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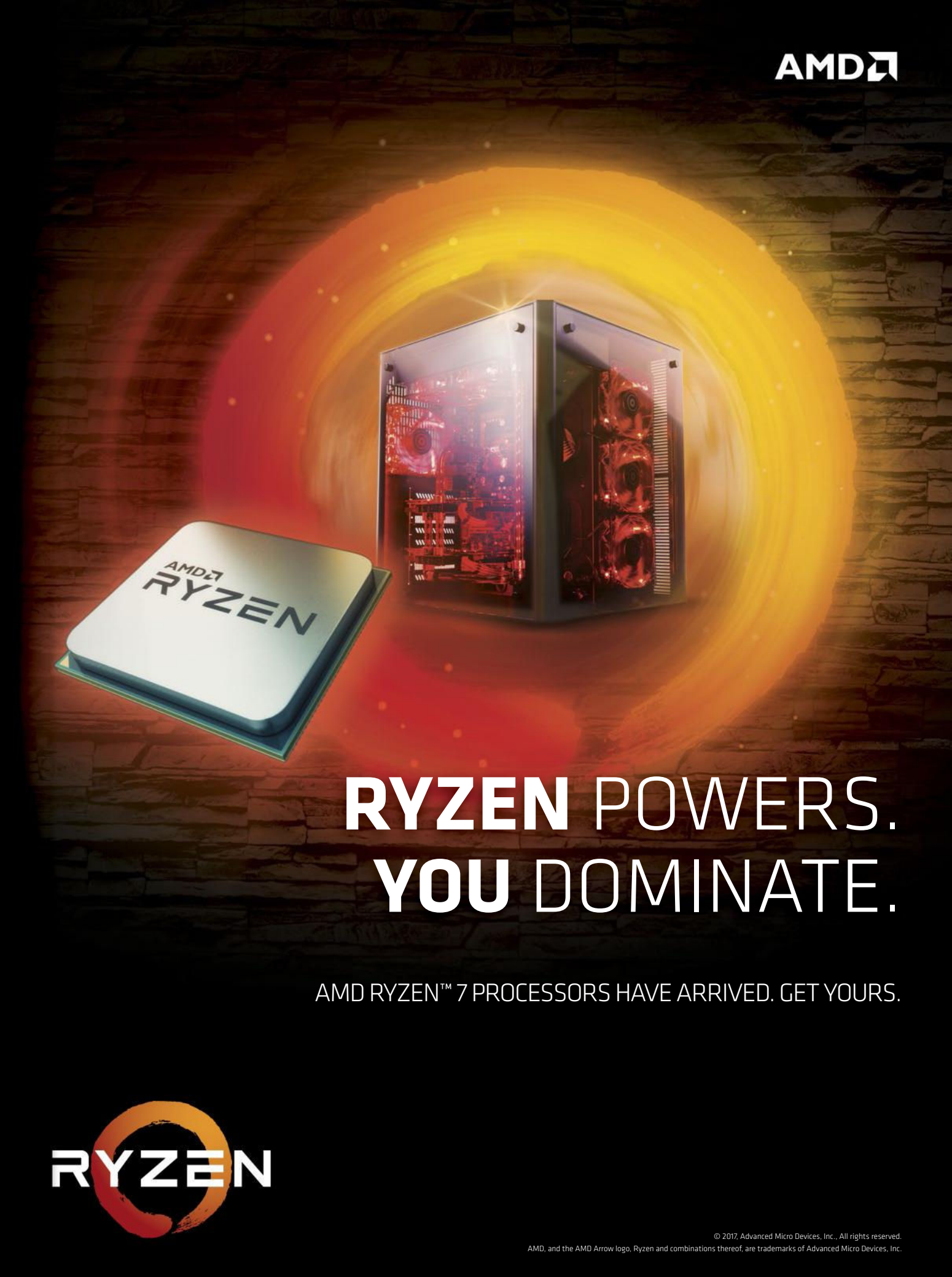

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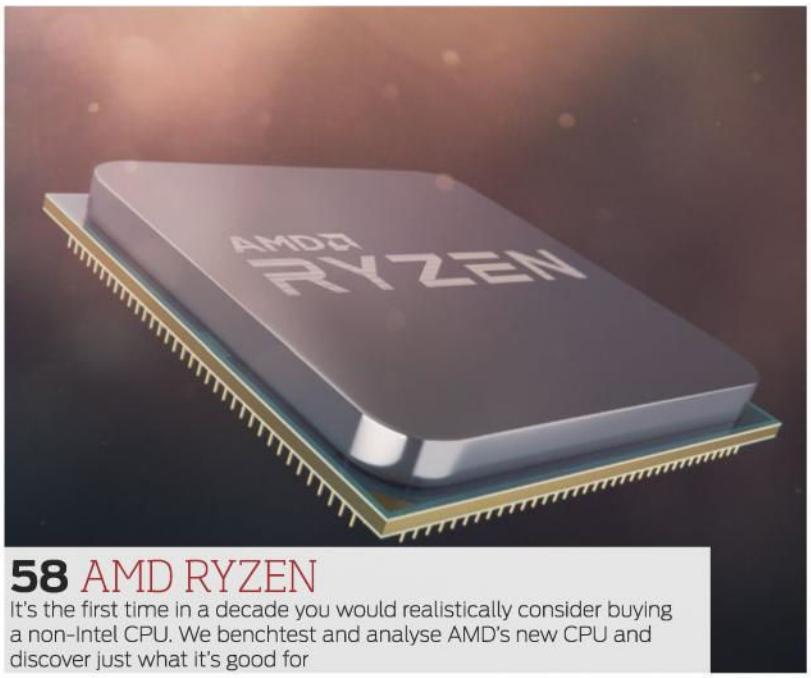

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THE GAMER BRAND

It's Fiat's Ferrari

I know many of you aren't 'gamers', just as I know many of you are. Most of you do like to play games, while, again, most of you also regard yourselves as purely into PCs – whether as a hobby or as a profession. This, I know thanks to our most recent reader survey from last year (so thanks to the great many of you that took the time do help us with that).

But those who don't identify as a 'gamer' must surely wonder at the number of gamer products that appear in PC & Tech Authority. The fact of it is that the gamer monker has so utterly and completely taken over PC gear that it's attached to pretty much all the good stuff – whether the gear is intended exclusively for gamers or not. So it's not us choosing to mostly review gamer gear, it's that so much gear is marketed and sold because companies see gamers as the most demanding tier of users, so if it's good enough for a gamer, they think it's great for everybody.

And that's sort of true, but it certainly does alienate some. But here's the truth: look at motherboards as a top example. The very best ones, with the most features, the nicest audio DAC, the most connectivity options are almost invariably branded 'Gaming' or somesuch. When, in fact, gamers tend to go for lower spec motherboards because they do the gaming job just as well, but cost less which means more money to put into components that actually matter for gaming in their PC, like graphics cards or a bit more memory.

The same is just as true for mice and keyboards – mice especially. All the really nice mice are marketed or branded as being for gamers – when there's nothing gamey whatsoever about the hardware itself. Yes, there are proper MOBA mice with a couple of dozen buttons on the side – which is one of the few examples when a 'gaming' product is properly identified.

But all the things gamers want in a mouse also happen to be the things that everybody else treasures. Being great ergonimics, high quality buttons and switches that don't wear out in a hurry, good looks (austere is the new fashion and thank the design gods for that) and beatifully slippery gliding across the mouse pad (also being a thing that is under the spell of 'gamer' branding, and you should always buy 'gaming' mouse pads because they're incredible!). It's the software that none of us need install that turns these lovely mice into true gaming animals, allowing complex macros and the obligatory personalisation options for the millions of strobing colurs on tap.

Keyboards, yes, again. All the good stuff will boast gaming prowess, but are equally wonderful to use blatting out a Word doc.

So, take any word with gaming connotations you see in a product name as a really good thing. It probably represents gear that's best of breed, beautifully designed and a pleasure to use.

Ben Mansill
Editor
bmansill@nextmedia.com.au

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FONTIFICATION

Jon Honeyball's article, March 2017, about missing fonts doesn't mention the answer to this problem. I was receiving files from a Word user and as I was using LibreOffice Write, it showed I had a problem as the files were songs with the chords in the line above the words. Unless the same letter spacing is used, things won't line up.

Fortunately there is a free answer, Google's fonts, in this case Carlito = Calibri and Caladea = Cambria. They are identical in size and shape and can be downloaded from:
https://fontlibrary.org/en/font/carlito
and
https://fontlibrary.org/en/font/caladea

After installing, if using LibreOffice Write:
Open Tools > Options > Fonts >
Tick "Apply replacement table"
Find in to the box under Replacement Table: Font: Calibri – Replace with: Carlito. Click on the Tick to the right and then click the box "Always". Do the same for Cambria and Caladea.

When you get a document in say, Calibri, it will show in the font box as Calibri but actually be running/showing Carlito. The same with Cambria and Caladea.

Alex Ferguson

Ben Mansill replies: *Top tip – thanks Alex!*

PORT VERSIONS

I realise you can't put everything in to a table but would it be possible in future to include the HDMI and Displayport version? I ask because not all 4K HDMI ports are created equal, with version 1.4 supporting 2160p at 24/30 frames per second and version 2.0 supporting 50/60 frames per second plus HDR. Similarly, Displayport version 1.4 adds support for HDR10 which version 1.3 does not have. When connecting a graphic card to a latest generation TV/monitors the frame-rate and bit depth become very important to match so it would be helpful the version was included in your reviews.

Tony

Ben Mansill replies: *Good idea Tony, and sorry for not doing this before. We shall start doing this!*

WHICH NBN?

Hi James, I read your article the other day in PC & Tech Authority. I am curious if you have heard of other people having the issues that we are having. I am curious because it never gets mentioned in the media and there is very little on the internet when you search for it.

NBN FTTN that was installed in our locality and went live 12-13 months ago. We have been told by NBN emails that rather than being serviced by a normal node we will be serviced by a CSD or "Compact Sealed DSlam". I have also heard it referred as a micro node. After our persistence/pestering, all NBNCo have done is correct their website so it shows that we don't have NBN available. I believe our area is now classed as "more infrastructure required". Although we don't have NBN our lines are now owned NBN.

We logged a technical problem with Telstra for continual poor internet speeds and the technician stated that he couldn't touch it because the lines were now NBN's. The problem was escalated and NBN tech's came out but still couldn't fix our problem. What really worries me is the NBN tech's didn't know what a Compact Sealed DSlam or Micro Node was.

Mike Barron

DEFAULT APPS

Read with interest the article on Software Licensing and Forced Upgrades. Have had numerous similar incidents (with Coral, Adobe, Nuance, etc.). The most annoying upgrade mistake I (and thousands/millions of others?) made, though, was the one to Windows 10.

Most annoying was that Windows 10 immediately set my default PDF and media files to Microsoft programs that are unattractive and woeful.

For years I've been using a combination of Adobe PDF Standard, Adobe Reader and Nuance PDF Prof for making and viewing PDF files of my documents. The Adobe Reader (early version) had the advantage of, in Window File Explorer, having thumbnails of the front page of each PDF file and one could scroll through the thumbnails of all pages in the preview panel. That made sorting and selecting the requisite file a quick and easy process. The other two PDF programs have editing features (batch processing, media inserting, etc.) that I find useful.

Windows Edge just displays a useless 'e' icon, and then, to actually work with and edit a file in a preferred program, one has to right click "open with..." to select the program each time.

Like hundreds of other users, I have tried Microsoft 'fixes' to set defaults (per directions posted on their forum and in Windows 10 help 'chat'), and even tried a suggested adjustment to the Windows Registry... to no avail. Within minutes, or at best a few days, Windows 10 automatically hijacks and resets defaults to their own useless programs.

Larry Wheat

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

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TECH NEWS

The latest trends and products in the world of technology

WINDOWS 10 CLOUD TO TAKE ON CHROMEBOOKS

Microsoft is preparing a slimmed-down operating system, but doubts remain over app compatibility

▲Analysts say that Windows must respond to the rise of Chromebooks

Microsoft looks set to release a fresh flavour of Windows aimed at low-cost machines in the shape of Windows 10 Cloud, providing direct competition for Google's Chromebooks.

The upcoming version of the operating system has yet to be confirmed by Microsoft, but screenshots have leaked online and reports from Microsoft watchers suggest that the rumoured variant could appear later this year.

The operating system is something of an echo of Windows RT, and will again only allow consumers to install Universal apps available from the Windows Store. However, there are some key differences between Windows 10 Cloud and its ill-fated predecessor, which was effectively discontinued with the launch of Windows 10.

"Where Windows RT was ARM only, Windows 10 Cloud will run on both Intel and ARM platforms," said Microsoft specialist Paul Thurott, who has gained access to early builds of the operating system. "It is a mainstream Windows product edition," he wrote on thurrott.com.

The other difference between the failed RT project and Windows Cloud is that users will likely be able to upgrade to a full edition of Windows if they later choose.

"Where Windows RT was a one-way, dead-end street because of its incompatibility with desktop (Win32/.NET) applications, Windows 10 Cloud isn't because it can be upgraded to Pro, and given that capability," Thurrott claims.

APP LIMITATIONS

However, while there may be a market for stripped-down, cloud-centric machines in schools, not everyone is convinced that there's a huge consumer appetite for such machines outside the classroom.

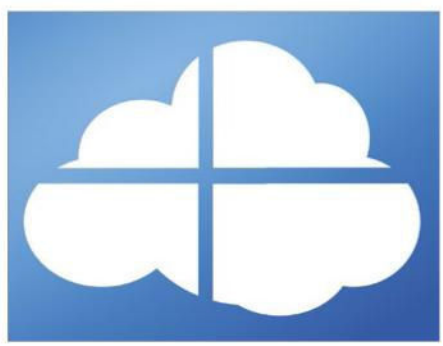
Windows 10 Cloud devices aren't expected to run x86 apps, which was one reason why Windows RT failed to ignite. Stores reported high return rates of Windows RT devices when consumers found they couldn't install regular desktop apps. It's possible that developers will be able to use the Desktop Bridge platform to make

> **"If it cannot run the apps that people want to use, and if developers do not write apps for it, then it will fails"**

desktop apps work, but that's not possible with the build that's currently being put through its paces in early testing.

"If, like Windows RT, it cannot run the applications that people want to use, and if developers do not write applications for it, then it will fail," Michael Cherry, a senior analyst with Directions on Microsoft, predicted.

"It is not just about the education market. When the trade-off for lower price is about restrictions on software that the device will run (and that the user has become committed to), the device generally fails. It has to run software people want, and attract developers to increase the library of software over time."



Nevertheless, other analysts are more upbeat, noting that Windows must address the rise of Chromebooks in the classroom, which, from Microsoft's point of view, could mean students continuing with Chrome into adulthood. For school administrators, for example, users being restricted to approved apps has significant benefits.

"For Microsoft, the market's growing comfort with the Chrome OS philosophy has been a concern and a response is warranted," said Raghu Gopal, an analyst with research firm CCS Insight. "Microsoft needs to react before the Chromebook creep becomes a torrent.

"As Google prods Chrome OS into Windows territory with offline applications, we expect Microsoft to acknowledge the growing success of virtual platforms with its response," Gopal added. "A lighter version of Windows, which would only run Universal Windows Platform apps, would mean a safer PC environment – a compelling thought for educators, consumers and enterprises."

At the time of publication, Microsoft was still remaining tight-lipped on a release date for the Windows 10 Cloud – and, in fact, its existence altogether – but market watchers speculate that it could be made available even as early as April, alongside the Windows 10 Creators Update.

Microsoft declined to comment when we asked for details. ●

◀Microsoft is remaining tight-lipped about even the existence of Windows 10 Cloudof Chromebooks

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AUSSIE AMBOS FIRST TO USE VR TRAINING

A revolution in critical training, by Bennett Ring

Proving that Virtual Reality can be used for more than merely immersing gamers in intensely interactive shooting galleries, the Victorian State Government recently announced that Ambulance Victoria will use VR to train all of its paramedics to respond to violent situations. With over 5000 emergency responses in 2015/16 that involved some form of violence or aggression – an average of 13 per day in Victoria alone – the new training programme aims to arm paramedics with the tools and experience to lessen the chances these call-outs will degrade into violent episodes. It's the first time an Australian government organisation has utilised VR outside of the defence force to deliver training that takes advantage of the increased immersion that the technology has, allowing for far more effective, realistic training.

▼There's nothing wrong with having fun while you're learning!

Developed in conjunction with PRO-COM Consulting, a company of law enforcement officials who specialise in hostage and crisis negotiation, critical incident management, special operations, and close personal protection, the Government's new Ambulance Action Plan uses 360-degree Virtual Reality video re-enactments.

> "paramedics are overwhelmingly receptive to the technology"

According to Ambulance Victoria's CEO Tony Walker, the training aims to be more than, "...just another PowerPoint presentation... offering the opportunity to immerse those being trained in the safety of the classroom".

Each class takes just a day, and covers two filmed situations where paramedics must keep their eyes peeled for potential threats, from blatant signs such as a large knife in one of the simulated environments, to subtler signs such as body language that could indicate potentially violent behaviour. Each scenario was filmed using Samsung 360 degree cameras from the perspective of a third paramedic, with the cameras positioned between the driver and observer.

The films are then viewed using Samsung Gear Head Mounted Displays and when compared to standard class-room based training the results have been incredibly positive. Mr Walker explains that, "The feedback to date has been amazing, with paramedics overwhelmingly receptive to the technology and training delivery."

At a cost of just $900,000 to implement the VR-based training, the platform was developed over a period of just four months, and it appears to be money and time well spent. According to the Minister for Ambulance services, Jill Hennessy, "We're putting the safety of paramedics first with trail-blazing virtual reality training that gives them (paramedics) the skills they need to calmly and effectively mitigate violence on the job". In addition to this training, another $500,000 will be spent trialling high-tech, body-mounted cameras worn by paramedics in high-risk scenarios. The entire Victorian paramedic force will take part in the training over a three-month period, and this part of the training takes just a single day.

Given the impressive results of the VR training compared to traditional class-room based approaches, we can assume that other government agencies will start to investigate the use of VR in their training programmes. Mr Walker shared that Abulance Victoria had, "... interest from other agencies in Australia and overseas" and that, "The scope for utilising VR in Ambulance Australia is limited only by our imagination.

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COOL INNOVATION

GAMING NEWS

Just for the fun of it

INTERVIEW: FRANK SOQUI, ANTEL'S GENERAL MANAGER OF VIRTUAL REALITY

Intel is doubling down on VR. We talk about games, the lack of AAA content, and how the technology can change... everything.

Everyone's bullish about virtual reality. Developers are continuing to develop new titles, and are starting to design games that take advantage of the unique opportunities of the medium. The makers of the HMDs themselves are starting to see sales increase, and with that increased market, we're seeing the first round of price drops, with Oculus now cutting about a hundred dollars from the Rift's starting price.

And, at the Intel Extreme Masters in Katowice, Intel is pushing the technology hard – after all, you need high end PC hardware to make the most of VR, so anything which drives CPU sales is definitely a good thing.

The one sticking point, though, remains the lack of truly killer titles and applications. Even Intel's own Frank Soqui, the General Manager of the company's VR division, admits that we're still waiting for the content that's really going to make VR sing. "We need those triple AAA titles," he told me. "The games that will drive VR take up." Essentially, VR needs its Crysis moment, when a game is so good that people will invest not for the novelty of the hardware, but for what can be done on it.

Which kind of begs the question – is VR actually... ready? Is it, as many vendors continue to promise, actually here to stay?

"Well, for me 'here' has a specific meaning," Soqui says when I ask him, after pointing out that it is a kind of nebulous thing right now. "But I look at the level of industry investment; I'm looking at the hardware capabilities that are there. I'm looking at the cross-sector investments that are being made, not just in gaming, but they're getting made commercially, in the enterprise. I look at price points coming down, at the quality of the experience – I think that's here. What's not here, is the compelling content. "

We're really, really close, though. At Intel's hardware demo area at IEM, VR featured heavily alongside high-end gaming PCs pushing out 4K gaming content, and sleek laptops with all the power of a desktop themselves.

> **"VR needs its Crysis moment to show what can be done on it"**

"For me," Soqui went on, talking about the game that was his 'ah ha!' moment, "it was playing a game where my avatar was a woman, and I looked down, and... Wow! I'm in someone else's body!"

"I've talked to film makers about this," he says, warming up to the topic, "about empathy. How does it feel to be in someone else's shoes?" The second impressive use of VR was in eSports broadcasting. Watching a stream of a game online is nothing new, but what Intel's aiming for is letting viewers get inside these matches – virtually. There's something very compelling about the chance to be virtually present in the arena for a big eSports match, and even more compelling about then being able to actually get inside the game, to watch it from any angle. In fact, finding new ways to present eSports to wider, more diverse crowds is one of Intel's big challenges in growing competitive gaming. Another challenge that's facing VR at the moment is the hardware-based silo mentality that tends to be the norm when it comes to technology and software development. Games that are only on one platform, for instance. Developer Ubisoft has already promised that all its VR titles will be hardware agnostic – they'll run on PSVR, Rift, and Vive. But more needs to be done keep VR open.

"I wouldn't say we're pushing for open standards, but we're certainly trying to influence people about the value of interoperability. It serves both consumer and business interests to have more content on more platforms. There's often a tension between business interests, as well as providing the best experience possible, as well as open standards - a lot of times those conflict with each other until the market matures."

"I know that if I lock something down, I can create the best experience. But is that what the end user wants? Yeah, they want to the best experience, but they expect interoperability."

"You just can't lock people into one platform," Soqui adds.

David Hollingworth

We also tried a Star Trek bridge simulator

A gamer tries VR at Intel's Extreme Masters event

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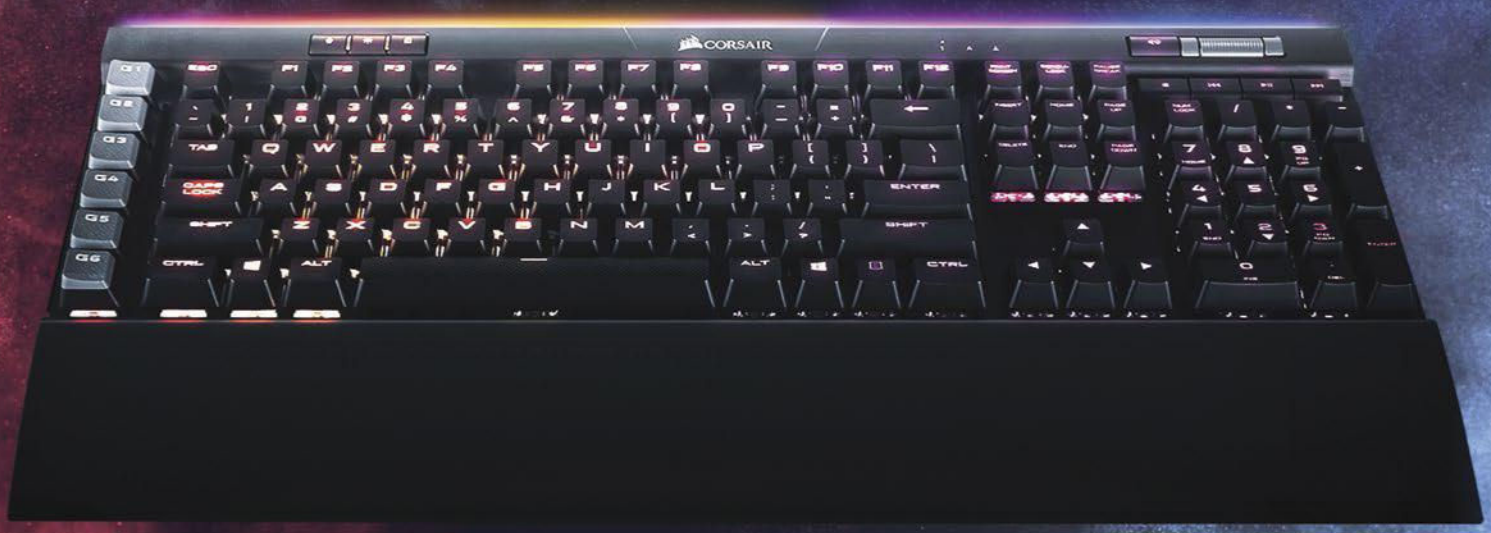

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CHIP NEWS

It's AMD's moment to shine, but just as it took to centre stage it had a few little stumbles before putting on a glowing performance then announcing its smaller siblings. **Mark Williams** reports on a busy month for AMD

CPU

RYZEN 5 LINE-UP ANNOUNCED

With AMD's Ryzen 7 out on the market demolishing price/performance metrics, AMD is continuing the Ryzen rollout with the announcement of its Ryzen 5 line-up of CPUs. Curiously the Ryzen 5 range is split into two parts, hex cores and quad cores. Here's the model list with specs and expected Australian pricing:

- 1600X - 6C/12T, 3.6-4.0GHz, 95W, $359
- 1600 - 6C/12T, 3.2-3.6GHz, 65W, $319
- 1500X - 4C/8T, 3.5-3.7GHz, 65W, $275
- 1400 - 4C/8T, 3.2-3.4GHz, 65W, $245

AMD's pricing places the 1600X up against Intel's i5 7600K which sells in a similar price bracket and is Intel's only mid-range overclockers part. With the 7600K being just a quad core without hyperthreading, the 1600X is by far the better deal with an amazing three times the hardware thread count.

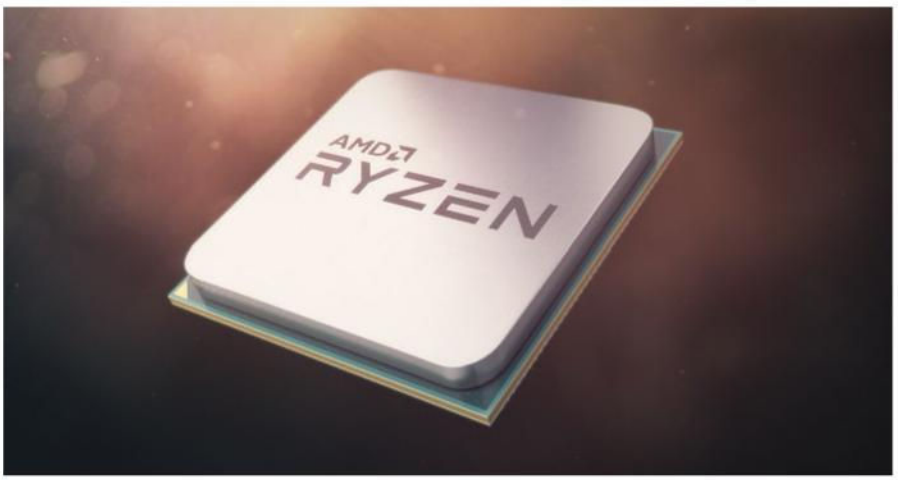
AMD's first quad core part based on the Zen microarchitecture, the 1500X is compelling as well. Although it's not clocked up into the 4GHz range like all of Intel's 7000 series K products, the price places it against Intel's i3 7350K, a dual core hyper threaded part meaning the 1500X (and 1400) are offering a doubling of hardware core and thread counts at the same price. The only downside being the MHz differential and lack of an iGPU.

For those that only game, Kaby Lake is probably still your best choice of CPU currently due to the megahertz speed advantage. However, if you do any productivity work Ryzen suddenly becomes a choice that's hard to resist.

BUGGY MCBUGFACE

Ryzen hasn't had the smoothest of launches. Having a completely new from the ground up architecture and system design, there was always a chance of some issues showing up in such a complex design. A few problems have indeed popped up since Ryzen has been on sale, each are minor or edge case issues but it's still interesting and important to know for early adopters.

The first issue raised its head with early reviewers who received instructions from AMD with their review equipment to make sure Windows High Precision Event Timer (HPET) was enabled when



using AMD's Ryzen Master overclocking application. Naturally some decided to try overclocking with HPET turned off, because when someone tells you not to do something, you naturally get curious about why. Having HPET being enabled was simply so the Ryzen Master software could report sensor readings accurately, some found that if the system had HPET off and the system went to sleep,

> "A few problems have indeed popped up since Ryzen has been on sale"

then woke up again later, benchmarks were suddenly appearing to report a greater than 12% increase in scores. This sequence of events turned out to be a bug that caused the system timer to run slow, and so anything that relies on timing like benchmarks to incorrectly measure time thus reporting artificially inflated scores.

The next issue was quite serious but has thankfully already been dealt with by AMD. It was to do with executing 128-bit FMA3 (fused multiply add) instructions. Ryzen can execute such instructions but for some reason when a developer went to test his application that executed such instructions the Ryzen system completely froze up every time requiring a hard reset. Most importantly this could be done without administrator privileges, making it quite a serious security risk for anyone who wanted to perform a DOS attack on a Ryzen powered system. However, AMD confirmed that they already knew of the issue and had issued a microcode (BIOS) update solving the problem. So, if you own a Ryzen system make sure you have the latest BIOS version installed to remove this issue.

The last major issues were addressed publicly by AMD in a community update post. Early reviews had picked up on two facts. Ryzen seemed to run a little hotter than expected, and disabling simultaneous multi-threading (SMT) could improve performance. Tackling the temperature issue, it turns out that the 1700X and 1800X Ryzen models have a +20°C offset in their reported tCTL temperatures (that you see reported in BIOS and temperature monitoring software) and what the actual Tj temperature is (the temperature between the CPU die and heat spreader). This was done, AMD reports, to make sure Ryzen fan profiles were consistent across all models. The 1700 model isn't affected by this and AMD expects all temperature monitoring software to eventually know to automatically subtract 20°C from measured results for those two models. In the meantime, owners of those models can simply subtract 20°C to get the real CPU temperature.

The SMT issues were a bit more intriguing. AMD confirmed that SMT still needs to be better addressed in some programs/games to correctly utilize the CPU core and cache technology to remove the performance penalty SMT seems to be causing. AMD said they were "simple changes" too. So, expect patches for affected games and programs soon to better support Ryzen.


AORUS
GIGABYTE EXCLUSIVE SWAPPABLE OVERLAY FOR
ACCENT LEDS AND MEMORY LED DIFFUSERS
AMD
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AM4
X370
SUPPORTS ALL AMD AM4 PROCESSORS
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GREATNESS
WITHIN
GIGABYTE AORUS GAMING MOTHERBOARDS
> 8-CORE SUPPORT WITH EXTREME DIGITAL POWER OVERCLOCKING
> POWERFUL GAMING AUDIO WITH DUAL SMART HEADPHONE AMPS
> VR GAMING READY WITH ADJUSTABLE VOLTAGE USB DAC-UP 2
RGB
FUSION
Smart Fan 5
VR Ready
Dual
ALC 1220
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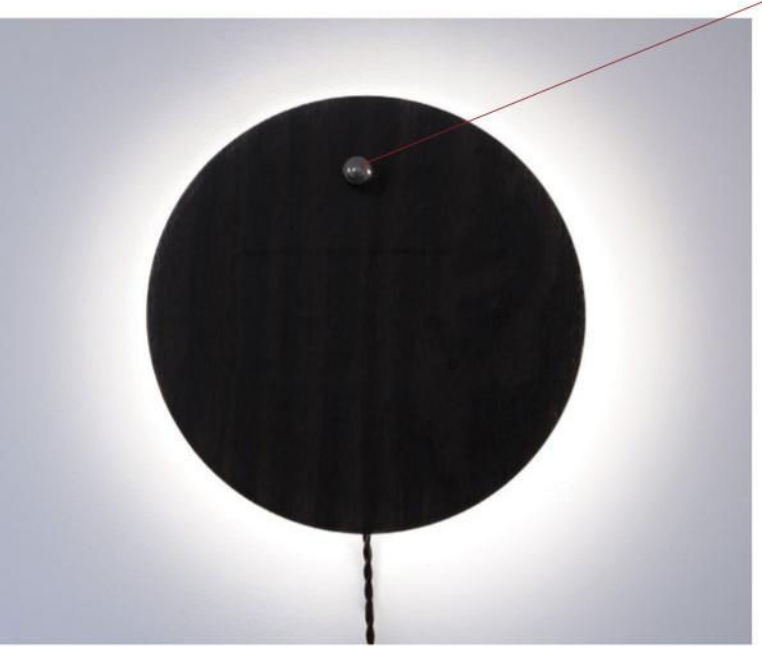
MOST WANTED

Anthony Fordham gets his gear on



STORY: The Levitating Timepiece

This isn't a bit of instruction to the art director that we forgot to delete, this thing really is called the STORY. And the whole timepiece doesn't levitate, just a ball-bearing to mark either minutes, hours or even years. So it's also heavily configurable. There's a dot-matrix LED hidden in the middle, which lights up, you know, when you actually need to know what time it is.

WANTED: The "orbit" of the "chrome sphere" can be adjusted via smartphone app - just set the length of interval and the chrome sphere will take that long to make one full revolution. Set it to 17 minutes. Set it to 30 years. Whatever you want! Also magnetic levitation is always cool.

NOT WANTED: Owning this makes you one of those insufferable people who, when asked the time, says "ah, right, well, let me show you how my special clock works"...

Grace Digital Mondo+

Have you discovered the wonder of internet radio? It's great: literally hundreds of thousands of stations, all free, all day. The downside? Dialling through the stack is tedious, and searching via genre can be worse. We demand additional convenience! Most good internet radios support Bluetooth and Wi-Fi, but the Mondo+ is the first to include Chromecast. That means flicking content from your phone, tablet or PC to the kitchen radio with a single tap. Convenience achieved!

WANTED: All the world's audio platforms mashed into one attractive little unit powered by a decent D-class amp. A neat display plus a big knob makes calling up favourites easy, and Chromecast lets you explore new content, helped by your smartphone or tablet.

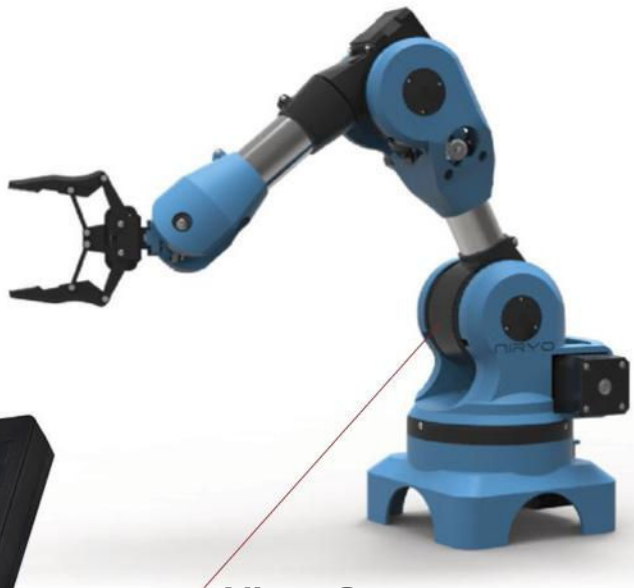
NOT WANTED: Why do these products always go whole-hog on content support and then stick with a single speaker? Why not make a nice compact stereo? We don't get it. You can add a second Mondo+ and link them for stereo, but come on!

Tesoro Excalibur SE

Tesoro is a known brand among the kind of people who gleefully spend $300 on a keyboard. And the Excalibur SE is notable because it uses optical switches.
Unlike a fully mechanical switch, beneath the spring and clip, an optical switch has an IR sensor to detect when the key has been "actuated" (keyboard fetishists don't say "pressed", they say "actuated"). Optical sensors allow the manufacturer to adjust the actuation point to a very fine degree no wait come back it's a good keyboard we swear...

WANTED: Solid, well-built keyboard with a switch system that's an alternative to the inevitable Cherry switches on everything else.

NOT WANTED: "Babe, I know I already have seven mechanical keyboards, but this isn't a mechanical keyboard, it's an OPTICAL SWITCH keyboard!" CUT TO: Man setting up blanket and pillow on couch.



Niryo One

Remember in all those classic 1980s movies, if a mad scientist or an inventor had a lab or workshop, he also had his own robotic arm assistant? It was a way to show how futuristic and forward-looking the character was.
Of course anyone who knew anything about robot arms in the 1980s would ask - what does he DO with that thing? How does he program it? Robot arms are specialised tools, you can't just plonk one on a desk and expect it to hold your soldering iron.
Well, now you can. Niryo One is a six-axis arm powered by open source software, which means making it do something is only a quick download... or three weeks of programming... away.

WANTED: Do we really need a reason to own a robot arm? Look at it! Lets you pick stuff up, hold stuff, position stuff really precisely. There's also a cheaper Mini Niryo for kids to learn robotics.

NOT WANTED: The $775 kit version comes without the 3D printed plastic parts, you have to make those yourself. A full kit costs $1000. Utility of this robot is heavily dependent on a community building software for it.

Superscreen

Here's a mild twist on a way to turn your smartphone into a bigger machine: not a dumb laptop, but a dumb tablet. Superscreen is a 10.1-inch 2560 x 1440 display for your phone. It acts as an additional display, not just a mirror, so phones with screen resolution lower (or different, thanks Apple) than 2560 x 1440 won't have stretched or scaled content.
With a 6000mAh battery on board, Superscreen claims your phone will use 70% less battery, and it will (may?) also support the Apple Pencil.

WANTED: Tablet-sized display for a hundred US bucks? Easy choice! Perfect for watching a movie or catch up TV and... uh... whatever else it is that tablets do better than a high-end smartphone.

NOT WANTED: Creator Transcendent Designs claims the Superscreen communicates with the host phone via "a patent-pending technology" that's "faster than Wi-Fi" yet they also claim it will be compatible with 97% of new phones. What is this magical wireless protocol presumably already inside our phones that only Superscreen will unleash?

System news

AMD HAVE FINALLY COME OUT SWINGING ON THE CPU FRONT. IT'S LANDING MANY BLOWS, BUT NO KNOCKOUTS. **MARK WILLIAMS** EXPLAINS WHY

Ryzen is a rising. From the plucky little microprocessor company we all want to see do well, AMD, Ryzen has gotten off to a good start. With its primary party trick being its fantastic performance per dollar ratios it certainly has everyone in the business talking and saying good things, but once you let the crepuscular (God/sun) rays of shiny awesome new tech seemingly beaming out of these products dim, you begin to see that Ryzen so far is a great jack of all trades but master of none.

Ignoring price, performance is the main factor we judge CPUs by. Performance is a function of core and thread counts, IPC, memory bandwidth and clock speeds amongst others, all of which AMD cannot currently lay claim to being the best at.

IPC was a big thing for AMD to nail with Ryzen and they've beaten their own expectations. Unfortunately, this still leaves them about a year behind the likes of Intel's Kaby Lake, a far better situation than where they were with Bulldozer for sure. This leaves Ryzen in a middle ground between Intel's current HEDT Broadwell-E line-up where Ryzen can beat it out with raw IPC (if you ignore AVX loads) but falls behind when compared to Skylake/Kaby Lake.

Clock speeds are another sticking point. With the first iteration of Zen, AMD has not had the luxury of being able to tweak the architecture and manufacturing process for years like Intel has been doing to reach stock clock speeds beyond 4GHz. In fact, Ryzen 7's base clock speeds are at best only around the mid 3GHz range. Leaving the likes of Intel's Kaby Lake to demolish it with base clocks of 4.2GHz available on tap for straight line single threaded tasks.

With overclocking not giving much more than 300MHz above boost speeds, Ryzen isn't the most exciting for overclockers either, something Intel's CPU's will gladly provide more of with 500MHz+ overclocks easily possible on both Kaby Lake and Broadwell-E. Further, Ryzen when overclocked doesn't support the use of its power saving downclocking features for when the CPU is idling, meaning it's constantly running at maximum speeds and voltages which is not ideal for longevity, heat and electricity bills.

On the memory front Intel has Ryzen on the ropes with Ryzen still struggling to get memory supported up to 3000MHz in dual channel mode. Kaby Lake and Broadwell-E will both happily run DIMMs with XMP profiles well beyond 3000MHz and OC on up to 4000MHz+. Broadwell-E even has quad channels to keep its CPU's well fed, something Ryzen struggles with as a result and why it responds so well to higher memory speeds.

Despite Ryzen sitting somewhere around HEDT Broadwell-E performance levels, the AM4 platform it sits on is decidedly lacking sitting somewhere below even Intel's consumer platform. Certainly adequate, but going up against the IO monster that is X99 and the more feature rich Z270, AMD are still about a year behind on the platform front too.

After a far too long period AMD has certainly done a great job to catch up this closely to Intel, but AMD need to and must keep iterating at least as often as Intel now to stay in touch and close the gap on all these fronts. But so far, with prices and core counts offering double the price/performance ratios of Intel's offerings it's quite easy to overlook Ryzens current foibles.

SHOP TALK

What do you think of AMD's new Ryzen CPU and platform? Are you seeing solid demand for these systems?

Jaimie, Leader Computers:

"Leader Computers have been seeing strong demand for gaming rigs based on the new Ryzen platform, the demand is outstripping early supply and the supporting motherboards have also been on tight allocation. From all the builds we have been doing our initial opinion is Intel have a fight on their hands for the first time in nearly a decade!

The value proposition for Gamers cannot be ignored, with the top of the line Ryzen R7 1800X being of a very similar performance to Intel's Flagship CPUs at close to half the price. We look forward to developing a range of very high performance Resistance gaming rigs based on the Ryzen platform which will be incredibly attractive from a bang Vs buck perspective. Watch this space!"

Jaya, Mwave:

"AMD Ryzen CPU's offer great value to our customers, especially for heavily threaded workloads. The transition to the AM4 platform provides modern I/O such as M.2 NVMe support, USB 3.1, multiple USB 3.0 FP headers PCIe Gen 3 etc. There is definitely solid demand for these systems."

John, TI Computers:

"The Ryzen CPU and platform is like the Intel X99 platform, a great option for high performance designer PCs requiring massive parallel processing power for rendering work. The tuning potential is also quite reasonable, we can easily achieve close to the max Turbo Core ratio on all cores with reasonable cooling. Unfortunately, due to the platform being less than one month old, we have yet to see real demands asking specifically for them at this stage. To date we have not seen actions from Intel lowering Broadwell-E pricing to compete with this new platform. We do not see this happening any time soon either, with AM4 going head-to-head against Broadwell-E on processor cores and performance."

Market snapshot

THIS MONTH WE LOOK AT SOME RYZEN PCS HITTING THE MARKET

PURPLE REIGN

PC Case Gear Prism 1080 Gaming System

$2,499 · http://tinyurl.com/mxup4xu

Tempered glass and RGB lighting. This system is definitely ticking boxes for all of the latest fads for enthusiast PC fashion.

Housing the latest in CPU fashion too in the form of the Ryzen 7 1700, this system is ripe for overclockers as the 1700 offers the same core and thread count as AMD's top end 1800X but being two SKU steps down from the top saves on the purse strings too. The stock Wraith cooler isn't the best for overclocking but it's not incompetent either.

Sensible SSD and RAM choices paired with a great GPU, for the price point, make this a great system for budget conscious tinkerers who want a PC that's dressed to impress.

KEY SPECS

CPU: AMD Ryzen 7 1700 · **Cooler:** AMD Wraith Spire · **Motherboard:** ASUS Prime X370 Pro · **Graphics:** Asus ROG GeForce GTX 1080 Strix Aura 8GB · **Memory:** G.Skill Trident Z RGB 2400MHz 16GB DDR4 · **Storage:** Samsung 850 EVO 250GB SSD, Seagate Barracuda 2TB HDD · **Power Supply:** Be Quiet! Pure Power 9 600W · **Case:** Phanteks Eclipse P400S

A BIT OF A ... LOOKER

PLE Computers Ryzen AM4 1800X Custom Gaming PC

$3,313 · http://tinyurl.com/knwdgsb

I'm going to say it, this case looks ugly, but maybe it's just me. Either way there's no denying the power that lies behind the slated facia of this system. Housed in a very spacious case with dual cooling chambers the beating heart of this rig is none other than AMD's most powerful CPU to date. Cooled with a good AIO water cooler this system provides ample opportunity and cooling capacity to push AMD's latest to the max.

A generously sized NVME SSD and the always potent GTX 1080 make for a system that'll be a joy to game on at any resolution and quality setting under 4K.

This system feels a little pricier than it need be but it does have some good specs to match.

KEY SPECS

CPU: AMD Ryzen 7 1800X · **Cooler:** Corsair Hydro Series H110i · **Motherboard:** Gigabyte AORUS AX370-Gaming 5 · **Graphics:** Gigabyte GeForce GTX1080 G1 Gaming 8GB · **Memory:** Corsair Vengeance LPX 2400MHz 16GB DDR4 · **Storage:** Samsung 960 EVO 500GB SSD, WD Blue 1TB 7200RPM · **Power Supply:** Corsair RM650x 650W · **Case:** Corsair Carbide Air 740

A TOTAL STATE OF FOCUS

Mwave Define Zen Gaming PC

$2,060 · http://tinyurl.com/lym2vgz

The cheapest of the four systems this month, this PC sports the middle child of the AMD Ryzen 7 line-up paired with AMD's current best GPU offering in the RX480, which in fact is a mid-range card. Leaving this system quite lopsided with the GPU as the bottleneck.

With a water cooled eight core CPU ripe for overclocking this system is best used by people who run CPU bound tasks that require lots of threads. No doubt it'll handle 1440p gaming ok but you should only consider this system if you primarily need the CPU horsepower.

The 240GB SSD as the sole storage device needs to also be pointed out as owners will need to keep an eye on storage space.

KEY SPECS

CPU: AMD Ryzen 7 1700X · **Cooler:** Fractal Design Kelvin S24 · **Motherboard:** Gigabyte AX370 GAMING 5 · **Graphics:** Gigabyte AMD Radeon RX 480 G1 Gaming 8GB · **Memory:** Corsair Vengeance 16GB DDR4 2666MHz · **Storage:** WD Green 240GB SSD · **Power Supply:** Fractal Design Edison M 550W · **Case:** Fractal Design Define C

VALUE RYZEN

Umart Ryzen7 GTX 1080 Gamer

$2,889 · http://tinyurl.com/mezfsnn

Coming in $500 cheaper than the quite similar PLE Computers offering this month, this seems to be providing a better performance bang for your buck. There's some give and take on the storage front to save money with a bigger HDD and thus total storage capacity but with a smaller SSD.

Memory is rated at 3000MHz, which is nice and something Ryzen will happily lap up giving extra performance.

The only other major difference is the PSU which is from the cheaper line of Corsair's PSU line-ups.

If the SSD size suits you, this system seems the better choice over PLE's pricier offering this month.

KEY SPECS

CPU: AMD Ryzen 7 1800X · **Cooler:** Corsair Hydro H110i · **Motherboard:** Asus PRIME X370-Pro · **Graphics:** Asus Strix GTX1080 A8G Gaming 8GB · **Memory:** Corsair Vengeance LPX 16GB DDR4 3000MHz · **Storage:** Samsung 960 EVO 250GB SSD, Seagate 2TB 7200RPM HDD · **Power Supply:** Corsair VS650 650W · **Case:** Bitfenix Aurora

GETTING BATTERED BY SUPPORT

The long wait for help

Modern notebook computers are reliable. The technology in them is mature and, in most cases, major components are reasonably easy to replace. But not all parts are commodity items that can be easily picked up. Batteries are a good example of this.

One of our readers, John, sent me the following note.

I have a Dell XPS 15 laptop. The touchpad stopped working and their [Dell] technical diagnosis is a swollen battery. It is still under guarantee and after a bit of a run-around I am told that there is no ETA for a new battery.

A look through Dell's support forums reveals this isn't an isolated incident. And many others, across the world, have reported long wait times for a replacement part – some owners have simply ordered their own, third-party battery from online retailers and carried out the replacement themselves in frustration.

John has a few questions regarding this issue. He says the problem is not new and suggests it is a design flaw. Certainly, there have been plenty of cases reported of laptop batteries failing with several manufacturers issuing recalls. However, it has been several years since Dell has done this on a large scale.

John asks "What do I do in 12 months when it, presumably, will happen again and my expensive computer is no longer under guarantee? Why are Dell still selling XPS15 without comment?".

Anthony Caruana
has worked for almost every major masthead in the Australian IT press. As an experienced IT professional – having worked as the lead IT executive in several businesses, he brings a unique insight to his reporting of IT for both businesses and consumers.

^ The laptop in questions is a Dell XPS 15

As a matter of consumer law, the companies that sell, hire or lease items must ensure products are safe, lasting, with no faults, look acceptable, and do all the things someone would normally expect them to do.

In John's case, these obligations are not being met.

When it comes to the warranty, you can seek the party who sold you the product to either repair or replace the item, or you can seek a refund. Repairs need to be carried out in a "reasonable time" under Australian consumer law. And with replacements, you do not have to return products in the original packaging to get a refund.

> "do the things someone would normally expect them to do"

Importantly, while manufacturers may specify warranty periods on their products, goods sold into Australia are subject to a higher standard. Even though Dell's warranty documentation only specifies a year, given there's a reasonable expectation that a well-cared for computer would last significantly longer than 12 months he could still seek warranty repairs beyond the manufacturer's warranty period.

John supplied us with lots of detail, including his email conversations with Dell regarding this matter. We sent those through to Dell for comment and received this boilerplate response.

Dell places the highest priority on customer satisfaction. This situation has been resolved with the customer.

Unfortunately, John is about to head overseas and the situation hasn't yet been resolved.

