to my hotel from the online store. You can't yet order it in Europe, but this is being fixed. These cables are gorgeous: thin, flexible and they plug in just like any other Thunderbolt cable. With three 10m runs in my office, I've managed to move tens of terabytes of storage off my desktop and over to the far side of the lab. Finally, I have some desktop space back and the noise level is dramatically reduced. The cables aren't cheap, at more than $300 each – and there's now a 20m option at $619 and a 30m at $899.

I'll confess that I had a – shall we say – "robust" discussion with the Corning team at CES along the lines of: "Did you have any idea what a delivery date actually meant?" I received apologies and explanations about the process. Apparently Intel is requiring that all lengths are individually tested and certified, so you can't make a 20m cable and then assume that a 10m will therefore work fine. And, to be fair, we're moving up into a rarefied area when dealing with a 50m or 100m cable running at full Thunderbolt 2 speed of 20Gbits/sec. There are new chipsets at either end – in the Mac Pro itself and the Thunderbolt 2 peripherals that you're plugging into it – and the chipset and fibre transducers inside the Thunderbolt fibre plugs are also new, so there are plenty of opportunities for things to go wrong.

I complained that these cables were available through Apple in the US, but not in Europe and was told that this situation will change soon. However, there's now a second supplier available through **www.macsales.com** (Other World Computing, a highly respected Mac technology vendor), which appears to have the 30m cable in stock for immediate delivery.

▶ iA Writer Pro is my favourite writing program, and it's just been improved



The arrival of fibre-optic Thunderbolt 2 cables is an important part of the Mac Pro platform, enabling you to run extremely high-speed connectivity over long distances, and to do so without any fear of electrical/radio interference. For the pro user who has software that can benefit from the Mac Pro architecture, including the new Thunderbolt 2 fibre cables, it has indeed been a joyous New Year.

On the LaCie stand at CES, I spotted the tiny LaCie Little Big Disk Thunderbolt 2 drive. This is a small desktop drive that gives throughput speeds of 1,375MB/sec. Yes, well over a gigabyte of data per second sustained read/write speed. This ships very soon, and I can't wait. Have a look at **www.lacie.com/au/products/product.htm?id=10621**.

IA WRITER PRO

My favourite writing program has just been improved. iA Writer Pro (iAWP) is already a gorgeous writing tool for the iPad: clear, simple and does just what you need. It even adds a row of custom keys to the onscreen keyboard to make editing a snap. And with the desktop version, iAWP has really pushed the boat out.

The purpose of iAWP is to make it as simple as possible to write, edit and deliver copy, which is why it supports four main modes of operation. Starting in Note mode, you simply write down freeform ideas as they come to you, and assign them structure by using the various Heading templates. After Note comes Write mode, where you pour in all the main content, pulling together all the various themes and strands. Edit mode comes next, with features designed to help you modify the structure of your text and, finally, there's Read mode.

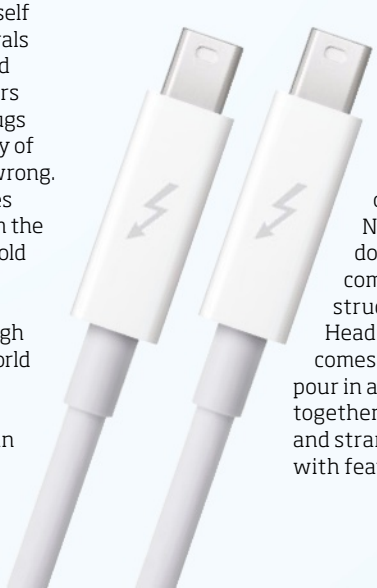
What's interesting, apart from its clean and clear UI, is the Syntax slider. In the default Off mode, you'll see everything. Choose Sentence mode and the current sentence is highlighted, and all other content greyed out. In Adjectives, Nouns, Adverbs, Verbs, Prepositions and Conjunctions modes, these components are highlighted, which is incredibly useful if you want to spot that you've used the word "incredibly" several times too closely together, which would look clunky to the reader. Or to spot that a sentence is much longer than you thought. And so forth. Overall, iA Writer Pro is excellent and I use it all the time.