Follow up on Telstra and the NBN Modem

Last month, we reported on the story of Carl and trying to get the technical details of the Sagemcom F@st 5335 Telstra VSDL that was supplied as part of his NBN installation. Carl's challenge was in configuring VoIP and port forwarding.

Telstra didn't answer before we went to print, nor since then. But one of our readers provided his experience following a similar installation.

Peter said "Apparently, the techs who come to the house or on phone support have not had any training for the modem in question and unable to fix things as you are unable to reset the sagecom".

So, it seems Telstra's technicians and support people have as much access to good documentation and support for this modem as the rest of.

Our advice – if your NBN retailer gives you a choice of modem/router, choose one that has plenty of documentation and get the installer to walk you through all the configuration screens and take some notes.

v One of the most common NBN modems

NEED HELP? EVER HAD AN ISSUE AS A CONSUMER? INVESTIGATOR CAN HELP.

If you've had an issue or had something happen and you think investigator could help, email your problem to ***investigator@pcandtechauthority.com.au***

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THE GLOBAL ROBOT

Keeping planet Earth on our good side

< Any similarities to a Dalek are purely coincidental (note: this is a real robot. Flee!)

At the recent Open Source Leadership Summit (OSLS) well-known security expert and CTO of IBM Resilient, Bruce Schneier, floated an interesting observation: "I contend that we're building a world-sized robot without even realizing it" he said, referring to the combination of the internet and the billions of devices connected to it.

There are three core elements to this: sensors, prevalent among internet of things (IoT) devices; the 'smarts' of processors on these devices, but also those in the cloud; and the actuators that affect our environment, such as smart thermostats changing temperature or – an easier analogy to relate to – a driverless car steering on the road.

Earlier in the year in a blog post Schneier had elaborated on this idea, stating "you can think of the sensors as the eyes and ears of the internet. You can think of the actuators as the hands and feet of the internet. And you can think of the stuff in the middle as the brain. We are building an internet that senses, thinks, and acts."

And while there's no central intelligence at the moment – though we can clearly align developments in AI as filling the gap here – the combination of real-world computing devices interconnected via the internet to dictate that consumers want ever more features for increasingly less cost. In the process of making such products, security often plays second fiddle.

We've already seen plenty of examples of what this looks like, from DDoSing botnets that can knock a small country off the internet through to spying children's toys, hackable pacemakers, and cars that can be taken over remotely.

But while consumers devices bear the brunt in publicity, it's important to remember this isn't just about TVs, DVRs, phones, toys, smart home appliances, driverless cars... it also applies to the coming developments of smart suburbs and eventually smart cities where we'll see sensors and actuators that can control energy distribution, street lights, building temperatures, and transport. And then, of course, there's industrial IoT as well: power stations, factories and more – what happens when you lose control of these? At the recent RSA Conference 2017 Ed Skoudis, Faculty Fellow and Penetration Testing Curriculum Lead at SANS, talking on ransomware asked "What would you pay to turn your lights back on? What would you pay to turn your heat back on?... What about what would you pay to turn your factory back on?"

The stakes are massive. Our giant, global, robot is permeating every part of our lives and perhaps can be best summed up by Schneier when he so clearly states: Computer security is now everything security.

It's going to be an interesting decade, but one thing is sure: any solution will need skilled ICT professionals to play their part – which may include you – as will an increased focus on security in education and in certification. It's time we took security seriously.

However our global robot turns out, let's hope it's more *Data* than *Dalek*. In the end, at least.

none the less poses an interesting problem. In his talk at the OSLS Schneier summed it up cleanly with "there's a fundamental difference between when your spreadsheet crashes, and you lose your data, and when your car crashes and you lose your life."

> "Our giant, global, robot is permeating every part of our lives"

Which, of course, we've seen already with at least one high-profile example involving Tesla.

And therein lies part of the problem: we place so much trust in the technology we use today, often without thinking about it, on the assumption that if it made it to market it must be safe and reliable. Someone, somewhere, has done all the checks and balances and said it's good to go.

But as anyone working in ICT knows, this isn't the case. Software and hardware can be prone to bugs, simply because humans make mistakes. And more importantly, market forces appear

Ashton Mills
has been writing about technology for 20 years and still gets excited for the latest techy gear. He's also the Outreach Manager for the Australian Computer Society (www.acs.org.au), you can email him on ashton.mills@acs.org.au.

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HAS APPLE ABANDONED PROS?

APPLE'S PERSONAL COMPUTERS ARE MORE POPULAR THAN EVER, BUT POWER USERS AREN'T HAPPY. ARE MACS STILL FOR PROS? **ADAM BANKS**, FORMER EDITOR-IN-CHIEF OF MACUSER MAGAZINE, INVESTIGATES

From its beginnings as a niche computer maker to its dominance as a lifestyle brand, Apple has maintained one proposition: its hardware is worth more because it's better. The logo's association with creative professionals was built on the Mac's features and performance.

However, as Apple flourished amid a shrinking PC market, the Mac Pro desktop tower was discontinued. Even 2013's belated new Mac Pro desktop was compact rather than expandable.

Meanwhile, MacBooks became the laptop of choice, but the designer's favoured 17in was replaced by slim, light and general-purpose models. By 2016, it was common to see headlines such as "Apple's disgracefully outdated Mac lineup is killing sales". When an update to the MacBook Pro range finally arrived in October, many pros were less enthused by its innovative Touch Bar than frustrated at its limited specs and even higher prices. Has Apple lost interest in the pro market?

SURRENDERING THE HIGH GROUND

Henry Capper is sales director at Amsys, which supports predominantly Apple systems for businesses. Does he think Apple still meets the needs of high-end users? "It depends what you mean by high-end users," he told us. And thereby hangs a tale: even within this category, requirements vary widely. "We work with a huge number of design companies, but 'design' is a funny word. What you require in a computer can range from '16GB is more than enough' to the guys who need 64GB," explained Capper, referring to the controversial 16GB RAM ceiling of the MacBook Pro.

"IF ANYTHING, MORE DESIGNERS ARE WILLING TO MOVE ACROSS TO APPLE"

Among Amsys' clients, "day-to-day users tend to find any mid-range Apple device off the shelf is exactly what they need. We have a lot of very big brands doing a lot of heavy design work, and it's very rarely we have someone say, 'Look, I'm completely under-specced.'"

For the minority who need more, he adds, "the Mac Pro does pick up the top end. It seems to work." No concerns that this machine hasn't been significantly updated since 2013? "It's not something I'm hearing." This isn't surprising, as Apple expects a Mac buyer to keep it for four years, and many last far longer.

In the past, deploying Macs in business was seen as problematic, but Capper says the tools around Apple in enterprise have been "completely revolutionised". While Apple's own efforts have helped, for example through its partnership with IBM, third parties have also stepped in. "Apple tools like Profile Manager don't do the job, but then you look at something like Jamf Pro and it's a fantastic management-deployment solution," Capper said.

What of the users themselves? "If anything, more designers are willing to move across to Apple," reported Capper. He credits this to the Mac's focus on usability. "Apple builds its devices around 'just working'". When it comes to concerns about spec, "I think this is more of a PC-led question".

Horace Dediu, who runs market intelligence site Asymco (asymco.com), also sees a decoupling of user needs from tech specs as characteristic of Apple. "I believe Apple is very keen on 'high-end' Mac users, but does not think of them in terms of product specifications, rather what they do with those products."

PERFORMANCE IS FOR PC

The idea that talking about performance is for PC users, while Macs just do the job, is something Apple would endorse: it avoids competing on specs with rival brands. This would, arguably, be meaningless as other PCs come in a vast range of configurations.

For some users, though, that's the point. "The MacBook Pro is too minimalist," said Andrew Reid, who runs the EOSHD videography blog. "It's fine to simplify things for consumers, but not for pros. Not enough ports, not enough expansion options, too many major parts soldered in, and underpowered GPUs because of the thinner chassis."

Experimental designer Brendan Dawes also struggles with Apple's stripped-down ethos. "I'm not one of these people who upgrades all the time, although some of the stuff I work on is for very large screens, so a powerful GPU is good. I have a MacBook Pro, but not the new one – I need USB ports, an SD card slot and a bloody headphone jack," he said.

The macOS's old nemesis, compatibility, can still be an issue. "I'm using Derivative TouchDesigner, and the Mac beta isn't as fully featured, so I'm speccing up a kick-ass PC," said Dawes.

Photographer and former staffer Dave Stevenson also mourns the SD slot, a victim of Apple's wholesale move to USB Type-C. "I hate the idea of toting around a card reader, and I use Gigabit Ethernet to connect to my image library NAS, so I'd be one of those tedious folk who moans about dongles," he said.

Ports aside, however, Stevenson doesn't believe a PC would deliver more. "Show me a laptop, spec for spec, pixel for pixel, that doesn't cost just as much." We show him an Asus K501UX with a 4K screen, Core i7 and Nvidia GeForce GTX 950M for less than $1,500, compared to more than $3,500 for the cheapest comparable MacBook Pro, but have to concede that it features an older-generation CPU, half the battery life and weighs 50% more.

Nor does it take more than 16GB of RAM. Video editor Reid accepts that Apple offsets this restriction – a design decision to help the MacBook Pro achieve ten-hour battery life, while Intel's CPUs remain unable to address low-energy RAM in higher capacities – by implementing "very good memory management and compression" in macOS. But this doesn't benefit third-party software such as Adobe Premiere Pro CC to the same extent as Apple's Final Cut Pro X. Meanwhile,

"ATTACHMENT TO APPLE PRODUCTS HAS UNDOUBTEDLY BOOSTED THE MAC"

small cases and limited macOS support restrict the choice of GPUs even in the desktop Mac Pro.

James Tonkin is the founder and director of Hangman Studios, which produces video for high-profile clients. A happy Final Cut Pro X user, he has thoughts about what Apple needs to offer. "Our 2013 Mac Pro, the trashcan, does still perform pretty well, but now that we finish almost exclusively in 4K, we're seeing some limitations," he said. "I respect Apple's closed-hardware approach, but the option of faster GPUs on Windows and Linux systems is something we can't ignore."

One answer is external graphics processing (eGPU), using Thunderbolt 3 to connect third-party graphics cards outside the case. "An Apple-certified eGPU is what I'm most interested in," Tonkin explained. He will stick with Apple, if possible: "We love the speed and integration benefits between the hardware and software. Apple isn't ignoring the pro market – when you see Final Cut Pro X's support for the latest $100K-plus cinema cameras, that isn't for consumers. As professionals, we do demand faster hardware, but we also want it rock-solid for 20-hour post days."

NOT A MATTER OF LOYALTY

Ultimately, though, "our clients don't care what machines we render on, as long as people aren't waiting all night," said Tonkin. The point is echoed by Peter Kosminsky, director of films and TV dramas including the multi-award-winning Wolf Hall. "I work with VFX teams, sound teams, picture graders and editors, but they choose their apps and platforms," he said. Kosminsky's faith in Apple was shaken by the cancellation of Aperture, its pro photo editor – leaving him and others fearing for the prospects of Apple's remaining pro apps, Final Cut and Logic Pro X. Recent upgrades, however, seem to have shown commitment.

"With the recent price hike and the lack of anything new

CEO Tim Cook promises Apple is still "committed to desktops"

or exciting for quite a while, I can't help feeling [Apple has] slightly lost its mojo," said Kosminsky. But "it will take much, much more than that to make me bail. I use Apple for all my personal computing."

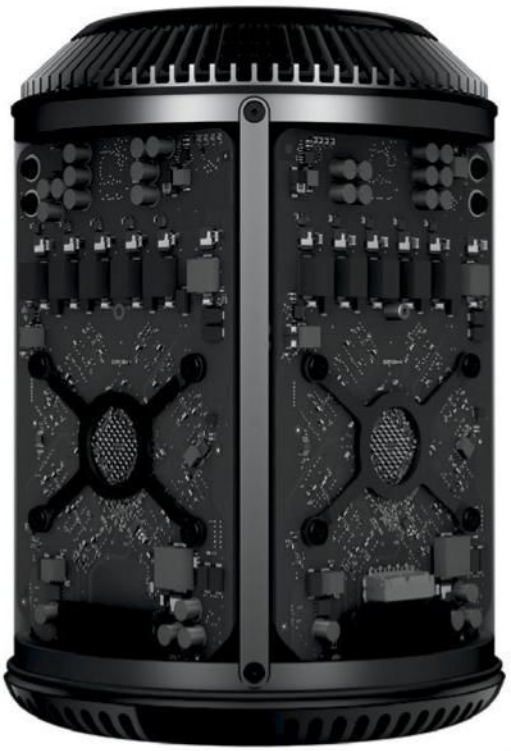
THE PERSONAL TOUCH

This personal attachment to Apple products has undoubtedly boosted the Mac. "CEOs buy an iPhone, and then they buy a Mac, and all of a sudden they're turning to IT directors saying 'what could these do in our business?'," explained Amsys' Henry Capper. And macOS does delivers benefits to enterprise: "They're easier to maintain, and with people's experience of using them at home, they empower users to solve some of their own issues."

Keith Martin, a senior lecturer at London College of Communication, part of the University of the Arts London, echoes this sentiment. "Over the past ten years, we've installed more and more computers, almost all Macs. The major software runs on both platforms, but macOS does seem to fit more smoothly into the minds of design and media students." His experience with support mirrors Capper's. "Our IT people know both platforms inside out, and despite the Macs outnumbering the PCs by way more than ten to one, they have more maintenance to do with those PCs."

Martin, whose own practice includes 360-degree photography, doesn't believe Apple has let performance become a problem. "The idea that every creative spends their days juggling 50 layers of gigapixel imagery is nonsense. Sometimes when I'm working with large chunks of data I'd like a bit more speed, but mostly the bottleneck is me."

As for the demise of user-upgradability, Martin adds: "I'm generally fine with that now. Years back, computers were barely keeping up with us. Today's Macs are more than enough for most



"IT IS FINE TO SIMPLIFY THINGS FOR CONSUMERS, BUT NOT FOR PROS"

^ The Mac Pro hasn't had a significant update since 2013, but is still powerful enough for most purposes

^ The MacBook's thin chassis restricts the choice of GPUs

people."

So are many PCs, of course. Digital designer Anna Halsall admits design clients "expect you to be a Shoreditch-working, Bernie Sanders-voting, rice-milk-drinking yogi who travels the world with your elegant MacBook in your Swedish backpack," yet her laptop isn't an Apple. "I have an Acer that I love. I agree the MacBooks' battery life is better and the screens are awesome," but prices are significantly higher "and if your Mac breaks, the repair will cost a fortune".

Although independent Apple repair shops might dispute that claim, Halsall's point is clear: "I simply calculated what I'll actually use it for in order to justify the price." She also sees Apple's corporate image as a negative, citing concerns about supply-chain workers, tax avoidance, and the unjustified worship of Steve Jobs.

STOPPING SWITCHERS

Choosing Windows or Linux means investing in a platform with a far more extensive choice of hardware. So is the Apple usability advantage enough to prevent professionals from decamping? Motion designer Darren McNaney finds himself on the cusp. "My current iMac is starting to struggle [with processing and rendering], and certain 3D processes are impossible," he told PC & Tech Authority. "If I was a dedicated 3D animator, I'd have switched to PC. If Apple just updates the iMac's components this year, I'll go for it – even though it's still likely to feel dated [when compared to desktop PCs] – because the thought of Windows is horrible. I'm sure I'd adapt to the OS, but I'm concerned about privacy and malware."

McNaney is also put off by Apple's price increases: "Professional doesn't mean you can keep shelling out thousands." For the past decade or so, a top-end MacBook Pro or iMac to suit a demanding user would come in at a little over $3,000. Today, the cheapest 15in MacBook Pro, with a Core i7 processor and 16GB of RAM, starts at $3,599, but has only a 256GB SSD, which can't be upgraded later. A more practical 1TB adds $960, while bumping the AMD Radeon Pro 450 to a 460, giving the 4GB of video RAM required for some tasks, costs $320 – almost breaking the $5,000 barrier.

Some of the cost reflects the fall in sterling, but Apple's base dollar prices have risen too, partly thanks to the Touch Bar, a multi-touch display strip now included as standard. During October's launch event, this was demoed in tasks including video editing. McNaney was unimpressed: "The mock-up of an edit suite was laughable. Their idea of a 'professional' seems to be a hipster sitting in a Starbucks uploading YouTube content shot on an iPhone 7 while sending emojis via the Touch Bar. Ugh."

Videographer James Tonkin sees more potential: "Any possibility to speed up workflow by putting the tools directly at your fingertips is a benefit." Asymco's Horace Dediu identifies the Touch Bar as a reinforcement of what distinguishes the Mac from "third-wave" touchscreen devices. Soon after the Touch Bar launched, he wrote: "The keyboard and mouse/trackpad are what define the Mac… The Touch Bar coupled to the other two inputs is a totally new way to interact. It's not an "easy" interface… Indirect inputs are powerful and lend themselves to muscle memory. This is the way professional users become productive."

We put it to Dediu that high-end users couldn't be productive without high-end systems. "By this definition, a high-end car user would be one who would not buy an 800-horsepower car because there exists a car with 1,000 horsepower. Yet driving at 60mph requires only about 60 horsepower, and a bicycle with 0.3 horsepower might be faster in a city."

"PROFESSIONAL DOESN'T MEAN YOU CAN KEEP SHELLING OUT THOUSANDS"

^ The principle of right-sized agility clearly informs Apple's current lineup

FAILING TO KEEP PACE

As we've seen, though, some of Apple's most loyal customers are racing drivers. And every marque has a souped-up top-end supercar, even if few are sold. Doesn't the same logic apply to Apple if it wants to remain a premium brand? "Tough question," said Jean-Louis Gassée, the former senior Apple executive and co-author of the Silicon Valley blog, Monday Note. "Let's see what Apple does later this year with the Mac line. Let's see what the iPad does with new models." The iPad Pro attempts to expand the third wave to the high end of the spectrum, but so far it's estimated to account for barely a third of iPad sales, far smaller numbers than the Mac.

Still, the bicycle was one of Steve Jobs' favourite metaphors, and the principle of right-sized agility clearly informs Apple's current lineup. It's hard to argue this isn't working: as Dediu points out, last year Apple became one of the top five PC vendors for the first time, despite a lull in Mac sales as buyers waited for new models. Furthermore, despite complaints, the late 2016 MacBook range broke sales records, according to Slice Intelligence, beating the earlier launch of the popular 12in MacBook by a factor of seven over the first five days.

However, Jobs also recognised the importance of professional users. "I met with Steve the second day he came back to Apple in 1997," recalls veteran tech consultant and columnist Tim Bajarin, "and asked him how he planned to save Apple. He told me that he was going back to taking care of their core customers, creatives. He felt that the people who ran Apple had forgotten them."

That said, Bajarin doesn't believe history is repeating itself. "I do expect [Apple] to innovate around the Mac. I know from talking to them that they really understand the creative audience and will continue to support them, as I believe Jobs instructed them to do before he passed away."

Users aren't necessarily feeling the love, though. "I've remained loyal since my first Apple studio computer," said musician Robin Rimbaud, also known as Scanner, "but I don't think I'm alone in questioning where to move to next. The latest MacBook Pro again demonstrates a complete lack of understanding." The company's notorious secrecy also rankles. "It's as if they're simply too arrogant to care. Don't they realise that without creative professionals they wouldn't have the aesthetic and appeal that they do?"

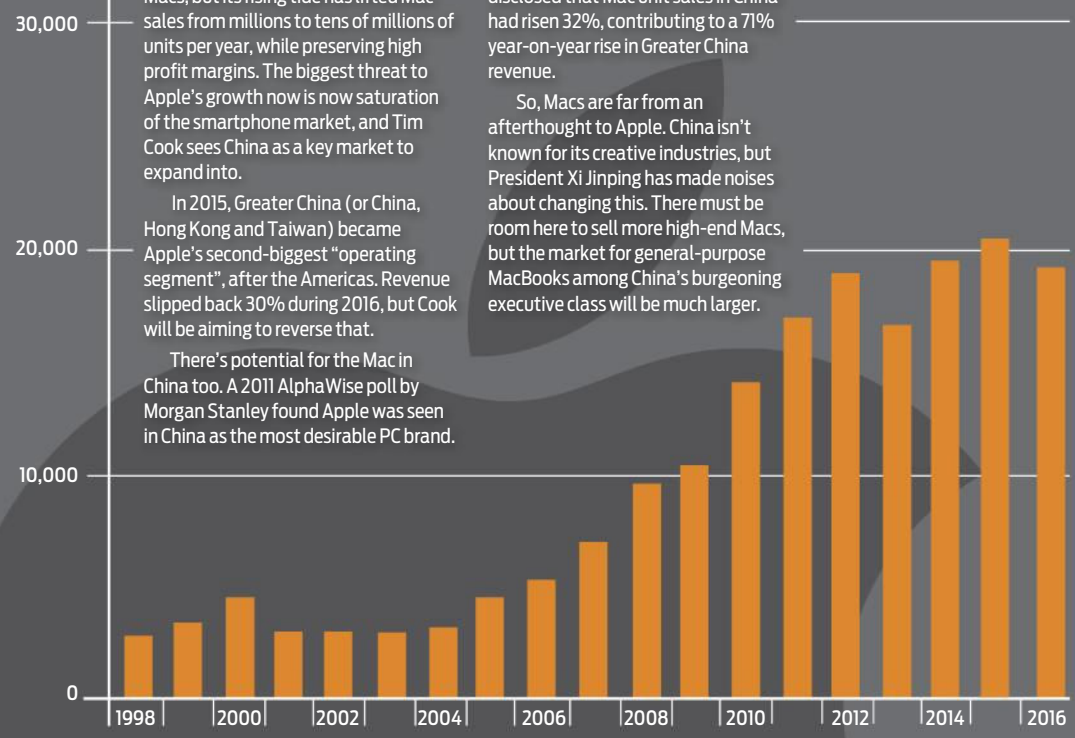
In December, Jobs' successor, Tim Cook, told employees in a leaked memo that the company was "committed to desktops". "Let me be very clear: we have great desktops in our roadmap. Nobody should worry about that." The statement, of course, implied somebody was worrying. But Cook was explicit: "The desktop is very strategic for us. It's unique compared to the notebook because you can pack a lot more performance in... Desktops are really important, and in some cases critical, to people."

Indeed. We'll only know when new models appear, but perhaps Apple does still understand that, as James Tonkin puts it: "We just need hardware that doesn't limit our creativity." ●

v Final Cut Pro X's support for the latest cinema cameras is one sign Apple is still dedicated to creative professionals

Mac unit sales (000s)

1998	2,763
1999	3,448
2000	4,558
2001	3,087
2002	3,101
2003	3,012
2004	3,290
2005	4,534
2006	5,303
2007	7,051
2008	9,715
2009	10,396
2010	13,662
2011	16,735
2012	18,158
2013	16,341
2014	18,906
2015	20,587
2016	18,484



HOW MUCH DO MACS MATTER TO APPLE?

The iPhone has far outstripped sales of Macs, but its rising tide has lifted Mac sales from millions to tens of millions of units per year, while preserving high profit margins. The biggest threat to Apple's growth now is now saturation of the smartphone market, and Tim Cook sees China as a key market to expand into.

In 2015, Greater China (or China, Hong Kong and Taiwan) became Apple's second-biggest "operating segment", after the Americas. Revenue slipped back 30% during 2016, but Cook will be aiming to reverse that.

There's potential for the Mac in China too. A 2011 AlphaWise poll by Morgan Stanley found Apple was seen in China as the most desirable PC brand. By the second quarter of 2015, Tim Cook disclosed that Mac unit sales in China had risen 32%, contributing to a 71% year-on-year rise in Greater China revenue.

So, Macs are far from an afterthought to Apple. China isn't known for its creative industries, but President Xi Jinping has made noises about changing this. There must be room here to sell more high-end Macs, but the market for general-purpose MacBooks among China's burgeoning executive class will be much larger.

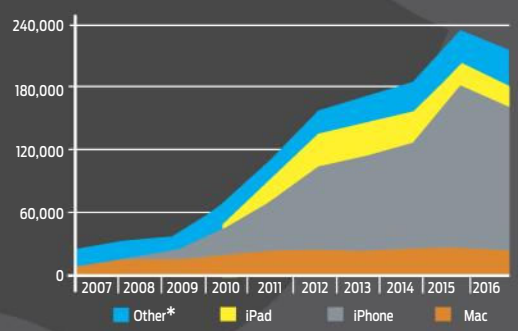
WHO BUYS MACS?

We asked Slice Intelligence, a company that analyses brand demographics, to produce a report to assess who buys Macs. Looking at purchases by individuals over the past four months, it found 34% of Mac buyers were millennials and 33% "generation X", outnumbering "baby boomers" at 26%. The iPad Pro was more attractive to older buyers, with boomers accounting for 34% of sales. Over 45% of online MacBook buyers had at least a bachelor's degree and over 45% had an income greater than $75,000. Fair to say, then, that Apple addresses the high-end market.

Sales revenue by product line ($million)

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Mac	10,314	14,276	13,780	17,479	21,783	23,221	21,483	24,079	25,471	22,831
iPhone	123	1,844	6,754	25,179	47,057	80,477	91,279	101,991	155,041	136,700
iPad	N/A	N/A	N/A	4,958	20,358	32,424	31,980	30,283	23,227	20,628
Other*	13,569	16,359	16,003	17,609	19,051	20,386	26,168	26,442	29,976	35,480

*Includes iPod, software, services not counted in other segments

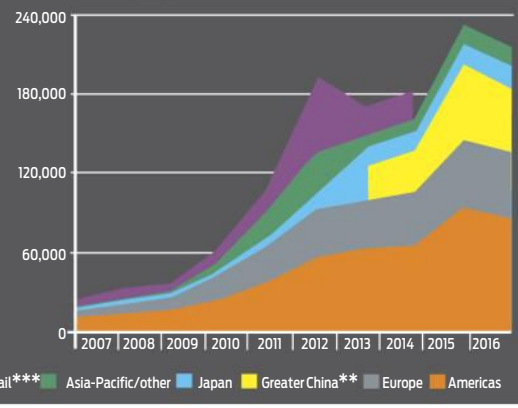


Sales revenue by region ($million)

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Americas	11,596	14,573	16,142	24,498	38,315	57,512	62,739	65,232	93,864	86,613
Europe	5,460	7,622	9,365	18,692	27,778	36,323	37,883	40,929	50,337	49,952
Greater China**	N/A	N/A	N/A	N/A	N/A	N/A	25,417	29,846	58,715	48,492
Japan	1,082	1,509	1,831	3,981	5,437	10,571	13,462	14,982	15,706	16,928
Asia-Pacific /Other	1,753	2,460	2,625	8,256	22,592	33,274	11,181	10,344	15,093	13,654
Retail***	4,115	6,315	6,574	9,798	14,127	55,977	20,228	21,462	N/A	N/A

**Greater China was first broken out as a region in Apple's filings in 2013; here included in Asia/Pacific until 2012

***Retail sales were included in region totals from 2015



SECURE YOUR

10 STEPS TO STOP HACKERS

DAVEY WINDER EXPLAINS HOW TO LOCK DOWN YOUR WI-FI NETWORK AND FIND DEVICES THAT ARE STEALING YOUR BANDWIDTH – AND, POTENTIALLY, YOUR DATA

The days of worrying about your data allowance are largely a thing of the past, courtesy of faster broadband speeds and generous caps. But that doesn't mean you should forget about who's using your Wi-Fi. Whether you're a home or small-business user, identifying who and what is on your network is as important as ever.

An unauthorised user could be streaming pirated movies, hogging your bandwidth and, potentially, landing you in a spot of legal bother. They could be indulging in more nefarious activity, maybe even trying to hack into your systems. This shouldn't come as any great surprise when research commissioned by Broadband Genie shows 54% of broadband users are concerned about someone hacking their router, yet only 19% had accessed the Wi-Fi router configuration controls, and a measly 17% had changed the admin password from the default.

Avast recently scanned over 4.3 million routers and found 48% had some sort of vulnerability. Thankfully, there are plenty of tools and tricks to identify who's on your connection and how to get rid of them.

ADVISING USERS TO DISABLE WI-FI-PROTECTED SETUP (WPS) MAY SEEM COUNTER-INTUITIVE, BUT IT'S BROKEN

1 CHANGE THE ADMIN PASSWORD

If you want to know what your wireless network is up to, you'll need to roll up your sleeves and head straight for the admin gateway of your router. If you've swapped out the supplied router for one of your own preference, Google is your friend.

Alternatively, you can head over to routerpasswords.com – most makes and models are listed there, complete with login details. And if that doesn't convince you to change your router from the default settings, nothing will...

Default login settings should only be used to get up and running out of the box, after which you should change the password to something long and complex, and change the username if your router allows it. Long and random is great passkey advice, which is almost always ignored on the basis that people want to join the Wi-Fi network without any hassle. Well, duh! Ask yourself this: how often does any user actually have to enter the Wi-Fi password manually? Certainly within the home, and for many small-business scenarios, the answer is usually hardly ever after the initial setup.

A key that's over 20 characters long, with a randomly generated mix of upper and lower-case alpha-numericals, with special characters, is your best bet. LastPass' tool (https://lastpass.com/generatepassword.php) is excellent for producing randomly generated and secure passwords.

2 DON'T BROADCAST YOUR ROUTER DETAILS

While you're in your router settings, you should change your service set identifier (SSID). This is the name of your network that the outside world sees; it commonly defaults to the router manufacturer's name. In light of how easy it is to find admin logins online, best not make the hackers life any easier than it already is. A determined hacker isn't going to be prevented from detecting and accessing your network simply because there's no SSID being broadcast, but using a random name rather than the factory default makes sense. Not least as it suggests the user is more security savvy than someone who is still broadcasting the router manufacturer.

BELOW Online databases of router logins are surely reason enough to change the defaults

RouterPasswords.com

Welcome to the internets largest and most updated default router passwords database.

Select Router Manufacturer:

ZYXEL

Find Password

Manufacturer	Model	Protocol	Username	Password
ZYXEL	PRESTIGE	HTTP	n/a	1234
ZYXEL	PRESTIGE	FTP	root	1234
ZYXEL	PRESTIGE	TELNET	(none)	1234
ZYXEL	PRESTIGE 643	CONSOLE	(none)	1234
ZYXEL	PRESTIGE 652HW-31 ADSL ROUTER	HTTP	admin	1234
ZYXEL	PRESTIGE 100IH	CONSOLE	n/a	1234
ZYXEL	PRESTIGE 650	MULTI	1234	1234

3 DISABLE WI-FI-PROTECTED SETUP (WPS)

Wi-Fi-Protected Setup (WPS) uses the press of a button, or entry of a PIN number, to establish an encrypted connection between a device that supports it and your network. Advising users to disable WPS may appear counter-intuitive, but it's broken. It makes use of what appears to be an eight-digit PIN code – but looks can be deceiving. The last number is always a check digit, so already the PIN is reduced to seven numbers, which makes brute-forcing much easier. As does the fact that most routers don't include a cooling-off timeout between WPS guesses. Here comes the stinger, though: as far as validation is concerned, the first four digits are seen as a single sequence, as are the final three. That means the possible number of combos just shrank from over ten million to around 11,000. No wonder pen-testing tools such as Reaver (youtube.com/watch?v=T7OGcLzouYc) can brute-force WPS in a matter of seconds.

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Ethernet WAN NBN Ready | Ethernet WAN UFB Ready | 500x VPN | 100x SSL-VPN | TAIWAN EXCELLENCE 2012

- 4 x Gigabit Ethernet WAN ports
- 1 x SFP WAN port
- Multi-WAN Load Balancing & Failover
- 2 x Gigabit Ethernet LAN ports with 120,000 NAT sessions
- 1 x SFP LAN port
- 500 x VPN & 100 x SSL-VPN tunnels with Central VPN Management
- High Availability Mode
- Object-oriented Firewall with Content Security Management (CSM) and QoS
- IPv6 x IPv4
- Multi-subnet WAN/LAN through 802.1Q
- Bandwidth management
- 2 x USB ports for 3G/4G LTE mobile broadband access, USB printer, storage, and thermometer
- Support VigorACS SI management system
- Smart Monitor Traffic Analyzer (up to 500 nodes)

Vigor3220 Series

Qaud-WAN Gigabit broadband router with Security Firewall, 100 x VPN tunnels, and 50 x SSL-VPN tunnels

Ethernet WAN NBN Ready | Ethernet WAN UFB Ready | 100x VPN | 50x SSL-VPN | TAIWAN EXCELLENCE 2016

- 4 x Gigabit Ethernet WAN ports
- 1 x USB port (USB3.0) support 3G/4G LTE mobile broadband access
- Multi-WAN Load Balancing & Failover
- 1 x USB port (USB2.0) support file sharing, external storage, network printer or thermometer
- 100 x VPN and 50 x SSL-VPN tunnels with Central VPN Management, Load Balance and Redundancy
- 1 x Gigabit LAN port with 100,000 NAT sessions
- 1 x Dedicated Gigabit Ethernet DMZ port for connecting servers
- 1 x Console port (RS232)
- Object-oriented Firewall with Content Security Management (CSM) and QoS
- IPv6 x IPv4
- 802.11n Wi-Fi for Vigor3220n
- Central AP Management
- Central Switch Management
- Support VigorACS SI management system
- Smart Monitor Traffic Analyzer (up to 200 nodes)

Vigor2952

Dual-WAN Broadband Fibre router with Security Firewall, 100 x VPN tunnels, and 50 x SSL-VPN tunnels

Ethernet WAN NBN Ready | Ethernet WAN UFB Ready | 100x VPN | 50x SSL-VPN | TAIWAN EXCELLENCE 2016

- 1 x Gigabit Ethernet/SFP combo WAN port
- 1 x Gigabit Etherent WAN port
- 1 x USB port (USB3.0) support 3G/4G LTE mobile broadband access
- Multi-WAN Load Balancing & Failover
- 4 x Gigabit LAN ports with 60,000 NAT seesions
- 100 x VPN and 50 x SSL-VPN tunnels with Central VPN Management, VPN Load Balance and Redundancy
- High Availability Mode
- Object-oriented Firewall with Content Security Management (CSM) and QoS
- IPv6 x IPv4
- 1 x USB port (USB2.0) support file sharing, external storage, network printer or thermometer
- Central AP Management
- Central Switch Management
- Support VigorACS SI management system
- Smart Monitor Traffic Analyzer (up to 100 nodes)

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4 UPDATE YOUR FIRMWARE

The same Broadband Genie research mentioned earlier also shows only 14% of broadband users had updated their router firmware - and, to be honest, we're surprised it's that high. If you're one of the 86%, though, do it today. Updating your router firmware boosts your security at no cost and in very little time, yet it's a step that most home and small-business users fail to take.

Why? Because our mindset is wrong. In the home, and in many small businesses, the concept of "patch management" doesn't exist - but it should. We're all used to watching Windows disappear into the land of suspended resource time as it installs an update, after all. The majority of routers will have an automatic update option, so hunt it down and enable it. Be advised that sometimes a firmware upgrade might default the router back to original settings - do a quick check afterwards to be on the safe side.

5 TRY A DIFFERENT DNS SERVER

Just as you can install an alternative to the firmware that runs your router, you can choose a different Domain Name System (DNS) server instead of the ISP default. There may come a time when the DNS servers used by your ISP come under attack, by a distributed denial-of-service (DDoS) attack, for example, or someone changing the DNS to effect a cloned banking fraud. The bigger ISPs are a target for this, since the consequences of hacking their DNS servers would be enormous.

We've seen the DNS servers of the larger providers suffer downtime, so having a backup and knowing how to flick the switch is useful. The most common choice will be Google Public DNS server (on 8.8.8.8 and 8.8.4.4 for the IPv4 service) or OpenDNS (on 208.67.220.220 and 208.67.222.222). There's a setup guide at www.opendns.com/setupguide/, which details changing your DNS for home routers, laptops, smartphones and servers.

Essentially, though, open your router admin panel and look for the Domain Name Server addresses configuration page; input a primary and secondary DNS IP. Some routers will have a third server option, and for OpenDNS this would be 208.67.222.220. And that's it, other than to test it's working by hitting the Test button on the OpenDNS guide pages.

Certain providers prevent you from adjusting the DNS server addresses in their own-brand routers, but you can still set individual computers to seek alternate servers.

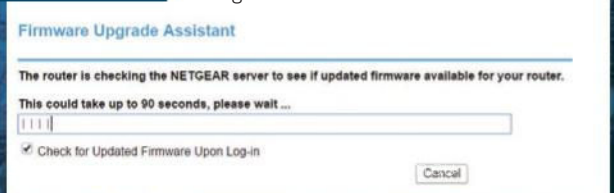
LEFT Switching to OpenDNS is dead simple with the handy online guides

6 INSTALL ALTERNATIVE FIRMWARE

The more adventurous user may take the "update your firmware" message a step further and install totally new firmware from an alternative source. If you think of your router as being a mini-computer, it's akin to changing the OS on a laptop from the supplied Windows install to a Linux distro.

Why would you do this? To gain functionality missing from the original firmware, especially relating to security. And why wouldn't you? Your warranty will be invalidated, so it's best left to older routers. If you go ahead, you'll probably find yourself choosing between DD-WRT and Tomato, which is easier to use but at the cost of being less feature-rich.

BELOW Regularly check for updated router firmware



WE'VE SEEN THE DNS SERVERS OF PROVIDERS SUFFER DOWNTIME, SO HAVING A BACKUP IS USEFUL

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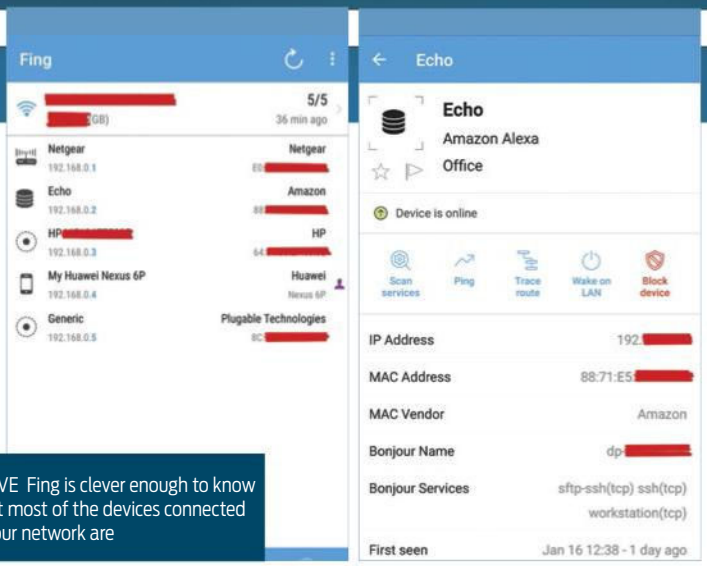
7 SNIFF OUT ROGUE DEVICES

Now we've covered most of the major security precautions you could take, how might you discover who's actually using your Wi-Fi? You can do this from your router gateway, and it varies from router to router as to where the option will be.

Most Netgear routers, for example, will hide the attached devices list in a Maintenance menu. There are lots of tools out there to help you do the same, and they don't have to be as complex as something such as Nmap (see Tips for small businesses, opposite).



ABOVE Fing is clever enough to know what most of the devices connected to your network are

One of our favourites is Fing for Android or iOS. This app scans any IP range and shows what's connected – and in plain English, where possible. So whereas the some routers will often only list a device's IP address, Fing usually spells out the device's manufacturer, making it easier to identify the dozens of devices we have connected these days.

If the numbers don't add up, it's a good idea to determine why. If you only have a laptop, a phone, an Android-powered TV set and a printer connected to your hub, why are there nine devices using your Wi-Fi? And how do you know how many people are using it and what those devices are?

See something you don't recognise and Fing will, at the touch of a button, reveal the information you need to block it from your router admin gateway. That you can do all of this from your smartphone, anywhere in the home or office, makes keeping tabs on who's using your Wi-Fi hassle-free.

8 EMPLOY MAC FILTERING

The information that Fing reveals when you want to block something from using your Wi-Fi is our old friend the Media Access Code (MAC), which every device connecting to a network is allocated. It's a 48-bit digital identifier used by the device to tag network packets, to be precise.

By default, your router will connect to anything that wants access, provided it has the correct password. If you want to prevent a device from connecting, even if the user has the correct password, that's where MAC filtering comes in.

Once you have a MAC address code, you can use an online specialist site such as What's My IP (www.whatsmyip.org/mac-address-lookup/) or MAC Vendor Lookup (macvendorlookup.com) to identify any piece of connected kit that you don't recognise. Fing does the MAC lookup for you in the background and then automatically displays the device maker on-screen as part of its auditing process.

When you've identified the culprit, head to the "access control" section of your router controls, which is MAC filtering by another name. Here you can either block all new devices, so before anything can join the network you'd have to whitelist the device's MAC address, or block individual devices by blacklisting their MAC.

ABOVE MAC Address Lookup searches can be found online, in case your app doesn't display the translations automatically

It isn't foolproof: most devices allow their MAC to be changed in software, so a determined hacker could clone a device that you whitelist and gain access. Ultimately, if you don't want someone to use your Wi-Fi, don't give them the

9 USE A VIRTUAL PRIVATE NETWORK

Whether you're using the original router firmware or have installed an alternative, there's a strong chance that virtual private networks (VPNs) will be supported. When people think of a VPN, they think of a third-party application that re-routes all their internet traffic through a proxy server - at a cost. What's less commonly considered is operating your own VPN through your router.

This will give you the advantage of being able to securely access your home network, across an encrypted internet tunnel, when you're away. It gives you the same end-to-end encryption as a subscription service, so you can securely use that coffee shop or hotel Wi-Fi, but with no fees or bandwidth implications. You'll almost certainly need a Dynamic DNS (DDNS) service to resolve a domain name to your router as a home user, to get around the fact that most ISPs don't offer a static IP address for your router; the free-to-use No-IP (noip.com) is as good as any for this.

THERE'S PLENTY TO BE SAID FOR ADOPTING THE "THINK LIKE A HACKER" APPROACH

10 SET UP A GUEST NETWORK

The trouble with passing out your Wi-Fi passkey to family and friends who visit is that, every time you do, it dilutes your security. Not only do they know your password, but they might also give it to someone else. You could change to a new password after every occasion, which is the most secure, if not the most convenient, solution. More conveniently, and pretty secure as well, is going the whole nine yards and setting up a guest network for visitors. If the concept of a properly secured guest network isn't supported by your router, all is not lost: simply buy a better router or change the firmware as mentioned earlier. The popular replacement router firmware Tomato (polarcloud.com/tomato) supports a guest mode, and means you can provide users with a key that puts them online on a virtual network without exposing your own connected devices.

TIPS FOR SMALL BUSINESSES

There are plenty of tools out there to help map your network and see what's connected at any given time, as well as identify your network's weak spots. The good news is that these needn't cost a fortune – or, indeed, anything at all. Even if they don't require a direct financial investment, however, they do require you to invest some time to learn how to best use them and properly understand the results they're returning.

For the small business that really wants to get to grips with network security, there's plenty to be said for adopting the "think like a hacker" approach. Using the same vulnerability discovery tools as they do is one great example, and such tools don't come any better than Metasploit.

Unfortunately, Metasploit is no longer free, although the owners (Rapid7) do offer a free small-business edition (rapid7.com/products) that lets you simulate real-world attacks on your network to expose holes a malicious hacker may otherwise exploit. Individual users (look for the Community Edition) also get access to the Rapid7 Nexpose vulnerability scanner, which provides a contextualised view of the network attack surface.

If your small business has a security budget then it's well worth investing in a business-grade firewall that goes beyond password-only access, and takes Wi-Fi into the realm of certificate-based EAP-TLS authentication. Simply put, this would mean that every client and every router would have to identify itself to the other using public-key cryptography before any connection is allowed. That's all fine and dandy, until you mention the Internet of Things...

The majority of IoT devices are built to budget, and a low one at that. This means certificate-based authentication (as described above) almost certainly won't be supported. All is not lost, however, as most consumer-grade routers actually support the use of multiple virtual LANs (VLANs) and will even go as far as managing the port-forwarding options as well. This means it's possible to circumvent some of the insecurities of IoT devices by connecting them to a VLAN that's different than that to which your laptops and smartphones are connected.

Your router firewall, assuming it has such functionality, is worth enabling for an additional layer of security. Layered security is usually a good thing: if a casual attacker peels off one layer and there are even more to burrow through, then they'll likely give up. A determined hacker, who has good reason to compromise your network and the skills to exfiltrate your data, will most likely succeed whatever you do, so it's almost worth considering them a lost cause to defend against.

If that sounds defeatist, it really isn't: 99% of the attackers probing your networks will be casual hackers trying their luck. The good thing with the firewalls that are built into routers is, for the most part, they can be used to set up rules that will lock devices down as well the ports that might broadcast information to non-trusted parties. You can also set up firewall rules so that traffic isn't allowed to cross between VLANs, with the exception of connecting from your main network to the guest, and not the other way around.

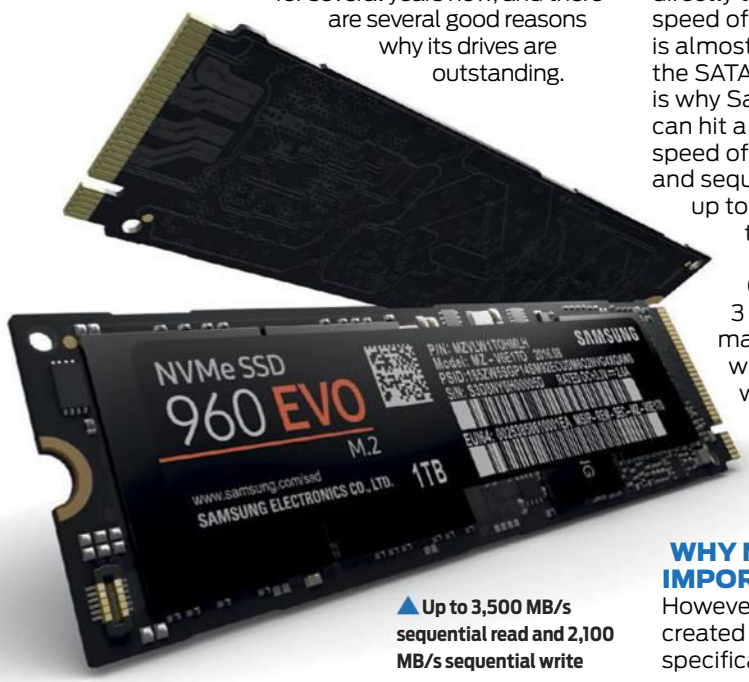
Something the home user doesn't have to worry about, for the most part anyway, is the physical security of IT devices. Let's face it, whose house have you visited where the router was secured with a Heath Robinson Kensington lock contraption? While the small business may not have to worry too much about someone stealing the router, a prankster resetting it could be more than a little problematical. Keeping it secure in a locked cabinet makes good sense all round, but may not always be practical.

If not, then try locating on a high shelf or cupboard top, where stealthy access is simply impossible. It also makes it much harder for a would-be data thief to simply walk up and plug a cable into a spare Ethernet port in an attempt to sidestep your Wi-Fi security measures. Talking of which, ensure your Wi-Fi network is firewalled off from the rest of your network.

Samsung SSDs – not like the rest

UNDERSTANDING HOW A **SAMSUNG 960 PRO** OR **EVO** MAKES ALL THE DIFFERENCE

If there's one area of PC hardware that has blown through speed barriers exponentially, it's today's Solid State Drives, or SSDs for short. With the latest drives delivering much faster performance than drives released just a few years ago, they've experienced explosive growth when it comes to throwing data around your system. And there's one company that has consistently scored highly in product reviews, which is why you'll find its drives in most pre-built gaming systems. Samsung has been the leading SSD-maker for several years now, and there are several good reasons why its drives are outstanding.



▲ **Up to 3,500 MB/s sequential read and 2,100 MB/s sequential write**

WHAT'S AN M.2 DRIVE?

First, a quick refresher if you're not familiar with M.2 SSDs. They look a little like a stick of memory, and require a special M.2 slot on your motherboard, which is usually nestled by your PCIe slots. You can also use an M.2 to U.2 adaptor, but U.2 ports are about as common as USB 1.0 ports on today's motherboards. M.2 drives bring several benefits over the original SATA 3 6Gbps connection used on the first 2.5-inch SSDs, namely a huge increase in bandwidth. They have four PCIe 3.0 lanes piped directly to the M.2 slot, hitting a speed of up to 32Gbps, which is almost a sixfold increase over the SATA 3 6Gbps speed. This is why Samsung's 960 PRO can hit a huge sequential read speed of up to 3,500MB/sec, and sequential write speeds of up to 2,100MB/s, making them incredibly fast in their category. Compare this to SATA 3 6Gbps drives which maxed out at 600MB/sec whilst doing sequential writing and you can see the huge boost that M.2 delivers to sequential reading and writing.

WHY NVME IS SO IMPORTANT

However, not all M.2 drives are created equal. There's another specification that you need to think about when buying an M.2 drive, and it's called NVMe for short. If you want to impress your friends, you can rattle off what this stands for - Non-Volatile Memory Host Controller Interface Specification. It replaces some of the old technology used on mechanical drives, allowing NVMe SSDs to access flash memory extremely fast. Key to this is the ability to process multiple queues at once. NVMe really helps boost this. This means that NVMe equipped drives can process a staggeringly huge amount of random read and write operations, otherwise referred to as IOPs.

In the case of Samsung's flagship 960 PRO NVMe drive, this means it can handle up to 440,000 read IOPs in its largest drives, while random writes is up to 360,000. Compare this to our non-NVMe equipped drive, these numbers are at least up to twice as fast for writes, and often up to four times faster

> **The problem lies in the fact that most people assume all M.2 drives come with NVMe, but they don't.**

for reads. The problem lies in the fact that most people assume that all M.2 drives come with NVMe, but they don't. Many M.2 SSDs have no support for NVMe, and can be at least half the speed of NVMe powered beasts. However, all of Samsung's latest 960 series SSDs are equipped with NVMe as a standard, so you can rest assured you're getting the fastest of our fast SSDs.

▲ **V-NAND technology allows Samsung to fit more memory on M.2 drives**

LANE FREEWAY

There's also the fact that not all M.2 drives operate using a full four lanes of PCIe bandwidth, with some models only using two. Again, Samsung doesn't scrimp in this regard, always utilising the full four lanes offered by M.2. Yet Samsung is also renowned for being extremely affordable considering the performance on offer. Using its technical wizardry, and the fact that it is one of the only SSD makers who builds every SSD component in their drives in-house, and Samsung managed to extract incredible performance from relatively affordable TLC memory on its EVO range of drives. The company has pioneered a 3D format of stacking the memory, which means it can also fit more memory onto the tiny SSD drives, up to 2TB in the 960 PRO. It's called V-NAND, and is only used by Samsung. It's based on the ability to stack up to 100 layers on top of each other, using a technique known as Channel Hole Technology. This allows memory cells to connect vertically with each other, whereas traditional Samsung 2D memory can only communicate horizontally. Samsung's SSD 960 PRO 2TB's remarkable technology packs in a staggering 48 layers in each of the 16 chips in each die package, for a total of 768 layers of memory – all in a sliver the size of your finger!

ACCELERATE YOUR PC

The end result to gamers when using Samsung's latest M2 SSDs is a huge speed boost to nearly everything you can think of doing on your PC. Once you're at the desktop, applications will fire up in the blink of an eye, and switching between open applications will be snappy and responsive (provided you've also got enough system memory). When it comes to games, they'll often load incredibly quickly, and level load times are dramatically quick. This can be super-important with online games, where getting in early gives you and your clan time to set up.

Games that rely on streaming from the hard drive regularly, such as open world games like Fallout 4, should also experience less stuttering and chopping due to storage bottlenecks, as the SSD feeds data to the system memory so fast. It's no wonder then that Samsung drives should be the SSD of choice for gamers and anyone who demands absolute top performance.

IN THE LABS

You won't find better reviews anywhere in Australia!

AMD AGAIN

BEN MANSILL LOVES A THRIVING CPU MARKET

One thing we never suffer from is a blasé attitude to new tech. Even the lowliest, most mundane new product excites us. When a new box arrives in the office it's guaranteed the whole team will swarm around wanting a gander. Well, that's not *entirely* true, when you've seen one Bluetooth speaker, you've seen them all.

But when a truly seismic shift occurs in PC tech we all go kind of crazy. Such is the case with AMD's Ryzen.

There are many factors at play here. There's no denying that many people – particularly those who were into PCs big-time in the early-2000s – have a sentimental soft spot for AMD. And that's ok, it's human nature, when one is so deeply invested emotionally in the hobby we love, being the PC. We all had AMD systems back in the day. We all remember the Athlon being the first to crack the 1GHz barrier. We all had a Duron and overclocked it by drawing on a couple of connections with a pencil so current would pass where it was not intended to, opening the door to massive overclocks, at a price far below Intel's offering at the time (though while we're being nostalgic let us not forget Intel's fabulous Celeron 300A CPU, which was also capable of ridiculous overclocks.

And yes, we all watched AMD slide away as Intel embraced unlocked CPUs (something it officially turned away from for so long). When the Intel Conroe Core 2 CPU came along it really was game over for AMD in the CPU scene. And when the quad-core Intel Sandy Bridge was released there was no way AMD could compete. Yes, AMD had its own dual- and quad-core CPUs but Intel's ever sophisticated architecture kept AMD at bay.

We also remember the nasty competitive market and manufacturer manipulation Intel used to keep AMD down. There was a reason almost every Dell or HP or (pick your major vendor) favoured Intel, and it wasn't a simple case of performance or value. The end result is that AMD just didn't have the revenue to keep developing new cores of the same level of performance as Intel. Frankly, it's amazing that AMD has kept its head above water for so long. Of course, strong market performance from its GPUs kept the money coming in for AMD, as well as its other activities, yet it never abandoned the CPU. Budget and low-power mobile CPU offerings became the focus. Now it's got a very high performance CPU, hoorah.

A NEW ERA

As you can see from our testing and analysis AMD is truly back in the game. I'm in equal parts thrilled that the CPU market is alive again with true competition that surely must force Intel to dramatically lower prices, and I'm personally just feeling good to see that AMD has achieved so much with Ryzen. And it's still early days! As Bennett concludes, motherboards and the new chipset still have room for improvement. And at this stage Ryzen is more of a general purpose CPU than a gaming monster. I can't wait to see how things unfold and how Intel reacts!

AMD RYZEN
58

SAMSUNG
CF791 MONITOR
45

HUAWEI P10
50

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 MEAN

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

HOW WE TEST

Our benchmarking tests are the best in the business. Read on to find how they work...

2D TESTS

Desktop PCs and laptops are tested using our own custom bench testing suite, which has been carefully designed to test all aspects of a system and rate them in a way that's useful to you.

Our benchtesting cover three main tests: a typical video editing test, a demanding 4K video editing test and a multitasking test that stresses all aspects of the system.

We look at the time it takes for each test to run, which is then compared to our reference PC to produce a normalised result. This score is shown on a graph, and to help you understand just where the PC we're reviewing sits in the grand scheme of things, we will often include other system's scores.

The median score of 100 is based on our reference system:

PC & TA REFERENCE PC. SCORE: 100

Intel Core i5-4670K CPU; 8GB of DDR3 RAM; AMD Radeon R7 260X graphics card

On occasion we will run publically available bench testing software, predominantly PCMark 8 from Futuremark. This is run in the Home setting, in Accelerated mode. You can get PCMark 8 as well as 3DMark (below) from www.futuremark.com

3D TESTS

For video cards, as well as Integrated Graphics Processing Units, we use:

- ***3DMark Firestrike***
- ***Shadow of Mordor***
- ***GRID Autosport***

3DMark is designed specifically to test video cards, and you can download and run the same tool as us to help you gauge where your own GPU ranks compared to what we are reviewing.

The two games were selected because they are relatively well balanced in performance between AMD and Nvidia, favouring neither. Both feature a wide range of DirectX 11 shaders. GRID Autosport is fairly easy on GPUs, while Shadow of Mordor is quite demanding, so each provides a helpful gauge for you showing what to expect from a GPU in your favourite games. We will update these to cover DX12 once that API gains traction.

Tests are run using three resolution ranges, depending on where the GPU sits in the market:

Entry level: 1920 x 1080
Mid-range: 1920 x 1080 – 2560 x 1440
High-end: 2560 x 4K

BATTERY TESTS

Screen brightness is set to 120cd/m2, playing a 720p video on loop until the device runs out of power.

REVIEWS

NVIDIA GTX 1080 TI **58**

Corsair One Pro PC

IT'S A TRIM, TAUT, AND RATHER TERRIFIC SECOND GO AT PC BUILDING FROM CORSAIR

Corsair's no stranger to PC building. Apart from having a wide range of components under its belt, from cases to power supplies, it's also had a go with the Bulldog kit PC. It was an odd first choice for the company, and a product that seemed to be a solution in search of a problem. The same cannot be said for the Corsair One (of which the Pro is the top model), a complete PC solution that is not only powerful, but very well-engineered.

There are two things you first notice about the One (which is impossible to type without thinking of The Matrix). The first is that it looks amazing. Its enclosure measures only 12 litres in volume, so it's surprisingly small for what it packs inside, and the matte-black aluminium panels and green lighting from the trim gaps between those panels make for a system that looks both elegant and powerful. And since it's so small, it's also very versatile, at home on or under a desk, or in your loungeroom, for some PC-powered gaming. If you've got a 4K television, and want to expand your gaming setup, the One will not look out of place next to your giant flatscreen. And given the front HDMI slot, it's also ready for convenient VR setup out of the box.

When you turn it on, though, it's also amazingly quiet. This is impressive in and of itself in a case this size, where you might expect tiny hamster-cage fans whizzing away to keep everything from overheating. But this is the where the vertical form-factor comes into play – the natural shape of the One allows natural convection to do a lot of the heavy lifting when it comes to cooling, assisted by a fan mounted in the top of the chassis, beneath a grilled and vaned heatsink.

Solid cooling is important, too, as the One Pro is packed with performance parts. Under the hood is an Intel Core i7 7700K backed by 16GB of DDR4 RAM, and an overclocked MSI GTX 1080. Power is courtesy of a custom-made XFX 80-plus Gold PSU, complete with a passively-cooled zero-fan mode. The PSU has been tuned for this particular case interior, further helping noise and heat dissipation.

The slim design aesthetic extends to the software side of things, with Corsair delivering very little in the way of bloatware on the One's base install. There's Corsair's Link utility, which is very handy, and a few game installers, which makes perfect sense given the One's gaming focus. Aside from the operating system, there's very little other clutter on the Corsair-made 1TB SSD that serves as the system's main storage.

And performance-wise, the entire thing practically sings. Well, hums along very, very quietly, to be more accurate.

Not only did the One handle 3DMark's Firestrike test with aplomb, it did so extremely quietly, able to top out the more intense tests at around 90-100 frames per second, and scoring 8845 overall. In PCMark 8 tests, the One was just as spritely, hitting an impressive 4799, which places it well above the minimum score for not only a solid VR experience, but also a 4K gaming one. And, all the while, the case remained barely audible, and that only in our enclosed, very quiet test-lad. In a real-world environment, with a game or music running, and the sounds of your average house, it's practically silent.

So the One is powerful, it's quiet, and it won't heat up your room. But what it is not is all that upgrade-friendly. Corsair has told us the case can be opened up, but replacing any of the parts yourself – which is theoretically possible – voids the two-year warranty. To keep up with new parts, however, Corsair is planning to open service centers around the world (and including Australia) where you can take your One for in-warranty upgrades by professionals, no doubt equipped with just the right tools for the job.

This is an elegant enough solution, and a wonderfully engineered PC, but for tinkerers it clearly marks Corsair's One as not the right PC for them.

David Hollingworth

KEY SPECS

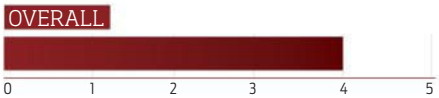
$3,159 · www.corsair.com

Core i7 7700k CPU · 16GB of DDR4 RAM · 1TB Corsair SSD · custom MSI GTX 1080 video card · custom XFX power supply · Mini-ITX motherboard · HDMI 2.0 port (front), USB3 port (front), HDMI port (rear), 2x DisplayPort (rear), 2x USB3 port (rear), 2x USB3 port (rear) · audio ports · two-year warranty.

BENCHMARKS

3D Mark firestrike: **8845** · PC Mark 8 Home: **4799**

OVERALL



TI AMD Gaming Workstation

FOR WHEN GAMING AND WORK ARE EQUAL PRIORITIES

This PC comes from TI Computers and like their system from last issue, also comes pre-overclocked out of the box.

The system is housed in a Cooler Master MasterBox5 chassis which has plenty of room inside for everything, even a 240mm radiator up front if desired. Two thirds of the front grill lifts off easily for cleaning as it acts as a filter for the included 120mm fan up front. The front IO panel has everything you'd expect including dual USB 3.0 ports. Up top it has a large 170mm2 vent suitable for up to a 140mm fan. Underneath there's the removable dust filter for the PSU, and around the back the 120mm exhaust fan accompanies 2x USB 2.0 ports, 4x USB 3.0 ports, 2x USB 3.1 gen2 ports, a PS/2 port, DVI-D, VGA, HDMI (for future Ryzen APU support) and three audio jacks all on the motherboard. With the graphics card providing a further 2x Display Ports, 2x HDMI ports and another DVI-D port.

Looking inside the see-through side panel while it's on you won't see any RGB LEDs here, however the fans attached to the heatsink do have red LEDs at each corner providing some illumination. The 2TB hard drive sits in a cage at the lower front of the case, an optical drive up top and a modular 650W PSU in the lower rear. All the cabling is well routed behind the motherboard tray with no excess cabling visible. Well put together.

The speedy Intel 600P series 256GB NVME SSD drive is slotted in between the HSF and the stock clocked GTX 1070.

Looking closer, the HSF is in a push pull configuration with the exhaust aimed straight up out the top 170mm vent. With the rear 120mm fan exhausting out the rear you could almost argue there's three fans cooling this CPU.

Speaking of which, this Ryzen 7 1700X's base clock is normally 3.4GHz with a boost clock of 3.8GHz. This system came pre-overclocked at 3.75GHz @ 1.35v, slower than the CPU's own boost speed. This got us wondering, what if we ran a test with the CPU at stock clocks, where boost and even XFR can kick in by themselves, and compare it to TI Computers' OC at a fixed 3.75GHz. When running PCMark8's Home Conventional test with AMD defaults we saw core frequencies spike to 3.9GHz (thanks XFR!) so we're confident that the default clocks would win out. Scoring 4201 we then retested with TI Computers overclock. Despite the lower max speed the pre-made overclock won out scoring 4367. Obviously the CPU is downclocking more often than it is boosting, so the shop OC - despite initial appearances - is better than stock.

Attempting to tune the overclock further ourselves, we managed to only raise it a little higher stably to 3.95GHz @ 1.4125v. For fun, we even disabled six of the eight cores and managed to go all the way to 4.25GHz with a silly 1.55v. With the CPU reporting near 110°C at just 3.95GHz (which is likely 90°C -- see this issue's Chip News section) with all cores enabled and anything higher causing an immediate crash we suspect the HSF cooler is inadequate for what this chip is actually capable of. For those who like to tinker, an all-in-one liquid cooler would've been preferred.

Benchmark results for 3DMark were quite good. Time Spy (DX12) gave us 6219 and Cloud Gate (DX11) reported 38894. When we tried them again with the CPU at our custom 3.95GHz speed and with the GPU at maximum overclock (which allowed it to go above 2GHz core speeds) Time Spy gave us 6413, Cloud Gate 40394 and PCMark8 4391, just a 4% increase. It appears TI Computers has wrung just about all it sensibly can from this system which is good to see.

Putting this into perspective, the 7700K system we reviewed last issue (which is basically the same in every way expect CPU) came pre-overclocked at a massive 4.8GHz, giving Time Spy, Cloud Gate and PCMark8 scores of 6169, 37068 and 4825 respectively. With PCMark8 favouring single threaded performance this Ryzen system falls behind, but in the 3DMark tests where a bit of multi-threading is included Ryzen pulls ahead. And we didn't even get around to testing things that would properly stress an eight core CPU.

And that's the rub. This system doesn't and will never have the fastest CPU for single or lightly threaded programs and games, but as soon as you want to throw some multi-threaded tasks like Twitch streaming, video editing or file compression at it, this system suddenly becomes a no brainer. Your workload simply needs to be able to make good use of it. A great PC for people who both work and game on the same system.

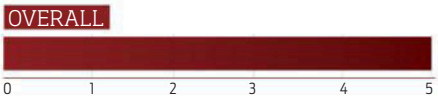
Mark Williams

KEY SPECS

$2,195 · www.ticomputers.com.au

AMD Ryzen 7 1700X @3.75GHz · Asus Geforce GTX 1070 · Asus Prime B350-Plus · Cooler Master Hyper 212 Turbo cooler · 16GB 2400MHz DDR4 Kingston HyperX RAM · 256GB Intel 600P SSD · 2TB Seagate HDD · Cooler Master MasterBox5 case · Fractal Design Integra M 650W PSU · 22x Asus DVDRW burner

OVERALL



Epson WorkForce WF-3620

IF YOU'RE NOT WORRIED ABOUT PRINTING PHOTOS, THIS IS THE PERFECT HOME OR SMALL-OFFICE ALL-IN-ONE

This is a bargain machine for the home or small offices

We're not fans of throwaway printers at PC & Tech Authority: rather than be lured in by the false promise of $100 inkjet multifunction printers (MFPs) that plague supermarket shelves, we think it's better to invest in a high-quality printer with affordable ink cartridges.

The Epson WorkForce WF-3620 is exactly such a printer. It's equally well suited to a home office as it is a demanding household, to support a mixed output of photos, letters and homework.

Unusually for something we review - it's been around for a couple of years. This is our first opportunity to test the WF-3620, though, and we were pleasantly surprised by what we saw.

First, you'll be immensely relieved to hear it includes a fax modem, because you just never know when the 1980s might get in touch. It's also equipped with wired and wireless networking, plus duplex print, scan, copy and faxing. There's a 35-sheet automatic document feeder (ADF), and USB, SD and Memory Stick slots, so you can scan to or print from an inserted device – the only obvious omission is direct PDF printing.

Epson claims a 20,000-page-per-month duty cycle, which is reflected in the sturdy 250-sheet input and 125-sheet output trays, while the scanner lid sits on beefy hinges that extend to cope with thicker books or stacks of documents. The design isn't perfect, however: opening the WF-3620's scanner lid flips open the dust cover on the single-sheet special media slot at the rear.

The WF-3620 uses a combination of touchscreen and physical buttons, but it's not entirely idiot-proof. The screen can take time to register touches, and the layout of the top level of the menu baffled me for a minute. There is one very welcome addition, however:

"You'll be relieved to hear that the WF-3620 has a fax modem, because you never know when the 1980s might get in touch"

unlike its predecessor, the WF-3620 supports multitasking, so you can scan a document while it's busy printing or vice versa.

I wouldn't expect blistering speed at this price, but the WF-3620 is fairly quick. Tested over a wired network connection, it reached 17.4 pages per minute (ppm) when printing black text, and almost 5.4ppm on our far more complex colour graphics test. Photographs aren't this printer's forte, though: it delivered one 6 x 4in print every two-and-a-half minutes, and quality isn't up there with HP's similarly priced OfficeJet Pro 6960.

Photocopies are quick: a single mono copy took 13 seconds, while using the ADF to copy ten pages took less than a minute and a half. In colour, the equivalent tests took 17 seconds and two-and-a-half minutes. Scans were fast, too, with a 300 dots-per-inch (dpi) capture of an A4 sheet needing only nine seconds, and a 1,200dpi scan of a 6x4in photo taking 33 seconds.

The quality of those scans is impressive, even by Epson's high standards; the results are unusually sharp and display an excellent dynamic range. Prints and photocopies are also very good, if not perfect: colours lack saturation, and draft-quality text was very faint.

The WF-3620 takes XL-rated colour inks, which last for 1,100 pages each, and an XXL black cartridge that's rated for 3,400 pages. Epson has stopped estimating the page life of the additional maintenance box that catches waste ink in WorkForce printers, but based on earlier models it's likely to be tens of thousands of pages, and costs less than $70 to replace.

The WF-3620 performs well, has some great features, and is reasonably cheap to buy and run. It's not ideal for photographers, and the interface takes a little getting used to, but it's a near-perfect MFP for home or small-office use, and a cut above the cheap MFPs you'll find on the supermarket shelves. In particular, it has an edge over its closest OfficeJet rival from HP thanks to its longer-lasting cartridges. As such, this is now the printer we recommend in our A-List as the best All-in-one machine.

Simon Handby

The XXL black cartridge is rated for 3,400 pages

KEY SPECS

$249 · www.Amazon.com.au

4,800 x 2,400dpi A4 inkjet · 2,400 x 1,200dpi colour scanner · claimed 33/20ppm mono/colour printing · 6.8cm touchscreen · 802.11n Wi-Fi · 10/100 Ethernet · USB 2 · fax modem · SD card slot · 250-sheet input tray · 35-sheet ADF · duplex · Epson Connect software · 1yr RTB warranty · 449 x 417 x 243mm (WDH) · 9.7kg

OVERALL

PC &TECH AUTHORITY RECOMMENDED

Samsung CF791

ANOTHER FANTASTIC QUANTUM DOT CURVED MONITOR FROM SAMSUNG; EXPENSIVE, BUT WORTH IT

There are two main categories for curved monitors: those built for gamers and those built for professionals. But what if you want the best of both worlds? A monitor with a fast refresh rate, low input lag, fast response time, good viewing angles and fantastic colour reproduction? Step forward the CF791, a 100Hz curved monitor that combines Samsung's quantum dot technology with a gamer-friendly VA panel.

The price may seem high, but even at these dizzy heights there's plenty of curved monitor competition from the likes of Acer (Predator Z35, $1200), Dell (U3417W, $1,250) and Philips (BDM3490UC, $950).

Where the CF791 immediately wins is looks, with low-profile silver bezels and a white rear giving it a suitably premium and futuristic look. The stand is beautifully engineered and provides both height and tilt adjustments, while a VESA mounting kit is included in the box if you want to wall-mount it.

Samsung also makes plenty of fuss about its 1500R curvature: the aim, it says, is to get as close to the human eye's natural 1000R curvature as possible; early curved screens started at 4000R. Combined with a 21:9 aspect ratio and a 34in diagonal, you really do feel like you're being sucked into the action when playing games and watching films.

> Hide unsightly cables away using the plastic cover that snaps onto the stand

Don't be put off by its slower response times and refresh rates than dedicated gaming monitors. Firing up Counter Strike: Global Offensive showed this screen's 4ms response time will satisfy even the most demanding gamer, and there's support for AMD FreeSync.

I found a very slight difference when cycling through the Response Time options in the onscreen menu, with Standard offering a slower response than Faster and Fastest, but I saw no signs of overshoot ghosting in any modes, so I could use the monitor set to Fastest without having to worry about ruining the visuals. Plus, unlike the Samsung C24FG70FQU, there's no brightness cap in Faster and Fastest modes; the CF791's brightness remained untouched at 315cd/m2. That's fine even in sun-drenched rooms.

The CF791 uses the same clever quantum dot technology as in the C24FG70FQU, with similarly excellent results. An average Delta E of 0.56 means this screen is ideal for colour-critical work, and sRGB coverage hit an impressive 99.1%, Adobe RGB coverage 81.2% and DCI P3 gamut coverage is again strong at 87.2% (while set in sRGB mode).

Because the CF791 uses a VA panel, its contrast ratio is much higher than your average IPS display. Indeed, I measured a contrast ratio of 2,330:1, which translates to amazingly lifelike imagery.

^ The curved screen is no gimmick – it does make a difference – but you pay for it

It's evenly lit too, while viewing angles are immaculate – that's in contrast to many other ultrawide panels, such as the Philips BDM3470UP, where the display tails off if you view it off-axis.

Connectivity is another strength. There's DisplayPort, a pair of HDMI 2 inputs, a 3.5mm headphone jack and two USB ports. It also has two integrated 7W speakers, which produce incredibly good sound for a monitor; I'd be happy to listen to music and streaming TV audio through the CF791's speakers. Coming from someone who typically listens to music via headphones and a discrete DAC/headphone amp, that's quite some praise.

Yet another nice touch: if you route your cables through the monitor's stand then you can clip on the plastic cover at the back to keep it all hidden away. It's also good to see Samsung avoid the use of touch buttons, instead offering a clickable joystick located at the back of the monitor in the bottom-right-hand corner. Through the OSD you can adjust the gamma, colours, and response time of the monitor.

The Samsung CF791 might be expensive, but justifiably so. It's simply a fantastic all-rounder. Its dramatically curved 21:9 ultra-wide panel provides an immersive, cinematic experience whether you're working, playing or watching. The 3,440 x 1,440 resolution provides ultra-crisp visuals and, coupled with great colour accuracy and a lack of motion blur, it's suitable for not only the photo editor but also the competitive gamer. If you can afford it, don't hesitate to splash out.

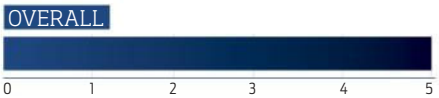
Christopher Minasians

KEY SPECS

$1499 · www.samsung.com.au

Curved 34in VA panel · 3,440 x 1,440 resolution at 100Hz · 4ms response time · DisplayPort · 2 x HDMI · 2 x USB · 3.5mm headphone out · 100mm height adjustment · -2 /14 tilt · 1yr warranty · 808 x 309 x 516mm (WDH with stand) · 8kg

OVERALL



PC &TECH AUTHORITY RECOMMENDED

Nvidia Geforce 1080 Ti

THE BIGGEST PERFORMANCE JUMP FOR A TI CARD EVER

It's been almost a year since Nvidia's Pascal GPU was launched, and in that time there have been several iterations, from the top-end discrete GTX 1080 and GTX 1070, mid and budget range GTX 1050 and 1060 – along with a tweaked 1050 TI. In the mobile space Pascal has been a raging success as it offers desktop performance in a mobile GPU, and that's been used to produce truly exciting products with very high resolution (up to and including 4k) screens, and/or very high refresh rate screens.

The king of the Pascal pack was the Titan X, which has the full suite of processing units onboard (see table), and sold for a hefty premium over the standard Ti. Now, for the second time in a row, people who bought a Titan have seen the Ti version equal or exceed Titan performance at a far lower price. All because this particular Ti card is an absolute ripsnorter, delivering the biggest jump in performance over a standard GPU that Nvidia has ever achieved. Nvidia claim approximately 35% greater performance for the new GTX 1080 Ti over the regular 1080, and our testing bears that out.

This means different things to different people. For gamers it's a card that can smoothly drive gaming on a 4k monitor, and for compute applications the 1080 Ti represents far better value than the Titan X, which costs hundreds of dollars more, and can match it for processing power.

It gets there by two means. First, the Pascal GPU used in the 1080 Ti (which is designated GP102-350-A1) is near enough identical to the Titan X's GPU (GP102-400-A1), and packs in the full meat tray of shader units and texture units, and almost the maximum render units. As you can see on the table it's quite a jump from the standard 1080's 2560 shaders to the 3584 used on the 1080 Ti (and Titan X). Texture mapping units are also increased considerably over the regular 1080, with 224 vs 160 (again, equal to the Titan). The Titan X only holds a lead for render output units, but the difference is slight, and largely inconsequential.

Also inconsequential are the differences between the clock speeds. Yes, the standard 1080 has a higher base core clock (1607MHz vs 1480MHz), but thanks in part to a better stock cooling solution and presumably refined manufacturing of the GPU itself, it boosts during gaming to frequencies equal or better than a stock 1080. Better yet – the 1080 Ti appears to welcome aggressive overclocking, which pushes its performance even higher. Our review sample held steady at a lofty 2025MHz, while the memory was easily stable at 1501MHz over the default 1376MHz speed. Temps were solid at 86 degrees while overclocked near the limit, though Nvidia's reference cooler, revving along at 3300rpm (70% of maximum), put out annoyingly high levels noise and heat. In real world use we would definitely wind back the overclock for that reason, knowing that exceptional performance was still on tap, but more bearably.

It's the memory that gives the Ti its second major advantage. Working with memory partner Micron, Nvidia has been able to bump throughput to 11,000 megatransfers per second (MT/s). That's a 10% increase over the standard 1080, and matches the Titan X. But that's not the whole story. Nvidia has also doubled the number of power controlling FETs to deliver more stable performance at higher frequencies. The Titan X still has 1GB more memory in total (12GB vs 11GB), but again, that's not going to make a big difference, and the 11GB onboard the 1080 Ti is sufficient to handle the large textures 4k gaming demands – which further reinforces this card's abilities as a 4k monster. Incidentally, this new GDDR5x memory and the new Micron controller will be used in all new standard GTX 1080 cards manufactured from now on.

Nvidia has delivered a monstrous gaming card with the GTX 1080 Ti. It makes single-card 4k gaming feasible and will eat up anything at standard resolutions no matter how high the detail settings are. It's the new king of cards.

Ben Mansill

KEY SPECS

$1,150 · www.nvidia.com

11GB GDDR5x · 7680x4320@60Hz maximum resolution · 250W power required · 3 x DP 1.4, 1 x HDMI 2.0b

BENCHMARKS

Test PC: i7 6700k @ 4GHz, 32GB RAM @ 2133MHz

3DMARK FIRESTRIKE

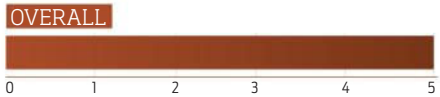
GTX 1080 4K- **5415** 1080p - **21,922**

GTX 1080 Ti 4K- **6567** 1080p - **27,658**

GTX 1080 Ti OC* 4K- **7367** 1080p - **29,958**

**(1999.5MHz core, 1501MHz memory)*

OVERALL



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Billion BiPAC 8920NZ Dual-SIM 3G/4G LTE Embedded V/ADSL2+ Wireless-N VPN Firewall Router

AN EMBEDDED LTE MODEM ENSURES YOU STAY ONLINE 24/7

Having a backup internet connection used to be something only businesses making heaps of cash could justify. But with the popularity of cheap pre-paid 3G and 4G data plans, having a contingency plan for when your internet goes down at home or small business, is cheaper than ever. Billion's latest BiPAC 8920NZ VDSL modem router makes implementing a secondary internet connection seamless.

From the outside, the BiPAC 8920NZ looks just like any other Wi-Fi modem router on the market. It supports VDSL, so it'll work with FTTN/FTTC NBN and has a dedicated Ethernet WAN port, as well as 4-port gigabit Ethernet switch. A USB port on the back allows for an external HDD to be attached to act as network storage.

The core feature of the BiPAC 8920NZ is its tri-WAN configuration. In one box, there's traditional Ethernet WAN, ADSL/VDSL modem WAN and an integrated 3G/4G modem with dual SIM card slots. When configured correctly, this allows for seamless failover. Just a warning though - just because there's two SIM slots, doesn't mean you can use both SIMs simultaneously. It's there so you can set up failover between SIMs, not for link aggregation.

There's no need to worry about USB 3G/4G modem compatibility like on other routers that claim have 3G/4G support, as the modem is built directly in to the router itself. No USB dongles required. As soon as the router detects that the primary WAN interface is down, it'll move all traffic over to the 3G/4G modem and then move back to the primary interface once it starts working again.

The 3G/4G modem in our test unit is the MC7430 from Sierra Wireless, that supports the B1, B3, B5, B7, B8, B18, B19, B21, B28, and B38-B41 LTE bands and the B1, B5, B6, B8, B9, B19 WCDMA/3G bands. Basically, it'll work on every network in Australia. Sierra claim the MC7430 supports 300 Mbps down and 50 Mbps up, but Billion's documentation for the BiPAC 8920NZ state a maximum of 100 Mbps for downloads.

In testing, it was rare to achieve more than 60 Mbps on Optus or Telstra, but that's likely to be the typical randomness of radio frequency communications, rather than a lack of effort from the modem. Compared with a standalone LTE modem, speeds were roughly identical.

Besides the tri-WAN setup, the BiPAC 8920NZ has all the other goodies you'd expect in such a high-end modem router.

Detailed QoS options, 16 simultaneous IPSec VPN tunnels (L2TP client and server support), a deep packet inspection firewall and loads of other obscure networking features. For those who need to manage a fleet of these things, protocols like TR-069 and SNMP are supported.

The only sore point with the BiPAC 8920NZ is the lack of 802.11ac Wi-Fi. 802.11n is fine and all, but 802.11ac is standard on all but the cheapest Wi-Fi routers these days. There isn't even support for 5 GHz 802.11n – something that may be important if you're in a densely populated area that has poor 2.4 GHz spectrum availability.

Setup is not as friendly as say, Netgear or D-Link's more consumer facing models, but is on-par with other enterprisey level devices from Cisco and Draytek. Billion's support is excellent though, with regular firmware updates and a detailed user guide that's written by someone with a solid knowledge of the English language, unlike some other manufacturers.

Unless you specifically need the 3G/4G modem feature, there's much cheaper and equally capable VDSL Wi-Fi routers. The fact there's a cellular modem built-in bumps up the price significantly. USB 4G modems are practically given away by telcos at supermarkets now, so is it worth the hundreds of dollars more for a feature that can be added on to a cheaper router with a $19 dongle?

If having one less thing sticking out of your router and an instant, seamless transition between the fixed and cellular connections is important to you, then the Billion BiPAC 8920NZ won't disappoint.

Anthony Agius

KEY SPECS

$TBA · au.billion.com

ADSL/VDSL modem · integrated 3G/4G dual-SIM modem · 802.11n Wi-Fi · 4-port gigabit Ethernet switch · 1x gigabit WAN port · 1x USB 2.0 port

OVERALL

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THE NEW YORK TIMES

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Huawei P10

POTENTIALLY THE BEST VALUE ANDROID PHONE AVAILABLE

Caption about a million colouts etc

Huawei has grabbed all the best bits of its flagship Mate 9 and crammed them into the latest iteration of its P Series smartphone, the P10.

The headline act of this sleek handset is its cameras – all three of them. Around the back, the same Leica dual lens setup found in the Mate 9 has been used here and lines the top edge of the phone, much like its predecessor, the P9.

That setup deploys a 12MP colour camera and a 20MP monochrome one, which together produce photos on par with the best that Apple, Google and Samsung have to offer in their range toppers, in most scenarios.

Around the front, the front-facing camera gets new functions in the form a new smart mode that detects multiple faces and auto adjusts to wide angle to suit, and Leica effects.

Other components borrowed from the Mate 9 parts bin include the Kirin 960 chipset, the octa-core processor, and 4GB of RAM, meaning the P10 can handle anything you throw at it.

The lightning-quick fingerprint sensor has moved to the front at the bottom, which may irk some, but it has picked up a neat party trick in becoming a combined, home/back/view open apps button with a simple setting change, replacing onscreen versions of those functions.

While the tap and hold actions for back and home respectively worked perfectly, I could never get the exact swipe motion required to view the open apps first go.

Conveniently (or not), Huawei have pre-installed a screen protector for the phone, which is basically their way of telling you it's not their fault if you drop the thing and shatter the lovely full HD display.

At the time of writing, Huawei hadn't set a local price, and a vague release timeframe of May/June. But if it enters the market circa $800 like its predecessor, you'd be looking at the best value-for-money Android phone on the market, bar none.

Peter Gutierrez

KEY SPECS

$TBA · http://consumer.huawei.com/au

5.1in 1080x1920 IPS LCD display, 3,200mAh battery · Kirin 960 chipset, ARM octa-core CPU, 4GB RAM, 64GB on-board memory (expandable via microSD) · 0MP/12MP dual lens rear camera, 8MP front camera, dual-SIM · Android 7.0 via Huawei EMUI 5.1

OVERALL

Astrohaus Freewrite

IT'S WEIRD, IT'S WONDERFUL, IT'S EXPENSIVE, BUT WRITERS WILL ENJOY THE FREEWRITE'S OLD-WORLD CHARMS

> The mechanical keyboard is highly reminiscent of typewriters

Set Your Story Free, the Freewrite typewriter tells me, beneath a stylised illustration of Edgar Allen Poe. The command gives a clue to the purpose of this backwards-facing piece of technology – a device that intentionally eschews the digital in favour of a design that emphasises clunky keys and sturdy physical levers. As I write this very review, the text appears on a small rectangular screen embedded into the typewriter, in E Ink. That makes it usable outside even in sunlight, with the promise of "weeks of battery life", while a frontlight means it's possible to use in the dark too.

The words I type now are automatically uploaded to my account, but – just like a typewriter – there's no means to go back and select previous sections of this document on the Freewrite itself, save from deleting everything up to that point. Any typos and misguided paragraphs must be corrected on mylaptop later.

As someone who has never written with an actual typewriter for a sustained amount of time, this rhythm is totally alien to me. Everything is flattened onto a single, linear plane, and I'm left to forge my way forward, one mechanical clunk at a time. From the physical levers to the nostalgic case design – angled towards me like a set dressing from series one of Mad Men – this machine wants me to consider a way of typing that isn't joined at the hip to emails and messages and Spotify playlists and news and Twitter and copying andpasting.

It's a strange experience. I feel vulnerable. As if I'm writing words that are hard to erase and without completely knowing where they're going. My only option is to keep pushing on, or to give up. Perhaps this is why depictions of typewriters in film are full of frustrated writers, tearing off sheets of paper and tossing them into bins.

> You'll only need the frontlight on in the dark, as the Freewrite uses E Ink technology

There is an elephant in the room. The Freewrite costs US$499. I've had to guess that number from memory, because I don't have a tab open to search for the information, but I will correct it afterwards (I did). This is a silly amount of money to spend on something that, on the surface, gives you far less than...

I stopped writing that paragraph because a colleague sent me a video on my actual computer, of a singing Japanese robot. Normally that would go unmentioned, but I feel as if I need to be honest with you. There's an intimacy to writing like this. I've closed the lid of my laptop now. We are alone.

"It's easy to dismiss the Freewrite as an oddity for well-heeled posers, but writing technology doesn't move in a straight lin"

Yes, the Freewrite is ridiculously expensive for what it is. You could buy a Chromebook for less than half the price, then install apps designed to disconnect you from theinternet. You could even buy a vintage typewriter on eBay, although you'll need to find ink ribbons, and it may be more of a task to lug it around with you. Why would you spend that money...

Sorry. I stopped writing that paragraph because I decided to post the video of the Japanese singing robot to Twitter. Again, I normally wouldn't mention this. It would simply be folded into the structure of writing we've all become accustomed to, flitting between tasks and thoughts as they crop up. I've put myphone away. We are alone again.

So the Freewrite costs an absurd amount of money, and yet, and yet... There is something about this typing and this intimacy I'm feeling with the thing I'm writing. I once went to a talk by Will Self and Iain Sinclair about their dead friend, the writer, JG Ballard. It took place in a church hall, which was fitting because the pair spent most of the time bemoaning the loss of typewriters. Self in particular fetishised the pattern of writing typewriters offered, and at the time I thought: this pair of old coots and their nostalgia, pfft.

Now, I can start to get a grip on what they were saying. Writing in thismanner does feel different, and itcreates a different type of writing. Adifferent way of thinking, even. One that befits the idea of a novel, perhaps, with its space for internalised thought.

It's easy to dismiss the Freewrite as an expensive oddity, angled to nostalgic retirees and well-heeled posers, but it shows that the progress of writing technology doesn't necessarily travel in a straight line. With its USB Type-C port and automatic cloud syncing, the Freewrite doesn't ignore internet connectivity, but instead keeps it under tight control. It shows an alternate path, a cul-de-sac even, where typing doesn't happen across 20 tabs.

Thomas McMullan

KEY SPECS

US$499 · www.getfreewrite.com

OVERALL

Serif Affinity Photo

AT LAST, A SERIOUS AND POWERFUL RIVAL TO ADOBE PHOTOSHOP - AND FOR A FRACTION OF ITS PRICE

PC &TECH AUTHORITY RECOMMENDED

^ Rather than apply filters to the whole image, you can do so to layers alone

There can be few Adobe Photoshop CC subscribers who don't look at that steep fee leaving their account every month and wonder if there's a cheaper alternative out there. Until recently, the search for competent alternatives would have drawn a blank. But the arrival of the $80 Affinity Photo on Windows changes everything.

If you're thinking $80 per month still sounds teeth-suckingly steep, relax. This isn't a monthly subscription but a one-off fee: cheaper than a mere three months' worth of Photoshop. Can something so inexpensive really compete with Adobe's industry standard? Yes, yes it can.

PICK A PERSONA

At first tilt, Affinity Photo appears to be something of a crossbreed of Lightroom and Photoshop, offering different stages of workflow (Develop, Photo, Export etc) as "personas", whilst offering the full editing capability of Photoshop.

Open a raw photo in Affinity and you'll be thrust into the Develop persona, where you can make a series of adjustments to your file. There are sliders for tweaking exposure, saturation, vibrancy and other tonal parameters; tools for applying lens correction and vignettes; plus options to boost the sharpness of the image and apply noise reduction. Largely, the same tools you'll be used to from Adobe's Camera Raw importer.

Once the raw photo has been "developed" it moves into the Photo persona, which is roughly akin to Photoshop's default editing workspace. Immediately, you'll notice that the strip of available editing tools down the left-hand side of the screen is populated with familiar names from Adobe's behemoth: crop, selection tools, healing brushes, dodge and burn, mesh warp. So far, so familiar.

There, are, however many subtle differences in the way tools and filters are applied in Affinity Photo versus the way they are in Photoshop. Take the dodge and burn tools. To burn some extra fury into dark clouds, for example, Affinity Photo provides a live preview of the burn effect when you hover the brush over the affected area, giving you a chance to adjust the strength of the effect without having to apply and undo an edit. The same is true of most brushes.

Then there's the live filter layers. Instead of applying filters to the whole image, filters can be added as layers. This means you can apply a depth of field filter (mimicking the effect of using a wide aperture in-camera) and switch that layer on or off, making it a totally non-destructive edit.

Talking of which, I'm a big fan of the way Affinity Photo lets you scroll back and forth through the history of your edits. As with Photoshop, there's a History window that lets you jump back to any previous step of the edit. However, Affinity also includes a History slider that you can drag back and forth and return the image to a previous state, whilst watching a live preview of the changes in the editing window. It's extraordinarily slick.

POWER TOOLS

Affinity's not short of power tools, either. Photoshop's Content-Aware Fill, for instance, is a great tool for photographers who want to remove a stray object or interlopers. Affinity has an equally powerful alternative called the Inpainting Brush Tool, where you simply brush over the item you wish to remove and it attempts to heal the background.

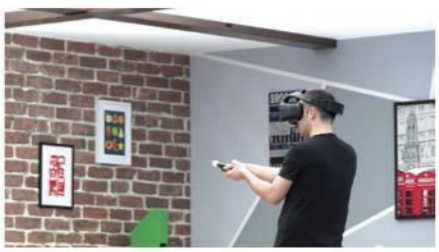
It performed admirably in several tests, including quite a tricky job of removing a painting from a brick wall background (see below left). There was some distortion on the brickwork, but nothing a little work with the clone brush wouldn't fix – and it didn't warp the shape of the bricks in the same way Photoshop did. As with Photoshop, the Inpainting tool is also available to stitch gaps in panoramas.

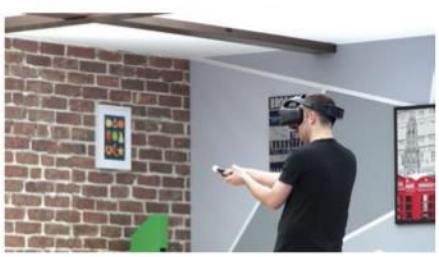
Other power tools include a superb HDR merge facility, which opens one of Affinity Photo's other personas – Tone Mapping. This provides fine control over the various tonal qualities and allows you to prevent that HDR effect from becoming too overblown. The Tone Mapping persona can even be used to give a convincing HDR quality to single exposures, adding punch in the highlights and shadows.

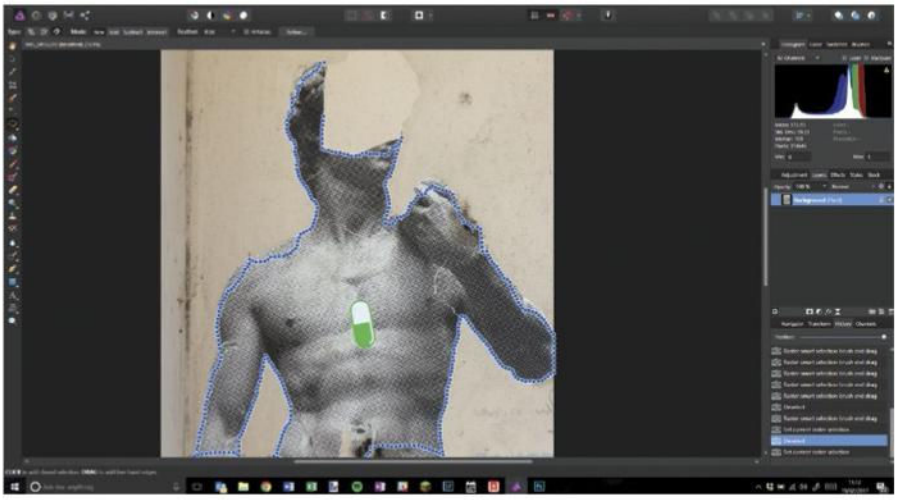
Many of these tools are difficult to master if you just wade in, but Serif has published a large Vimeo library of video tutorials (pcpro.link/271aff), which diligently walk you through all manner of advanced techniques.

The final step in Affinity Photo's workflow is the Export persona, which offers a wide selection of formats to save your photos in. These include the usual suspects of JPEG, PNG and TIFF, plus PSD for continuing to work in Photoshop and other Adobe applications, and esoteric

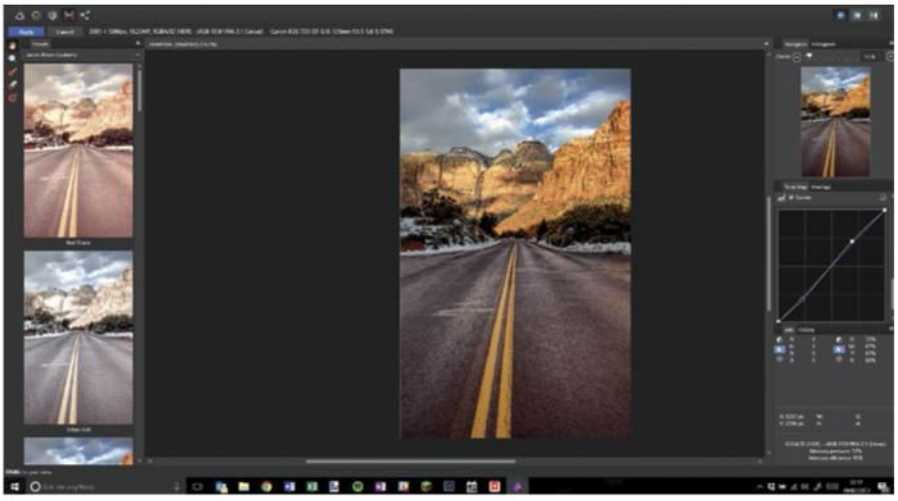
v Affinity's Inpainting tool allows you to brush objects, such as this poster, out of existence







Affinity's "Magic Wand" Selection Brush automatically detects edges and more



One of Affinity's greatest strengths is its versatile HDR merge facility

options such as 32-bit Radiance for HDR photography. However, we were a little bemused by the Save dialog itself. Even when exporting as JPEG, this describes the file type as "Affinity Files" – fear not, the image is saved to disk in the correct format.

LAPTOPS BEWARE

If there's one fly in the ointment, it's performance. Affinity Photo seems to lean much more heavily on the graphics chip than Photoshop, so if you're relying on integrated graphics, as I was on my test laptop, you're going to suffer significant lag.

It's far from unusable, but even on my Core i7-6600U ThinkPad with 16GB of RAM, I found myself waiting ten seconds or so for a raw file to open in the editor and over a minute for HDR merge to complete with three raw images.

Photoshop CC 2017 is, by comparison, a gazelle on the same system, with the same photos ready for editing in a second or so, and no significant wait when processing or exporting single images, as there was with Affinity. Given that many photographers tote around a laptop for on-the-job editing, that's a significant black mark for the usurper.

Even still, when you consider the range of features you're getting for less than $80, many photographers may well conclude that it's a compromise worth making. For photography enthusiasts who crave Photoshop-like power but can't justify the subscription fee, Affinity Photo is a no-brainer. It will even give professionals some serious pause for thought.

Barry Collins

KEY SPECS

$79.99 · www.affinity.serif.com

REQUIREMENTS: Windows 10, 8, 7; OS X 10.7.5 or later l 2GB RAM (4GB recommended) l DirectX 10-compatible graphics or above

OVERALL

ZTE Axon 7

WHEN A PHONE COMES OUT BOASTING AKM AUDIO CHIPS, AND PROMISING THE HIGHEST AUDIO QUALITY, WE THOUGHT WE OUGHT TO HAVE A LOOK AT SOUND QUALITY!

PC &TECH AUTHORITY RECOMMENDED

The phone is the premium model for ZTE, one of the giant Chinese companies that you don't hear much about in the consumer space. But if you were paying attention to the Mobile World Congress, you'd have noticed ZTE picking up a slew of awards for shockingly high performance from its 4G+ infrastructure.

Here the phone sells for $699, or $300-odd less than similarly specced phones from better known brands. Except none of them claim to have those chips.

THE PHONE

So, as a phone this is a large screen model – 5.5 inches with AMOLED in 2560 by 1440 pixel resolution, with Gorilla Glass 4 for robustness. It runs a fast Qualcomm Snapdragon 820 processor, has 4GB of RAM and employs Android 6.01 Marshmallow as the operating system.

It has space for either two SIMs or one SIM and a microSD card of up to 128GB. There's a back camera of 20MP, a front one of 8MP. It connects to the world via USB Type-C (hurrah!). It has a fingerprint scanner on the back for unlocking. And it has unusual audio facilities.

AUDIO

It has, unlike some phones, a headphone socket. It is – unusually it seems these days – located at the top of the phone where it belongs instead of at the bottom. It also has two AKM chips, The ZTE website says that 'the AKM 4961 HiFi Recording Processor combined with the AKM 4490 HiFi Audio Amplifier provide the best audio that can be found in any handset today.' They may be right about the closing part and the opening part (the 4961 is an analogue to digital converter for recording), but the AKM 4490 appears to be a DAC rather than an amp if I read the chip's datasheet correctly.