PATENTLY WRONG

There has been some controversy about iA Writer Pro's Syntax mode, with the firm claiming that it was seeking to patent this feature. This was controversial, since the feature appears to be based on the functionality built into Apple's iOS itself. This story rumbled along for a few days, with iA promising that it wouldn't sue anyone who used the same functionality, but it all became rather messy for everyone involved. In the end, iA did the right thing by backing down. I understand how we can all be quite protective of our new features, and lose sight of the broader public view. What iA tried to do by monopolising this technology was wrong, but the company did put it right.

It doesn't change my view that iA is doing interesting work in this space – on tablets, desktops and laptops – and that it's definitely worth a look if, for example, you're a professional writer, or you want help working on an easy-to-read university thesis. ■

▼ The arrival of fibre-optic Thunderbolt 2 is an important part of the Mac Pro platform



Effective workplace policies

FIONA TEAKLE UNDERSTANDS THE VALUE A DISCIPLINED WORKFLOW STRUCTURE CAN BRING TO YOUR PRODUCTIVITY AND STRESS LEVELS

With the change in technology, one of the major transformations that has occurred is the way in which we work or run our business. No longer is there an expectation that you are in the office from 9-5 in order to be working. The way in which people want to work or work at their optimum level is changing.

There is no doubt that increased productivity is beneficial to your business, so how can you help to facilitate an increase in productivity? The EY Australian Productivity Pulse states that if we move or retrain workers so their skills are better aligned to their roles, create high performing and supportive team environments, streamline processes and cut red tape, and continue to work on staff engagement, productivity can and will increase. If these are the key to success then how can you begin to implement change?

The report also highlights the importance of communication. As we've become a more integrated society, we have also lost sight of the importance that communication has on the morale of an organisation. If employees are left to wonder, or worse spread rumours, not only are they less engaged and therefore less productive, but it may also interfere with how they interact with the customers. Sometimes you may be communicating something bad, but those are the most important times to communicate. Uncertainty and unknown can do more damage than good.

One of the changes that we are also seeing take effect is the change in workplaces. This allows the employees to find the best space for them to work in and then come together when required, with spaces allocated for specific things – a quiet area for high focus time, open meeting space to facilitate discussions and connection amongst employees and meeting rooms to facilitate video or teleconferencing, to name a few. However the other options in these environments are for the employees to not come into the office at all. They may work more effectively at a café with a good cup of coffee. This invokes a high level of trust in your employees. You are providing them with the freedom they need to work to the best of their ability while not actually enforcing a way to work that isn't necessarily the best way to achieve results.

> "...move or retrain workers so their skills are better aligned to their roles, create high performing and supportive team environments, streamline processes and cut red tape"

One of the major benefits for changing the way the employees can work is that the company reduces its overhead costs in property rental. You are then in a position where the spaces are developed for the different uses and are actually being used for the right reasons rather than people being at a desk when they would rather work elsewhere to get things done.

While changing the workplace may work for some companies it is important to note that this approach may not be suited for every company. If you are considering the move then you need to look at your company's direction and how you may incorporate this into the future strategy to allow for continued change over a period of time. Remember, you are dealing with humans, and the majority of people dislike change if it is forced on them before they are ready to accept it. If it is a good decision for the company, then you have the opportunity to take the employees on the journey with you and start with smaller steps, rather than completely renovating your office space!

While there are changes that an employer can make to help facilitate productivity increases, there are ways in which you work that may help ensure you are making the most of your day. As it has been recognised that most people are working harder and are committed, there may be a couple of things you can change to help get through some things quicker.

These may include:

- Only checking your email at certain times: allowing a specific half hour period during the day to focus on emails means you can focus on other tasks during the other times. This helps ensure you are working on the most important things first and not jumping around
- Write a list: record your activities for the day and prioritise them
- Learn to say No: while it may be hard for many, this allows you to be more realistic about what you can achieve and ensure you achieve what you need

With the changes occurring in the industry, the expectation is that we achieve more with the same amount of time; this is an ongoing trend that unfortunately does not seem to be going away. It highlights even more the need for a high level of professionalism to be shown by the employee, which can be safeguarded by hiring a member of the ACS. Members are bound by the code of conduct and ethics.