A very high quality DAC to be sure, which uses 256x oversampling delta sigma decoding, with support for 32 bit and 768kHz sampling, plus quad speed Direct Stream Digital. THD plus noise is specified at -112dB. There is a choice of five filter implementations for PCM conversion (of varying degrees of smoothness or sharpness).

So if I have read things correctly, we don't know anything about the headphone amplifier itself, except what we can glean from performance. I did manage to glean a little. Also built in is Dolby Atmos decoding, which means Dolby Atmos faking. I played a little with this, and it did seem to change the character of the sound field, but failed to convince me with regard to a surround effect.

I should note that the phone came with a very handsome looking set of earbuds as well. They were largely white, with rose gold (to match the body of the phone) sleeves on the cables and the inline remote. The earpieces looked to be shaped like those provided with the iPhone. I did not use them. Hard earbuds require one's ears to conform, instead of them conforming to one's ears.

< It's a good looker that can't help remind us of HTC's look and feel

SOFTWARE

The music player which comes with the phone looks pretty but had a couple of issues which made me use it only reluctantly. First, it was slow. I had dumped in about five and a half thousand tracks onto the SD card. What's the point of having a 128GB SD card in a phone unless you use it for media, after all? So perhaps the slowness was due to too many tracks.

The player opened on a default screen and to get to the index screens – All Songs, Artist, Albums, Genres – you have to touch a section called "All Songs", and then wait three to five seconds before the screen would first appear and then be populated. It always opened on "All Songs", as the name suggested, rather than Artists or Albums. So then it was necessary to touch "Artists", and that took quite a while to fill. In fact, opening up the Artists screen took about 17 seconds in total. I imagine it's faster with a smaller music collection, but likewise would also be slower with a longer one.

Secondly, songs were presented alphabetically ordered based on the "Title" field in the ID3 tags, not by track number, and played in random ('shuffle') order. I could find no way to make them play straight through in track number order. On the much better side of things, while the Android warning about turning the phone up too loud appeared occasionally, it didn't appear all the damned time!

The app was certainly happy to find all the stuff I piled into various folders in the phone, including MP3, FLAC (up to 192kHz) and AAC. Excepting, though, DSD which it did not recognise. Which seems a bit odd given the DAC support.

I did most of my testing using USB Audio Play PRO software. It is capable of delivering DSD to an external DAC,

but was unable to recognise the DAC capability of the internal one (perhaps because Android was mediating matters), so it converted DSD to 176.4kHz PCM for internal consumption.

The phone also supports OTG (On The Go) connections so you can use an external DAC should, for some reason, you find the internal performance to be of insufficient quality or you insist on hardware decoding of DSD.

SOUND

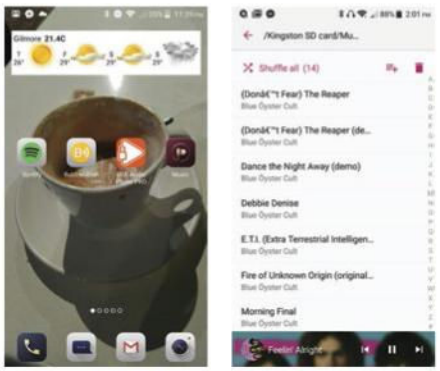
I don't normally bother to comment on the sound quality, such as it is, of internal speakers on phones. Goodness, what can you expect? But I do have to remark on this phone. It has two long and skinny sets of perforations on the front, one near the top and one near the bottom of the phone, and it uses these as a stereo pair: left at the top, right at the bottom. Prop the phone up sideways to enjoy stereo. By comparison to most phones, the quality was actually quite good. There was a touch of lower midrange – I wouldn't deign to call it any form of bass – which improved things considerably compared to most phones.

Incidentally, there are also three microphones – one on the top, one on the bottom and one I don't know where – so that ADC might have some good material to work with. But I didn't look into that.

It's great to see a phone company using first class DACs in their phones. Unfortunately, there's more to audio design than that. In particular, a low impedance output is needed on the output. If there isn't a low impedance output, then there are two clear results. First, the output of low impedance earwear is reduced because the internal impedance of the output stage acts as a voltage divider. The higher the internal impedance relative to the load, the more power wasted in that internal impedance, and the less available for the load.

Secondly, the tonal performance becomes unpredictable. Quite a few headphones have the fine characteristic of presenting an even impedance across the frequency spectrum. They will be powered by a high impedance output evenly across the range. But many otherwise fine headphones have, like virtually all loudspeakers, an uneven impedance load according to frequency. They will consequently suffer from frequency response variations, with peaks at the frequencies where their impedance is high, troughs where it is low.

The ZTE Axon 7 unfortunately appears to have a resistive load in line with the headphone output of around 63 ohms, or so my calculations from the output drop



A fairly clean Android skin

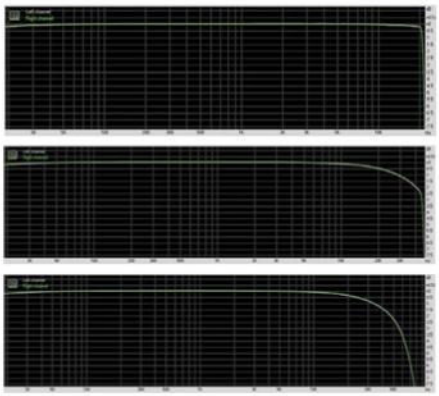
at various loads suggests. So while the output with a full scale sine wave was around 0.91 volts RMS into a 47kOhm load, it dropped to about 0.75 volts into the 295 ohm test load, and 0.18 volts into the 15.9 ohm test load. That meant that the output peak was around 2.8dB above headphone sensitivity for high impedance headphones, and 3.2dB for low impedance ones. For comparison, iPhone 6s and Samsung Galaxy phones typically provide about at leat 9dB of output above headphone sensitivity (14dB for the Samsung).

The effect on frequency response will depend entirely on the headphones used. As it happens I used a pair of Sennheiser Momentum In-Ear earphones (M2 IEG) for in-ear work, and a pair of Oppo PM-3 closed back planars for over ears work. Both of these are reasonably sensitive within their categories and both lowish in impedance (18 ohms for the former, 26 for the latter). And both have been tested to present dead even impedance loads across the spectrum. In both cases, calculations suggest peak outputs with this phone of perhaps 105dB. Given that there was no clipping at the output, that's probably enough. I could certainly wind the phone up with both sets to uncomfortably high levels without any distortion.

With both sets of ear gear, this phone sounded great. It was bright but well balanced, and with first class detail in the sound. As I mentioned, the volume was loud enough – although some who really want extreme levels may be disappointed. It really is a pity about that inline resistance.

MEASUREMENTS

I've given much of the measurement game away already with the above discussion, but to recap. I used three signals – 100 hertz, 1002 hertz and 10,000 hertz – all sine waves modulated to peak at full digital scale. Then I turn up the output



Output frequency response, top to bottom: 44.1kHz, 96kHz, 192kHz

at various loads to see the maximum output before clipping. With this phone, there was no clipping even at maximum volumes. With my 295 ohms test load, at all three frequencies the phone was capable of delivering around 1.9mW. But with the 15.9 ohm load, this increased to only 3.2mW. Even modestly endowed phones like the LG G5 manage 4.7mW, while the iPhone 6S produces 9.4mW and the Samsung Galaxy S7 gets to 24mW.

For high resolution audio, ZTE seems to have chosen the smooth, gentle roll-off option. With 192kHz signals the high frequency output was down by 0.4dB at 20,000 hertz, 2.2dB at 50,000 hertz and 5.8dB at 70,000 hertz. Measured noise (including the test rig) was at -103.2dBA, while THD was 0.0011%.

With 96kHz, 24 bit sound the noise and distortion performance was identical. Output was down by 0.5dB at 20,000 hertz, 1.1dB at 30,000 and 2.0dB at 30,000 hertz.

Distortion levels were similar with 16 bit, 44.1kHz signals, and noise was an impressive -97.8dBA. There's a very slight roll off in the higher frequencies to -0.2dB at 20,000 hertz, at which point the output hits a brick wall.

CONCLUSION

So look for headphones with flat impedance curves (good luck finding that in specifications though!) and fairly high sensitivity, and all should be fine.

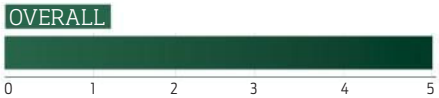
Stephen Dawson

KEY SPECS

$699 · www.ztemobiles.com.au

5.5in, 1440 x 2560, 538ppi AMOLED screen, 64,4GB RAM · Quad-core CPU on Snapdragon 820 chipset, Adreno 530 GPU · 20/8MP cameras, Android 6.0.1, 3,250mAh battery · Fingerprint reader, microSD slot/dual-SIM card, 152 x 75 x 8mm, 175g

OVERALL



Asus AiProtection

THE SMART AND EFFECTIVE WAY TO BLOCK INTRUDERS

There are thousands of nefarious hackers out there who would absolutely love to install a piece of nasty ransomware on your computer. There's always someone who wants to use your nifty Internet of Things devices to fight in a massive distributed denial of service attack and there will always be scammers after your juicy personal information so that they can steal your identity.

These examples are just a handful of the thousands of ways someone can take over your computer and do what they want with it, exposing you and your family to unnecessary risk online.

WHO TO TRUST?

Unfortunately, it's easy to fall for hacker's traps. You or your kids click some link in an email. Maybe you click an innocent looking ad. Or you click link a friend sends promising a funny video on social media, that wasn't actually your friend, but someone pretending to be your friend in the hopes you'll click that link and turn your computer over to them.

Unless you're extremely savvy or paranoid, the chances of falling for this ruse, at least once, is quite high. This is why a plethora of computer security products exist, some good, some not so good - to prevent or minimise the damage if something does go wrong.

To make things more difficult, most homes have more than one device accessing the internet - usually a mix of desktops, laptops, tablets and smartphones. Possibly even a variety of smart devices like TVs, health trackers and lightbulbs. These are all portals for someone to get in to your network and do damage.

ASUS AIPROTECTION

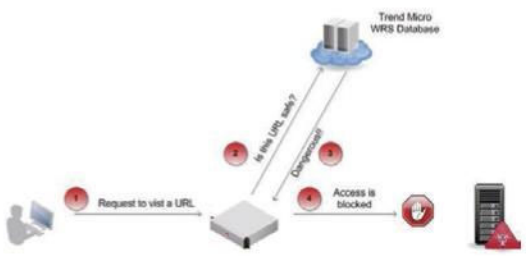
Now, you can secure each device one by one, installing anti-virus and anti-malware software, firewalls and intrusion detection apps on each one, but the foundation for good network security is a holistic approach and Asus's routers with AiProtection bring commercial grade security to your home network. As Internet traffic flows between your router, out to the devices on your network, AiProtection can monitor and inspect the traffic and make sure it's not going to ruin your day. AiProtection also checks to see if your network has any obvious holes in it that an attacker can take advantage of, such as default passwords or guest logins, unnecessary open ports in a firewall and weak Wi-Fi settings.

The key way AiProtection does its thing, is by inspecting internet traffic as it comes in to your network. AiProtection partners with Trend Micro - world leaders in internet security - to maintain a database of all the nasties that linger around on the internet. This is called Web Reputation Services (WRS) and it is constantly updated with info from the millions of other Trend Micro users and Trend Micro security experts.

> The brilliant Asus RT-AC68U includes AiProtection absolutely free – along with over a dozen other Asus routers!

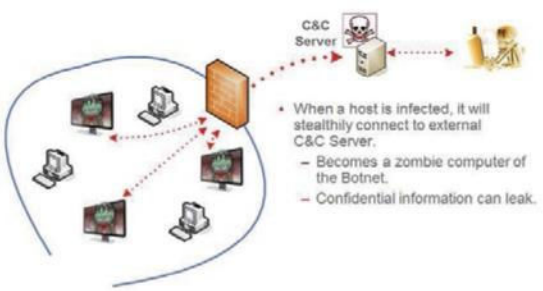
PARTNERS AGAINST CRIME

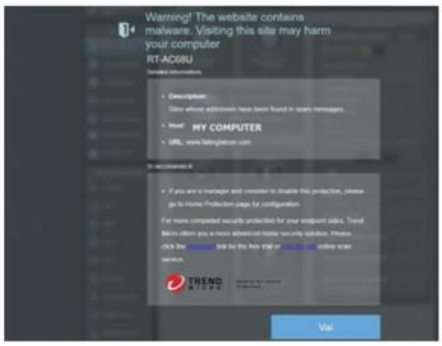
AiProtection's deep packet inspection has the ability instantly detect any incoming traffic that resembles a known threat from Trend Micro's database. This prevents the malicious traffic even getting close to your precious devices, as it is all blocked at the router. AiProtection also uses Trend Micro's

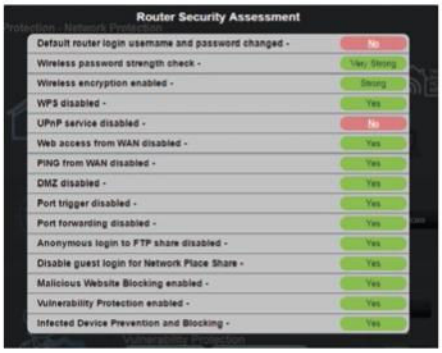


< Trend Micro's Web Reputation Services (WRS) can determine if traffic is safe or malicious, so AiProtection can block the nasty stuff

> AiProtection prevents devices joining botnets by blocking access to known command and control (C&C) servers







Web Reputation Services to block access to known dodgy websites. This helps against those notorious "I'll click anything!" type users that lead to nasty malware infections. Trend Micro and Asus have a huge tracking network of URLs that lead to malware, spyware, phishing attempts, spam and remote access. If someone on your network decides to visit one of those sites, either on purpose or accidentally, AiProtection will refuse to load it and display a warning.

LEFT: AiProtection covers network security as well as parental controls
ABOVE: If your child stumbles across a naughty website, this is the warning AiProtection will display
RIGHT: The Router Security Assessment locks down your network with ease

PREVENTATIVE PROTECTION

Another line of defence AiProtection implements, is specific preventative measures that stop attacks from occurring in the first place. A router with AiProtection can diagnose itself to see if it's set up correctly to avoid any attacks that take advantage of a poorly secured router. The Router Security Assessment feature will check things such as changing the default username and password, mandating a strong wireless network password, disabling WPS if it's no longer needed, disabling access to the router's administration page over the WAN port and a dozen more various security checks. If the security assessment finds a fault, it can secure itself with a single click.

In the unlikely scenario that a nasty piece of software does manage to get in to your network (perhaps someone brings a dirty device with them and connects to your network), AiProtection can mitigate against the impact of such malware. Usually this sort of software talks to a "command and control" (C&C) server. Trend Micro keeps a database of these malware servers and AiProtection can block any device on your network from communicating with these servers, ensuring your confidential information is kept away from the nasty hackers and your computer is prevented from joining the zombie hoard in a botnet.

EMAIL ALERTS & PARENTAL CONTROLS

AiProtection can be configured to send you an email if any of its "oh crap, something bad happened!" triggers are set off, so that you are fully aware of what's going on in your network. You can then take further steps to fix the issue, such as removing the malware or resetting the device causing problems.

"Just log in to your Asus router, turn AiProtection on and you're covered"

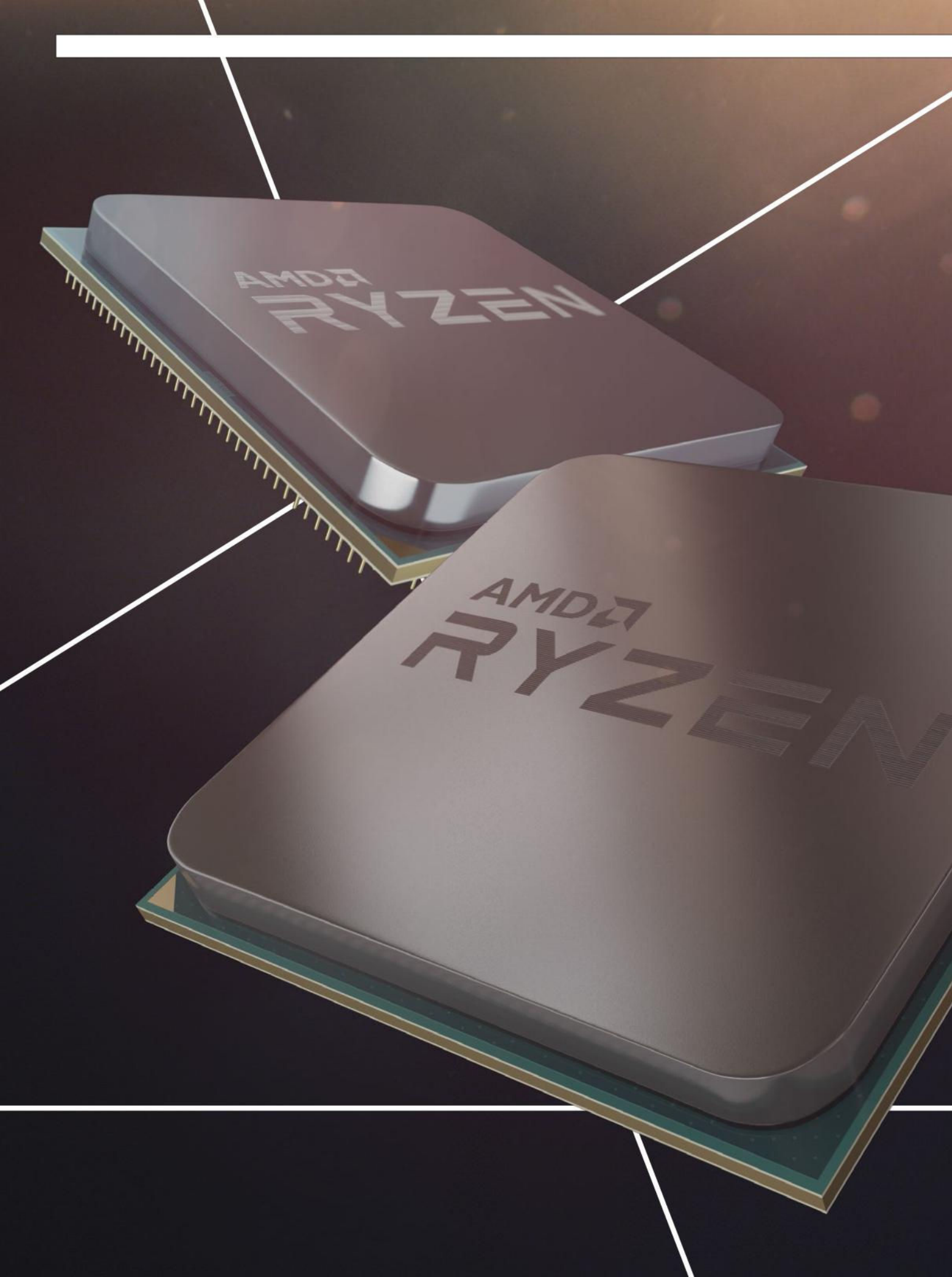
Not only can AiProtection safeguard your home network, it can keep your children safe from the nasty content lurking on the Internet too. Unlike device based parental controls, that can often be worked around or removed, AiProtection's parental controls operate on the router itself, which is something children can't get access to, so it's always running.

AiProtection's parental controls work by blocking categories of websites, gathered from Trend Micro's vast catalogue of internet traffic. Parents can decide to block websites in categories such as adult, instant messaging, P2P and file transfer and streaming and entertainment. The restrictions can be applied to specific devices on the network, via their unique MAC address, so that older children, or adults, can have open access to the Internet from their devices. Restrictions can be enabled via a time schedule too, so when the kids are sleeping, the parents can surf the web with no limits.

If a child visits a website that AiProtection is blocking, they will receive a message saying they're not allowed to view this content.

All the features of AiProtection – preventative security, malicious site blocking, infected device detection and blocking, vulnerability protection and parental controls are a click away. Just log in to your Asus router, turn AiProtection on and you're covered. No configuration is required! To sweeten the deal, Asus doesn't even charge an extra fee for it. AiProtection is built in to the GT-AC5300, RT-AC88U, RT-AC68U and ten other Asus routers, absolutely free. It couldn't get any easier to keep safe online with Asus and AiProtection.

Another router that includes AiProtection is the high performance Asus GT-AC5300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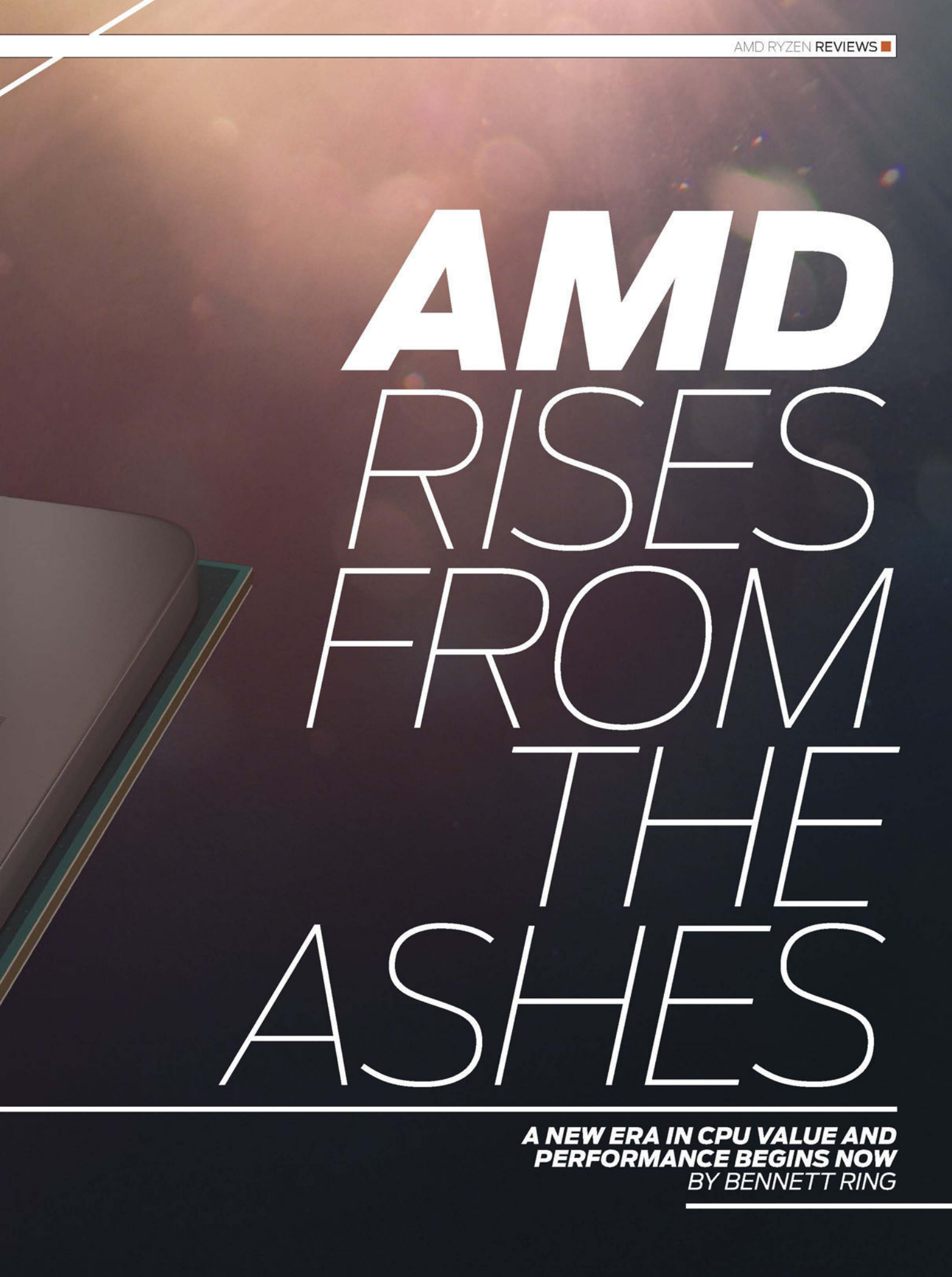


AMD RISES FROM THE ASHES

A NEW ERA IN CPU VALUE AND PERFORMANCE BEGINS NOW

BY BENNETT RING

"This is the greatest single leap in CPU raw performance that we've ever encountered."

It's been a long, long, time coming, but AMD's much-hyped, brand-new CPU architecture is here at last. Codenamed Zen, it's at the heart of the company's new Ryzen family of CPUs, and it's the first chip in over half a decade that promises to compete head on with Intel when it comes to raw grunt.

There are huge expectations for this new CPU; since Intel's Core architecture took off and left AMD choking on its silicon dust over half a decade ago, the world of CPUs has become increasingly dull. With AMD preferring to focus on integrating better GPUs into its chips rather than improving CPU performance, Intel hasn't been pushed to improve its products. We've been left with incremental upgrades each year as a result, with minor speed boosts of around 7% becoming the norm. Compare this to ten years ago, where CPUs would leap by as much as 30% performance annually, and it's become a bit of a snooze-fest. Most of Intel's minor speed improvements have come from frequency boosts, so those who overclocked their three-year-old i5 chips were already hitting today's i7-7700K levels of performance.

A NEW ERA

Zen promises to shift this paradigm dramatically. Ryzen is what AMD likes to call a "clean-sheet design", which means it went back to the drawing board to come up with what is basically an entirely new design. It took four years from inception to launch, and the goal was to deliver like-for-like, per-core performance against Intel, while retaining a low power usage. The initial goal was a 40% increase in IPC, but AMD went one better, in the end delivering a staggering 52% IPC performance boost... in certain tests at least.

This is the greatest single leap in CPU raw performance that we've ever encountered. Not only has AMD achieved this, but it's managed to do so in an eight-core processor that is less than half the price of Intel's nearest competitor. Let's take a look at the first three chips that are launching under the Ryzen banner, before taking a deeper dive into the design changes that make these products tick.

RYZEN 7

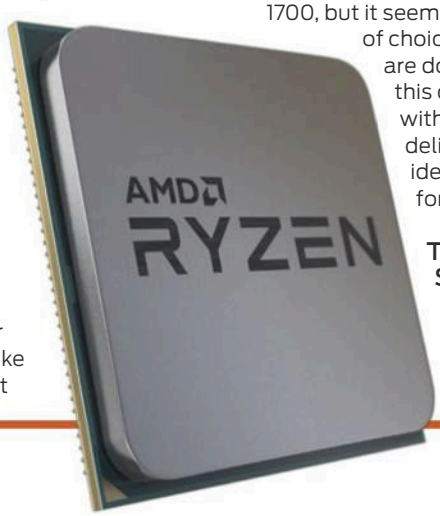
Unlike AMD's last GPU launch, which went for the mainstream, the company is aiming high with the initial launch of Ryzen. There are three new chips which fall under the R7 banner, and they're all meant for high-performance users who don't mind spending a little more, though as you'll see their prices are still extremely competitive.

At the top of the stack is the Ryzen 7 (aka R7) 1800X, the flagship Ryzen chip that AMD intends to take on Intel's I7-6900K. Like Intel's chip, it's an eight-core design, but uses a technique similar to HyperThreading to deliver 16 threads of performance (more about this later). The Base Speed is 3.6GHz, with a guaranteed Turbo speed of 4GHGz. However, notice that X on the end of the product name? This stands for XFR, or Extended Frequency Range. Think of this as basically Turbo v2; in the right thermal conditions, this can crank out an extra 100MHz of frequency, giving it a theoretical top speed of 4.1GHz. It's not guaranteed though; if the chip isn't cool enough, you may only receive boosts in 25MHz increments up to the extra 100MHz, if any at all. The R7 1800X also has 16MB of L3 cache, while the total TDP is a very competitive 95W. This chip is currently priced at $699, less than half that of Intel's competing i7-6900K, which currently retails for around $1500. Unlike overseas, it doesn't seem that Intel has dropped the price of the 6900K, where in the US it lowered prices by between US$100 and US$200.

1700X

The next chip down is the Ryzen 7 1700X. It's basically identical to the 1800X but with slightly different frequencies, dropping to a base of 3.4GHz and a Boost of 3.8GHz, though it does also include XFR. It includes an identical amount of L3 cache, at 16MB, and is currently retailing for $569. AMD intends this chip to take on Intel's i7-6800K, which retails for $600, but only has six cores instead of eight. Finally we have the Ryzen 7 1700. Again, it's basically identical to the other two, with frequency drops being the main difference. Base speed tops out at 3GHz, while Boost hits 3.7GHz, and there's the usual 16MB of L3 cache, but there's no XFR support for this chip.

Every single chip in this line-up is multiplier unlocked, although early tests show that the R7 1800X isn't much of an overclocker, with the average being about 4.1GHz to 4.2GHz when using decent air or water cooling. We should point out that the two most expensive chips don't actually come with a cooler – you'll need to buy your own. Only the X7 1700 comes with a cooler, AMD's Wraith Spire RGB cooler. Our review samples came with a Noctua NH-U12S SE-AM4 cooler. We didn't get a chance to overclock the R7 1700, but it seems to be this could be chip of choice for tweakers. There are dozens of reports online of this chip easily hitting 3.9GHz with a minimum of fuss, delivering performance identical to the R7 1800X for $230 less, at just $469.



THE NEW AM4 SOCKET

All of these new chips are based on the brand new AM4 socket design, which uses

> Along with the Ryzen CPU comes a range of new HSF coolers

1331 pins. Like prior AMD chips, these pins are mounted on the CPU itself, with the socket itself having the holes that thee pins fit into. We're not a big fan of this design, as it's much easier to bend the pins on the CPU itself than Intel's method, where the pins are partially protected as they reside in the base of the socket. It's not a big deal, just something we'd have liked to see improved, as we've spent many an hour unbending pins with tiny screwdrivers over the years.

While the new socket uses a different layout to prior AMD platforms, the good news is that most owners of modern CPU coolers won't need to upgrade. The likes of Corsair, Thermaltake and Noctua are all offering upgrade kits for use with existing kits, some of which are totally free, while others cost a mere $10 to $20. AMD is also launching several new coolers to accompany the new chips. All use a new spring-screw clamping mechanism, and have an RGB controlled LED light ring around the main fan. The three announced fans are the twop-end Wraith Max (38dBa), mid-range Wraith Spire (32 dBa) and finally the Wraith Stealth (28dBa). Unfortunately none of these were available at the time of our review.

THE DEEP DIVE

Given that the Zen architecture is basically brand new, there's quite a lot of technical information about how AMD managed to increase its IPC performance so dramatically. We're going to give you a look at the key technologies from a top down view, explaining them in a way that doesn't require a computer engineering degree to understand.

1 As you can see from this image, each Zen core is split into two major regions. The blue area is the front-end, where instructions are fed into the processor and decoded into micro-operations. The red section is the back-end where the real computation takes place, focusing on integer operations. The orange works similarly, but handles floating point loads. This is a very similar layout to other x86 chips, but one of Zen's first improvements is the introduction of a micro-op cache. Rather than reload regularly used instructions, they're stored in this cache, saving them having to be reloaded through the processor. Intel's chips feature this, and according to the folks at Anandtech, Intel's version can handle 1536 uOps with 8 way associativity. AMD bumps this up to 2048 micro-ops.

AMD has also radically changed its cache structure. Today's x86 chips have three levels of cache – the L1, L2 and L3 caches. Zen is designed around a system of modules, each known as a CCX, or CPU Complex, whereby each module is comprised of four cores and eight threads. Each module has 64kb of L1 I-cache, 64KB L1 D-cache, 512KB of L2 cache per core, and 8MB of shared L3 cache. As the R7 series has two CCX modules, this is why the chip itself has a total of 16MB of L3 cache. This modular approach will make it easy to scale the design down to 4-core versions, such as the upcoming Ryzen X5.

2+3 We mentioned before that AMD has implemented its own take on Intel's HyperThreading, which it calls SMT, or Simultaneous Multi-Threading. In effect, this allows each core to handle two threads at once, which is why the X7 range are all able to handle up to 16 threads simultaneously. Obviously this only works in best-case scenarios, and AMD has slightly changed its approach to Intel; where Intel uses joint schedulers and buffers to enable HT, Zen has independent dual schedulers, one for INT and the other for Floating Point.

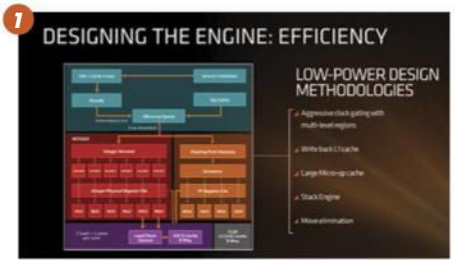
TO 14NM

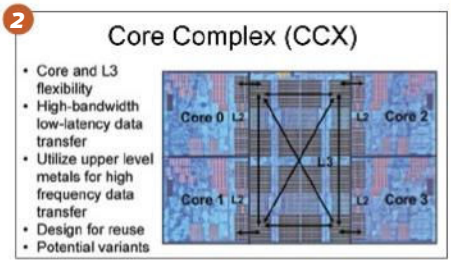
Another huge improvement for AMD was the move to a new manufacturing process. It's now building all of its Zen chips on a 14nm process, which leads to huge energy savings, and allows the new chips to be as powerful as they are while remaining relatively small and cool, packing in a total of 4.8 billion transistors into a die size that only measures 192mm square. The company moved from TSMC to GloFo foundry's 14nm FinFET process, putting it on par with Intel when it comes to transistor technology.

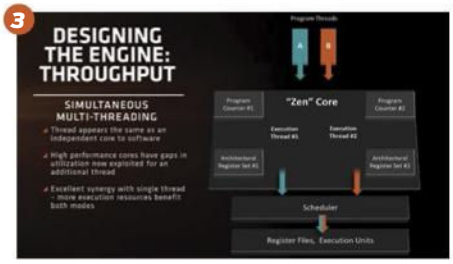
OVERCLOCKING ONBOARD

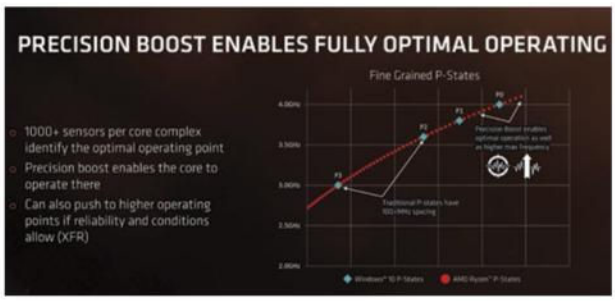
One of the most important new technologies in Zen is what AMD calles SenseMI; this is basically a spread of sensors throughout the CPU that allow it to monitor voltage, temperatures and speed at an intricate level never seen in an AMD product before. There are over 1000 of these sensors spread through the CPU die, and they poll the CPU every millisecond, ensuring it's operating at the optimal power level, which has helped them pull off that excellent 95W TDP.

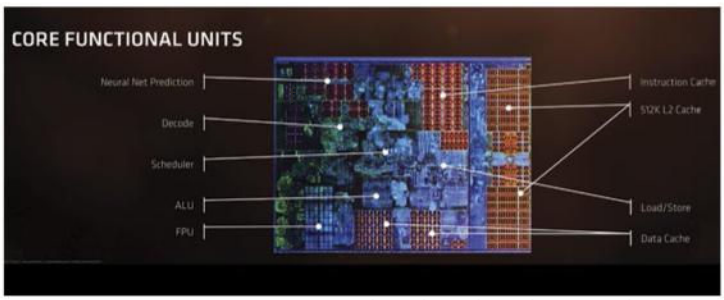
The first stage of SenseMI is called 'Pure Power', which is based on something AMD calls 'Infinity Fabric'. Basically, by measuring the temp, speed and voltage constantly, it allows the CPU to dish out energy to areas of the chip where it's needed most, and lower energy where it's not needed, ensuring the CPU is operating at peak energy efficiency. It also means that when it detects extra workload, it can increase the voltage and frequency to those areas.











LEFT: Multiple onboard sensors allow real-time dynamic overclocking
RIGHT: Inside a Ryzen 7 core

The second stage of SenseMI is called 'Precision Boost', which allows the CPU to adjust its frequency in 25MHz steps, which is far more granular than previous CPU designs. In contrast, Intel adjusts its frequency via singular multiplier movements, which only allows adjustments in 100MHz amounts. This feature also feeds into the XFR support, which is why the R7 chips that support this can have extra boosts in 25MHz increments up to the maximum of 100MHz.

On that note, XFR is the third stage of SenseMI, allowing the CPU to operate at even greater frequencies given the right operating conditions. If you want XFR to work perfectly, it's worth shelling out extra for a high-end cooler for better overall thermal performance, which is probably why AMD supplied us with the Noctua cooler instead of their stock variants.

NEURAL NET PREDICTION

The final two stages of SenseMI are called 'Neural Net Prediction' and 'Smart Prefetch'. While the first sounds like something out of the Terminator films, it actually refers to that golden oldie we hear about whenever a new CPU is released – better branch prediction and pre-fetch. This became an issue when the Pentium 4 got branch prediction so wrong, leaving its extra-long pipeline full of incorrect instructions that needed to be flushed, leading to poor performance. Zen now has a new Neural Net Prediction method that works in conjunction with Smart Pre-fetch to insure that instruction behaviour is accurately predicted, as the CPU "learns" what to expect in operations that are routinely repeated.

One last important point about Ryzen is that it does not feature an integrated GPU. Unlike the company's APUs, you're going to need a discrete GPU if you want to game with this CPU.

RYZEN MASTER

Along with the new range of CPUs, AMD gaming benchmark, with a 25% drop in minimum framerate and an even larger 42% drop in average FPS. Gamers will want to keep this software disabled while gaming, which is a shame as it is a great way of monitoring temps and CPU usage. We're confident AMD will iron out these issues in the future, but until then, only use Ryzen master for tweaking, not monitoring.

As with AMD's Crimson software for its GPUs, the interface is gorgeous, a lesson that Nvidia would do well to learn. It looks easy enough to use, but we had issues with certain settings taking effect. For example, when we tried to increase the memory speed from 2133MHz, which is what our kit defaults to, up to the 2666MHz supported by the R7, it simply didn't budge. When we tried to change these settings, the Ryzan Master software warned us that HPET was disabled, and would need to be re-enabled. Yet AMD had specifically asked for HPET to be disabled during testing, as it conflicts with the SenseMI technology. Once we had re-enabled HPET, the memory overclocking function worked perfectly.

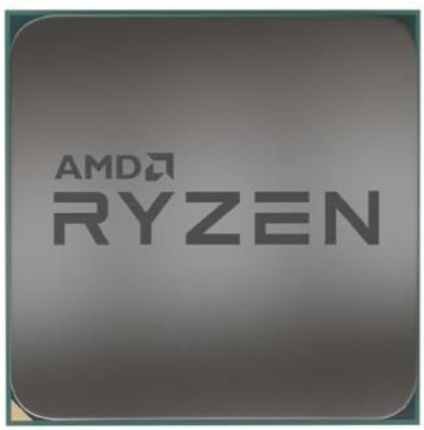
THE CHIPSETS

As this is an entirely new platform, it obviously comes with a new chipset to power the AM4 socket design. There are initially three new chipsets at launch. Enthusiasts will want to go for the X370 chipset, which is aimed at power-users. Then there's the B350 for mid-range users, followed by the A320 for entry-level. Unlike Intel chipsets, some of the traditional southbridge duties are handled by the Zen CPU itself, leading to an almost SoC-like design. This allows the new chipsets to handle AMD's Ryzen processor, 7th Generation APUs and upcoming Raven Ridge APU, and AMD intends for all of its upcoming products up to 2020 to work with the new AM4 socket. This is a common strategy from AMD, where its sockets tend to last for several years, compared to Intel, which upgrades its socket every year or two.

STORAGE AND CONNECTIVITY

The X370 delivers twin USB 3.1 Gen 1, six USB 3.1 Gen 1 and six USB Gen 2.0 ports, along with four SATA 3 6Gbps connections. It also has twin SATAe drive ports, which can be used as another four SATA 3 6Gbps ports. We've yet to really see SATAe drives hit the mainstream, so most users will instead stick with basic SATA functionality. It also has eight lanes of PCIe Gen 2.0, while the most commonly used RAID modes are also supported, in the form of 0, 1 and 10. It comes with twin PCIe slots for CrossFire/SLI setups, and fully supports multiplier overclocking.

The mainstream B350 is nearly



identical to the X370. It too delivers twin USB 3.1 Gen 2, but USB 3.1 Gen 1 has been cut from six to two ports, along with another six USB 2.0 ports. However, it only has twin SATA ports according to the official documentation AMD

"Ryzen does not feature an integrated GPU, unlike the company's APUs"

A wide range of AM4 motherboards are available

supplied, yet can convert the other two SATAe ports into four standard SATA 3 6Gbps ports. It only has six PCIe Gen 2.0 lanes though, while the RAID support is identical to the X370. It does not support twin PCIe slots for multi-GPU use though, yet it does support multiplier overclocking.

Finally we have the budget model A320, which obviously sees the most cuts to the feature set. Only a single USB 3.1 Gen 2 port is supported, while there are only twin USB 3.1 Gen 1 ports. Finally we have the usual six USB 2.0 ports. Twin SATA 3 6Gbps ports can be expanded to six if you disable the twin SATAe ports. There's a mere four spare lanes of PCIe Gen 2.0, though the RAID support is identical to the other two. Like the B350, only a single GPU is supported, but the biggest difference is the removal of multiplier overclocking. We have no doubt that crafty motherboard manufacturers will get around this limitation in time via custom BIOS'.

All of these chipsets when used with an R7 have a total of 24 PCIe lanes, which is one area where these new chipsets lag heavily behind intel's competing i7-600K, which has 40. When we asked AMD why this was so, they said that the chipsets are designed to cover their entire range of users, from the entry-level up to the high-end. It's possible for motherboard makers to add additional PCIe lanes if they want to, so you'll see more expensive boards offering more support for additional M.2 drives, multiple SATA drives and USB devices.

MEMORY

All three chipsets support NVMe drives via an M.2 slot, which operates at speeds of up to PCIe 3.0 x 4. It also can drive up to three display outputs; an HDMI 2.0, eDP v1.4 and DP 1.2a. Unlike Intel's competing X99 platform, memory support is limited to just four ports of DDR4, and the speeds supported vary depending on the type and amount of memory supported:

- Dual Channel/Dual Rank/4 DIMM: 1866MHz
- Dual Channel/Single Rank/4 DIMM: 2133MHz
- Dual Channel/Dual Rank/2 DIMM: 2400MHz
- Dual Channel/Single Rank/2 DIMM: 2667MHz

We have to say that memory timings were the main issue we had when testing the various motherboards that follow. We used the Corsair Vengeance DDR4 3000 16GB (2 x 8GB) kit that was supplied with the motherboard, and every single board defaulted to a memory speed of 2133MHz. To hit the correct 2666MHz that is supported by twin sticks of dual channel, single rank memory, we had to delve into the memory multiplier and increase the speed manually to 2666MHz. However, even then, half of the boards then failed to boot. In this case, we had to manually set the memory timings to 16-16-16, and once had to increase the default voltage from 1.2V to 1.3V. There is an XMP memory profile on some boards that automatically overclocks the memory to 2933MHz, but as not all boards support this, and it's not official, we chose to leave this disabled.

HOW WE TESTED

AMD doesn't have the same amount of financial resources behind it as Intel, so it was obvious there were going to be more teething pains with the launch of such a major product when compared to an Intel launch. However, we do wish AMD had waited another month or so to iron out the kinks with its motherboard partners, as some of the errors we had were simply annoying – one board's Ethernet LAN port refused to work until we reset our router. It's little things like this that slowly pile up to become one rather lengthy headache, but we're happy to report that the results were worth the additional effort.

Before going into our benchmarks, we should point out that we had to test with a set of instructions from AMD in place to ensure the CPU's new features worked properly. First and foremost, Windows' HPET (High Precision Event Timer) feature had to be manually disabled,

The new Ryzen cooler range

as it didn't play nicely with the SenseMI technology. We also had to manually change the power mode to performance rather than balanced, again due to the way the SenseMI Pure Power and Precision Boost features work – we have no doubt Microsoft will patch in a fix for both of these issues. Obviously every motherboard also needed a full BIOS update, and with new updates arriving every couple of days, we could only test with the latest BIOS on the day that we tested each board.

Finally, as discussed earlier, there were the memory issues – this is why the very first test we ran on each board was SiSoft's memory controller benchmark, to ensure it was hitting the 31.5GB/sec expected from these chipsets. Only then could we be sure everything was working properly. Now, onto the results.

For our tests, we used the Asus Crosshair VI motherboard with a Corsair Vengeance DDR4-3000 16GB kit, Aorus GeForce GTX 1080 Extreme Edition GPU, and SanDisk Ultra II SSD. A clean install of Windows 10 with the latest drivers for each platform was used. We weren't able to get an i7-6900K, so used the ten-core i7-6950X instead, but disabled two cores – however, this $2500 CPU still has more cache than the $1500 6900K, giving it a slight advantage regardless.

THE TESTS

Our first test focused on the 3D renderer, Cinebench R15. The single-threaded test is a great way to test IPC, and it's clear that the Zen architecture is faster than the Broadwell E architecture at the heart

> *"AMD has pulled off a minor miracle with the R7 series"*

of Intel's 8-cored products. However, it's not as fast as the latest Kaby Lake architecture in use in the i7-7700K. Yet when we ran the full test utilising all cores, the R7 1800X came out on top, where its four extra cores deliver a huge performance boost.

Next up was the latest nightly build of Handbrake, which uses as many cores as it we can throw at it. We converted a 1.1GB 4K video to a H.265 720p30fps MKV file, and once again the R7 1800X delivered better performance than the Intel chip selling for twice the price. POV-Ray is another 3D renderer that likes lots of cores, and once again we saw the R7 1800X coming out on top.

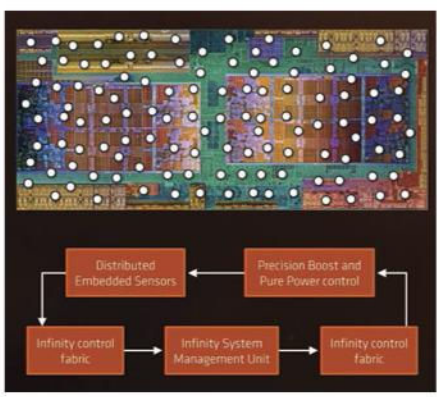
PCMark 8 Home uses a variety of programs to test overall performance, but it's not optimised for more than four cores. As a result, the better IPC of the i7-7700K saw it scoop the win. Surprisingly 7-Zips Multi-threaded test, which uses multiple cores, saw all three chips delivering relatively comparable performance.

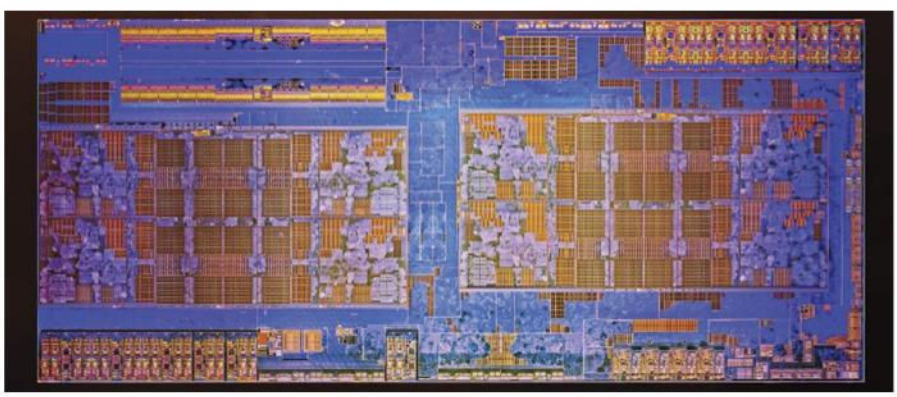
SiSoft Sandra is a purely theoretical benchmark that uses simulations to test performance. The higher memory speed of the R7 1800X saw it easily win this benchmark, though the huge win in the multimedia test to the 6950X was surprising – we're guessing the larger amount of cache came into play here. Yet the Arithmetic test saw the results reverse, with the R7 1800X once again taking the lead.

GAMING

Gamers will probably be disappointed by our final two tests; Grid Autosport and Shadow of Mordor. We tested both at extremely low resolution to remove the GPU as a bottleneck, and both really only make use of four cores. As a result, while the R7 1800X came close to the 6950X when it came to minimum framerates (a metric that is far more important than

BELOW: Ryzen sensor locations and the dynamic thermal management routine
BELOW RIGHT: The complete Ryzen 7 CPU die





averages, as that's when gamers notice their games start stuttering), the 7700K had the easy win in both tests. We were quite surprised to see the 6950X do so well in the Shadow of Mordor test though – by all rights it should have performed on par, if not slightly worse than the R7 1800X.

CONCLUSION

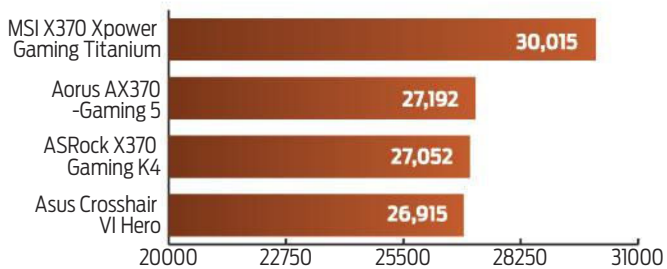
When it comes to multi-threaded performance in software that can make the most of eight cores/sixteen-threads, there's no denying that the R7 1800X is a massive kick in the pants to Intel's overpriced i7-6900. It beat out the equivalent processor in nearly every test, which is amazing considering it's half the cost.

However, when it comes to raw IPC, it seems AMD still has some ground to gain. Intel's 8-cored chips use the older Broadwell E architecture, which is a good 15% to 20% slower than the latest Kaby Lake architecture used in its quad-cored chips. In this regard, Zen is very competitive with the Broadwell E architecture, and the huge leap compared to prior AMD CPUs is simply staggering. Yet it still lags behind the latest Kaby Lake design, showing that AMD has work to do to catch up to Intel in IPC performance. As a result, we think gamers are still better off with the Intel i7-7700K processor, at least until we start to see more games make use of more than four cores. DX12 is set to make this easier thanks to its support for multiple cores, but we honestly can't see DX12 becoming mainstream for another couple of years at least.

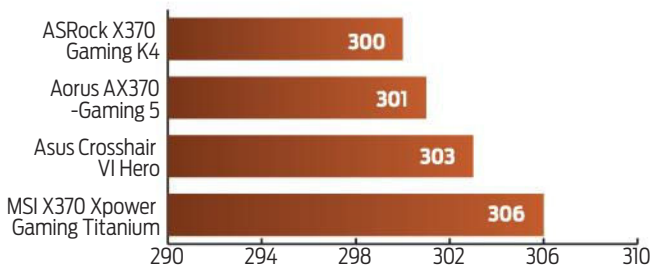
Yet if you're in the market for a machine that will be running software that can handle eight cores, such as CAD, 3D rendering or video editing, or need to run many programs simultaneously, AMD's Ryzen is a huge breath of fresh air to the CPU market. Delivering better performance than Intel's competing products at just half the price, it's just the flame we needed to reignite the CPU wars. AMD has pulled off a minor miracle with the R7 series – now we look forward to seeing what it can do against Intel's quad-cored CPUs, which is what the majority of the market uses today. Rest assured, we'll have in-depth coverage of the impending R5 in the very near future.

BENCHMARKS

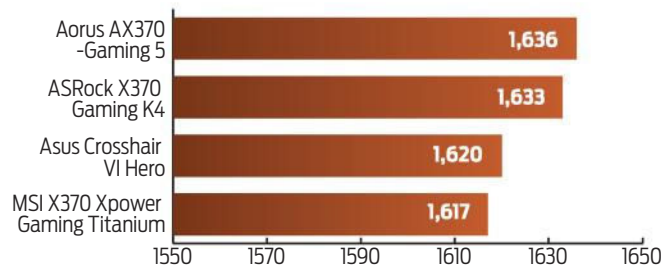
7-Zip Multithreaded file compression - 192MB
Dictionary Size *Total Rating (MIPS) higher is better*



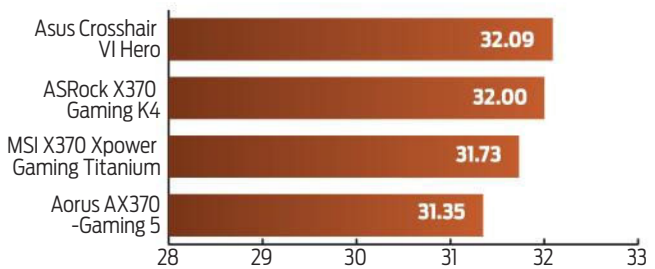
HandBrake nightly build: 1.1GB 4K Video to Matroska H.265 MKV 720p30 *Score time (seconds) lower is better*



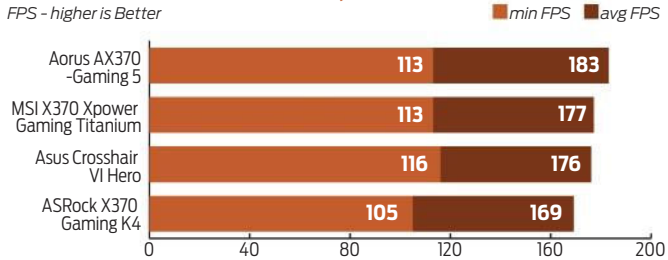
Cinebench Multithreaded
Score - bigger is better



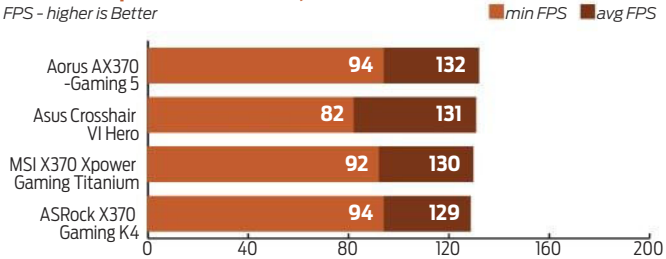
SiSoft Sandra - Memory Bandwidth
Aggregate (GB/sec) higher is better



Shadow of Mordor - 640 x 360, Ultra Detail
FPS - higher is Better



Grid Autosport - 800 x 600, Ultra Detail
FPS - higher is Better



Aorus GA-AX370-Gaming 5

AFFORDABLE EXCELLENCE

Made by Gigabyte under their new gaming banner, Aorus, this motherboard is targeted at the mid-range gamer. It sits right in the middle of the pack when it comes to price, another huge benefit of the R7 series when compared to Intel's competing products, which require vastly more expensive motherboards.

As with all of the boards this roundup, the GA-AX370-Gaming 5 is based on the top-end X370 chipset, so comes with the usual feature set. There are three full-length PCIe lanes, all steel reinforced, and the top two can be split to operate at x8 speeds, supporting SLI. The third will function at x4 speed, but only if the three separate PCI Express x1 slots are all empty.

A single M.2 connector is supplemented by the inclusion of an additional U.2 connector, but the former is disabled when the latter is enabled, a limitation of the X370's smaller amount of PCIe lanes. Gigabyte has added an extra ASMedia USB 3.1 Gen 2 controller on the board, delivering a single Type-C connector plus an additional USB 3.1 Gen 2 Type-Port in addition to the usual twin USB 3.1 Gen, six USB 3.1 Gen 1 an four USB 2.0 ports, the last of which require a USB header. They've also added two extra SATA 3 6Gbps slots, for a total of eight (four can be converted to twin SATAe connections).

Onboard audio is up to Gigabyte's usual excellent standard, but this time around uses two separate Realtek ALC1220 chips instead of the one found on most boards. One is dedicated to the rear outputs, while the other is for the front connection; no longer will gamers have to choose a single port for the best audio quality. There are also twin Ethernet ports; one is powered by the Killer E2500 chip, the other an Intel chip. There's also a plethora of RGB lighting options, while the Smart Fan 5 support delivers 2 amps to each of the eight fan/pump connectors. We were hard pressed to fault this board, although it was one of the two boards that required the memory timings to be massaged to get it running stably at 2666MHz. This was balanced out by the fact that took out the number one spot in most of our tests. Overall an excellent board for the price, though it's pipped at the post by Asus' slightly more expensive Crosshair VI.

KEY SPECS

$319 · www.gigabyte.com.au

ATX · 3x PCI Express full-length slots · 3 x PCI Express single-length slots · 1 x HDMI 1.4 · 1 x M.2 + 1 x U.2 · Four USB 3.1 Gen 2 (one Type-C), Eight USB 3.1 Gen 1 (four via internal header) four USB 2.0 ports (via internal header)

OVERALL

ASRock Fatal1ty X370 Gaming K4

AN ANNOYING BIOS SETS THIS BUDGET BOARD BACK

At a mere $219, this is one of the cheapest R7 boards on the market, yet it still uses the X370 chipset. Throw in an X7 1700 for another $469, and – provided you don't mind overclocking - you end up with a platform costing just $688 that will defeat a $1900 Intel i7-6900K system. This is simply phenomenal value for money, and we have no doubt there are many 3D renderers out there with their credit cards at the ready. However, because it's so affordable, ASRock has had to make this board as simple and feature-lite as possible.

There are just two full-length PCI Express lanes, but at least they're steel reinforced. There are another four PCIe 2.0 x1 lanes, though two of these will be covered if you use twin GPUs with double slot coolers. A single M.2 slot is provided, while display options are limited to a single HDMI 1.4 output.

Realtek's ever-popular ALC1220 codec delivers the audio, and it delivers a claimed 120dB SNR with the assistance of a TI NE5532 premium amp and Nichicon fine gold series capacitors. A single Internet port is powered by an Intel I211AT chip. SATA options are also a little limited, with just six SATA 3 6Gbps ports. Thankfully there are two M.2 connections, though only one is rated to handle the full PCIe 3.0 x4 speed (32GB/sec), while the second is limited to two lanes of PCIe 2.0 (10GB/sec).

There's not a lot of USB options either, with 1 USB 3.1 Type-A, one USB 3.1 Type-C and six USB 3.0 ports. We're guessing the USB 3.1 ports are Gen 1, which is half the speed of the newer Gen 2 version. Surprisingly there's a PS/2 connector for both mouse and keyboard.

Where this board disappointed most was its BIOS. To be frank, it had one of the worst layouts we've seen – it took us over ten minutes simply to find where the memory timings were, and ASRock has used non-standard naming for many of the fields here. Getting it to run stably at 2666MHz was much more difficult than any other board. It does however has XMP support which boosts the memory to 2933MHz... supposedly. We engaged this, and the SiSoft memory bandwidth dropped to 26GB/sec, down from the 32 when running at standard 2666MHz.

Despite the BIOS issues and relatively lacking features, we have to balance them against that incredible price point. If you're looking for the best damned value AM4 board with the top-end X370 chipset, look no further.

KEY SPECS

$219 · www.asrock.com

Two full-length PCI Express 3.0 lanes · Four x1 PCIe 2.0 lanes · 1 USB 3.1 Type-A, one USB 3.1 Type-C and six USB 3.0 Type-A ports · 2 x M.2 connections (1 x PCIe 3.0 x 4; 1 x PCIe 2.0 x2) · Intel I211AT Ethernet, 1 x HDMI 1.4

OVERALL

Asus ROG Crosshair VI Hero

THE KING OF MID-RANGE AM4 BOARDS

This was the board that AMD actually sent out with our test CPU, which suggests already that it's going to be rather darned good. And indeed it was, delivering a wealth of features all at a very nice price point. It's a rather sexy all black design, though as with all boards at this price point it's covered in a variety of RGB lighting options.

Three full-length PCIe lanes are included, though only the top two are version 3.0 – the last is 2.0. The top two are steel reinforced, and can be split to run at x8/x8 to deliver SLI compatibility. Another three single length PCIe x1 lanes are included.

A single M.2 slot is ready for your high-speed storage, and it's the real deal, delivering four lanes of PCIe v3.0. Asus has also beefed up the SATA support with eight SATA 3 6Gbps slots in total, four of which can be converted into twin SATAe connections.

Tweakers will be happy with the onboard power, reset, safe mode and clear CMOS buttons, while the detailed BIOS will present users with dozens of options that are unique to the Ryzen/X370 platform. We're happy to report that our memory ran at 2666MHz, without the need for any timing or voltage changes.

Asus has worked with Realtek to deliver a specialised version of the ALC1220 codec, which is called the S1220 codec. You'll need high-end headphones to really notice the difference, but it's nice to know that Asus went the extra mile to deliver one of the best onboard audio solutions on the market.

A single Intel I211-AT chip delivers Gigabit Ethernet, but Asus has really gone to town with USB support. Best of all, you won't need a header to make the most of nearly all of them. On the rear I/O panel we counted fourteen in total! There are eight USB 3.0, four USB 2.0, one USB 3.1 Type A, and one USB 3.1 Type C. There's also a dedicated USB 3.1 connector for front ports, delivering both Type A and C. This gives it by far the most connectivity options of the lot. If there's one thing that wasn't so great about the board, it's the slightly mixed benchmark results. It posted near the top of the pack in most, but the Grid minimum framerate is slightly worrying. We're sure it's just a glitch though, as the rest of the benchmarks came up gold.

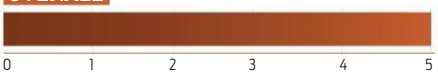
In the mid-range price point, this board is king, and rightly wears the Asus ROG label with pride.

KEY SPECS

$369 · www.asus.com.au

Two full-length PCI Express 3.0 lanes · One full-length PCI Express 2.0 lane · three x1 PCIe 2.0 lanes · 8 x USB 3.0, 4 x USB 2.0, 1 x USB 3.1 Type, 1 x USB 3.1 Type C · 1 x M.2 connections (1 x PCIe 3.0 x 4) · Intel I211AT Ethernet

OVERALL



MSI X370 Xpower Gaming Titanium

NOT FOR THE MASSES

Considering the exceptional value of the other boards in this roundup, there'd better be something darned special about the MSI X370 Xpower Gaming Titanium. At just under $500 it's by far the most expensive board here, which is a bit of a contrast to the whole premium performance/friendly price approach to the Ryzen proposition.

It has the usual PCIe arrangement; twin PCIe 3.0 full length slots with another single full length PCIe 2.0 slot, along with three PCIe x1 slots. That's one less than both the Asus and Aorus. Twin M.2 slots are included, one limited to PCIe 2.0 x4, while the other runs at full speed. There's also a U.2 port, but this can't be used at the same time both M.2 ports are being used. SATA connectivity is rather basic, with just six SATA 3 6Gbps ports, and none of them can be converted to SATAe use. There are six fan headers in total, which is again less than the seven found on the Aorus board.

Audios is delivered courtesy of MSI's take on the Realtek ALC1220 Codec, which it calls Audio Boost 4. Basically it's the usual assortment of custom amp, high-end capacitor, PCB isolation, and the like. The I/O solution isn't anything to rave about. On the rear I/O panel we have a total of nine USB ports; three USB 2.0, five USB 3.1 Gen 1, and a single USB 3.1 Gen 2 Type C connection. There's a PS2 connection for mice our keyboards, but we do appreciate the inclusion of a DisplayPort and HDMI output, allowing easy dual monitor setups. We also like the discrete USB 3.1 chip designed for front panels.

However, compared to the other $350-range boards, there's not much here to impress... unless you're a tweaker. It's obvious that MSI is aiming this board at overclockers, as it comes with a huge number of features specifically targeted at that market. Novices will like the Game Boost knob, which is basically a small dial that automatically overclocks the CPU.

Serious overclockers will get the most out of the other features though. There's the usual onboard power and reset buttons, as well as a BIOS flashback option which allows the BIOS to be flashed via a special USB port without having to enter the BIOS itself – handy if you've corrupted the BIOS. There's also slow mode support, premium power phases which is fully digitally controlled, an onboard debug LED, as well as an easy-to access clear CMOS button.

KEY SPECS

$469 · www.msi.com

Two full-length PCI Express 3.0 lanes · One full-length PCI Express 2.0 lane · three x1 PCIe 2.0 lanes · 2 x M.2 connections (1 x PCIe 3.0 x4, 1 x PCIe 2.0 x 2); 1 x U.2 (PCIe 3.0 x 4) · Intel I211AT Ethernet · 3 x USB 2.0, 5 x USB 3.1 Gen 1, 1 x USB 3.1 Gen 2 Type C connection · 6 x SATA 3 6Gbps · HDMI and DisplayPort

OVERALL

Cloud backup

WE PUT TEN OF THE MOST POPULAR CLOUD BACKUP SERVICES TO THE TEST TO HELP YOU DECIDE WHERE YOU SHOULD STORE YOUR IRREPLACEABLE DATA

We all know the importance of backing up our data, but it's easy to find excuses not to do it. Setting up an external drive or NAS box, for example, is an expense and a hassle.

However, the modern generation of cloud backup services make the job effortless. Getting started is as easy as downloading and installing a lightweight client – and then sitting back, secure in the knowledge that your files are being continuously replicated to a remote data centre. You can download copies whenever you need them, and the off-site approach means they're safe even if your home is hit by a fire or burglary.

Of course, not all cloud backup services are the same. Depending on who you go with, you'll pay differing amounts for different allowances of online storage. Performance may vary, with some systems taking much longer to back up and restore files than others. Features can make a difference, too: for example, some clients will let you set up multiple backup sets, and duplicate your backups to a local drive for easy restoration, while others keep things as simple as possible.

We've put ten of the biggest cloud backup services to the test, to help you find one that's worth entrusting with your precious data.

CONTENTS

6 questions to ask before buying cloud storage

^ If you want to protect a household of computers, look for one subscription that covers them all

BUYING THE WRONG CLOUD STORAGE SERVICE COULD BE COSTLY IN BOTH HOW MUCH IT COSTS AND THE TIME IT TAKES TO UNPICK THE MESS

1. HOW MUCH STORAGE DO YOU NEED?

Let's reframe the question: what do you actually need to back up? This may be a lot less than you imagine: even if your hard disk is nearly full, a lot of that space will be taken up by Windows and program files, not to mention miscellaneous downloads and temporary files that don't need to be archived for the ages. Carry out an audit of what really needs protecting and you may find it's just a gigabyte of documents and spreadsheets.

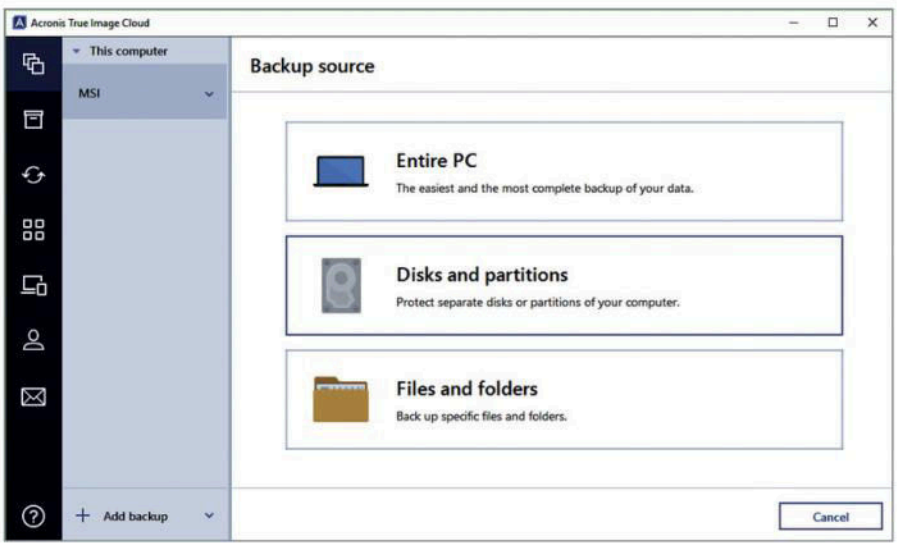
It's worth thinking about whether you want to include music files and photos in this audit, since these are likely to take up the lion's share of your personal storage. If your songs were bought from iTunes or a similar service, you can normally redownload them for free in the event of a crash. Alternatively, you can use free cloud services such as Google Play Music and Google Photos to store backup copies of your songs and pictures. That said, always read the small print: uploaded files may be compressed or transcoded, so they won't retain the full quality of the originals.

And don't be too discriminatory about what gets backed up. It's easy to think of backup services primarily as protection against system failures, but they can also provide a safety net when you delete a file that seems unimportant at the time, then later realise you need it after all. But for that to work, you need to start by backing up all the files that don't, at the time, seem useful.

> *"In all, we'd recommend an inclusionist approach: if there's any doubt as to whether an item should be backed up, play it safe"*

In all, we'd recommend an inclusionist approach. If there's any doubt in your mind as to whether an item should be backed up, play it safe and include it in your audit. Then, pick a cloud backup option with plenty of room for this, plus all the updates and new files you're going to make in the foreseeable future. Since this may well be hard to estimate, you might be tempted to go for an unlimited-storage option – although you can save money by picking a service with a fixed quota.

V Acronis True Image 2017 stores the most recent 20 versions of a file



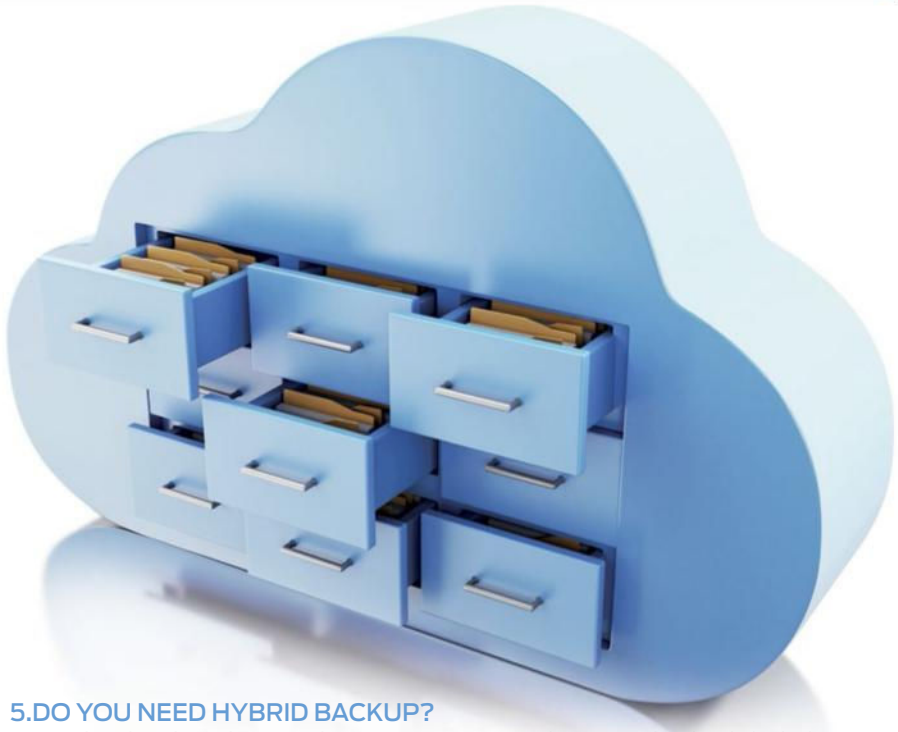
2. WHAT DEVICES SHOULD YOU PROTECT?

In this month's Labs, we're focusing on personal backup services, which are mostly aimed at single users. That often means you pay a monthly or annual fee to back up files from a single PC or Mac. Under a licence like this, if you want to back up a second system, you'll normally need to pay for a second subscription.

If you want to protect a whole household full of computers, it's a good idea to look instead for a service that covers them all under one subscription. These services typically come with fixed storage limits, because if they were to offer unlimited uploads from five or ten PCs, the sheer quantity of data would be cost-prohibitive to store.

What if you want to back up the contents of an external drive? As our feature table overleaf shows, some providers will count a USB hard disk as just another drive and back it up under a single-PC licence; others see this as an additional service. Similarly, if you want to back up a NAS drive, you may well find your regular service doesn't cover it, which is fair enough if you're talking about multiple terabytes of data, but a bit annoying if it's just a few folders.

Most cloud backup services also offer dedicated smartphone apps for Android and iOS. Some of these only let you browse and download files that have been uploaded from the desktop, but others let you back up downloads, photos and other items from your phone.



3. HOW MANY FILE VERSIONS?

Backup isn't just about recovering files that have been deleted. On occasion, you may need to turn back the clock and access an older version of a file, before it was edited and all the useful information about x was replaced with more up-to-date information about y.

Most cloud backup services will automatically detect when a file has been updated, and will keep a copy of the old version alongside the new one. Exactly how this is handled varies from service to service: some offer a time-limited rollback period, while others retain a set number of versions. For example, Acronis True Image 2017 automatically stores the most recent 20 versions of a file, ready to be recovered with a click.

Very few services will store unlimited file versions, though – so if you want to be sure of not losing potentially useful data, it's a good idea to get out of the habit of repeatedly updating and overwriting old files. It's far safer to rename them in some self-explanatory way (for example, add "2016 version" to the end of the filename), then copy their contents into a new file and work from that.

4 CONTINUOUS OR SCHEDULED BACKUP?

Traditionally, it's been considered good practice to run backups to a fixed schedule: a business, for example, might typically run a big central backup job in the middle of the night, when no-one's around to be impacted by the increase in network activity and server load.

For personal cloud backup, however, continuous backup is the norm: in other words, when you edit or save a file, you can expect it to be backed up right away, or at worst within an hour. This makes a lot of sense as the most common file types are pretty small and can normally be sent up the line in a matter of seconds, meaning you get very good protection with little or no impact on your computing experience.

However, there may be situations in which continuous backup isn't appropriate. For example, you might be working with very large files, and not want to tie up your connection with constant uploads. Or, you might be making lots of little edits all day that you don't want to count towards your versioning limit.

In this case, a nightly or weekly backup run might make sense – or you might even prefer your software to launch a backup only when manually triggered. As you'll see from our feature table overleaf, most systems let you control scheduling, but some are more flexible than others.

5.DO YOU NEED HYBRID BACKUP?

As we detail to the right, one of our tests this month involved timing how long it took to restore files from each of the cloud backup services. Most providers let us download our files at close to the full speed of our internet connection. But if your line is slow, you could still be left waiting around for hours to recover critical files.

If you're concerned about long restoration times, the answer could be hybrid backup. That sounds like enterprise jargon, but it simply means simultaneously backing up to both the cloud and a local destination such as an external hard disk or NAS appliance. This means that when you need to recover files from your archive, you can get them from a local source rather than having to download them over the internet. If you need to restore multiple gigabytes of data, the speed advantage can be huge.

There's another benefit to hybrid backup too: it ensures that you'll be able to get at your backed-up files, even if your internet connection goes down or your cloud provider goes out of business. Certain cloud backup services include hybrid backup features. However, if yours doesn't, there's nothing stopping you from installing a basic free backup tool and setting it to make local backups in parallel with your chosen cloud client.

6. WHAT ABOUT DATA SECURITY AND ENCRYPTION?

Many cloud backup services are based in the US, so unsurprisingly that's where your data gets stored. In all cases it's encrypted at rest, so you don't need to worry too much about an opportunist hacker getting into the system and rifling through your personal emails and so on.

Note, however, that by default the encryption key is held by the backup operator. They could be legally compelled by the powers that be to decrypt your data and hand it over. Or, in the case of a major security breach, a dedicated hacker could theoretically even get their hands on the key and thus unlock your private information.

These scenarios seem very unlikely, but if you're wary of the US authorities, you may feel happier choosing a provider whose servers are in a different locale. For absolute peace of mind, several services also let you specify a custom encryption key which is never seen by the operator (the encryption and decryption are handled locally on your PC). This makes it effectively impossible for your data to leak from the data centre – but it puts a big responsibility on you to take care of the key, because no-one in the world can get your files back if it's lost.

HOW WE RATE THE PRODUCTS

Each of the backup products on test this month is awarded a star rating out of five. In determining this score, we start by fully exploring the user interface and features: we're looking for a client that's easy to use and offers a good range of useful configuration options.

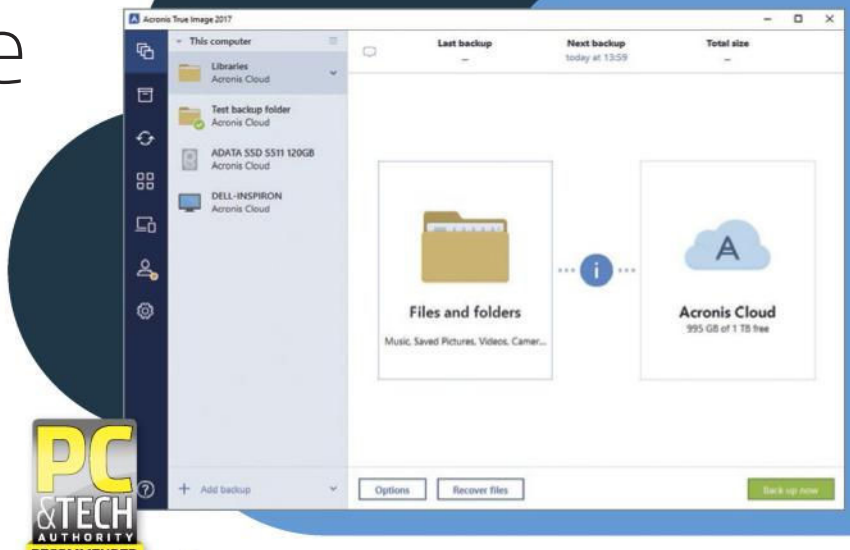
Next, we test the speed of each product.

Finally, we consider value for money, in light of each product's features and performance, and how much cloud storage is included in the price. All of these considerations are factored into the overall score.

	RECOMMENDED			LABS WINNER						
	Acronis True Image 2017	Backblaze	Carbonite	CrashPlan	IDrive	Livedrive	MozyHome	Norton Online Backup	SpiderOak One	SugarSync
OVERALL	★★★★☆	★★★★☆	★★★★☆	★★★★★	★★★★☆	★★★★☆	★★★☆☆	★★☆☆☆	★★★☆☆	★★★☆☆
Website	acronis.com/en-au	backblaze.com	carbonite.com	crashplan.com	idrive.com	livedrive.com	mozy.com	au.norton.com	spideroak.com	sugarsync.com
Data centre location	User-selectable	USA	USA	Not stated	USA	UK	User-selectable	Not stated	USA	USA
Free trial	30 days	15 days	15 days	30 days	5GB free service	14 days	None	30 days	21 days	30 days
Personal plan from: 1	$60yr per PC, 50GB	US$50/yr per PC, unlimited storage	US$60/yr per PC, unlimited storage	US$60/yr per PC, unlimited storage	US$52/yr, unlimited devices, 1TB storage	£5/month per PC, unlimited storage	US$5.99/month per PC, 50GB	$79/yr for 5 PCs, 25GB	US$5/month, unlimited devices, 100GB	US$7.49/month, unlimited devices, 100GB
Business plan from: 1	$139yr per PC, 1TB	US$5/TB/month	US$270/yr, unlimited PCs, 250GB total storage	US$10/month per PC, unlimited storage	US$75/yr per PC, 250GB storage	£15/month, up to 5 PCs, unlimited storage	US$110/yr, unlimited devices, 10GB storage	N/A	US$12/month, unlimited devices, 1TB	US$55/month, 3 PCs, 1TB
Desktop platforms	Windows 7, 8, 10, Home Server 2011; macOS 10.9 or later	Windows XP, Vista, 7, 8, 10; macOS 10.6 or later	Windows 7, 8, 10; macOS 10.6 or later (Plus and Prime packages for Windows only)	Windows 7, 8, 10, Server 2008, Server 2012; macOS 10.9 or later; Red Hat Linux 7.1 (64-bit) or later; Ubuntu 14.04 (64-bit) or later	Windows XP, Vista, 7, 8, 10, Server 2003, Server 2008, Server 2012; macOS 10.8 or later	Windows Vista, 7, 8, 10; macOS 10.8 or later	Windows Vista, 7, 8, 10; macOS 10.6 or later; see website for Linux options	Windows XP, Vista, 7, 8, 10; macOS 10.6 or later	Windows XP, Vista, 7, 8, 10; macOS 10.8 or later; Debian/Fedora/ Slackware Linux	Windows 7, 8, 10; macOS 10.6 or later
Mobile platforms	Android 4.1 or later; iOS 8 or later (restore only)	Android 4 or later (restore only); iOS 8.1 or later (restore only)	Android 4 or later; iOS 8 or later (restore only)	Android 3.2 or later (restore only); iOS 7 or later (restore only)	Android 4 or later; iOS 9 or later	Android 4.1 or later; iOS 9.3 or later (restore only)	Android 2.2 or later; iOS 7 or later	None	Android 4 or later (restore only); iOS 8 or later (restore only)	Android 1.6 or later; iOS 7 or later
FEATURES										
Back up external drives?	✓	✓	With Plus service ($100/yr per PC)	✓	✓	✓	✓	✓	✓	✗
Hybrid backup (to local media)	✓	✗	Business plans only	✓	✓	✗	✓	✗	✓	✗
Restore files from web	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Custom encryption key	Optional	Optional	Optional	Optional	Optional	✗	Optional	✗	✓	✗
Two-factor login	✗	Optional	Optional	✗	✗	✗	✗	✗	✗	✗
Cloud sync	✓	✗	✗	✗	✓	✗	✗	✗	✓	✓
Backup schedule	Continuous /daily/ weekly/monthly/ manual	Continuous/daily / manual	Continuous/daily	Continuous/daily	Continuous	Hourly/daily	Idle/daily/weekly	Automatic/daily/ weekly/monthly/ manual	Continuous/daily	Continuous
Multiple backup sets	✓	✗	✗	✓	✗	✗	✗	✗	✗	✗
Versioning	20 versions	30 days	30 days	Adaptive	10 versions	30 versions	90 days	✗	Unlimited	5 versions
Other major features	Explorer integration, clone disk, rescue media builder	Find missing PC, email alerts	Explorer integration	None	Explorer integration, disk image backup, script access for Linux	None	Explorer integration	None	Explorer integration	Explorer integration
Support options for home users	Live chat, email	Email	Email	Live chat, web form, US phone	Live chat, web form, email, US phone	Web form	Live chat, web form	Live chat, UK phone	Email	Email, US phone (chargeable)

Acronis True Image 2017

FAR MORE THAN JUST A CLOUD BACKUP AGENT, THIS FEATURE-PACKED DATA-PROTECTION SUITE IS IN A CLASS OF ITS OWN



We were able to redownload a Zip archive of all our files in a mere 19 minutes

We've been fans of Acronis True Image since long before "the cloud" came along. While this latest release fully embraces remote backup, it doesn't ditch the flexibility and features that made it a favourite back in the days of tape drives. Depending on your needs, you can buy it as a standalone backup client, with no cloud component, for a one-off fee of $69.99.

The more modern option, however, is Acronis' personal subscription service, starting at $59.99 per year. This gets you the full client – and updates while your subscription remains current – and 50GB of cloud storage.

That may look a bit mean next to the unlimited quotas of Carbonite and CrashPlan, but if you have only a small amount of critical data to protect, it's cheaper in absolute terms. Upgrade options are affordable, too: you can step up to 1TB for $139.99 a year. The top tier offers a gargantuan 5TB, at an annual cost of $379.

Accessing your cloud storage is simple. When you launch the True Image client software, Acronis Cloud is automatically selected as your default backup location, and a non-stop backup of your personal files begins in the background. We were impressed by how fast this happens: although Acronis wasn't quite as fast as Carbonite or MozyHome, it backed up our 5GB of data in a respectable 2hrs 14mins. With this done, a click on the "Recover files" button directed us to the Acronis website, from where we were able to redownload a Zip archive of all our files in a superfast 19 minutes.

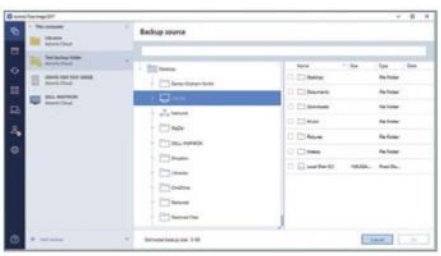
While non-stop backup makes sense for critical data, alternative scheduling options include daily, weekly, monthly or manual backups – or you can configure Acronis to run a backup job whenever you log on, log off, restart or shut down your PC. Furthermore, there's an option to set the backup only to run when the computer is idle, and disable sleep/hibernation to ensure your uploads don't get cut off.

For those who like to take control, there's a whole bunch of additional advanced features. You can set up email notifications, to provide confirmation of completed jobs; change the backup process priority, to balance network usage against backup speed; and – uniquely among the clients we've tested – select a cloud destination from a variety of data centres in different countries. This means that if you're not comfortable with your data being stored in the US, you can choose to have it kept in Australia, the UK, Switzerland, Singapore or a variety of other locales. You can also optionally provide your own encryption key, to ensure that Acronis can't access or share the information you upload, even if asked to by government authorities.

One capability that sets True Image 2017 apart from almost all of its rivals is its support for multiple backup sets. You can define dozens of different jobs, each with its own files and folders, its own security settings, its own schedule and even its own destinations – so you can, for example, keep a secondary backup of critical files on a local hard disk or NAS box, for high-speed disaster recovery.

You can also carry out periodic backups of your entire PC, or even upload an image of an entire disk or partition, separately from your regular backup regime. A handy rescue media builder lets you create a bootable USB flash drive or CD, so you can restore your entire system from either local media or the Acronis Cloud in the case of a catastrophe.

What sets True Image 2017 apart from nearly all of its rivals is its support for multiple backup sets



True Image Home 2017 isn't really intended for corporate environments – businesses are advised to buy the professional Acronis Backup 12 suite and add Acronis Cloud services as needed. Those working from home, however, may be tempted to upgrade to a Premium subscription: starting at $139.99 per year with 1TB of storage, this adds a trio of data-protection tools to the suite. Acronis Active Protection steps into antivirus territory by monitoring your system for ransomware-like activity, as well as automatically recovering files that have been maliciously encrypted. Meanwhile, the Acronis Notary and ASign services use blockchain technology to archive document checksums and digital signatures, allowing you to establish with certainty that a file was in a certain state, and acknowledged by certain parties, at a specified date – which could be useful for resolving legal or business disputes.

If we had to criticise True Image 2017, we'd point out that its interface could be clearer: buttons and menus aren't always where we'd expect to find them, and there's too much reliance on cryptic, unlabelled icons. And if you've multiple terabytes of data to protect, there are certainly more cost-effective options.

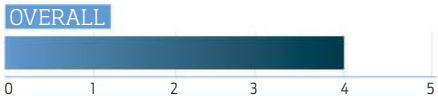
Still, when you look at Acronis' performance, and the tremendous range of data-protection features it offers, it's an appealing package for anyone who values their data.

KEY SPECS

From $59.99/yr per PC, 50GB

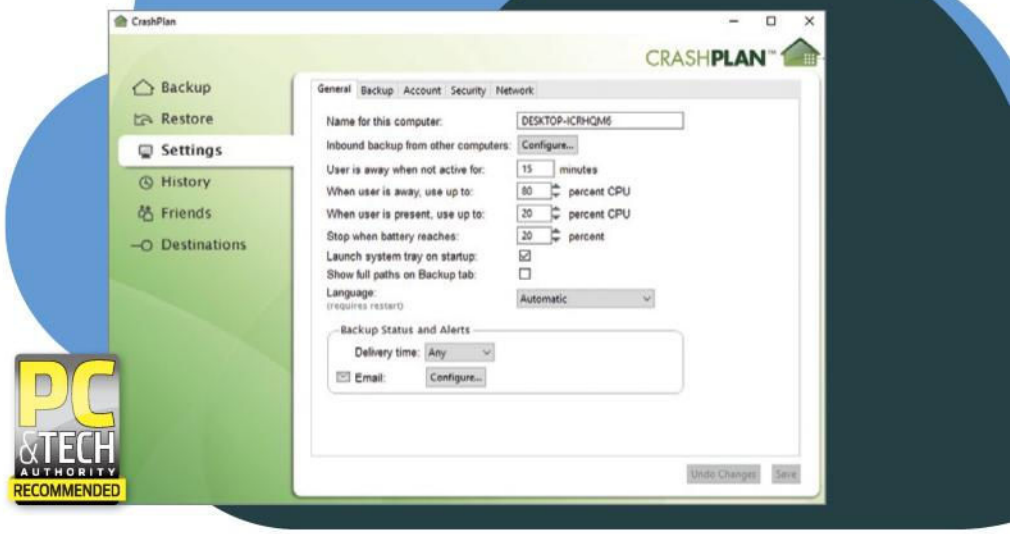
· acronis.com/en-au

OVERALL



CrashPlan

THIS SEEMINGLY CHEAP AND CHEERFUL SERVICE OFFERS A RICH RANGE OF FEATURES - AND GREAT BACKUP PERFORMANCE



CrashPlan offers granular control over the client's CPU usage

CrashPlan is one of several cloud backup providers offering a simple headline proposition: for a nominal fee (in this case around US$5 per month), you get a "set-and-forget" service with unlimited storage, so you don't need to worry about clearing out old files, nor indeed think about backup at all until disaster strikes.

For many of us, that's a persuasive pitch – when you look at how much the likes of Dropbox and OneDrive charge for storage, it almost sounds too good to be true. But having put CrashPlan comprehensively through its paces, we're pleased to confirm that there's no catch.

Let's start with performance. You may expect a cloud backup provider to cut costs by cheaping out on bandwidth, but in fact CrashPlan was one of this month's fastest backup services. Our 5GB folder of personal files was uploaded in a whisker under two hours: only Carbonite was faster. And when we came to restore our backed-up data, it came back down the line at more or less the full speed of our fibre connection. Our complete set of files was back in place in a mere 21 minutes.

Nor does CrashPlan play games with the promise of unlimited storage. You can happily back up files from external media as well as internal drives; the client will even allow you to back up network shares, although on Windows you have to use a little unsupported trickery to get the software to see them.

Moreover, while CrashPlan won't keep unlimited versions of old files forever, the client lets you decide how frequently updated files should be archived, according to their age. For example, you might specify that you want to keep an hour-by-hour history of files from the last three months, but only need a monthly history of files more than a year old. If need be, you can keep track of file changes as often as every 15 minutes. Similarly, you can choose when files that have been deleted from your desktop are also purged from your cloud archive – the default option being "never".

There are a few other welcome options. You get nice granular control over the client's CPU usage, both for when your computer's in use and when it's idle. You can also switch between continuous and scheduled backup, and use wildcards to exclude files from backup – although, since your storage is unlimited, it's hard to see why you'd bother, unless you're generating gigantic files that will bottleneck your network connection.

There's a good range of security options, too. You can password-protect the application itself, to prevent unauthorised users from accessing your download settings, and optionally specify your own backup encryption key. If you do this, you can choose whether to share it with CrashPlan or keep it secret: the latter option provides unbreakable data security, making it impossible for anyone to decode your backed-up data – something you might welcome, since CrashPlan coyly doesn't reveal the location of its data centre. But, as with all backup services, if you keep the key private and then manage to lose it yourself, you're sunk.

Like Acronis True Image 2017, CrashPlan also elevates itself above the crowd with its support for multiple backup sets. From the one client, you can have specific files and folders backed up to the cloud according to one schedule, while a second backup job runs at different times, moving another set of files to a range of destinations.

Uploading to a friend's computer is as simple as sharing the code shown in the client software

This brings us to another of CrashPlan's strengths. In addition to CrashPlan's own servers, and your own local and network drives, you can also upload your (encrypted) data directly to a friend's computer. This is a simple way to gain an additional offsite backup without paying a penny – assuming that your friend doesn't bill you for the storage. As long as CrashPlan is running on both computers, getting set up is as easy as sharing the unique six-character code that's generated by the program, then configuring your backup task as usual.

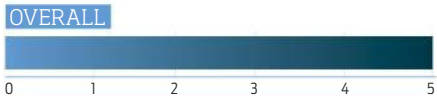
Along with the standard home-user licence, CrashPlan offers a business-level "Pro" service, costing US$10 per device per month. It's a very similar service, but with centralised management, which allows the administrators to remotely configure and update clients, as well as initiate backups, monitor resource usage and enforce policies.

While the basic formula of cheap, unlimited storage is hardly unique to CrashPlan, the package is more rounded overall than its rivals. Your subscription even includes telephone support – although you'll want to keep an eye on your phone bill, since you'll be calling the company HQ in Minneapolis. It may still not be quite as feature-packed as Acronis, but if you've got a substantial archive of data, CrashPlan is an impressively versatile and cost-effective way to keep it safe.

KEY SPECS

From US$60/yr per PC, unlimited storage
· crashplan.com

OVERALL



Backblaze

A LOW-COST CLOUD BACKUP SYSTEM THAT'S ENDEARINGLY SIMPLE - THOUGH IT'S NOT PARTICULARLY FAST OR FLEXIBLE

Backblaze's headline offering is the same as CrashPlan's, namely unlimited cloud backup for US$5 a month. In fact, if you pay for a year upfront, it's cheaper than CrashPlan, coming in at just US$50.

The philosophy is very much "set-and-forget": simply point Backblaze at a hard drive and it will start continuously backing up almost everything it finds, meaning you don't need to fiddle about configuring complicated backup parameters or schedules. Generously, external drives are backed up, too.

That said, there aren't many advanced options to configure. You can throttle bandwidth and CPU usage, as well as optionally specifying a private encryption key for unbreakable security. It's also possible to use the Backblaze web interface to track the geographic location of a registered client, in case it's lost or stolen – a nice touch that could spare you from having to set up a separate anti-theft system.

Backblaze does come with a few caveats, the first of which concerns performance. Our 5GB test folder took 4hrs 35mins to upload to Backblaze's American data centre, making it one of this month's slowest services. File recovery was on the sluggish side, too: we had to wait 46 minutes for our data to come back down the line, while other services supplied it in less than half that time. However, if you're in a screaming hurry to restore a lost file, Backblaze will send you an external drive containing your selected files by next-day international courier. Naturally, this service certainly isn't cheap, costing US$99 for a 128GB USB flash drive, or US$189 for a 4TB external hard disk.

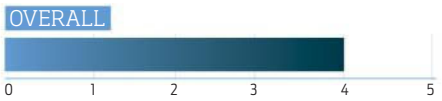
You should also be aware that Backblaze isn't a full-system recovery solution. While the software takes a liberal approach to file types and locations, it won't back up your OS and application files. It's also not a long-term archival service, as files that are deleted from your system are purged after 30 days. If you're using Backblaze to back up external drives, this means you'll need to ensure your media is connected at least once a month to prevent those files from dropping off the system.

If those limitations don't put you off, though, Backblaze is worthy of your consideration. While it's not the fastest or most comprehensive, it's straightforward, and for annual customers it's the cheapest unlimited deal around.

KEY SPECS

From US$50/yr per PC, unlimited storage
· backblaze.com

OVERALL



Carbonite

THE FIRST UNLIMITED CLOUD SERVICE, BUT THE BASIC PACKAGE STRUGGLES TO COMPETE ON FEATURES

Carbonite is the original all-you-can-eat cloud backup service, and the basics work just as you'd expect: once installed it continuously backs up most user files, including documents, spreadsheets, email archives and music. If you prefer a more structured timetable, you can configure a single daily backup at a specified time, or specify quiet hours so Carbonite doesn't interfere with your working day.

One distinctive feature of Carbonite is its Explorer integration. Adding items to your backup is a simple case of selecting them in Windows Explorer, then right-clicking and selecting "Back this up" from the Carbonite contextual menu. A coloured blob should then appear overlaid on the file's icon: green means safely backed up, orange means awaiting upload.

It's a great way to see at a glance what's backed up and what isn't. Unfortunately, if you're already using another utility that uses icon overlays (such as Dropbox or OneDrive), you might find the dots don't appear. This isn't Carbonite's fault – it's a limitation in Windows – and it can be fixed with a Registry tweak, but it's still an unwelcome speedbump.

Carbonite put in a good performance in our backup test, beaming our 5GB of personal files up to the cloud in just 1hr 32mins – faster than any of the competing packages. Restoration was less impressive though; we waited 52 minutes for the same files to come back down the line, while some clients managed the same feat in under 20 minutes.

Carbonite has some other limitations to be aware of, too. The regular edition of the software won't back up files stored on external drives – that capability comes only with a $100-per-year Carbonite Plus subscription, which also adds the ability to create a recovery image of your entire system.

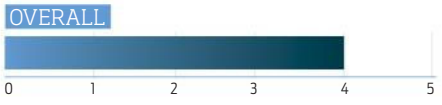
There's no option to mirror your backed-up files to local media for quick access either, and weirdly video files aren't automatically backed up unless you shell out for a US$150 Prime subscription. If you live in the US this tier might have its appeal, as it also includes a courier recovery service for speedy restoration of large archives – but that isn't available in Australia, making the deal a very poor one indeed for we Aussies.

What Carbonite does it does well, and we're big fans of the icon overlays – when they work. At the end of the day, though, it's hard to recommend when CrashPlan offers greater flexibility at the same price.

KEY SPECS

From $59.99/yr per PC, 50GB
· acronis.com/en-au

OVERALL



IDrive

A WELL-EQUIPPED MULTI-DEVICE BACKUP SERVICE, BUT WE HIT BIG PROBLEMS WITH PERFORMANCE

While most cloud backup services restrict you to one PC, IDrive supports unlimited devices. The trade-off is a fixed storage quota, although we doubt many individuals will be seriously constrained by the standard one-terabyte allocation.

To help you make the most of your space, IDrive doesn't automatically select what's going to be backed up and what's not. The client opens with a list of personal data folders, which you can customise to your heart's content. Continuous backup is enabled by default, or if you prefer you can set your backup to run at certain times and on certain days. It involves a little back-and-forth, but you can define multiple backup jobs to run at set times, and back up files to both the cloud and local destinations.

IDrive can also automatically synchronise files across linked computers, like Dropbox but with a much greater storage allowance. And there's a built-in Disk Image Backup wizard, which can create a complete copy of your system drive in case of disaster – although this must be saved to a local drive, rather than being directly uploaded to the cloud.