Providing flexibility and allowing employees to change the way they are expected to work doesn't mean that the workplace is dead; it means that people will choose where to work and also when, ensuring that they are in the right spot to work on what they require to meet your needs. Productivity is an ongoing issue that needs to have the right level of focus from the management to ensure that your team is working to its optimal level. ■

FIONA TEAKLE is Director of the ACS Young IT Board. You can contact her at fionateakle@acsmail.net.au

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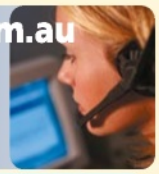

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Jon Honeyball isn't the new CEO of Microsoft, but he does have a few helpful ideas for him

So Microsoft has finally decided on who shall be its new boss. Despite all the rumours, the manoeuvring and leaked stories about who "might be interesting" and others who were "tipped for the top", the final choice was entirely predictable and utterly boring.

Or at least, boring at first glance. A 22-year veteran of Microsoft, Satya Nadella, is the safe choice. It's the choice that Wall Street will like. It's safe because he knows how Microsoft thinks and delivers things. It's safe because he has done very good work there, especially in his current role as executive vice president of Microsoft's Cloud and Enterprise group, work that was just good enough to get him the top spot, but not good enough to threaten any of the previous high-flyers.

His first video, put together by the Microsoft Thought Police and launched on YouTube, showed a thoughtful, intelligent chap who is clearly versed in all the modern corporate speak that you'd expect. Lots of unctuous words about working with customers, reaching out to their needs, engaging with developers – and all those other lovely slippery slogans.

Some commentators have leapt on a few phrases and spun out entire new corporate plans from them – for example, did his comments mean that Microsoft will launch a version of Office for Android and iOS soon? Is this part of the new openness and customer focus he was talking about?

Maybe it will be, but I have a horrible feeling that this will be a party where the girl in the fancy frock arrives fashionably late to her own party, only to find that everyone's gone somewhere else. As time moves on, I find that the lingering desire I might have had for Office continues to shrivel. I've done week-long business trips using an iPad and haven't needed a native Office app. The built-in tools, and the ones available from Apple and other third parties, do a good enough job. If I need "real" Excel or Word, I can launch myself into the Office 365 online tools and work there.

The problem with demanding Office for iOS or Android today is that we might get it. And it would be a weak, quarter-baked parody of the real thing. It almost certainly wouldn't screw up your complex files, but it would fail to deliver any sort of significant functionality. After all, if I can't have this now on Windows Phone, then what hope is there for an iOS application? Just remember, the Windows Phone version of Office is a pleasant but pale shadow of the full Windows.

Microsoft has so far decided to refrain from launching anything significant for iOS or Android as part of a bullying role taken by both the Windows and Office teams, each protecting their own interests. I understand this position, and it would have worked a dozen years ago. Today, it's just tired, transparently obvious and boring. The world has shrugged its shoulders, moved on, and continues to buy Android and iOS tablets by the plane load.

So, maybe the new CEO can galvanise Microsoft and shake it out of its corporate torpor. Maybe he can bring some clarity to the enormous sprawling mess, not only on the product front, but in the company's internal management structure, too. There's probably an EMEA Management Team for one-legged wombats somewhere in the European structure – it wouldn't surprise me.

Maybe he can do this while ingesting the huge structure that is Nokia. Maybe he can come up with a compelling story as to why, as it has been widely rumoured, Nokia has launched a phone based on Android. Maybe he can connect with the developers and ensure that Scott Guthrie – now in Nadella's old role as head of the Cloud and Enterprise group – is given the authority to bang heads together in the developer-tools division and come to market with coherent tools that look like they have a meaningful future. Maybe, given his cloud background, he can really push the Dynamics packages into the small-business space, and capitalise on the obvious cloud-based benefits for those customers.

"The world has shrugged its shoulders, moved on, and continues to buy Android and iOS tablets by the plane load"

Maybe he can re-engage with the customer base, by doing something really radical and brave – that is, making Windows for home users free, both for home upgraders and for OEMs. The resultant price cut in Windows laptops might be enough to inject some life back into that market that is rapidly, and entirely predictably, turning into a rotting corpse.

Maybe he can do all of those things. I really hope he can – but I'm not holding my breath.

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