While IDrive ticks a lot of boxes, it sure wasn't a winner in our performance tests. Our 5GB folder backup completed in a respectable, if not superfast, 3hrs 10mins, but restoring it was another story. Across repeated attempts and different devices, we found the archive consistently took more than 18 hours to download, at a glacial average speed of around 80KB/sec.

We raised the issue with IDrive technical support, but after a round of diagnostics were told that nothing could be done. To quote its report: "...we will not be able to increase or decrease the speed from our end. The connection speed largely depends on the number of inter connections and the routing hoops that exist between your network and IDrive Server." When we put the service to the test in a different location, with a different ISP, results did indeed improve, albeit not enough to challenge our winners. If nothing else, this emphasises how important it is to try a service yourself.

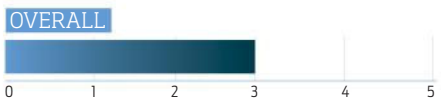
Assuming it does work for you, and note you can always sign up for the free 5GB account, there's much to like about IDrive (indeed, IDrive Business is our recommended choice for larger businesses). As a personal cloud service, however, it's up against tough – and, in our tests, faster – competition.

KEY SPECS

From US$52/yr, unlimited devices, 1TB storage

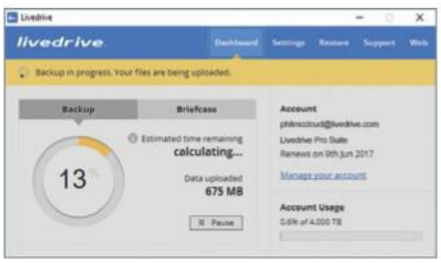
· idrive.com

OVERALL



Livedrive

A FAIRLY MINIMAL SERVICE THAT OFFERS DECENT BACKUP PERFORMANCE, BUT DOESN'T QUITE STACK UP ON VALUE



Livedrive is yet another lightweight backup client offering unlimited cloud storage. It's a bit more expensive than rivals, but you might appreciate not having to commit on a yearly basis.

Getting started is easy. You can select folders to be backed up by drilling down a directory tree in the main console; external drives can be added as well as internal ones – although USB flash drives aren't supported – and up to 30 older versions of updated files are retained.

It's also a decent performer: our 5GB folder of personal data was backed up in 2hrs 18mins, which isn't bad at all, and when we hit restore, the files came back down the line in 33 minutes. It's worth noting, though, that Livedrive's datacentre is located in the UK.

In light of recent legislation, if you're worried about privacy, that may not be a good thing, and it's worth noting that Livedrive doesn't support custom encryption keys, so there's no way to ensure that the company can't access your files. You can however password-protect the client itself, so that intruders can't mess with your backup regime.

When it comes to advanced features, there's not much on offer. You can adjust the frequency of backup runs, but your options are limited. You can either tell Livedrive to upload new files at a fixed interval, ranging from one to 48 hours, or launch a backup every day at a set time. Network throttling is available too, but the configuration options are similarly basic: there's no scheduling element, so you can't set uploads to be slow during the day and fast at night.

The client also invites you to set up your Livedrive Briefcase – a Dropbox-type service that automatically synchronises your files across multiple PCs. This requires a separate subscription costing £10 a month. That's not necessarily a bad deal, as it gets you a whopping 2TB of storage, but we find it a little distasteful to see a paid product pushing additional services.

Livedrive handles the basics perfectly well, but it's a stripped-down solution that lacks features such as multiple backup sets, hybrid backup to local devices and custom encryption. Even if you don't need those features, it's also more expensive than its direct competitors, so we'd suggest you look elsewhere.

KEY SPECS

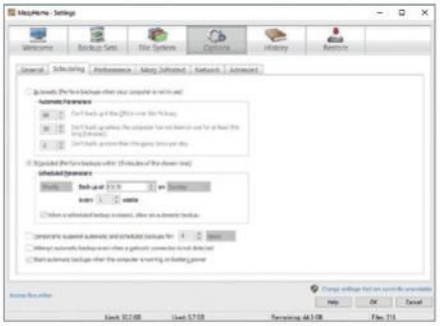
From £5 per month per PC, unlimited storage

· livedrive.com

OVERALL

MozyHome

A FAST BACKUP SERVICE WITH A GOOD SET OF FEATURES - BUTTHE STORAGE ALLOWANCE IS TOO MEAGRE FOR THE PRICE



The MozyHome front-end is tastefully compact, but click on Settings and a rich interface opens up. You can select which files to back up according to type rather than location, then easily add specific items and folders using the directory tree view – or by right-clicking in Windows Explorer and using the MozyHome contextual menu.

By default, backups run when your computer is idle, and you can specify what that means in terms of CPU usage and user input. If you prefer your backups to run at a set time, you can set a schedule from every day to once every seven weeks.

One nice feature is the "Mozy 2xProtect" option, which lets you mirror your cloud backups to a local volume for quick recovery. Using local media also extends your versioning options: MozyHome itself will store old file versions for 90 days, but you can make your local archive go back as far as you like. Of course, having to fall back on a local disk does somewhat undermine the point of paying for cloud storage in the first place.

This brings us to MozyHome's greatest weakness. Although the package itself works well, the pricing is terribly uncompetitive. The default 50GB storage allowance is tight – you could easily fill it up if you have a lot of old projects and images you want to keep safe – and the price is tough to justify when numerous alternatives offer unlimited storage for the same price or less.

It also seems unnecessarily mean that your subscription is tied to a single PC; the 125GB plan covers three computers, but that pushes the price up from US$5.99 to US$9.99 per month.

It's a shame, because we can't fault MozyHome's performance: the service enabled us to back up our 5GB test folder in a swift 1hr 49mins, and download it again in 21 minutes. That's incredibly speedy. Unlike Livedrive, however, MozyHome allow you to specify a custom encryption key when you first set up your backup options. This ensures that, even though your data resides in the US, it's impossible for the authorities to get their hands on it.

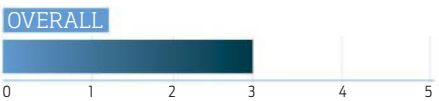
Unfortunately, whatever MozyHome's strengths, the pricing issue is inescapable. There are modest discounts for annual and two-year subscriptions, but even so you'll find much better value and a comparable set of features elsewhere.

KEY SPECS

From US$5.99/month per PC, 50GB

·mozy.com

OVERALL



Norton Online Backup

THE AGENT-BASED APPROACH IS REFRESHING, AND MULTI-PC SUPPORT IS NICE TOO - BUT IT HAS TOO MANY SHORTCOMINGS

Norton Online Backup doesn't have a local interface to speak of: all that's installed on your PC is a lightweight agent that runs in the background. Backup parameters and other actions are handled from the web console, which opens when you double-click on the Norton icon.

In truth, there's not much to configure: your options divide into three tabs headed "What", "When" and "Other". The first of these lets you specify the types of file to back up – such as music, pictures, contacts and so forth – and add or exclude specific files and folders. Under "When" you can switch from continuous protection to a daily, weekly or monthly schedule.

Finally, the "Other" tab lets you throttle backups by dragging a slider from "fastest" to "slowest", although there's no indication of what the scale really means. You can also enable or disable event alerts and automatic product updates. As feature sets go, it's rather rudimentary.

One area where Norton is quite versatile, however, is file restoration. From the online console you can send an archive to any connected PC (up to five can be linked to your subscription), directly download individual items or generate a time-limited link enabling others to access selected files.

Sadly, Norton proved to be one of this month's slowest backup systems. The company doesn't reveal the location of its data centres, but we suspect they're not local: it took 7hrs 19mins to upload our 5GB test folder, while some other services managed it in less than two hours. Restoration was slower than it should have been too, taking 53 minutes. If the worst does come to pass, the likes of CrashPlan will rescue your files in half the time.

There's no support for hybrid local backup, so you can't speed things up that way, and nor does Norton support sophisticated ideas such as multiple backup sets and custom encryption keys. The real kicker, however, is Norton's storage allowance. Your $79 annual subscription buys you just 25GB of cloud space: that's very miserly by modern standards, especially if you want to use the software across multiple PCs. You can buy extra space, but it's not cheap: going up to 50GB almost doubles the yearly price.

We don't dislike Norton's approach, which imposes almost no footprint on your PC. But it's slow, comparatively lacking in features and expensive for what you get, making it a poor choice overall.

KEY SPECS

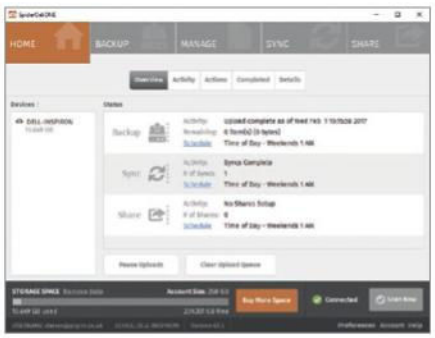
$79/yr for 5 PCs, 25GB

· au.norton.com

OVERALL

SpiderOak One

AN INTERESTING TAKE ON CLOUD BACKUP, WITH SHARING AND SYNCHRONISATION FEATURES THAT SET IT APART



SpiderOak might not be the best known name in backup, but it has some interesting plus points. For one, you get unlimited file versioning, so you can roll back through history as far as you like – at least, within your 100GB allowance.

The client also uses local encryption as standard: everything is encoded on your PC before it's uploaded, using your account password as the encryption key. By default, this password isn't relayed to SpiderOak, so as long as you stick to using the desktop client, the company has no way of decrypting your information. If you log in to the web console, the company's "zero knowledge" position is lost, but from here you can download files to any PC, and set up password-protected sharing to allow friends and family to access selected items.

Interestingly, SpiderOak One uses the same encryption model for hybrid backup as for the cloud; you can keep a copy of your backed-up files on a local drive, but you'll need to log into the SpiderOak client to unlock and restore them. As for what gets backed up, you can select items using a familiar directory-tree interface or right-click on files and folders in the Windows Explorer.

As well as regular backup, SpiderOak One supports Dropbox-style cloud syncing: the contents of your "Hive" folder are automatically synced across connected PCs, and count against your 100GB cloud storage allocation.

In our speed tests, SpiderOak ONE took 2hrs 57mins to back up our 5GB test folder: that's not too discouraging, but it is nearly twice as long as the super-quick Carbonite.

Clearly, in terms of raw storage per pound, SpiderOak One can't compete with the unlimited services. 100GB isn't too much of a squeeze, though, and if you need more space you can upgrade to 250GB for US$9 a month, or a full terabyte for US$12. Business plans add centralised management from US$9 per user, and, if you step up to the Enterprise tier, you even get Active Directory integration.

Those who just want a no-fuss backup at the lowest possible cost are unlikely to be won over by SpiderOak. But its distinctive feature set deserves a look from anyone wanting a bit more from their backup product.

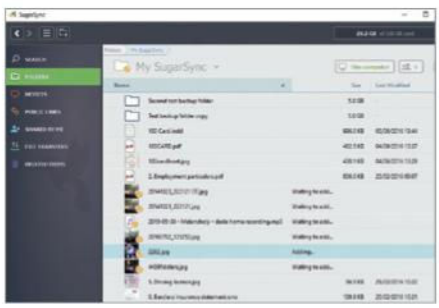
KEY SPECS

US$5/month, unlimited devices, 100GB
· spideroak.com

OVERALL

SugarSync

A TWO-IN-ONE SOLUTION FOR THOSE REQUIRING BOTH BACKUP AND SYNC, BUT YOU'LL FIND MORE FLEXIBILITY ELSEWHERE



SugarSync is an unusual backup service. At first you might take it for a cloud-syncing tool rather than a true backup solution, and certainly it can be used in that way, keeping files and folders continuously in sync across all PCs with the client installed. You can also share public links to your uploaded files, and share folders with other SugarSync users, offering either read-only or full access.

To that extent, SugarSync makes a perfectly good alternative to the likes of Dropbox and Google Drive. Where it differs is that you're not limited to a specific folder. SugarSync works with any number of folders, located anywhere on your system, so you don't have to adjust your way of working to suit it. You can also specify that certain folders should be synchronised across multiple PCs, while others are only to be backed up to the cloud. The only notable limitation is that you can't upload from external or network drives.

This novel philosophy means some of the traditional expectations of backup software don't hold. There are no scheduling options at all; everything happens right away, although you can temporarily pause syncing, or optionally throttle upload speed to 80% or 10% of available bandwidth. There's also no support for setting up multiple backup sets, and no specific options for hybrid backup to local volumes – although the local sync options effectively do a similar job.

In our speed tests, SugarSync gave an undistinguished performance, taking 3hrs 2mins to upload our 5GB of files and 37 minutes to download them again using the desktop client. Others are twice as fast.

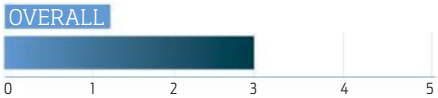
When it comes to versioning, the ability to roll back through five older versions of a file is pretty good, and it's nice that only the most recent version counts towards your quota – but other services offer much longer histories. You can also recover deleted files from the past 30 days.

Although SugarSync is one of this month's more expensive options, and not the most versatile in terms of pure backup, it could be a smart way to consolidate your needs if you're already paying for Dropbox or Google Drive. Note, though, that syncing happens via the cloud, so large files can take a few minutes to propagate across PCs. Hopefully a future update will add LAN-based syncing capabilities to speed things up.

KEY SPECS

$7.49/month, unlimited devices, 100GB
· sugarsync.com

OVERALL



View from the Labs

DARIEN GRAHAM-SMITH HAS A BACKUP CONFESSION TO MAKE, INCLUDING THE TALE OF A NAS DRIVE THAT WENT POP

This month's Labs has been of more than professional interest to me. The truth is, I need to sort out my own backup situation. Yes, I'm one of those terrible people who lectures friends and colleagues about backing up, yet doesn't have a proper system in place himself. In fact, I'll admit it: my home setup illustrates some quite serious backup mistakes.

It's not that I'm blasé about the possibility of losing my data. At home I have a 6TB NAS appliance, which hosts File History data for all my Windows machines – plus Time Machine for the increasing number of Mac clients in my household. So I know that if I manage to leave my laptop on the W7 bus, my data at least can be recovered.

So far so good; my first big mistake was to assume, on setting up this system, that it provided all the data security I needed. In reality, as we detail on p86, there are some scenarios in which on-site backup simply won't suffice.

That's something I learnt the hard way early last year. Luckily for me, the wake-up call wasn't anything so dramatic as a fire or a break-in, but rather a good old-fashioned hardware failure. For that I count my blessings: if I had lost both my computers and my NAS box, I would have been completely sunk.

In the event, when the NAS drive went pop, I was able to keep on working without any immediate interruption. However, I lost access to older versions of my files – and any new work I did wasn't being backed up. What's more, here's my second big mistake:

> *"My first big mistake was to assume, on setting up the NAS appliance, that it provided all the data security I needed"*

somewhere along the way I had got into the habit of using my NAS appliance not merely for backup, but for archiving my largest, most rarely accessed files. At the time, this seemed like a clever way to free up space on my desktop clients; when the unit died, it dawned on me that the "backups" I had lost were my only copies of certain files.

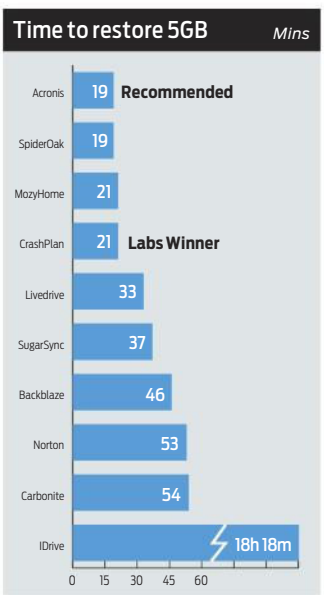
The story has a happy ending, more or less: I was able to take the disks out of the NAS drive and, with the aid of a four-bay USB enclosure, hook them up to a Linux VM, mount the RAID array and copy my data off onto a fresh NAS device.

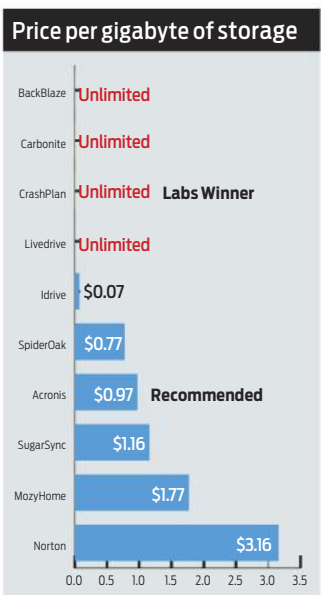
But I don't mind telling you that, until the files were safely recovered, I was holding my breath. And at the end of the process, one fact was clear. This stressful, complicated and time-consuming procedure would never have been necessary if I'd relied on a reputable cloud backup service to either replace my NAS box or mirror it.

Yes, some part of me still bristles at the idea of paying good money for an online service that – touch wood – I may never need. But I've come to realise that a reliable backup service is worth whatever your data is worth. Hopefully, if you're still on the fence about backup, my story will inspire you to do the right thing.

One last piece of advice: after reading our reviews and choosing your preferred backup provider, I suggest you take advantage of the free trials offered by most services. Not only will this help you confirm that the features and interface suit the way you work, it also gives you an opportunity to test performance for yourself (read the IDrive review on p85 for an illustration of this issue in practice). Our figures below represent our own real-world experience, but depending on your line speed, location and ISP, you might get different results.

Test results





HOW WE TEST

We test performance by backing up and restoring a 5GB folder of personal files, including Word documents, PDFs, images and audio files. To ensure a level playing field, we disable any bandwidth- or CPU-throttling features; the backup is carried out over a domestic fibre broadband connection, rated at 52Mbits/sec downstream and 10Mbits/sec upstream. We time this upload, and then measure how long it takes to restore the files again from within the client. Naturally, we're hoping for both operations to be as fast as possible.

Build your own personal cloud

IF YOU WANT TO KEEP CONTROL OF YOUR OWN DATA, THERE IS AN ALTERNATIVE TO CLOUD BACKUP - WE PUT TWO "PERSONAL CLOUD" BOXES TO THE TEST

The MyCloud 4GB is a sleek device, but consider getting the RAID-equipped MyCloud Mirror

If you'd rather not get tied into a rolling subscription, you can always take the traditional route of backing up your data to a local device. Of course, this means your data will be at risk if (Heaven forfend) your house or office burns down, but if you buy a NAS appliance you may still have the ability to browse and access your files from anywhere in the world. This is often referred to as a "personal cloud".

There are other pluses to this approach. Because a NAS appliance lives on your local network, you can browse and restore old files at the full speed of your LAN connection, which will be many times faster than any internet service. There are plenty of options to choose from, with devices from the likes of D-Link, LaCie, Seagate, Synology and Qnap. We've gone hands-on with two such products to see how they stack up against pure cloud options.

WD MYCLOUD 4TB

$275 www.wdc.com

Western Digital offers a range of MyCloud NAS appliances, in capacities stretching up to a mighty 16TB. We tried out the MyCloud 4TB, an unobtrusive unit no bigger than a regular external hard disk – although it naturally plugs into your router, via a wired connection, rather than directly into a client PC.

Alongside backup, you can use the MyCloud for regular file storage. The friendly, web-based setup routine guides you through the process of creating user accounts for everyone in your household, after which you can connect in the usual way (and optionally map a drive letter) in Windows Explorer.

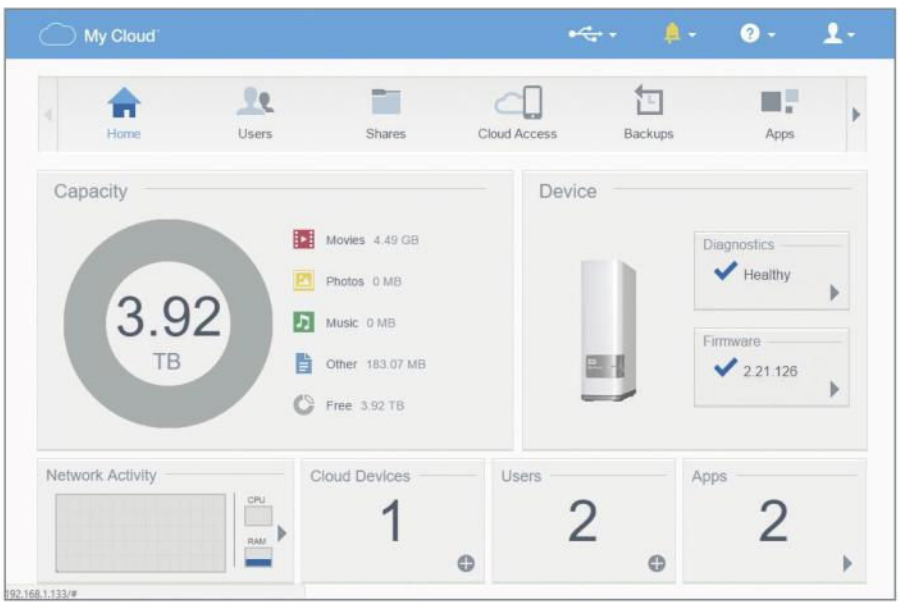
Backup duties are handled by WD's own SmartWare Pro package: despite the "Pro" moniker, this is lightweight software that backs up your chosen files either continuously or to a schedule. We found the interface fiddly and unclear (thanks to buttons that aren't obviously clickable until you hover the mouse over them), but you're not obliged to use it – any backup client worthy of the name will do the job just as well. And since everything only has to travel on your LAN, backup speeds are vastly quicker than any cloud service: we were able to back up our 5GB test folder in a mere 5mins 56secs.

The MyCloud's key selling point is its personal cloud capabilities, which allow individual users to access their personal folders (and any others you've given them access to) from any computer, smartphone or tablet. Setting this up couldn't be easier: to connect, you simply generate a user-specific 12-digit access code from the MyCloud web portal, then enter it into the MyCloud mobile app for Android or iOS – or the MyCloud desktop app for Windows and macOS.

By default, your remote connection to the unit is relayed through WD's central server, so you shouldn't have any problems with firewalls. If you're seeking the very fastest transfers, and don't mind getting stuck into some network settings, enable port forwarding on your router and connect to the MyCloud device directly via your router's external IP address.

It's worth noting that not only does the MyCloud lack the reassurance of an off-site backup, it only contains a single drive – so if that disk suffers a mechanical failure, your data is gone for good. We suggest you step up to the twin-drive MyCloud Mirror, which uses RAID 1 mirroring to protect your files from exactly that danger. Inevitably, though, that's a bigger, more expensive unit, with the 4TB model coming in at $455.

It's also possible to add a further layer of protection using the MyCloud's built-in self-backup agent: you can set it to



Western Digital makes it easy to access files from any device

automatically back itself up to a regular external hard disk, connected via the USB 3 socket at the rear of the unit. Or, most interestingly, you can configure it to regularly back up selected folders to a remote NAS device, located anywhere in the world – as long as it accepts remote connections and file transfers over SSH.

"If you seek the very fastest transfers, and don't mind getting stuck into network settings, enable port forwarding on your router"

The MyCloud isn't the most fully featured NAS device in the world: the 4TB unit we tested will act as a streaming server for DLNA and iTunes clients, but it doesn't let you install third-party apps like Plex or WordPress. It's very easy to use, though, and for $275 it's good value: you can easily pay $200 for a basic USB hard disk in this size, so if you're looking for remote access, it's a tempting option.

BUFFALO LINKSTATION LS520D

$106 from amazon.com

Where WD's MyCloud aims for simplicity, Buffalo's two-bay LinkStation LS520DE feels more techie-friendly. That starts as soon as you open the box: the unit comes unpopulated, so your first job is to screw a pair of 3.5in hard drives into the supplied caddies and clunk them into place. Once you've hooked it up to your router, your next port of call is Buffalo's NAS Navigator utility, which helps you locate the LS520DE on the network and view technical diagnostics.

From here, you can launch the web-based setup wizard, and things get a bit easier. You can choose to configure your two drives in striped, mirrored or JBOD configuration, although for backup purposes we strongly recommend mirroring: the other options let you use the full capacity of both drives, but if either one of the drives should fail you're almost certain to lose data. With this done, the device opens up its home screen: this looks a lot like a Linux desktop, which shouldn't be much of a surprise as the LinkStation runs a stripped-down Linux core. You can easily browse your files and shares, but there's plenty of technical information and advanced settings just a click or two away.

< Buffalo's Linux-based interface might scare some but it's techie-friendly

> Your first job is to populate the box with your own pair of 3.5in hard disks

Buffalo's backup software of choice is NovaBackup 18: the LinkStation comes with a licence for up to five clients, but no entitlement to technical support. It's an ugly bit of software, but a highly versatile one. You can set up any number of custom backup sets, each running to its own schedule, as well as taking a complete image of your system and creating a bootable CD or USB flash drive for "bare metal" recovery, should the need arise.

Personal cloud functions are provided by Buffalo's WebAccess feature. This isn't a hosted service like WD's, but rather requires your router to forward incoming connections on a specified port to the LinkStation. Setting this up isn't as daunting as it may sound: if you don't want to choose a port yourself, and set up forwarding manually, you can enable UPnP and let the router sort it out.

Aside from that, you simply need to come up with a unique name for your LinkStation, such as MyNAS123. Once you've registered this within the LinkStation's settings page, you can visit buffalonas.com/MyNAS123 from any browser and be forwarded directly to your LinkStation. There are mobile apps for Android and iOS too, so you can browse and download files on the go.

When it comes to backing up the LinkStation LS520DE itself, there's a built-in backup app, but this will only back up from one local directory to another, or to a USB 3-connected external hard drive; there's no option to maintain an off-site copy of your files. What's more, while the interface is quite technically sophisticated, there's no way to install additional apps, so you can't easily install a more versatile backup agent.

All the same, if you're looking for a capable NAS that will let you get at your files from anywhere in the world, this is a cost-effective option – especially if you already have some suitable drives to populate it with. We'd feel happier if it had some sort of off-site replication option, but RAID mirroring goes a good way to reduce your risk of data loss.

ENCRYPTED BACKUP

When your most sensitive data resides physically inside your own home or office, it's easy to assume it's completely secure. Unfortunately, even if your data is encrypted at rest – which is certainly not something you can take for granted – resourceful burglars and opportunist hackers may still be able to get in, by taking advantage of insecure or saved passwords.

For the most sensitive files, therefore, your safest bet is to invest in a specialist device. Regular readers will have seen Davey Winder and Jon Honeyball write, in particular, of the iStorage datAshur Pro. This flash drive uses AES-256 encryption and is physically secured with a PIN, so it can't be accessed by anyone until the correct code is entered on its keypad. It's available in capacities up to 32GB, typically costing $200, so it makes most sense for data you can't

POWER UP: WHAT'S NEXT FOR LITHIUM-ION BATTERIES

Slow to charge and sometimes dangerous, lithium-ion batteries may not be the best way to power our devices. **Nicole Kobie** reveals the research that may replace them

Flaming Samsungs aside, most of us lament our batteries for their lifespan and charging time. But what if there was a better way?

Researchers are searching for an alternative to the standard lithium-ion, redesigning how batteries work and trying new combinations of chemicals, in the pursuit of a long-lasting, fast-charging and safe alternative for smartphones, laptops, electric cars and more.

They've come up with a range of ideas, redesigning them from the ground up and substituting new materials. Although chemical challenges and funding complaints mean we'll likely be stuck with lithium-ion for a while, the future of charging could be just over the horizon. Here's what researchers are considering – and why.

PROBLEMS WITH BATTERIES

It's impossible to discuss lithium-ion batteries without acknowledging their apparent propensity to overheat and scorch people – or, in the case of one unlucky Samsung fan, go up in flames and burn their car. Paul Shearing, a senior lecturer in chemical engineering, warned not to get caught up in headlines. While lithium-ion batteries can fail and lead to fires, it isn't as common as it sounds.

"It's important to remember the complete ubiquity of lithium-ion batteries across all modern societies, from mobile phones to laptops to satellites to electric vehicles to aeroplanes," Shearing said. "The chance of failure is really extremely low." When they do fail, it's generally due to short circuits in the battery that cause heat and failure within the cell – a process called thermal runaway. Such batteries have safety features to avoid overheating, but manufacturing flaws, corner-cutting, or trying to cram too much battery into a smaller form factor can cause problems.

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Another problem with lithium-ion batteries is discharge cycles, which are usually limited to 800, or two years if recharging every day. "The battery is fine for the mobile phone because people tend to upgrade their phones every two years," said Donald Sadoway, professor of materials chemistry at MIT. "But when it comes to something like automobiles, people are not going to be trading in their automobiles every two years."

Such batteries have improved over the past decade, but optimisation has remained incremental – leading certain researchers to look not just for tiny improvements, but for the design and materials that will eventually replace lithium-ion.

POSSIBLE SOLUTIONS

Alternatives to lithium-ion need to tick the same boxes, notes Dr Martin Foster, professor of electronic engineering. They need to be better on cost, capacity, charge/discharge rate, size, safety and available capacity. "Most of these can be addressed but only to a certain degree [and] batteries are limited by material fundamentally," Foster said. "For instance, the lithium-titanate battery we have at Willenhall [an energy storage demonstrator] can be charged/discharged at higher rates than other lithium batteries, but they are more expensive."

There are a few promising options, however. Shearing's pick for the best alternative battery design is using solid-state materials instead of liquids, making them safer. Shearing said this involves "replacing some of the fallible liquids that are in the current generation of lithium-ion batteries with folate materials because those are known to be much, much safer".

Because they're less of a risk, they're easier to use in devices without as many safety precautions. Plus, they last longer and are lighter. While Shearing admits they're currently "precommercial", Dyson last year bought solid-state battery company Sakti3 for US$90 million.

Another way to upgrade batteries is using new materials in place of lithium. Options include sodium-ion, lithium-sulphur, and lithium-air.

Sodium-ion batteries are more likely to find a home in grid storage than consumer devices. They may be cheaper and more stable than lithium versions, but they're also heavier and have less energy density. Lithium-sulphur has seen investment from carmakers and NASA, which hope to use its increased energy density to power travel, be it down to the shops or far into space.

For our gadgets, researchers are

^ Carmakers, along with NASA, are investing in lithium-sulphur batteries to increase energy density
v Lithium-ion batteries are ubiquitous in smartphones

considering air. Last year, University researchers claimed to have boosted energy density by five times using lithium-air versus lithium-ion. Plus, they could be recharged 2,000 times – more than double lithium-ion models. Such results were echoed by an MIT study that used "solid oxygen" cathodes, helping batteries to hold onto energy and capacity for even longer.

Shearing said options such as air and sulphur had "huge promise", but were, again, "a little way off from commercial reality at the moment".

MIT's Sadoway said his eyes are on aluminium to replace lithium-ion because "aluminium is the third-most abundant element in the Earth's crust," he explained. "And if we make a battery that's based on aluminium, it's going to be cheap." Researchers at Stanford University unveiled an aluminium-ion version in 2015 that not only charged quickly and withstood 7,500 recharge cycles without capacity loss, but is so safe you can drill through it – making it less risky than lithium-ion and ideal for flexible devices. Similar options include magnesium and iron – anything that's "abundant and cheap", Sadoway said.

Beyond material changes, batteries could be completely redesigned – take a look at some of the more unusual ideas on the next page. The wonder material graphene makes an appearance in designs for supercapacitors, an alternative to batteries that store energy electrostatically rather than using chemical reactions, while bio-batteries that use biological structures such as amino acids could provide an alternative infrastructure. Don't hold your breath, though: much more research is needed.

WHY IT'S NOT HAPPENING

With all these options available, why are we stuck on lithium-ion? Sadoway pins the stagnation on the battery industry and a lack of funding in innovation, noting that lithium-ion itself didn't come from that sector, which preferred to stick with its investments in nickel-metal hydride batteries. Instead, it came from Sony, and he sees the same resistance to change now.

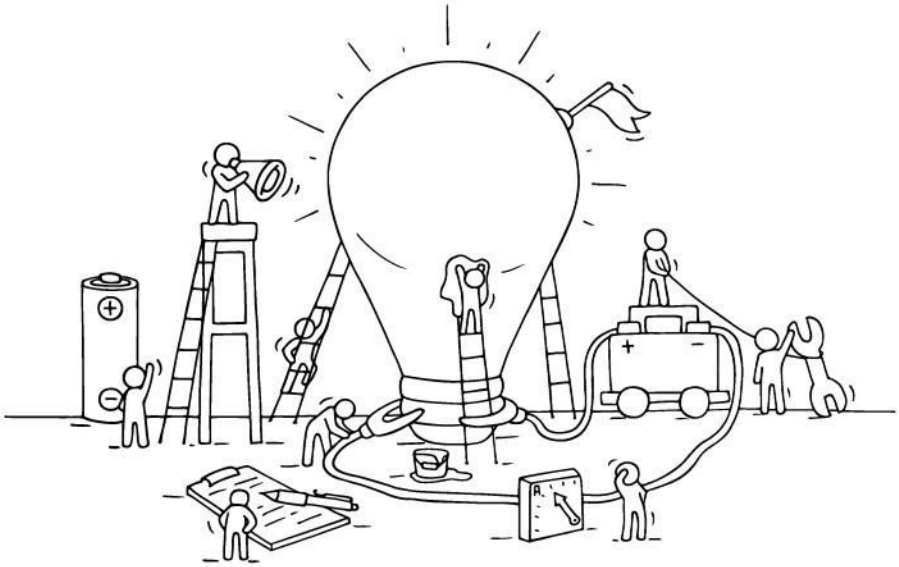
"We should be bolder and more imaginative in looking at something beyond lithium-ion," said Sadoway. "And my fear is that we're just not doing it." Instead, manufacturers are focusing on making lithium-ion "incrementally better". At the same time, the American government has over the past few years slashed research budgets, which remain low aside from life sciences, Sadoway said.

> *"The industry are not innovators. The industry is focused simply on driving down the costs"*

The lack of research funding on new designs or materials means none of the aforementioned options have yet proven to be commercially viable. Sadoway said that could be because they simply don't work, because we haven't spent enough money developing them, or because "of the collective IQ problem" – not enough researchers means not enough "intellectual horsepower" to leap the hurdles holding them back.

"The industry are not innovators," he added. "The industry is focused simply on driving down the costs." For mobiles and laptops, that's less of a problem than for electric cars. "If your computer battery dies, you just plug it into the wall," he said. "But if your car runs out of charge, this is a horrible experience." In other words, forget the inconvenience of having to carry a power pack to get your older smartphone through the day – much more is being held back by our refusal to upgrade batteries.

Shearing pointed to a laptop that would last a week between charges; a smartphone that lasted for a week; electric vehicles with longer range; or a battery that could charge to full in five minutes. "That would be quite transformative," he said. "And improvement in batteries will definitely anslate into some exciting technology."



THE FUTURE OF BATTERIES IS WEIRD

Researchers are looking to odd sources of inspiration for battery innovation, from nuclear waste to your gut. We reveal five of the strangest projects

Inspiration for new battery tech comes from the weirdest places: tattoos, intestines and a girl's best friend. Here are five ways researchers are looking to spark innovation.

EASY TO DIGEST

We have a gut feeling you'd be pleased if your phone battery lasted five times longer. It's an improvement promised by researchers at the University of Cambridge, who have solved one of the hurdles holding back lithium-sulphur batteries: degradation of the materials in the electrodes, which reduces their longevity.

Inspired by the villi cells lining the intestine, the researchers added tiny fingers of zinc oxide to the surface of one of the electrodes, helping to trap the material inside the battery and keep it working for longer. "By taking our inspiration from the natural world, we were able to come up with a solution that we hope will accelerate the development of next-generation batteries," said the lead author, PhD student Teng Zhao, in a statement.

Such lithium-sulphur batteries offer five times the energy density of lithium-ion versions, but won't be commercially ready for years to come.

MOULDY BREAD

Speaking of stomach-turning, the fungus that causes bread mould could lead to rechargeable batteries, say researchers at the University of Dundee. The fungus Neurospora crassa – or red bread mould – can manage the trick of transforming manganese into biomass materials that work well as supercapacitors.

"In comparison to other reported manganese oxides in lithium-ion batteries, the carbonised fungal biomass-mineral composite showed an excellent cycling stability and more than 90% capacity was retained after 200 cycles," said Professor Geoff Gadd, head of the Geomicrobiology Group at the University of Dundee, suggesting mould could help extend the lifespan of rechargeable batteries as it shortens the life of your bread.

DIAMONDS ARE NUCLEAR WASTE'S BEST FRIEND

If you shove nuclear waste inside a diamond, it can power low-current devices without any recharging or emissions. That extreme idea comes via experts at the University of Bristol, who showed a working prototype at the end of 2016, embedding Nickel-63 inside a man-made diamond and using it to generate a small current. The aim is to shift to a new nuclear material, Carbon-14, which is a waste material created in nuclear power plants.

"There are no moving parts involved, no emissions generated and no maintenance required, just direct electricity generation," said Tom Scott, professor in materials at the Interface Analysis Centre, in a statement. "By encapsulating radioactive material inside diamonds, we turn a long-term problem of nuclear waste into a nuclear-powered battery and a long-term supply of clean energy."

The nuclear-powered diamond batteries generate a tiny amount of current but last a phenomenal time: a battery with one gram of Carbon-14 would offer less power than an AA battery, but would take 5,730 years to reach 50% power. That means they won't be used in your phone, instead finding a home where it's more difficult to replace batteries. "Obvious applications would be in low-power electrical devices where long life of the energy source is needed, such as pacemakers, satellites, high-altitude drones or even spacecraft," said Scott.

CLEAR VISION, FAST CHARGES

Slow charge times are a pain point for power-hungry devices, but experts from the universities of Bristol and Surrey have found one solution – inspired by contact lenses. Working with local firm Augmented Optics, they developed a supercapacitor, which is an alternative to batteries for holding power. They charge and recharge quickly, but have poor energy density so require larger form factors to be useful.

Researchers believe they've found a way to change that by boosting density using flexible polymers, similar to those in soft contact lenses. These could let phones or electric cars be recharged in seconds. Jim Heathcote, CEO of Augmented Optics, hopes we won't have to wait long: "The test results from the new polymers suggest that extremely high energy density supercapacitors could be constructed in the very near future."

BIOFUEL TATTOO

Sadly, the reminder of the affection you hold for your mother that's inked on your skin won't power a smartphone, but researchers at the University of California, San Diego, have created a temporary tattoo that's also a biofuel battery cell.

The researchers were looking for a way to measure lactate in sweat to avoid subjecting people to blood tests, but found a way to create power from the chemicals on your skin gathered via a temporary tattoo.

"The current produced isn't that high, but we are working on enhancing it so that eventually we could power some small devices," said Wenzhao Jia, a postdoctoral fellow at the university.

Don't worry if you're out of shape: those who were less fit produced more power because they form more lactate.

23:57:30 IT'S TIME TO STOP WATCHING THE DOOMSDA

AUSTRALIAN

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AUSTRALIA'S PREMIER PC TECH EVENT RETURNS TO MELBOURNE WITH

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PC & Tech Authority, PC PowerPlay, Atomic and Hyper are joining forces once again to bring you another spectacular night of cutting edge PC technology, the latest advances in gaming and the coolest new gear around. The last Upgrade Australia event was hosted in Sydney, so now we're heading back to Melbourne with an all new show with new partners and gear. Get ready to experience the latest PC hardware, talk to experts in the field, witness live demonstrations, feast on free food and drink and stand a pretty good chance of walking away with freebies.

We know you can't wait to get your hands on the latest and greatest PC gear so jump on the website and register right away!

Register at:
www.pcauthority.com.au/upgradeaustralia

WHERE: Melbourne 's Monash University, Caulfield Campus
WHEN: May the 3rd, 6pm onwards
WHAT: Upgrade Australia 5.0, a unique PC event that sees the best hardware vendors showing off their latest and greatest technology as well as free food and drink
COST: FREE FOR ALL!

- Go hands-on with the hottest and most cutting edge computer tech
- See some of the greatest case mods in Australia
- Be the first to see demonstrations of tech that hasn't hit the market
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Visit www.pcauthority.com.au/UpgradeAustralia
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KRAKEN PRO V2

If you like big audio, value clear team communications and don't mind looking stylish, then the Kraken series from Razer is worth sticking your head in. With bold colours and refined acoustic engineering, these bad boys are a mean solution for hardcore gamers. With fat 50mm drivers the Kraken Pro V2 and 7.1 surround Kraken 7.1 V2 headsets create a rich and unashamedly loud soundstage. They're tough, too, with a sturdy aluminium frame wrapping around the entire headset.

OSVR HDK2

Come and stick this on your head at Upgrade Australia and see what all the fuss is about. The OSVR HDK2 has a proper 2160 x 1200 resolution display (1080 x 1200 per eye) and runs at a buttery smooth 90fps. That's what you need for real immersion without the headaches. And because the OSVR is open source it supports a wide range of games, software apps and peripherals. Over 300 titles on SteamVR!

So come along if you'd like a nice VR treat, give the OSVR HDK2 a go and lose yourself in a fantastic virtual experience!

BLACKWIDOW CHROMA V2

Through a combination of upgrades to the already widely respected BlackWidow keyboard, and a choice of three different mechanical switch types, Razer has created a new flagship keyboard in the form of the Razer BlackWidow Chroma V2. The three switches available cover the gamut of popular mechanical styles, with the two existing Razer keys, Green and Orange, offering tactile/clicky and tactile feedback respectively. The new Yellow switch, debuting in the BlackWidow Chroma V2 is a silent, linear speed switch that has a short actuation distance for rapid response and a silent linear action for smooth, comfortable gaming and typing. A row of macro keys and a large, padded, magnetically attached wrist rest, bright, easily controllable RGB lighting, USB pass-through and headphone port round out the features.

RAZER DEATHADDER ELITE

Ben here. I use this at home and it's bloody great. I like a simple design without fuss and this is it. I like a smooth natural feeling movement, and this has that. I prefer optical over laser, and this is indeed, optical, so the big benefit there is very precise movement in small areas (sniping!), and predicable big swooshes when I need to get from one side of the screen to the other quickly. All this is why the Razer Deathadder is our top pick for our Perfect PC in Kitlog. Come along to Upgrade Australia, give it a go and see if you agree! And, Razer will have another mouse at Upgrade Australia that's so new even I haven't seen it yet. Can't wait!

THE GAMING EDGE: GIGABYTE AND AORUS

Aorus, a premium gaming brand powered by Gigabyte, delivers a full spectrum of gaming products ranging from gaming laptops, motherboards, graphics cards, mechanical gaming keyboards, to many other gaming hardware and gear, offering the most extreme gaming experiences for enthusiasts worldwide!

RYZEN - POWERFUL IN PURPOSE. EFFICIENT IN DESIGN

The new Gigabyte Gaming and Aorus Gaming Motherboards will be built with support for AMD Ryzen CPU architecture. Ryzen, built on the AMD AM4 platform, has crucial technologies that ensure users have the most efficiency when it comes to performance and power consumption. With features like Pure Power, Precision Boost, Neural Net Prediction, Smart Prefetch and an Extended Frequency Range, Ryzen is ready to address the needs and demands of gamers and enthusiasts. Our Aorus Ryzen boards will feature RGB Fusion, the most advanced LED system on the market, with ability to customise colour output, colour zones and type of lighting effects via RGP Fusion App.

GEFORCE GTX 1080 AORUS XTREME EDITION 8G

Gigabyte, the world's leading premium gaming hardware manufacturer, is proud to announce its brand new premium Aorus line of gaming graphics card with the Geforce GTX 1080 Aorus Xtreme Edition. Packed with winning features such as VR front HDMI ports and RGB customization, the VR-ready GTX 1080 Aorus Xtreme Edition is a powerful graphics card that pushes the gaming experience to yet again reach new heights.

The new Aorus graphics card is equipped with our legendary Windforce Stack Cooling module. In addition to the GPU, the VRAM and MOSFET are properly cooled to boost performance. Up front, the large copper base plate efficiently transfers heat from the GPU and VRAM to the heat sink. Additionally, excessive heat can be dissipated through the back as well with an extra copper plate.

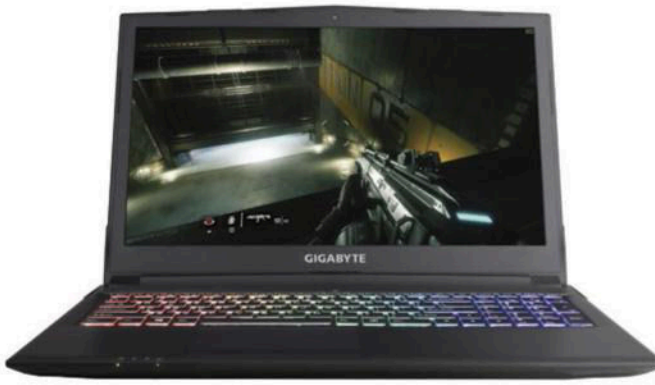
The rest of the Windforce Stack Cooling module makes no compromises with the three 100mm stack fans and 6 composite copper heat pipes for powerful cooling. The use of double ball-bearing fans ensures the card will go the distance. The silent semi-passive fan profile allows gamers to enjoy gameplay in absolute silence when the system is running light or idle.

GIGABYTE UNVEILS AND EXPANDS THE GAMING SERIES WITH THE ALL NEW SABRE SERIES

Traditionally the sabre is a curved sword designed to be fast and light in order to slash through enemies and are used in many militaries as symbols of rank, honour and respect. The Gigabyte Sabre series is all about well-designed, fast and light gaming laptops that provide good all-round performance for all gamers around the world.

Besides the new and powerful 7th gen Intel Core i7 processor. The Sabre 15/17 is also equipped with the newly announced Geforce GTX 1050 Ti 4GB / GTX 1050 4GB/2GB graphics, gamers can now fully enjoy the latest performance from the Pascal architecture, with fluid 1080p high graphics settings, presented beautifully on 15.6-inch or 17.3-inch Full HD 1920x1080 WVA anti-glare displays.

The keyboard plays a big role in winning or losing a game; that is why the Sabre 15/17 comes with optimized 2.0mm travel scissor type keys for added tactility and precision. On top of that, the Sabre 15/17 features RGB backlight keyboard with 16.8 million colours (optional) and is controlled through the well-known Flexikey software, giving gamers endless possibilities when it comes to to customising their keyboard.



HYPERX REVOLVER S

Extraordinary comfort and audio

The PC & Tech Authority and PC PowerPlay crew have long been fans of HyperX's brilliant Cloud series of headphones. PCTA editor Ben has them on his head for much of the working day, and they appear in both PC & Tech Authority's A-List and PC PowerPlay's Beast PC. Very few cans match the comfort (especially the comfort!) and sound quality of the $279 Revolver S.

So with interest we hope you are looking forward to trying the new Cloud Revolver S at the next Upgrade Australia. The upgraded model features several tweaks to the already excellent design. They feature the same 50mm drivers used in the other Cloud models, so they sound great. Clouds are fantastic for gaming as music, equally, with a clean yet punchy sound that's unadulterated by artificial processing.

The new Cloud Revolver S continues the HyperX tradition of award-winning comfort and competitive audio performance and has an in-line Dolby 7.1 sound card, and connects to your PC or console via USB. That means no software or drivers are needed on your PC or console - it just works, delivering high quality audio. If you prefer, the in-line sound card and USB connection can be removed allowing these to connect using the standard 3.5mm audio jack.

Backlit buttons on the clip-on audio control box allow you to quickly activate virtual Dolby Surround 7.1 audio, mute, and regulate mic and output levels.

Revolvers hold up magnificently to extreme volumes as well, whether it's booming gunfire or block rocking beats. It features three additional sound profiles - bass boost, flat and vocal equalizer modes - making it easier for gamers to swap between setups tuned for games, streaming, music or movies.

The mic is removable, too, and they have a lovely matte finish all over that looks and feels very cool indeed. HyperX has also improved the acoustics of the headband itself, so, while offering the strength of metal the band won't create any acoustic resonance itself.

There really aren't any alternatives in this price range, and they equal cans costing $500 or more for comfort and audio quality.

SAMSUNG PORTABLE SSD T3

For when data transfer speeds and serious capacity are paramount

For those who really need a portable drive with very fast transfer speeds PLUS easy portability, portable SSDs are a good option. Samsung's T3 is the class-leading option here. Its attractive tapered slab shape looks fantastic and is nice to hold in your hand. The case is sturdy metal and Samsung claims it can survive up to a 2m drop.

The big technical advances since Samsung's original T1 are the inclusion of USB Type 3 port as standard, its use of stacked 3D V-NAND to improve capacity while keeping costs reasonable, and the use of xFAT formatting to enable compatibility with PC, Mac and Android without the need to create OS-dependant partitions or make compromises with formatting.

Our testing yielded speeds of 435MB/s read, and 418MB/s write, exactly within expectations. That was via USB 3.1. The results were more or less identical on a USB3.0 port. It is also backwards compatible to USB2.0, albeit at lower transfer speeds - being a limitation of the old USB2.0 standard.

While the device itself uses the new Type C port, the included cable is Type C at one end and USB 3.1 (the traditional-looking USB, so it's backwards-compatible with 3.0/2.0 etc) on the other to attach to devices/PCs. We're seeing more and more devices and motherboards using Type C - including many new smartphones which rely solely on Type C.

The drive comes with an app that enables AES 256-bit hardware encryption. Once set up, the T3 Security Enabler prevents access without a password and that holds true whether you connect the drive via Windows, Mac or Android.

Capacities available are 2TB, 1TB, 500GB and 250GB.

Owning something like this is a delight. It makes things quicker and easier if you do a lot of file moving, and it's not a completely ridiculous point to make that there's a certain prestige cachet that comes from having such a premium portable storage solution that people will notice when you plop it on the desk or cafe table.

Tom Clancy's Ghost Recon: Wildlands

PSEUDO-SOLDIER MISCHIEF

Wildlands, despite the Ghost Recon name, has more in common with the Far Cry series than it does Ghost Recon. Sure, it is a squad based military game rather than a lone hero on an island or mountain slaughtering natives and animals with wild abandon so as to craft a better wallet or get some sweet new tribal tattoos, but many of the core concepts are similar. Take a large, beautiful open world, populate it with pockets of friends and enemies, numerous drivable vehicles and a maniacal, larger than life villain and you have the setup both for Wildlands and the inevitable next Far Cry title. Gone is the slow, granular and tense combat of previous Ghost Recon titles, replaced in Wildlands with a huge degree of player freedom. This is both good and bad.

The Ghost Recon squad is sent to Bolivia to take down the cartel responsible for massive amounts of death and the majority of cocaine flowing into North America. To achieve this end, players must destabilise the cartel,capturing, killing or interrogating the Santa Blanca hierarchy to make way to the next step in the chain, slowly making their way to the top, to once and for all cut the head off the snake. The cartel has a firm foothold in Bolivia, controlling the government and police, leaving only a small group of resistance fighters, along with the Ghosts, to fight for nation's freedom. The country is broken up into 20 or so provinces of varying sizes. All of these combine to make an absolutely enormous play space, and this is one of the real hurdles of Wildlands.

Although the country is huge and beautiful, it's also rather empty. There are a number of hidden upgrades and skill points to find, but most if not all of these can be pinpointed by finding intel drops, leaving negating the need or interest in exploration. Without having a full, living world with heaps to find and explore, Wildlands instead forces players to travel

long distances between missions and points of interest.

To make matters worse, vehicle controls are uniformly terrible on PC. Ground vehicles all feel digital – they are either on or off – so you have to constantly jump between accelerating and coasting to avoid going at full speed at all times. Controls for air vehicles are even worse, with helicopter flight being a constant fight between upward and forward thrust, making the nose bob up and down as you try and maintain altitude whilst moving forward at anything more than the pace of a fast jog. You do get used to the controls after a dozen or so hours, but that's way too long a learning curve, and even then the controls haven't improved, you've just come to accept their inadequacies and have learned to work around them.

The freedom of approach to combat afforded by the open world is, unlike the vehicle handling, wonderful, and the different environments around Bolivia ensure that the same tactics won't work for all encounters. Scouting locations and tagging enemies with binoculars or a drone allows players to monitor enemy movements if stealth is the desired approach, and a synchronised shot with AI squad-mates allows for multiple enemies to be taken out at the same time.

Clearing enemy bases and installations with AI controlled teammates is fun, but Wildlands only truly shines when player with a full co-op fire-team, even when players don't coordinate actions. Playing with friends, making plans and seeing them come to fruition is immensely satisfying, but even the chaos afforded by a group of random players trying to take down a cartel base is a great deal of fun. If you don't jump online, you're missing the real strength of Ghost Recon: Wildlands.

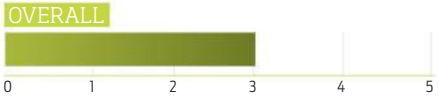
Daniel Wilks

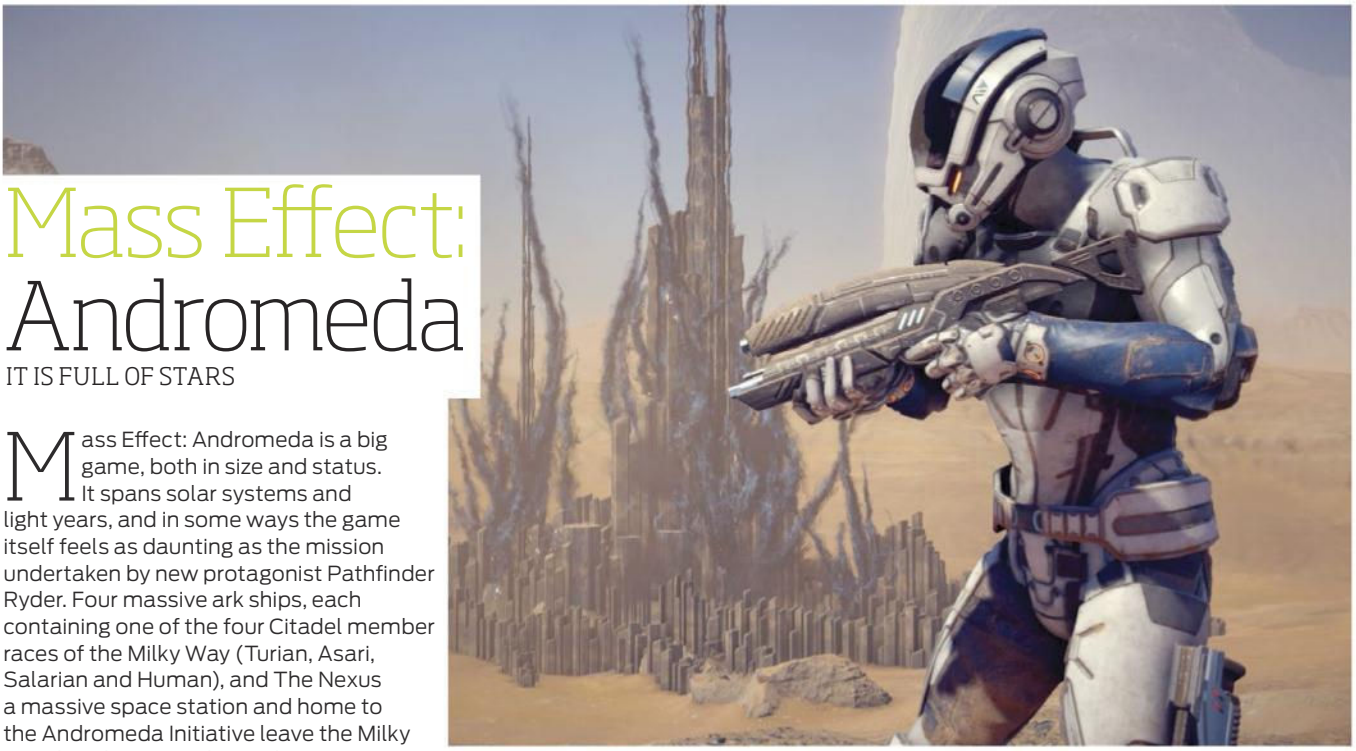
KEY SPECS

www. ghost-recon.ubisoft.com

Genre: Shooter · Developer: Ubisoft · Publisher: Ubisoft · Platform: PC, XBoxOne, PS4

OVERALL





Mass Effect: Andromeda

IT IS FULL OF STARS

Mass Effect: Andromeda is a big game, both in size and status. It spans solar systems and light years, and in some ways the game itself feels as daunting as the mission undertaken by new protagonist Pathfinder Ryder. Four massive ark ships, each containing one of the four Citadel member races of the Milky Way (Turian, Asari, Salarian and Human), and The Nexus a massive space station and home to the Andromeda Initiative leave the Milky Way, heading to Andromeda to start new colonies on the golden worlds discovered in the Heleus cluster of our nearest neighbouring galaxy. Even travelling faster than the speed of light with the passengers and crew in cryo-sleep, the journey still takes over 600 years. Things have changed since the ark ships set off. The golden worlds are barren, the Heleus cluster is in the grip of The Scourge – a mass of unstable dark matter of mysterious origin – and an aggressive, expansionist alien empire known as the Kett has plans for Andromeda and they don't believe in diplomacy. To make matters worse, The Scourge damaged The Nexus on arrival, and the Turian, Salarian and Asari arks are missing, presumed destroyed. There has been a mutiny on The Nexus leading to mass exiling and the Krogan leaving to form their own colony. THe human ark arrives over a year later than expected. The Pathfinder's sibling is in a coma.

The scope of the narrative is both a good and bad thing. It gives ample space for exploration and for the player to feel as though they are making an impact on the game world, but it can also lead to some quest fatigue as you begin to feel after a while that in a vast galaxy and on a space station of tens of thousands of people, you are the only person willing or capable of actually making an effort to get something done. The job of the Pathfinder is both straightforward and a little existential. On the surface they are explorers, scientists and diplomats looking for new worlds to settle, resources

for The Nexus, surveying planets and anomalies for data about the new galaxy and making first contact with any alien species that may be encountered in their travels. Think of a Pathfinder as being Captain Kirk, if the Prime Directive as to meddle as much as possible in alien affairs. Much like the protagonist of the previous ME games, Commander Shepard, the Pathfinder is also the official/unofficial spokesman and PR agent for the human race and the Milky Way as a whole.

For the most part this is achieved by travelling to planets and, through questing, making them viable for a settlement. Quests take on a variety of forms from the grand overarching war against the Kett to smaller, more intimate standalone affairs. What most of the quests have in common is that more often than not they will entail a fight. The shooting engine of Andromeda is a definite step up from that of previous Mass Effect games, combining cover based shooting with hotkeyed timer based abilities gained through the skill trees. While the action is not on par with dedicated shooters, the enemy AI is good enough to provide a challenge, even at normal difficulty. Anything lower, however, is so easy that most combats can be completed by AI squad mates alone.

Mass Effect: Andromeda is an excellent and ambitious new chapter in an already excellent series, but it's not one without its faults. The scope and ambition of the game sometimes works against it, with a quest log that fills up so fast and so full it's hard to keep track of where to go next, and there are some issues with some facial animations. Ultimately though, these are small gripes. If you have time to play Mass Effect: Andromeda you should. Just make sure you have enough – 47 hours were played for this review, and there are still many planets left to explore.

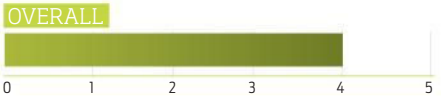
Daniel Wilks

KEY SPECS

www.masseffect.com

Genre: Shooter • Developer: BioWare Corporation • Publisher: Electronic Arts Inc. • Platform: PC, XBoxOne, PS4

OVERALL



The A-List

THE VERY BEST GEAR YOU CAN BUY

PRINTER TIME

While it's not a brand new model, we recently tested the Epson Workforce WF-3620 and loved every bit of it, as you can read in our review on page 44. So in it goes, replacing our long standing previous champ the still excellent Canon Pixma IP 8760.

TOP NEW ROUTER

After using the Synology RT2600ac there's just no way it can't go into the A-List. Synology has delivered tremendous performance along with its famously brilliant and beautiful interface. This is all the router you need for most homes, able to meet demanding media streaming and multiple users online without choking each other's performance.

PC DESKTOP

ALL-IN-ONE Apple iMac 27in with Retina 5k display

★★★★★

PRICE $2,799

SUPPLIER www.apple.com/au

The Apple 27in iMac with Retina 4K display is great. The best all-in-one computer around, and by a furlong.

SPECIFICATIONS Quad-core 3.1GHz Intel Core i5 processor; Intel Iris Pro graphics 6200; • 8GB RAM • 1TB HDD • 27in 4096 x 2304 Retina 5K IPS display • SDXC card slot • 4 x USB 3 • 2 x Thunderbolt 2 • Gigabit Ethernet • 802.11ac Wi-Fi

PERIPHERALS

WIRELESS ROUTER Synology RT2600ac Wi-Fi Router

★★★★★

SUPPLIER www.synology.com

This router really does do it all, and at a great price point. We'd go so far as to say it's the best 2600AC router on the market, with blazing speeds, a rich feature set and that oh-so-amazing interface. Highly recommended for both novices and network engineers alike.

SPECIFICATIONS dual channel (2.4GHz – 800Mbps; 5GHz – 1.73Gbps); EEE 802.11a/b/g/n/ac; twin USB ports (1 x 2.0, 1 x 3.0); MU-MIMO compatible; beamforming

NAS Synology Diskstation DS216+

★★★★★

SUPPLIER www.synology.com

For most people the Synology DS216+ is all the NAS they'll ever need.

SPECIFICATIONS 2x SATA 3 2.5"/3.5" drive bays • Intel Celeron Dual Core 1.6GHz CPU • 1GB DDR3 RAM • eSata, 2x USB 3.0 & 3x USB 2.0 • 1x Gigabit Ethernet

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

ALL-IN-ONE PRINTER EPSON WF-3620

★★★★½

SUPPLIER www.epson.com.au

It's a near-perfect MFP for home or small-office use, and a cut above the cheap MFPs you'll find on the office supplier shelves.**SPECIFICATIONS** 4,800 x 2,400dpi A4 inkjet • 2,400 x 1,200dpi colour scanner • claimed 33/20ppm mono/colour printing • 6.8cm touchscreen • 802.11n Wi-Fi • 10/100 Ethernet • USB 2 • fax modem • SD card slot

LAPTOPS

VALUE
Asus T100HA
★★★★★

PRICE $399

SUPPLIER www.asus.com.au

Performance that delivers everything typical day to day computing demands short of intense gaming, combined with a fantastic screen and a solid and we think, rugged design makes this the value king.

SPECIFICATIONS 10.1in IPS panel • Intel Quad-Core x5-Z8500 processor • 64GB eMMC SSD • 2GB LPDDR3 memory

GAMING
Asus GL502VS
★★★★★

PRICE $2,995

SUPPLIER www.asus.com.au

Asus has built a very solid machine around an incredible new GPU. This has totally revolutionised the performance we can expect from a laptop, putting many regular desktops to shame.

SPECIFICATIONS GeForce GTX 1070 GPU • Intel i7-6700HQ CPU • 8GB DDR4 • 15.6-inch IPS display • 1TB HDD • 256GB SSD

PROFESSIONAL
Microsoft Surface Book
★★★★★

PRICE $2,299 – $4,206

SUPPLIER www.microsoft.com.au

Truly beautiful, undeniably powerful and without doubt the best professional laptop you can buy.

SPECIFICATIONS 13.5in 3000x2000 IPS display • Intel i5-6300U/i7-6600U CPU • 8/16GB RAM, optional Nvidia GPU • 256/512GB PCIe SSD • 802.11ac Wi-Fi • Bluetooth 4.0, 2x USB 3.0 • Mini DisplayPort

ULTRA PORTABLE
Dell XPS 13
★★★★★

PRICE $2,499

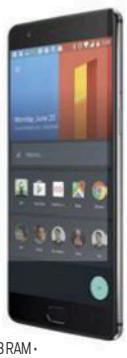
SUPPLIER www.dell.com

There's no denying how sexy Dell's latest XPS is. Premium. Sexy. Stylish. Lightweight. Damn does this Ultrabook impress. Along with a multitude of ports, the extra battery life is a very pleasing bonus.

SPECIFICATIONS Intel 7th Generation Core i7-6500 • 8GB memory • 256GB SSD • 13.3-inch QHD+ with Touch

HANDHELDS

SMARTPHONE
OnePlus3
★★★★★



PRICE $432

SUPPLIER

www.oneplus.net

Quick, beautiful, long-lasting and an incredible price; you won't find a better phone for the money.

SPECIFICATIONS Quad-core 2.2GHz Qualcomm Snapdragon 820 processor • Adreno 530 graphics • 6GB RAM • 5.5in 1,080 x 1,920 AMOLED display • 64GB storage • dual SIM • 16MP/8MP rear/front camera • 802.11ac Wi-Fi

TABLET
Apple iPad Pro 9.7in
★★★★★

PRICE $849 (32GB, Wi-Fi)

SUPPLIER www.apple.com/au

This is a tablet you'll want to use all the time, and there's no higher praise for any piece of technology than that.

SPECIFICATIONS 64-bit Apple A9X custom processor with M9motion coprocessor • 2GB RAM • 32/128/256GB storage • 9.7in 2,048 x 1,536 IPS display

EBOOK READER
Kindle Paperwhite
★★★★★

PRICE $119

SUPPLIER

www.amazon.com

The premium Kindle goes the extra mile, with a more attractive design, lower weight, and better contrast.

SPECIFICATIONS 6in 1,072 x 1,448 E Ink Carta display • 4GB storage • single-band 802.11n Wi-Fi • optional 3G • 1yr RTB warranty • 117 x 9.1 x 169mm (WDH)

SMARTWATCH
Apple Watch 2
★★★★★

PRICE $529

SUPPLIER

www.apple.com/au

The Apple Watch is the best smartwatch on the market – and the Series 2 can now claim to be among the best fitness trackers too.

SPECIFICATIONS

340 x 272 AMOLED • GPS • heart rate sensor

SOFTWARE

SECURITY Kaspersky Total Security
★★★★★

SUPPLIER www.kaspersky.com

Kaspersky Total Security is the only security package on test that achieved both perfect protection and false-positives scores.

BACK UP Acronis True Image 2015
★★★★½

SUPPLIER www.acronis.com.au

The 2015 version adds full-system backup and dual backup.

OFFICE SUITE
Microsoft Office 365 Home Premium
★★★★½

SUPPLIER

www.microsoft.com.au

The easiest to use Office to date.

WEB DEV Adobe Dreamweaver CS6
★★★★½

SUPPLIER www.adobe.com.au

This edition makes PHP and CMS its core focus.

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 6
★★★★★

SUPPLIER www.adobe.com.au

Lightroom 6 doesn't add up to a revolutionary update, but it improves on what was already an exceptional piece of software.

The Kitlog

OURS IS TO RYZEN WHY

Well, the time has come. Ryzen is here, and it's an excellent CPU, as we cover in great detail with our Labs feature starting on page 58.

So, does Ryzen go into the Game Box? No, it does not. As our benchmarks show, Intel still has the lead for gaming performance, and its i5 range more or less matches the Ryzen 5's pricing. AMD is actively working with game developers to cultivate a better understanding of the Ryzen architecture, and to help them make better use of Ryzen CPUs with more than four cores. We shall be watching developments there closely, but there's no denying that Intel is still the best choice for gamers – although there's not much in it – so if you also use your gaming PC for apps that are well multi-threaded then the story is different, but we classify it as a game PC here, so Intel holds on.

As for the Perfect PC, for the same reasons Intel keeps its spot. Yes, Ryzen can out-perform Intel with certain apps like the much vaunted Cinebench, but our Perfect PC must do it all, and that includes gaming – which is why we include expensive gaming components like a top end graphics card.

Again, if you want a PC mainly for 3D, image editing, video production and the like there's no hesitation to recommend Ryzen as the top choice, and it can definitely handle gaming, it's just not quite there yet as the do it all system. Remember though, there's almost nothing in it so don't take this as a recommendation to not buy Ryzen, do so if it meets your needs and you won't be disappointed!

TI TIME

With absolutely no hesitation the Perfect PC gets the new Nvidia GTX 1080 TI. It's a monster, able to run any game on Ultra at high resolution, can power a 4k screen comfortably and all in a single card. See our review this issue on page 46.

NEW GAMING MONITOR

IN PCTA 231 (page 56) we reviewed LG's UG79G and loved it, but didn't love it's RRP of $1,349. You can now pick these up for under a grand and it perfectly matches our AMD graphics card choice with FreeSync support.

THE GAME BOX

CPU

INTEL CORE I5 6600K

PRICE $319

Gaming generally doesn't make use of hyper-threading which makes this the CPU of choice for this box.

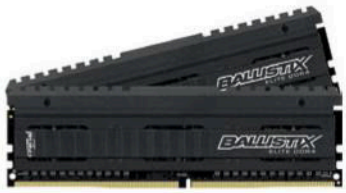
MOTHERBOARD

ASUS Z170 PRO GAMING

PRICE $229

Our Skylake Value Award winner, it packs in a complete set of features yet is priced reasonably. Good audio also means we don't need a sound card.

MEMORY

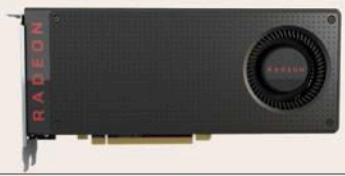


8GB OF DDR4

PRICE $65

The speed and brand makes so little difference to performance we can't recommend one over another.

VIDEOCARD



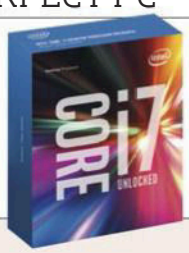
AMD RX 480 8GB

PRICE $380

This is the new mid-range GPU champ. Opt for the $50-cheaper 4GB version if you run a 1080p screen. An Nvidia GTX 1060 or 1070 are nice step-up choices.

THE PERFECT PC

CPU



INTEL CORE I7 6700K

PRICE $459

Intel's top-shelf unlocked i7 CPU.

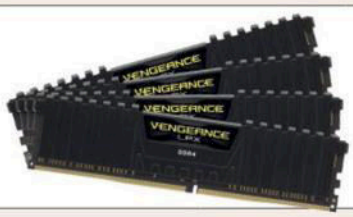
MOTHERBOARD

GIGABYTE GA-170X GAMING G1

PRICE $715

The most complete 100-series motherboard you can buy today.

MEMORY



32GB OF DDR4

PRICE $200

For a general-purpose build 16GB is all you need, but go big if you know you need more.

VIDEOCARD

NVIDIA GTX 1080 TI

PRICE $1,189

The fastest graphics card of them all.

TOTAL: $2,932 RIG ONLY: $1,661

COOLER

COOLERMASTER NEPTON 140XL
PRICE $85
Easy to install AIO CPU cooling, relative quiet and performance to rival twin-radiator units.

SYSTEMDRIVES

SAMSUNG 850 PRO 512GB
PRICE $319
This SSD offers greatly improved durability. Supplement it with a hard drive of your choice if needed.

DISPLAY

LG UC79G
PRICE $940
Ultrawide 2560x1080, curved, 144Hz with FreeSync, this is the gaming screen to bury your head in.

AUDIO

HYPERX CLOUD REVOLVER
PRICE $119
For the price they sound almost as good as $500 audiophile cans

CASE

BITFENIX RONIN
PRICE $106
Bitfenix continues to deliver great budget cases that look terrific and are easy to build in.

KEYBOARD

COOLER MASTER QUICKFIRE XTI
PRICE $149
Good looks, solid and reliable build and many gaming features.

MOUSE

TT ESPORTS LEVEL 10 M
PRICE $85
Mouse perfection. Lovely on-screen and on-pad movement, super accurate and delightful to use.

POWER SUPPLY

COOLER MASTER G750M
PRICE $129
Outstanding value for money, it's powerful enough for even performance PCs packing twin GPUs.

TOTAL: $7,366 RIG ONLY: $5,179

COOLER

CORSAIR H100IGTX WATER COOLER
PRICE $159
Excellent cooling that is easy to install with advanced monitoring.

SSDS

SAMSUNG 960 PRO 2TB SSD
PRICE $1,799
Significantly faster than any other SSD on the market.

HDDS

ANY HDD
PRICE $99 (2TB)
Supplement the SSD with cheap HDD storage.

AUDIO

ASUS PA329Q
PRICE $1,999
32-inches of 10-bit colour at 4k res, 100% RGB for professionals, and a luxurious delight for gaming and general use.

CASE

ANTEC S10
PRICE $255
If you absolutely must have what is very nearly the best case we've seen, this is the one.

KEYBOARD

LOGITECH G610 **PRICE** $139
Stunning looks and a delight to type on.

STEELSERIES APEX M500
PRICE $135
A similar alternative to the G610.

MOUSE

CM STORM REAPER
PRICE $49
Very solid and feels fantastic under the hand with sweet on-screen movement.

POWER SUPPLY

CORSAIR HX1000I
PRICE $305
Corsair's mighty HX1000i pumps out extremely reliable power, even when under full loads.

SUBSCRIBE TO PC & TECH AUTHORITY

for your chance to

WIN

A 7 NIGHT LUXURY ESCAPE ON THE SUNSHINE COAST

WIN
A TRIP FOR 2 VALUED AT $5770

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PARADISE SEAPLANES

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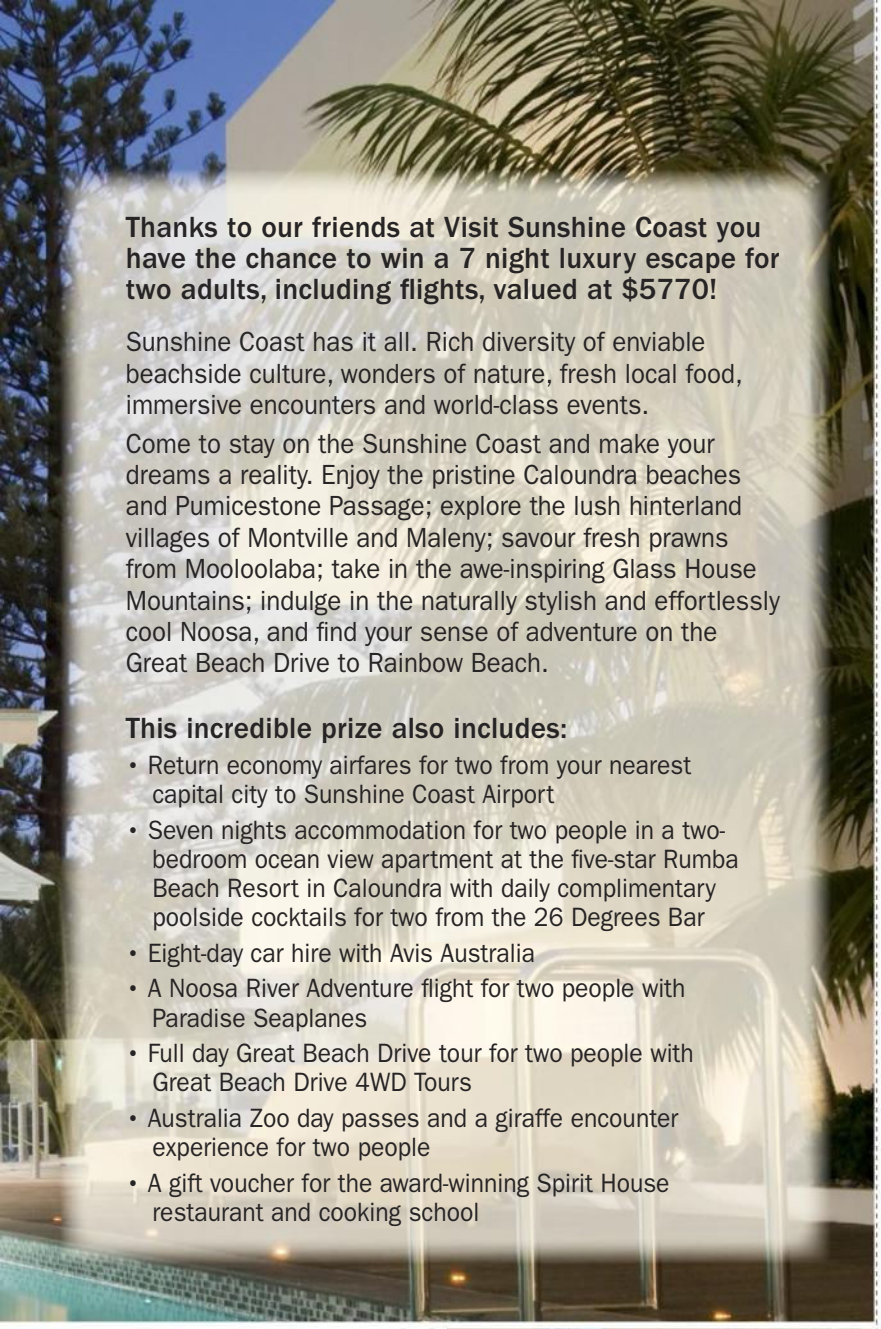

Thanks to our friends at Visit Sunshine Coast you have the chance to win a 7 night luxury escape for two adults, including flights, valued at $5770!

Sunshine Coast has it all. Rich diversity of enviable beachside culture, wonders of nature, fresh local food, immersive encounters and world-class events.

Come to stay on the Sunshine Coast and make your dreams a reality. Enjoy the pristine Caloundra beaches and Pumicestone Passage; explore the lush hinterland villages of Montville and Maleny; savour fresh prawns from Mooloolaba; take in the awe-inspiring Glass House Mountains; indulge in the naturally stylish and effortlessly cool Noosa, and find your sense of adventure on the Great Beach Drive to Rainbow Beach.

This incredible prize also includes:

- Return economy airfares for two from your nearest capital city to Sunshine Coast Airport
- Seven nights accommodation for two people in a two-bedroom ocean view apartment at the five-star Rumba Beach Resort in Caloundra with daily complimentary poolside cocktails for two from the 26 Degrees Bar
- Eight-day car hire with Avis Australia
- A Noosa River Adventure flight for two people with Paradise Seaplanes
- Full day Great Beach Drive tour for two people with Great Beach Drive 4WD Tours
- Australia Zoo day passes and a giraffe encounter experience for two people
- A gift voucher for the award-winning Spirit House restaurant and cooking school

GREAT BEACH DRIVE 4WD TOURS

26° BAR+VENUE

AVIS

DVD CONTENTS

THIS MONTH, WE OFFER YOU A RANGE OF SOFTWARE! CHECK IT OUT BELOW!

FEATURES

+ ABELSSOFT BEATSTAR + ASHAMPOO MUSIC STUDIO 5 + AUSLOGICS FILE RECOVERY 7 + DISK WIPER 15 PROFESSIONAL

DRIVERS

+ ATI CATALYST + NVIDIA FORCEWARE

HELP

+ DISCLAIMER + DAMAGED OR FAULTY DVDS + USING THIS DVD + INSTALLING SOFTWARE

EDITORIAL

+ BURNING AN ISO IMAGE
+ PC&TA EDITORIALS

TROUBLESHOOTING

+ SERIAL CODES + BLANK REGISTRATION WEBSITE + CAN'T FIND A FILE? + INSTALLATION ERROR

WINDOWS

+ 7ZIP + CCLEANER + CLASSIC SHELL + CUTEPDF + DEEPBURNER + DEFRAGGLER + FLUX + FOXIT READER + GREENSHOT + APPLE ITUNES + LIBRE OFFICE + OPEN OFFICE + MALWAREBYTES' A/M + SANDBOXIE + VLC MEDIA PLAYER

MAC

+ ALFRED + BETTERTOUCHTOOLS + APPLE ITUNES + DROPBOX + FLUX + GOOGLE CHROME + MOZILLA FIREFOX + PLEX + SKYPE + TEAMVIEWER + VLC

INTERNET

+ VUZE + DROPBOX + GOOGLE CHROME + MOZILLA FIREFOX + MOZILLA THUNDERBIRD + SKYPE + STEAM

LINUX

+ ANTERGOS

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 **dvd@pcauthority.com.au**. As the delivery platform only, *PC&TA* and nextmedia cannot and will not provide support for any of the software or data contained on these discs. Although all discs are virus scanned, nextmedia 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.

FULL VERSION

ABELSSOFT BEATSTAR

BeatStar is an easy-to-use application for discovering, listening to and recording internet radio.

A stylish interface organises its stations into genres, including Chill, Classic, Dance, HipHop, Oldies, Pop, Rock and Soul.

Clicking any of genre displays a lengthy list of matching radio stations, sometimes 200 or more. Fortunately you can cut this down to size by displaying only stations from a particular country, or using a Search feature to locate a specific station immediately.

Once you've found a station which looks interesting, tap the Listen button and BeatStar streams its content, while you sit back and relax.

A simple player bar includes a Record button to save whatever is playing right now to your hard drive. You can view and listen to this from BeatStar, but as it's just an ordinary MP3 file you're free to copy and play it from any other drive or device.

If you find a station you particularly like, tapping the star icon saves it as a favourite. Select the Favorites tab when you launch BeatStar next time and you'll be able to launch it with a click.

REQUIREMENTS:

- Windows 7, 8, 10 32/64-bit
- 10 MB hard drive space

LIMITATIONS:

- Registration Required
- http://www.abelssoft.net/

REGISTRATION & INSTALLATION:

- Download and run BeatStar_cs_uk_06_2017.exe
- During our testing, we were not prompted for a serial key, however, here are the registration instructions given to us:
- Get your registration code within the application. If you have registered a previous Abelssoft full product, you don't need to register again.
- For support of this software, please direct your queries to: https://www.abelssoft.de/en/contact

FULL VERSION

ASHAMPOO MUSIC STUDIO 5

Ashampoo Music Studio 5 is a capable collection of tools which makes it easy to build, manage and share your music collection. There are modules to rip your CDs, or burn audio files to disc. You can edit your files, check or edit audio tags, or convert music between various formats (MP3, OGG, WAV, FLAC, WMA, Opus). An Organizer renames or moves files based on their tags, a "Video to Music" function extracts and cuts video soundtracks, and there's an audio recorder, a normalisation tool, a cover art and inlay designer, and more.

These functions are often more complete than you'd expect. The CD ripper doesn't just grab all the files from a disc and dump then in a folder, for instance. You can now choose exactly which tracks to import, selectively edit key tags, define quality settings (sample rate, bitrate, channels), and pick your preferred file naming scheme (artist-title, track artist-title, track artist-title year, or some other custom arrangement of your own).

Ashampoo Music Studio doesn't take much effort to use, either. A straightforward interface organises its features into eight categories, and several of the modules deliver maximum power for the very minimum of effort. Point the "Analyze Files" option at your Music folder, say, and it'll scan for incorrect file extensions, missing tags and more, before fixing them all with a single click.

Even the lesser functions don't disappoint. The audio editor can't compete with a specialist tool, but it still displays the waveform of your chosen track, can trim sections as required, allows you to insert, mix or crossfade new files, tweak volume, apply fades and more.

REQUIREMENTS:

- Windows 7, 8, 10 32/64-bit
- 100 MB hard drive space

LIMITATIONS:

- Registration required
- http://www.ashampoo.com/

REGISTRATION & INSTALLATION:

- Download and install ashampoo_music_studio_5_19246.exe
- You will reach a prompt asking you to enter your license key. On the same screen, click the "Get a free activation key" button.
- A webpage will appear asking for your email. Please fill in accordingly.
- After you have followed the instructions

on the website, you will be presented with your license key. Copy and paste this back into the installer program.
- Congratulations! You have unlocked Ashampoo Music Studio 5!
- For support of this software, please direct your queries to: https://www.ashampoo.com/en/aud/sup

FULL VERSION

AUSLOGICS FILE RECOVERY 7

Auslogics File Recovery is a powerful undelete tool that will quickly bring many lost files back from the dead.

The program allows you to search for files by type (picture, music, video, document, software), last modification date, or name. And it can skip both zero-size, temporary and system files, which should help reduce the final list of recoverable files to manageable proportions

Scanning is reasonably quick (unless you choose the "deep scan" option, which examines every sector of your hard drive to locate files that other tools might miss). If the report does find too many files then you're able to apply filters there, too, viewing only files of the date, size and type that you're looking for. And a Preview pane allows you to preview images, videos, documents and PDFs, so you can be sure you've found the right files before you recover them.

REQUIREMENTS:
- Windows 7, 8, 10 32/64-bit
- 40 MB hard drive space

LIMITATIONS:
- Registration required @ http://recovery7.disc.pcauthority.com.au/
- http://www.auslogics.com/

REGISTRATION & INSTALLATION:
- Download and install file-recovery-setup.exe
- To obtain your serial code, point your browser to the following address: http://recovery7.disc.pcauthority.com.au/
- Register/login accordingly and you will directed to a new page.
- If you're a new user and experiencing difficulties logging in, open a new browser tab/window and point to http://recovery7.disc.pcauthority.com.au/ and login from there.
- Click on the blue button labeled, "GET SERIAL CODE" and your serial key will be generated.
- For support of this software, please direct your queries to: https://www.auslogics.com/en/support/product/file-recovery/

FULL VERSION

DISK WIPER 15 PROFESSIONAL

Paragon Disk Wiper is a handy tool which will securely delete your drive's free space, a complete partition or an entire hard drive, overwriting it multiple times to ensure that nothing can be recovered.

If you've just been working with some confidential files, for instance, then deleting them won't entirely remove the sensitive data from your hard drive, and they may still be recoverable with the right software. Tell Paragon Disk Wiper to erase your drive's free space and you can be sure the files have gone forever.

And if you're selling a hard drive or PC then you can similarly delete files, remove a partition, even format the entire drive, but all your personal data - user names, passwords, financial details, addresses, phone numbers and more - will probably still be accessible to anyone who goes looking. But again, use Paragon Disk Wiper to clean your drive and every byte will be removed, ensuring that your privacy is fully protected.

REQUIREMENTS:
- Windows 7, 8 or 10 64Bit
- 200 MB hard drive space

LIMITATIONS:
- Registration required @ http://diskwiper15.disc.pcauthority.co.au/
- http://www.paragon-software.com/

REGISTRATION & INSTALLATION:
- Download and install Paragon-401-PRE_WinInstallSN_10.1.25.328_001.exe
- For 64bit Users: Paragon-401-PRE_WinInstallSNx64_10.1.25.328_001.exe
- To obtain your serial code, point your browser to the following address: http://diskwiper15.disc.pcauthority.co.au/
- Register/login accordingly and you will directed to a new page.
- If you're a new user and experiencing difficulties logging in, open a new browser tab/window and point to http://diskwiper15.disc.pcauthority.co.au/ and login from there.
- Click on the blue button labeled, "GET SERIAL CODE" and your serial key will be generated.
- Copy and paste your serial code to complete the installation process.
- For support of this software, please direct your queries to: http://www.paragon-software.com/support/services/

FREE FULL VERSIONS: Each month, we offer *PC & Tech Authority* readers full registrable versions of some software on the DVD. See the installation instructions in the DVD menu to complete registration, if applicable. **IMPORTANT:** Full product registration closes on 24/05/17

PC & TECH AUTHORITY

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JON HONEYBALL

"MOST AV COMPANIES MAKE MY CYNICISM-O-METER HIT THE END STOP AND BEND AROUND A FEW TIMES THEREAFTER"

Jon reflects on the most interesting products from this year's CES, including a security-focused router from Symantec that might just live up to its promise

While trying to recover from the inevitable post-CES flu, and catching up on the work backlog, I've been going over several items that raised their heads at CES.

One that really piqued my interest is the new security router/Wi-Fi unit from Norton, a Symantec-owned brand. Now it's probably best to put my cards on the table, and this may shock you, but I'm a naturally cynical person. And most of the AV companies make my cynicism-o-meter hit the end stop and bend around a few times.

If you want to see examples of just how cynical these firms can be, browse their websites and try to work out which features are included in the various OS versions of their products. If you can do so, you're a better person than me. Especially when it comes to nitty-gritty issues such as, "does this feature work on Android 6 or 7?" Or explaining why almost nothing works on iOS – because, as we know, iOS is locked down hard and needs none of that stuff.

Anyway, I digress. Symantec creating some hardware is an interesting move, for a number of reasons. First, the home Wi-Fi router market is populated by products that would put a psychopathic chicken molester to shame. Let's just drop double NAT into your network; that sounds like a whole bundle of fun. Want some configuration screens? Come over and play with this web interface, which is written in unreadable-speak using terms that require sandals, a ponytail and poor personal hygiene.

As a parent you want to set up parental controls, time-filtering and content-monitoring. Excuse me, because I need a good five minutes to recover from this laughing fit. Do you have any faith that the settings you've engaged actually work? I accept that you've done your best, but do you have any confidence?

Want to ensure that the firmware is up to date, to try to ensure that some remote script kiddy in Moscow isn't hacking into your router and injecting poison into your DNS? Ah, that requires you go to the manufacturer's website, find the product buried deep in what laughably passes for a support section, only to realise that there are seven different hardware versions of your beloved box.

Having groped around the back of the box to see if it's the B or C revision hardware, you must then choose which firmware version to download. Now I don't know about you, but 3.45.16-ab_qwak-14-aj.zip sounds less like a firmware version and more like someone having a sneezing fit when hitting Save As. Even better is when it isn't a ZIP but some other compression format that you've never heard of, and requires the download of an un-compress tool from a website that also appears to offer Spanking Grandmothers.

Hey, we now have the BIN file! Time to install it, so you fire up the incomprehensible website within the router, struggle to the relevant bit, hit the "Choose file" button, then the BIN file; then sit back and wait. Once it's rebooted or, even better, has crashed on the shutdown routine so needs a hard reset, your router is back up and running. Except that it isn't, because it has managed to lose all the configuration information. So it has no idea where its ISP is, or what login information is required, or even what IP addressing it's supposed to use.

The Wi-Fi configuration has gone, too, so your laptop now needs an Ethernet cable to connect to it – and this is one of those modern laptops that doesn't have an Ethernet port. So you go looking for the USB-to-Ethernet adapter, and a cable too. Now it's in the loft somewhere...

Does any of this sound familiar? Is it any surprise that grown-ups are turning to solutions such as Cisco Meraki for their home networking, on the grounds that

CES had lots of VR on show, but I'm more interested in enhanced reality offerings such as the Microsoft HoloLens

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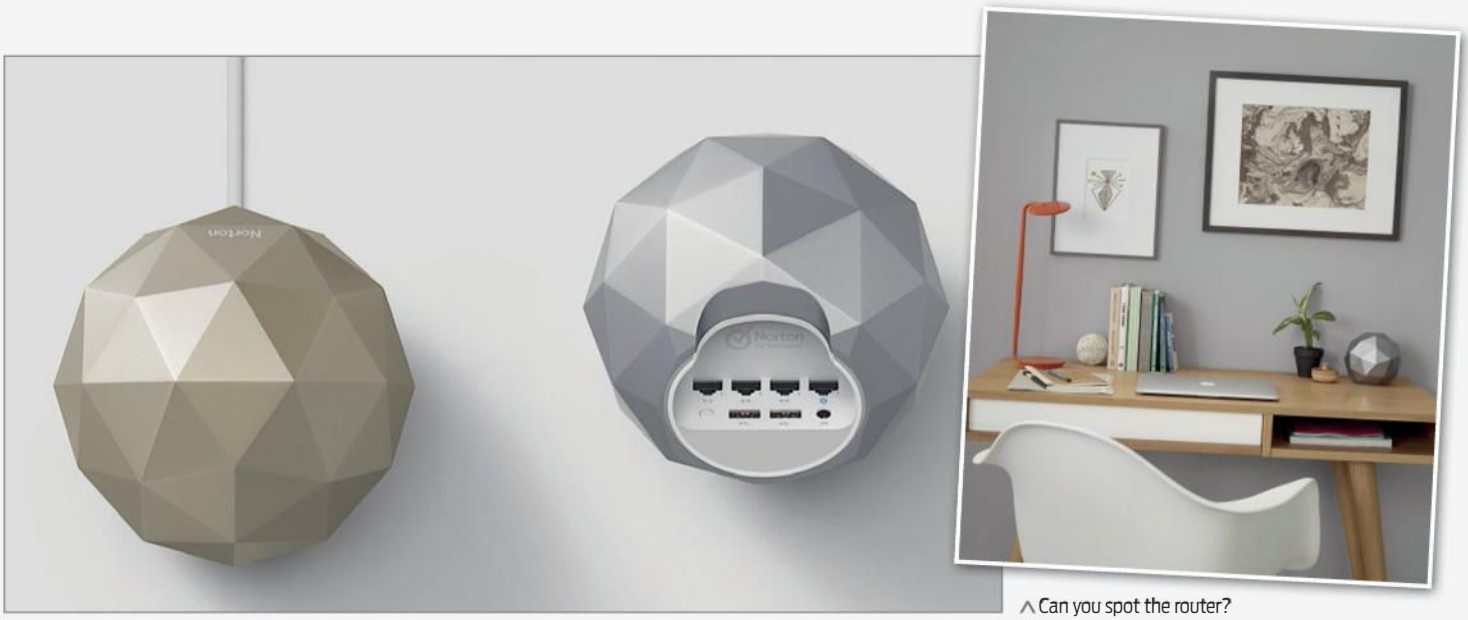


Can you spot the router?

everything described above is the very definition of untrustworthy?

Not surprising, then, that Symantec thinks it can do better. I had a meeting with the lead developers behind the firm's box – and I'm impressed. I threw every "I hope you aren't doing this?" question at them, and they responded with sensible answers. They have an app under development that looks like it wasn't written by Martians, and that will hopefully be usable by the man in the street.

They're not using the 192.168 address range, instead trundling down to the mostly forgotten 172.16.x.x to 172.31.x.x range. Why? Because it's then totally obvious whether an IP address has come from the DHCP in the Norton box.

It's likely that the upstream feed to it will have been NAT'ed already by the ADSL/fibre/cable box, and it's almost certain that this is presenting on the usual 192.168.x.x range. So it makes it obvious if you're in 192.168 land (and, hence, upstream of the Norton firewall/Wi-Fi/router) or in 172 land, in which case you're downstream of it. Most other vendors simply like to play footsie in the 192.168 space, so is it any wonder that confusion reigns?

Impressed, I dug deeper. The aerial design is interesting and I had a long chat with the lead hardware designer. It's capable of full mesh mode, so it can handle full-speed re-routing between a number of Norton boxes, but this may not be available in the first release of the firmware. The iOS software – as it stands today – is a little flaky, but is functionally nearly complete. Plus it shows a clear understanding of what's required to get such a product up and running, and properly configured in the home environment by normal human beings who aren't Cisco professionals. Or ones with sandals, a ponytail and poor personal hygiene.

So yes, I'm intrigued by this box. I like the clear thinking that's going into it. Symantec has genuinely started with a clean sheet of paper and is working towards a product solution that fits the home needs for 2017. The reason it isn't shipping until the summer is because it isn't quite ready, but it was ballsy of the company to sit its team down with me and go into full "politeness as an offensive weapon" mode with its key players. They survived the two hours with good grace and solid, interesting answers. Without doubt, this is a product move worth keeping an eye on. I sincerely hope Symantec doesn't mess it up between now and the summer.

VR HEADSETS AND DATA RATES

There was lots of VR on show at CES 2017. Lots and lots of VR. If you weren't strapping something on to your body, it wasn't a real tech (that's quite enough of that – Ed).

But here's the problem. Want to make VR work properly? It requires high-resolution images; let's say 4K as a good starting point. It needs two, one for each eye. Now let's just ignore the issues of strapping such a thing onto your head and hoping it doesn't bring on a major bout of head droop as your neck muscles give up the battle to keep your head level.

Instead, think about the sort of processing required to generate an immersive 3D space that's then rendered onto two 4K screens. This isn't the stuff of cellphones plonked into cardboard cut-out headbands. I've tried that on my Samsung Galaxy S7 Edge, and it's horribly low resolution. This is the stuff of a seriously high-end gaming rig, the sort of object that makes a teenage lad come out in even more spots.

No, VR isn't going to be serious for a long time. However, enhanced reality – where you drop artificially created things into your field of view – is an entirely different bag of frogs. Often one eye only, with potentially a lower-resolution display space, simply because the projection space isn't the full field of view. I know Google tried this, but it screwed its own project right from the start by insisting that the utterly irrelevant camera was built in, thus rightfully opening up a huge and wholly distracting argument about privacy.

I'm much more interested in this enhanced-reality solution than VR. I know it doesn't have the "whizz bang" wow factor of VR, but it's genuinely useful to a far wider range of users. And you can walk around with it too. Whether it needs to be a full quasi VR headset in the way of the Microsoft effort is something that only time will tell. I suspect not, but let's wait and see.

STUTTERING GRAND TOUR

I have a love/hate relationship with Top Gear. I loved the huge cinematic films that the show created, and I loved the pub-style banter among friends. It told me nothing about the cars, but that wasn't the point. As it went stale, and then fell off a cliff with the truly execrable 2016 reboot version, I was worried that the good bits were gone forever.

With the Grand Tour, Clarkson and crew are making a valiant effort to bring back the original magic. I'll not mince my words: much of the new series has been enough to make me wince. But the large cinematic pieces have been glorious. Why? Because they've taken the bold and brave decision to film everything in

4K. That means four times the data rate/storage of HD. And when you watch it via an Amazon Fire TV HD box on a big 4K HDR TV, the results are stunning.

That's until the picture stuttering kicks in. I have super-fast internet at home (two FTTC lines giving me 80Mbits/sec downloads) and even faster in our IEC-specification listening/viewing room at the lab. But even on that, the picture can take on a jerkiness that's deeply annoying, of the type that I haven't seen using Netflix in 4K. I think I need to dig out the network analyser tools to see what's going on. I suspect it's an upstream bottleneck issue that needs nailing.

On the subject of internet speeds, I've just upgraded the primary interconnect speed at the lab to 1Gbit/sec in/out on fibre. Cue the jokes about being able to download truly eye-watering amounts of porn in an unfeasibly short time period. The connection is between us, building number two in our office complex, and number five – which is our ISP (merula.net).

So I now have 1Gbit/sec between us and its data centre, which means I can move our boundary firewall into its data centre, and thus put storage and archive boxes in there that can be addressed at full LAN speed. This provides a level of additional security and resilience, because it's unlikely that a building fire at number two would spread across to number five.

Of course, this is all in addition to the other archiving and off-siting that goes on. But the useful upside is that we now have access to Merula's core network at full gigabit speed.

What's that – you'd be interested to know what sort of speeds we can get on a Speedtest.net check? Well, it runs to about 175Mbits/sec in/out. Merula doesn't have a spare gigabit of capacity for me to the London data centres, but I'm sure it would be happy to quote for the upgrade. More importantly, though, our expensive Cisco Meraki firewall tops out at about 250Mbits/sec when doing full packet inspection. Given that the whole point of a firewall is to firewall, doing full inspection with all the knobs turned to 11 seemed to be a good idea. At that point, it can cope with about 250Mbits/sec of throughput, which isn't unreasonable. I could get a faster one, but it would cost far more.

^ Sorry Samsung, but the Gear VR ain't high-res enough for me

Aha, you say, my WankyWoo Firewall Plus costing 120 notes can do faster than that. Maybe it can if the firewall isn't actually doing any work. But check the specs to see how well it can handle full firewalling on multiple devices. A few years back, when we had a mere 100Mbit line, I bought a well-regarded firewall that claimed it could cope with this throughput easily. No, not when you demand it does some real work. It might be worth looking at your firewall and working out just how well it can do real work in a meaningful way. Having increased our line speed, it's easy now to update 20 Windows laptops to current builds at full speeds. Yes, I could use a local update server for this, but it wouldn't work in this case for reasons that are too boring to explain.

FINAL THOUGHTS

First, I'm incredibly excited by the acquisition of Soundfield Solutions by Rode. Soundfield is a company that makes the Soundfield microphone. This is an incredibly clever device that records left/right, front/back, up/down and all-around, and it comes out with something called B-format, which you record on four channels of a digital recorder such as the Sound Devices 788T. I've used Soundfield kit for more than 30 years since the earliest prototypes; and we have an ST350 portable rig in the lab. Setting up eight speakers in a cube to do full height of playback of Spitfire planes going overhead is truly astonishing to hear.

> I'm quite unreasonably excited about the Rode VideoMic Soundfield

Rode is a top-flight microphone manufacturer based in Australia. Its products are high-quality at affordable prices. That's why you'll see its VideoMics on just about any sort of camera rig at shows such as CES. It's the go-to manufacturer in this space.

So why the acquisition? Well Soundfield has been going nowhere fast for far too long. It kept going by selling small numbers of mics to loonies such as me at prices that even I find embarrassing, and by getting into the surround marketplace for large stadium TV work – where it's done well.

Just the sheer mention of B-format, and what it can do, should make you think of VR, and all the platforms that support that (including YouTube). So I'm thrilled to see that Rode has already announced its VideoMic Soundfield, which is under development now. This allows you to pop one of these devices onto your serious camera of choice, and to be able to record B-format audio for post production. I can't wait to try it.

Speaking of B-format, the lovely software plugin called Harpex (harpex.net) has just been upgraded to version 1.4. And I see from the release notes that it now has default configurations to support Dolby Atmos.

We have a full calibrated Atmos setup in the listening/viewing room at the lab, using a large system from Pioneer with 5.1.4 or 7.1.6 output. Height information from Atmos-encoded Blu-ray or 4KBD (Ultra HD Blu-ray) is stunning. Being able to take my B-format recordings and output them onto the Atmos setup will be a fun project to try over the coming months. And it also allows videographers using the VideoMic Soundfield to do the same.

Second final thought. I don't like politicians, and I don't trust any of them. But given the actions in the first week of President Trump, one wonders how happy you might be with your data held by a US corporation now. Just a little thought to make you pucker up. ●

PAUL OCKENDEN

"IF YOU DON'T STUMP UP A MONTHLY FEE THEN THE CAMERA JUST BECOMES A VERY EXPENSIVE PEEP-HOLE"

Looking for a cloud-connected camera? Then you're in luck, as Paul concludes his roundup of the latest "cams"

As promised last month, I'm going to look at a few more cloud-based cameras in this column. On the desk in front of me I have a Nest Cam, a Ring Stick Up Cam (complete with solar panel accessory), a Y-Cam Evo HD, and finally, the new Arlo Pro I mentioned last month. All apart from the latter were kindly loaned to me by the folks at Vesternet.

Let's begin with the Arlo Pro. I'm using the new camera with my original Arlo base station, so I'm not able to test the siren or the local USB recording that the complete updated system provides; I'm just focusing (excuse the pun) on the updated camera. And I'm sure the fact that it will work in existing installations will please those who have already invested in Arlo setups.

The new camera is bigger and heavier than its predecessor, but it can be used with the same magnetic mounts, since it has the same circular "dent" in the body. As a result of the extra weight, I find it can wobble a little more when used outdoors, especially in a strong wind, but not to the point where it causes problems.

Since I've been testing the new camera, I've noticed that it requires a stronger wireless signal than the old one. I had one original camera that was right on the edge of reception, but when I swapped it for the Arlo Pro, I couldn't get a connection at all. A second camera was mid-range with the old Arlo system, but when I swapped it for the Arlo Pro I began to see break-up in my video recordings. Perhaps these problems would be resolved if I'd also used the new base station? I'll let you know as soon as I get access to a complete Pro system.

There are several benefits to the new camera, the most obvious that it can handle audio as well as video. This not only means that your video clips will be recorded with a soundtrack, but that you can trigger the recordings from sound pickup as well as motion – perhaps a door slamming or a vehicle approaching. The audio facility is two-way, so if you receive an alert that there's someone at your front door, you can see it's the Amazon guy and tell him to leave the package in the garden shed.

I mentioned last month that with the original Arlo system there exists a bit of a lag between motion detection and the start of recording. In fact, it's one of the main complaints by users. This is an issue you'll find to a greater or lesser extent with all battery-powered security cameras, but the delay is greatly reduced with the Arlo Pro. So much so, in fact, that I suspect it won't be an issue for most people.

What else is new with the Arlo Pro? Well a significant difference is that it now contains a rechargeable battery. It's a custom battery pack, though, so you can't just insert standard rechargeable batteries. And nor can you plug the charger into the battery pack; you have to charge it either in the camera (which probably means taking the whole thing down), or you can buy a separate charging station and plug the battery into that. This all feels a little awkward to me.

The micro-USB port used to plug the charger into the camera can also be used to permanently power the device.

< The Arlo Pro is similar in design to the original Arlo, but slightly bigger and heavier

PAUL OCKENDEN
Paul owns an agency that helps businesses exploit the web, from sales to marketing and everything in between @PaulOckenden

"The fact that you don't need access to change or charge batteries means you can mount it in places that are harder to reach"

^ The Ring Stick Up Cam isn't discreet, but Ring will replace any stolen units

Although, frankly, I can't see the point – if you don't need a truly wire-free camera then there are better options out there, some of which I'll come on to shortly.

All in all, the Arlo Pro is a worthy improvement over the original model. The two-way audio and faster startup times are especially welcome. But with more flexible charging options and better wireless sensitivity, it could have been even better still.

RING RING

Sticking with completely wireless cameras, let's look next at the Ring Stick Up Cam. By the way, notice how so many of these devices are now called "cam" rather than "camera" – there's a definite trend here.

Ring is a company best known for its connected doorbell range, but given the fact that these feature a built-in camera, it was a logical brand extension to build a standalone wireless "cam". The Stick Up Cam is suitable for outdoor use, although I note that the manufacturer describes it as "weather-resistant" rather than waterproof. It might be best to mount it under the eaves, or somewhere that provides similar protection from driving rain.

The key difference over the Arlo cameras (or, indeed, Blink – which I also mentioned last month) is that you don't need a base station. The Ring Stick Up Cam hops onto your Wi-Fi – and that's it. Much like the other two systems, recordings are stored in the cloud. Design-wise, the Stick Up Cam is less discreet than the Arlo or Blink cameras, so you might be concerned that people may notice it and steal it. But Ring offers to replace any stolen cameras for free (if the theft has been reported to the police).

One fascinating optional extra is a solar panel, which keeps the internal battery topped up. The fact that you don't need access to change or charge batteries means you can mount the camera in places that are harder to reach. Throughout my time testing it, I haven't noticed the battery level drop below 90% with the solar panel attached – even on cloudy days.

As is usual with such items, the Ring Stick Up Cam is controlled via an app, either Android or iOS. There's also a web interface, but that provides access only to the (paid-for) recordings; you can't use the live-view mode from a web browser. This is an annoying limitation. I've also noticed that, using the app, live-view can sometimes take quite a while to connect to the camera – usually around ten seconds, but it can take up to a minute.

The night-time view uses infrared LEDs to illuminate the scene, but, curiously, it doesn't switch to monochrome mode in the way of most other cameras. You can still see some colours, although you shouldn't rely on them for identification purposes. A black fleece jacket that I was wearing looked light blue at night!

Like the Arlo Pro, the Ring Stick Up Cam features two-way audio, and the quality is great – probably the best of the wireless cameras I've tested. Motion detection, on the other hand, can be laggy. It's on a par with the original Arlo cameras. Unless you position the device carefully, you'll find yourself recording lots of people as they just walk out of frame.

Ring has created a well-made, solid device, and in the box you'll find everything you need – not just the usual screws and Rawlplugs, but also a screwdriver and a masonry drill bit! I'm still undecided whether that's truly helpful or just a bit gimmicky, but let's give Ring the benefit of the doubt.

So, overall it's a great product. If the recording delay could be improved and a basic free tier provided for cloud recordings, the Ring Stick Up Cam would move to near the top of my list.

NESTING INSTINCT

Next up is the Nest Cam. It's important to note that the version I'm looking at here is the indoor model. The outdoor version is essentially the same thing, but with waterproofing and a longer power lead. Actually, there's a small difference with the hardware, too: the indoor version uses 2.4GHz and 5GHz Wi-Fi, whereas the outdoor version is old-school 2.4GHz-only. Although, confusingly, in the USA the outdoor model does 5GHz as well. To be fair, because of the range limitations of 5GHz, you'd probably have to use 2.4GHz outdoors anyway. It certainly isn't something to worry about.

Since the Nest Cam has a permanent power supply, it's able to work slightly differently to the other cameras I've looked at so far. The latter have all used PIR detectors to wake up the camera on sensing warm bodies. But when armed, the Nest Cam's camera is active all the time, and looking for movement based on changes in the actual picture it sees. This provides added flexibility.

Now, Nest is better known for its wireless thermostats and smoke alarms.

The cameras came latter (Nest bought a company called Dropcam), and you get the impression that it's been somewhat shoehorned into an existing infrastructure. Control is via an app and a website, but at times both can seem a little clunky. It probably makes more sense if you already have other Nest services, but when used purely for camera control, the Nest Cam isn't as slick or as intuitive as the others here.

With a Nest camera you're potentially recording a lot more than you would with one of the battery-powered cameras. You see, it doesn't just upload clips to the cloud when motion is detected; the Nest Cam records constantly. As a result, the company must surely be using far more storage (it's hosted on a combination of Amazon and Google cloud platforms). I suspect that accounts for at least some of the high subscription price.

This constant recording will eat into your monthly broadband bandwidth, and could pose a problem if you use a capped service. Typical use is around 60GB per month, but it can peak at up to 380GB if you select the highest quality. You certainly wouldn't want to use the Nest Cam if you rely on a mobile connection for your data!

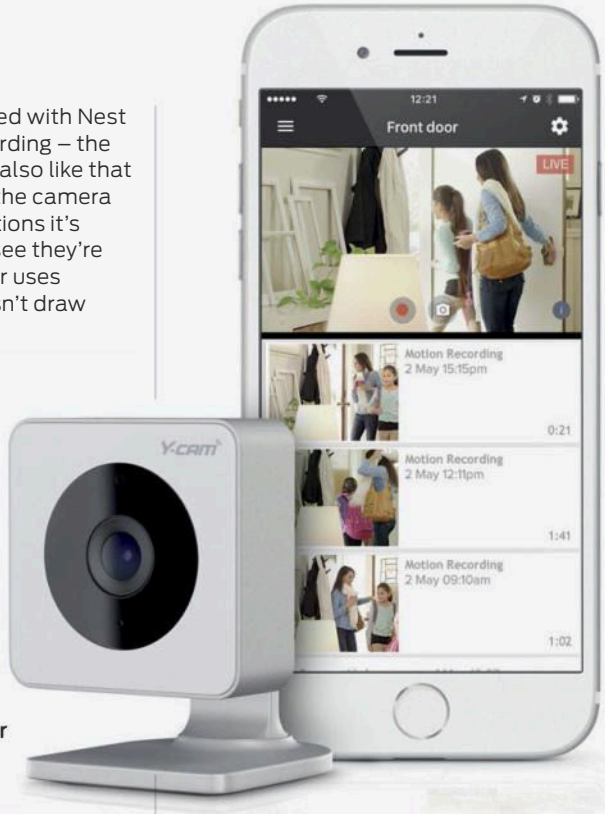
The Nest Cam is also useful because the quality of the image is excellent, and the streamed video works well. You can even embed it in an iframe on your website. I really like the Nest Cam. It's solidly built, displays superb image quality, can use even the weakest of Wi-Fi signals, and (when used with Nest Aware) offers constant recording – the only camera here to do so. I also like that you can control the LED on the camera from the app; in some situations it's important that people can see they're being recorded, but for other uses you want a device that doesn't draw attention to itself.

Nest Aware offers 24/7 recording in the cloud... for a princely sum

WHY THE Y-CAM?

My final option, the Evo HD from Y-Cam, offers much lower running costs. The first thing that strikes you is the size of the camera – it's tiny. Matchbox-sized. It's super-light, too. So much so that I was tempted at first to just stick it to a wall using VHB tape. Unfortunately, this isn't possible because the micro-USB power connector is on the back, rather than the side. You really need to use it with the supplied stand or wall mount, which is also tiny.

As usual, there are Android and iOS apps available, along with a website. The Android app works well, as does the web interface, but I struggled a little with the iOS app. It seemed sluggish, and would often miss the first few seconds when playing back a captured video clip. I think it needs some more time in the QA lab.



The tiny Y-Cam Evo is great, but the Android app seems much more polished than the iOS equivalent

In fact, sluggishness is something that seems to crop up at various places in the Y-Cam system. Even when using the website, it would sometimes take quite a few seconds to connect to the live video stream. On occasion, I also found that I'd receive a notification around 20 minutes after a clip had been recorded. At other times, I'd receive a notification of movement, but it would then take a while before the clip showed up in the app.

This is a shame, because in most other respects the Y-Cam Evo has plenty going for it, including the fact that you get seven days of cloud storage for free. There's no 24/7 recording, as with the Nest Cam, but for most people that won't be an issue. Especially since the camera uses an internal buffer, so the recordings it saves start a few seconds before the motion is detected. There's no control over the flashing LED when recording, though, so despite the small size, this camera will never be discreet. Two more pluses: the on-board speaker provides two-way audio and audio quality is pretty good, too.

So what's my final verdict? If you want an outdoor camera then I'd suggest the Arlo Pro. For indoor use, it's a toss-up between Blink and the Y-Cam Evo. For 24/7 cloud recording, go for the Nest Cam – just be aware that you'll need deep pockets. ●

KEVIN PARTNER

"AS MARKETERS WE NEED TO BECOME CLEVERER WITH THE WAY WE ENCOURAGE OUR CUSTOMERS' ATTENTION"

Want to earn more from existing customers? Kevin explains how to personalise your emails and provides five tips to boost customer numbers

Despite the rise of social media, email is still king of the internet marketing heap. I ran a promotion recently with a group of other creatives, using a combination of email, Facebook and Twitter promotion, and you won't believe what happened next. Over the period of the promotion, 87% of transactions could be attributed to an email, 8% to Facebook and the rest to Twitter. This, despite the social media audiences being an order of magnitude bigger than email lists.

The continuing effectiveness of email makes it all the more surprising that marketers don't innovate in their communications with customers. For example, it's common to use an email sequence to sell a product. The sequence usually begins with educational content and ends with the selling phase. Wouldn't it be nice if the marketer stopped sending sales emails once you'd bought the product, perhaps opting for a welcome email and tips on using it instead? By doing this, emails appear less impersonal to the customer and they feel they're getting the information they need – rather than being blasted by spam.

Similarly, many people sign up for an email newsletter because they like the overall content, but end up ignoring emails because too many are irrelevant. It's common for larger firms to have several lists into which they sort customers, based either on past behaviour or what the marketers think they might be interested in. However, it's much more effective to give subscribers the option, within any message, to opt out of subjects that don't interest them without unsubscribing from the list as a whole.

Debenhams, for instance, becomes interesting to me precisely twice a year: before Christmas and around the time of my wife's birthday. The rest of the time, its emails lie unopened in my inbox.

KEVIN PARTNER
is a serial entrepreneur who has set up a number of successful online businesses

THE TWO FACES OF MARKETING EMAIL

Broadcast emails are one-off messages to a mailing list. They're most often used to promote specific events, such as sales, so if customers open the email too late then the offer might have expired. Broadcast messages are the default form for email marketing, since they're both easy to set up and can produce instant results.

Autoresponder sequences (often called automations), however, are the bread and butter of most long-term internet marketing campaigns, producing results month in, month out, as new subscribers join the list. According to email analytics firm Litmus, while automated messages make up only around 5% of the emails sent by a firm, they contribute more of its income than any other form. Traditionally, an autoresponder begins as soon as a subscriber signs up; emails are sent at a set interval until the pre-programmed sequence is complete.

As inboxes fill up and the number of marketing messages a customer receives passes the saturation point, the days of "set and forget" are behind us. As marketers, whether that's on behalf of a corporation or our own micro-enterprise, we need to become cleverer with the way we use and encourage our customers' attention.

RELEVANT, INFORMED AND PERSONAL

One way to get future customers onto your mailing list is to offer something they value in exchange for their email address. Classically, this would be a report written to appeal to the specific market the business is targeting. Having provided their email address, the subscriber expects to immediately receive a link to download their report. This is typically the first email in a sequence that both expands on the information already provided and prepares the way for a later sale.

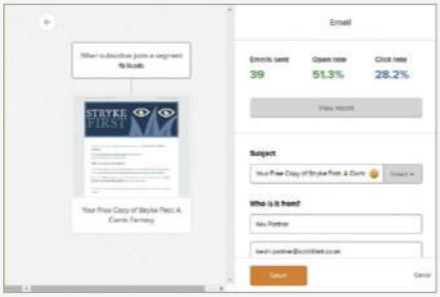
However, these sequences are almost always linear and assume the subscriber has both downloaded and read the report. If they haven't done either, the later messages are irrelevant and will likely be ignored. A better approach, then, is to set up the automation so that it takes a different path, one that depends on the actions of the subscriber.

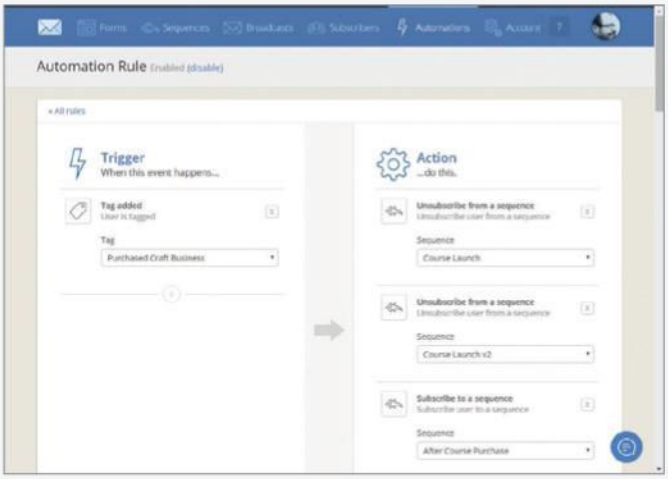
For example, if the subscriber doesn't click the link to download their report, the next email should be a gentle reminder to do so. Those who do click it receive a different message – one that thanks them for downloading it and, perhaps, offers suggestions about the best way to consume the material. This same message is sent to those that didn't download the message at first, but subsequently clicked on the link; subscribers that never click the link are removed from the automation sequence entirely.

WHICH EMAIL PROVIDER?

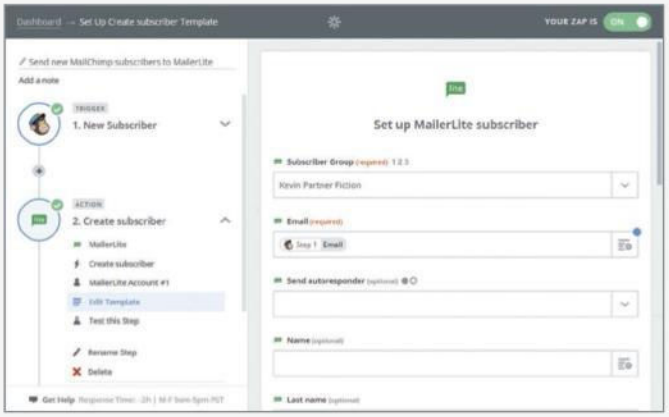
All the main email marketing services offer automation of some sort, but the level of sophistication varies according to price. MailChimp (mailchimp.com) is the default choice of most marketers and has been beefing up its automation

MailerLite is a lower-cost alternative to MailChimp with excellent workflow features





ConvertKit's support for multiple outcomes depending on triggers means you can personalise email communications



Zapier allows me to copy subscribers from a free MailChimp account across to MailerLite when I need the latter's superior automation

in the past couple of years to the extent that it can now, for example, send an email based on whether a link has been clicked. MailChimp also integrates with many other services, including several ecommerce providers, so it can be used to send emails to customers who abandon their shopping carts. This is an effective way of increasing your conversion rate at no extra cost.

MailerLite (mailerlite.com) is a cheaper alternative to MailChimp and is my favourite budget service. It offers most of its competitor's features, but its new automation workflow is easier to use than that of MailChimp, amounting to dragging-and-dropping a flowchart with decision

"Marketers need to worry less about what they want to say and more about what customers want to read"

blocks and multiple email sequences all in one automation.

Compared to MailChimp and MailerLite, ConvertKit (convertkit.com) offers a step up in the sort of personalisation you can use. By adding tags to subscribers in response to their actions, you can set up different automations for different combinations of tags. For example, you may have a tag that's automatically set when a subscriber completes a purchase. You then know not to ever email them again asking them to buy that product.

ConvertKit is powerful, but expensive. For a smallish list of 2,000 subscribers, it charges US$49; MailChimp is US$25 and MailerLite US$10. ConvertKit is only worth the extra if the subscribers on that list are valuable enough to justify the extra expense – and if you'd convert more of them into customers as a result.

A small firm building a list by sending out a monthly newsletter with the aim of keeping themselves in their customers' minds would be better off with MailerLite.

Whichever tool you use, the success of your email marketing depends on how you exploit its potential: successful email marketing is about getting the message right. And, to do that, marketers need to worry less about what they want to say and more about what customers want to read.

FIVE WAYS TO USE EMAIL TO BOOST CONVERSION

1 ABANDONED CART REMINDERS

Typically, only around 10% of visitors to an online shop will add products to their shopping cart – and of those, between 30% and 50% will buy. Of those who leave the site without buying, some will be because they were distracted or unable to complete the transaction at that time. By sending a well-written, polite email the following day, you'll convert at least some of these to paying customers. Almost all ecommerce systems will preserve the contents of a cart for a while, so the customer doesn't usually need to add their products again.

I've tested this at my online retailer and routinely rescue sales that would otherwise have been lost. Some ecommerce providers include this functionality, and MailChimp integrates with others, so the process is entirely automated.

2 TRANSACTIONAL EMAILS

I'm sure you've noticed that, for all the effort most firms put into their sales emails, when it comes to your order confirmation and shipping notice, the message looks as though it's been spewed straight out of a database, without ever passing across a designer's desk. And yet it is here that the customer is most positive about you and your company. In most cases, you'll have tried to generate enthusiasm in the customer during the sales process; this should continue afterwards. Once they've bought, it's the perfect opportunity to reinforce your brand and to make the customer feel good about their purchase and about doing business with you again in the future. You may even be able to cross-sell or offer a discount on future purchases.

3 BUILD A CUSTOMER PROFILE

Ask subscribers what interests them early on and send emails on those subjects – in automated sequences and as broadcasts. For example, if Debenhams bothered to ask me about my buying habits, it would send me emails about women's boots at Christmas and not in between.

4 MAKE THEM INTERESTING

Most emails read as if they were written by a machine. In an ever more crowded inbox, you can make your emails stand out by projecting your personality into them. This won't be appropriate for some businesses, but, in general, customers like to feel they're dealing with people rather than corporate systems. Having said that, you should avoid the sort of fake personality used by the biggest firms, particularly in the media industry.

5 SEND AN EMAIL ONLY WHEN YOU HAVE SOMETHING TO SAY

There's a lot to be said for having a regular schedule of email broadcasts, but don't think that customers will miss it if you skip one. In general, they're not that interested in you. This schedule exists to get you into the habit of formulating a regular email, but it shouldn't mean you send one when you have nothing to say. Every email must be interesting: if you're busy planning a major launch, the last thing you should do is send a filler message the week before. All that achieves is to lower the open rate for your launch email. ●

DAVEY WINDER

"I'D MUCH RATHER PEOPLE WERE USING THE WRONG ACRONYM THAN NO FORM OF ADDITIONAL LOGIN REQUIREMENT AT ALL"

Davey explains the difference between 2FA and 2SV, and reveals why your wireless mouse - and the attached computer - could be at risk

I start this month's column with a question: which type of user authentication system is the most secure? Is it a hardware token, a code-generating application, a code delivered by text message, or a system using push notifications?

I guess that most readers will be in a similar situation to me, being faced with all sorts of additional verification being sought to access one service or another. My business bank makes me input a passkey on my smartphone, which then spits out a time-limited code; my personal bank relies on me recalling a lucky dip of characters from a passkey, having already entered a PIN; and PayPal likes to send me one of those time-restricted codes by way of an SMS text message. Then there are other online services that ask for a code generated from the authenticator app of my choice, or request that I insert a hardware token into a USB port to finalise my login.

My favourite example of additional verification requirements is the Dashlane password manager, which I currently have configured to require a long and complex passkey that's committed to muscle memory – my fingers literally go into automatic typing mode when it's needed. Oh, plus a time-limited code generated by an authenticator app. Following all that there's a successful fingerprint scan required to gain access to my password vault.

You can use a resource such as Two Factor Auth (twofactorauth.org) to find out what methods any given online service offers.

The thing is, with so many methods of user verification out there, which should we be using when given the choice? The simple answer is any of them – because any is better than none. However, let's assume we accept that as a given; so which of these additional layers of security is the most secure?

You'll have noticed that most involve your phone in some way. This begs the question of whether this introduces an unnecessary weak link into the secure login chain? Let me repeat: using any form of Two-Factor Authentication (2FA) or Two-Step Verification (2SV) makes the account you're trying to access far more secure than just sticking with a bog-standard username and password.

You'll have spotted that I've mentioned 2FA and 2SV; in most articles about login security you'll see only the former. The truth is, there's a difference between the two, and true 2FA is a more secure method of identifying the owner of an account than 2SV. However, once again, using either is better than using neither.

In brief, there are three kinds of authenticating factor: something you know, something you have, and something you are. The knowledge factor is most often your username and password combo used to initiate the login process. A common technical error is describing a "Time-based One-Time Password" (TOTP) generated by an app on your smartphone, or sent via SMS to it, as being a second factor, and systems that combine a login with such a TOTP as employing 2FA. This is actually 2SV, because the TOTP is also something you know, and malware is capable of intercepting it.

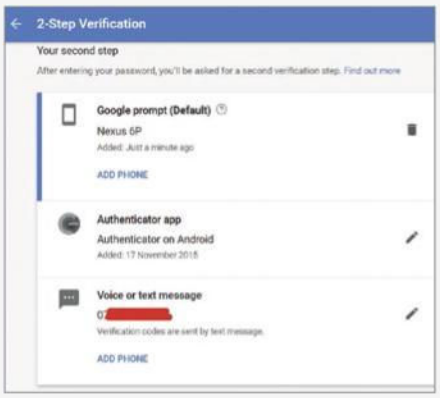
True, 2FA requires distinct factors, so a good example would be a login followed by a fingerprint hardware token (such as a YubiKey) scan. It's also true that two distinctly separate authenticating factors are more difficult to compromise than a single one with multiple verification requirements. However, in most scenarios, I feel it's just a game of security semantics.

Introducing multiple acronyms into the "more secure" equation only serves to confuse the would-be user, rather than clarify distinctions that mean little to most people outside of the security industry. I'd much rather people were using the wrong acronym than not using any form of additional login requirement, and I'd rather that was easy to deploy and use than adding layers of complexity into the security concept.

Which brings me nicely back to "which is more secure?". The answer, as you probably now realise, is the hardware token, for all those 2FA versus 2SV reasons. Yet hardware tokens also tend to be the most complex to deploy and expensive, be it for the small business or home user. SMS text messaging of codes would be last on my list since it demands a phone signal, and for the determined hacker, there are numerous methods of intercepting these codes.

New to the scene last year was Google prompt. This makes the process of authentication as simple as a popup on your smartphone asking if you just tried to access something, and giving you Yes/No buttons to press. It's easy to configure (see right) but there remains

Google certainly doesn't skimp on user verification options



DAVEY WINDER
Davey is an award-winning journalist and consultant specialising in privacy and security issues @happygeek

the potential for malware to intercept the notifications.

The same is true of authentication code-generating apps, which have been shown to be vulnerable to privilege escalation exploits, plus the encryption used to seed the codes could be broken by a determined attacker.

I'm happiest with services that let me pick how the authentication code is generated, so I can use the authenticator app of my choosing and then ensure that I make accessing it as difficult as possible for anyone who isn't me. As it turns out, that's pretty easy as my phone is encrypted, the lockscreen requires a fingerprint to dismiss, and my authenticator app also requires a fingerprint to open it. None of this would prevent a determined actor in possession of my smartphone from being able to circumvent my security; but if such a clued-up actor had possession of my phone, then it's game-over already.

MOUSEJACKING!

While the rampage of ransomware was the attention-grabbing story of last year, the subtitle for 2016 was comprised of just three words: Internet of Things.

Four words if you precede "things" with the almost obligatory "insecure". Many of the headlines concerning IoT technology focused on the fantastical. "Pisspoor IoT security means it'd be really easy to bump off pensioners" and "Can your kettle take down the internet?" were both real 2016 stories.

The first in The Register – which had a subtitle of "Killing pensioners, two keyboard taps at a time" – was a light-hearted look at DoS attacks against internet-connected central-heating thermostats. The second, in the Daily Mail, warned of the dangers of not changing default passwords in devices such as kettles. Interestingly, it spoke about these everyday devices being overlooked when it comes to the basic security smarts people have begun to understand with regards to laptops and smartphones.

That connected devices are of interest to hackers – and connectivity is all we're really talking about when we drop the IoT bomb into conversation – should come as no surprise. The devices themselves are usually a conduit to the real target, rather than being the target themselves. And so it's another set of everyday objects that have, perhaps understandably so, skipped the attention of all but the most security-minded on both sides of the legal fence: mice and keyboards.

As unlikely as it may seem, my favourite bit of technical hacking from 2016 was a class of vulnerabilities dubbed MouseJacking. A MouseJack is, per the Bastille Threat Research Team (BTRT) that discovered it, an exploit that can inject unencrypted keystrokes into a target machine from up to 225m away using cheap, non-Bluetooth radio transceiver USB dongles. Dismiss it as being just another theoretical code-injection exploit if you like, but for me this has a touch of evil genius about it. Sure, it's a bit low-rent when compared to the state-sponsored style of a Stuxnet attack, with multiple high-value zero-day exploits sacrificed to the gods of espionage; ten quid's worth of dongle and a total of nine vulnerabilities from brands that really ought to have known better is all it took.

< Many makes of wireless mice are still vulnerable, and it's all due to the RF dongle

Wireless keyboard manufacturers have pretty much wised up to the eavesdropping threat, and so keystrokes are sent encrypted when no wires are involved these days. A couple of years ago, writing on these very pages, I mentioned how weak wireless keyboard signals tend to be, and thus the risk of remote capture was, well, remote. I also mentioned how signal encryption was a key part of the wireless keyboard spec (every pun intended) and even specialist devices such as the KeySweeper – which captured and decrypted keystrokes – wasn't a threat to modern kit. Microsoft started using AES encryption after 2011, and KeySweeper couldn't hack these. So what's changed with MouseJack?

The clue is in the name. It makes the most of wireless proprietary protocols operating in the 2.4GHz "Industrial, Scientific and Medical" (ISM) band, which don't bother themselves with all that encryption nonsense. Instead, they happily use unencrypted communications between the mouse and the USB dongle attached to the computer.

Non-Bluetooth wireless mice from Amazon (Basics), Dell, Gigabyte, HP, Lenovo, Logitech and Microsoft were all found to be vulnerable to an attacker spoofing mouse movements and generating keystrokes. All the time, the target dongle thinks it's communicating with the wireless mouse or keyboard, but is getting the code the malicious actor is sending from a replacement dongle costing around $50 instead.

The attack mode could be used to send malware to the target machine, or extract credentials data from it. That Bastille managed to link a series of vulnerabilities to circumvent the keyboard encryption is impressive; that it even managed to work with dongles that required encrypted comms (by targeting the mouse instead) even more so. The clever bit is that the exploit can spoof a wireless mouse that tricks the target PC into thinking it's talking to a keyboard.

This spoofing element could become even more interesting over time, and as IoT grows ever bigger. Why is that, I hear you ask? Well, if it can trick a computer into thinking a spoofed mouse is a real keyboard, then what other cross-device treachery can RF-based protocol hacking come up with?

In typical IoT fashion, most of the vulnerable devices will need to be binned if security matters to the users. Firmware patches are thin on the ground in IoT territory, and that's also the case with wireless dongles and RF mice; the transceiver chips are designed to be programmable only once and so can't be updated. A decent list of at-risk devices can be found at tinyurl.com/j5l2h78, along with vendor responses and links to firmware patches where available.

Back in 2015 when I wrote about KeySweeper, I concluded that there were too many caveats to make it a real-world threat: distance, model of keyboard being used, the Heath-Robinson home-built hacking device requirement, the fact that Bluetooth mitigated the risk – albeit at the cost of introducing some of its own. The best risk mitigation back then was to suggest not using a wireless keyboard unless you had no other choice. Wired keyboards tended to be more reliable and were a lot cheaper.

That's not true anymore, and MouseJack plugs the real-world gap in terms of distance, cost of the attack dongle, and choice of likely target devices. My advice about not going wireless isn't going to stick with many folk now, but I'd suggest you stick with Bluetooth if you're going to snip the wires from your working life. ●

STEVE CASSIDY

"FORMATTED FOR A WINDOWS MACHINE, SENT IN A JIFFY BAG, THIS 2.5IN 1TB USB DISK WAS EFFECTIVELY WORTH $10,000"

Steve contends with a hard disk that's "just become a bubbling, evil swamp of despair", containing all a company's VMs and with no backup in sight

It's one thing to talk about preventing disaster; real experience is both rare and valuable. What happens when you're actually sitting down to work out what's left of a business' data, with the owner breathing down your neck and the clock ticking on both your diagnosis and the likely action plan? Like almost everyone I talked to during this month's crisis, I have a full repertoire of ways of keeping restorable backups; not a full repertoire of tools to try to drag data out of a hard disk that's just become a bubbling, evil swamp of despair.

So, feel free to do what all those colleagues and contacts did, taking up too much of my crisis-management time: ask a series of questions that might, in a different situation, have served up a restorable backup.

No, there wasn't a cloud backup product in place (in this case, the database supplier had elected to help out with that at one branch, but not the other). Yes, there was a RAID – of that rather irritating kind that VMware specialises in constructing, where it's up to the guest VMs to lay out a fault-tolerant disk architecture.

No, the available mirrors didn't seem to be usable. No, there was no hard deadline for recovering the database, but there also wasn't a month available for long scans of the misbehaving 2TB media in pursuit of potentially useful, but initially corrupt, mirror partitions.

No, the backups that had been taken off the database by the software supplier weren't deposited on a different server – indeed, not even on a different drive letter. Usefully, that particular discovery helped to fix a looming "too many cooks" problem, with all these questions – none of which speed up the data recovery, mind you – slowly drip-feeding in from said supplier and then suddenly falling silent when the boss-man realised why I was being so critical.

The downside to that being, of course, that I was on my own. I'd arrived with the assumption that the problem was the drive controller circuitry, and I knew I still had an exact match for the drive, so I pulled the board off my drive and put it in my pack for the trip.

This is one of those bits of voodoo work that aren't widely understood outside of the server-fixing, data-recovering professions. In theory, every controller board on a traditional hard disk can be swapped for one from a known working identical device. But in practice, it isn't always the board that's the seat of the drive problem. In this case, it took only a few minutes to work out that the 2TB WD Red drive with the dead VMFS volume on it actually had a better board on it than the one in my pack.

WD Reds have easily demounted controller boards, with all the contacts between drive and board made by spring-loaded fingers and neat, flat pads – but mine was heavily marked with dirt so fine that it resembled toner. The one on the troublesome drive was as clean as a whistle: I quietly hid mine away and went back to the original search, which was for data-recovery tools that recognise VMware's own VMFS disk and partition format.

This was one of the most frustrating searches I've ever undertaken. First, you have to penetrate the vast numbers of ignorant but opinionated helpers who lurk in internet product and support forums: not just this year's edition, but those of every year. Perhaps the most useful filter for their contribution is to put "-should -ought" into your Google search string. I don't want to think about the number of threads I worked through, where one or both of those terms reveal that a "helpful" answer is being delivered by someone with absolutely no clue about how to achieve what they're talking about.

No, dear internet, it isn't true that VMware volumes of the modern kind are plug-mountable to a Linux system by USB adapter. No, VMFS does nothing wonderfully magical with a single SATA volume to be inherently fault-tolerant. No, inquiring about snapshots is a dead end – the volume won't mount, never mind what's on it on other, not-really-similar systems with not-really-related disk failures.

After an intense run of research late into the night, I felt I had two options the following morning. One was a partition-rebuilding process, documented in superb detail on a chap's blog; the other was a complete VMFS volume-recovery

< WD Red drives have easily dismounted controller boards – useful in a crisis, if not this one

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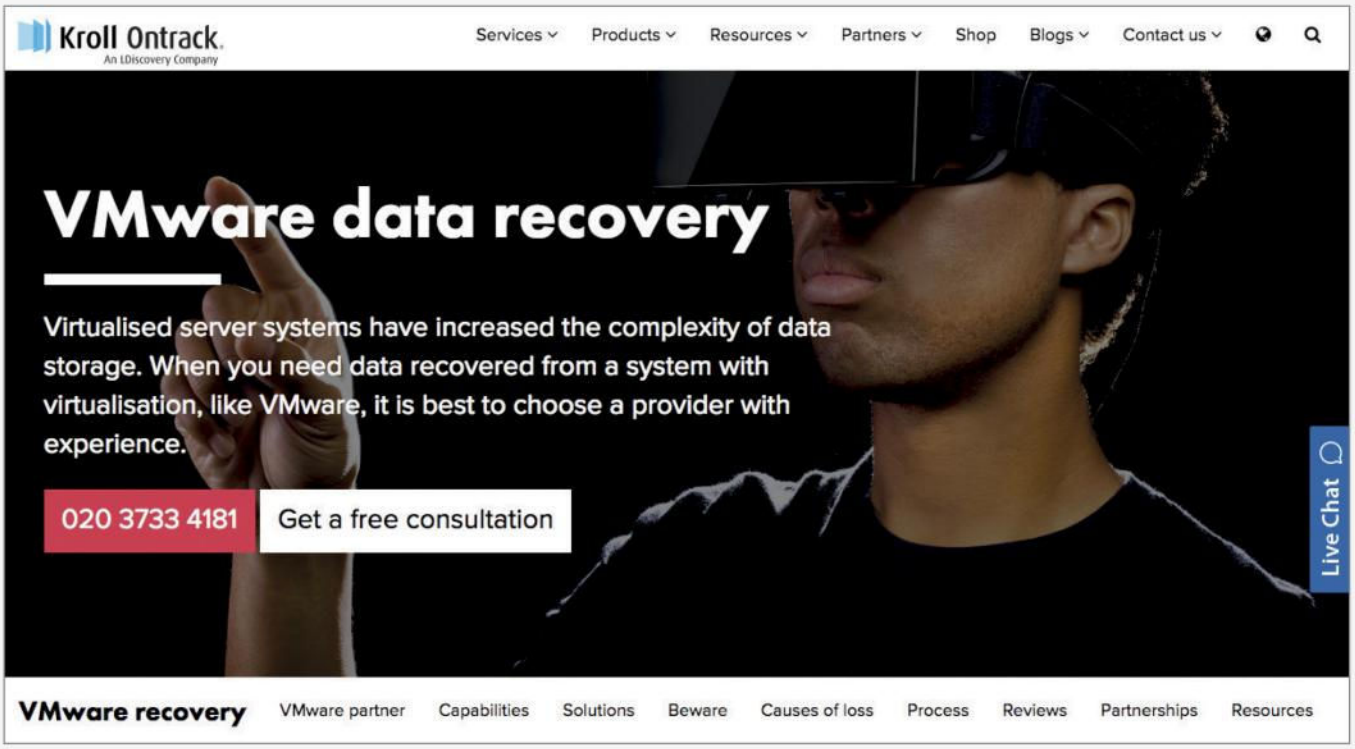

tool. Both use the VMware command line connection. Since this would be a long and involved install on a machine set up to manage the VM host, I felt a morning start on these tools was in order.

Bright and fresh the next day, with the command line on Windows nicely hooked up to the VMware hypervisor on the broken server, I dived into the instructions for repairing the apparently non-existent partition table on this horrible little specimen of a disk. The first few stages went well, bringing up all the data that the rest of the recovery process wanted. I even learned the interesting snippet that VMware only writes back to the partition table (when needed) at system shutdown, which appears to justify the care taken to make a safe, clean shutdown a convoluted process.

But I digress: the first dead-stop moment came at the point where I had all the information to overwrite whatever was being used as the GUID Partition Table – and then I ran into the follow-on comments to the blog entry, which came from people who had wanted to do a recovery "on their lab server". This is nerd code for "the autograph is for my son/daughter".

It seems that just corrupting that one bit may be common enough, but some forms of disk damage can cause the numbers used to recreate the table to be mis-read. Typing them back in can make subsequent attempts at recovery – by this or any other method – less likely to proceed. Therefore, it isn't recommended as a fix for disks that don't have backups of their contents held somewhere safe.

^ Contrary to what the internet says, VMware doesn't do anything magical to make a single disk fault-tolerant

My finger literally hovered over the Enter key on that one, then shifted to the Delete key. This wasn't a lab; that was, after exhaustive searching, definitely the only usable copy of the data.

Plan B – the actual tangible bit of software – was looking a lot more attractive. VMFS Recovery it said, among many other kinds. Able to sit on a Windows PC and remotely interrogate the disks of a VMware server, reporting back what it finds after one of several scan types, and configured to do that with the free download. Writing back or downloading found data requires a licence, which costs US$800.

The initial download and data-analysis run are best described as easy but long. If you've ever wondered how long it takes to read every bit on a single 2TB disk over Gigabit Ethernet, the answer is around 15 hours. This doesn't mean that much of value came up in the scan. While the faster short scan revealed a list of typical VMware files, the longer one just seemed to say "1 file found". That was it. Not much for 15 hours. And the short scan report gave just generic file names that could have been any VMware volume.

My reluctance re-emerged at this point, because I'd been unbelievably bored by the bits of the 15-hour scan that weren't in the middle of the night, and during that time I couldn't find a satisfactory information trail for this product. Sure, it had a Facebook page, with a few sparse posts from apparently happy customers – but none from the developers. Some loose links to a community of Russian or Ukrainian IT types, with a history of similar interests around VMware and storage in general, but nothing like enough proof that these identities were active or even correct. No visible comments or contributions in that vast labyrinth of forum postings on this subject from them – and suspiciously dead-end designs in their contact pages (which is one of several reasons why I'm not putting a link or even a screenie in this piece, to any of these sites). It just didn't add up.

In fairness, though, its software did use the VMware CLI to make a remote smart link to the VMware server; it did tell me exactly what type of drive it was; and it did show a few bits of disk info that countered my suspicion that this was scamware. But US$800 is just too much to spend speculatively, especially for something this vital. I really wanted these guys to be on the phone, and talk me through what the screens were saying, and explain why some of the features seemed to be completing while others weren't so happy. And I couldn't.

So I bit the bullet on the silent, invisible pressure coming at me from the business owner, and said that in my view the lack of social or professional footprint was enough to put me off the Ukrainian

> As prices drop, isn't it time you experimented with some 10GbE hardware?

option. Especially given that the local office of Kroll Ontrack was only a couple of hours away via courier. Even though its suggested pricing for a VMware system recovery topped out in five figures, well over ten times what the Ukrainian software men were asking, Kroll's approach gave far more cause for comfort.

Several phone calls in rapid succession followed to establish the scale of the problem, the scale of the charges, and the timescale, and for there to be a bit of gentle probing as to whether or not I could be trusted to make their job harder. Collectively, we agreed that it wasn't complex in terms of the amount of actual kit involved; it was quite likely (but no promises) that recovery was possible; but paying for the super-duper express option was almost completely pointless, since this would be a series of long-scan and recovery processes. I began to feel as if my job here was almost done and could hear the departures lounge beckon.

But first, Kroll's own remote diagnostic software had to be let loose on the server, in a setup remarkably similar to the anonymous Ukrainians – although Kroll didn't need the command line tools. It seems perverse to trust a company to run installs on a machine inside your LAN, and run another long bit-scan of the drive with far less visible, interactive utility programs, even before you've signed a contract or made a payment. But the results were reassuring and offered an explanation of why all the other approaches had failed. After Kroll's run finished, we had a curt voicemail: the drive media is physically damaged. Could we pack it up and send it to them for the next phases of analysis and, possibly, recovery?

Since Kroll's offices were very close to the airport, I volunteered to take the drive with me: much easier than arranging a courier, I thought. Kroll Ontrack disagreed, pointing out that almost all its jobs moved around on courier services, which showed a much lower failure-to-deliver rate than a lone driver in a strange country in bad weather. I was mortally offended – right up to the point where I couldn't drive on to the autobahn because there was a huge air ambulance helicopter parked right on the top of the access ramp. I had plenty of time to look at the 42-tonne truck lying on its side in the field by the carriageway in the ensuing diversion traffic jam, while pondering whether it was the groupage delivery for Kroll's' preferred courier in a little fit of schadenfreude.

As I flew home, after a total of 30 hours of deep bit-scanning and data-copying, Kroll Ontrack got everything back. Only the partition table had been "physically damaged", although neither I nor the client really wanted to spend any more money on validating what had actually happened, given that Kroll used the same courier to send back a single, tiny disk in a Jiffy bag. Formatted for a Windows machine, this 2.5in 1TB USB 3 disk contained all the missing VMs. It was, in my client's opinion, a $10,000 external disk.

> *"Kroll's remote diagnostic software had to be let loose on the server, in a setup similar to the anonymous Ukrainians"*

We had already copied over the backed-up VMs that had been completed from the separate NAS box; it seemed almost an anti-climax to plug in that little drive and get the missing data up and running.

HYPERCONVERGENCE FOR THE REST OF US

It's remarkable how slowly the whole industry updates its network infrastructure. Gigabit is the standard I encounter most often, even though most small networks don't achieve the practical maxima possible using that standard. Part of this is because the experiment to see if higher speeds are possible can be amazingly disruptive, even in a network with no other lurking configuration issues. But also because there's an incredible hike in cost between little plastic-case switches with "gigabit" written on the front and a full scale, web-configured, intelligent routing switch with customisable module ports, multiple ports on the front and back, and service access controls for the intensely paranoid network manager.

But time has been passing, and affordable 10GbE hardware is now creeping into the second-hand, ex-corporate market. I'm aware that lots of readers think this is one of my obsessions, but it seems to follow on that if you have scars from any kind of network tweaking, then your natural response should be to move forward with some low-cost experiments that don't put your head on the block.

This goes double for 10GbE networks, because the main prospect for kudos out of such an upgrade is to make use of hyperconvergence. That state where a server just has a single lead going into it, which can easily and fluidly balance all the different traffic types passing through it. Not something we should be finding difficult in 2017, surely?

Unfortunately, it is difficult. Especially with virtualisation leading to much more varied traffic types, all trying to live together. I'm pretty sure that a lot of the people who have a hard time "going virtual" are reporting failures based on single servers, connected by a single cable to a single switch, as a consequence of which they rarely see network speeds of as much as 25MB/sec.

And some of those converged services – such as iSCSI – don't like to cooperate or, indeed, even recover from a traffic jam on a crowded Gigabit connection. Trying a completely converged server can be disappointing, even on a fully tuned Gigabit LAN: I tend to use the relatively plentiful multi-port Gigabit Ethernet cards, but that may be because I love the cat's cradle complexity that they permit.

If you want the icing on the cake, then Microsoft says it won't support hyperconvergence on anything less than a 10GbE LAN. Here, right now, I have two 10GbE-capable devices: a Netgear XS716E for copper connections, and an SMC 48-port, which only presents 10GbE using a fibre port on the back of the switch. Just having them stacked up together in the computer room means that I can select a 10GbE card and pick my way through the traffic management setup, rather than the virtual port setup, in either VMware or Hyper-V: and my users have no idea it's happening.

That's the best way to dip a toe in the subject. ●

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IT'S TIME TO SWITCH OFF THE FAKE NEWS AND DO SOMETHING MORE INTERESTING INSTEAD, SAYS JON HONEYBALL

You may just possibly have noticed that there's a lot of news floating around about news right now, and in particular how accurate it is. Mr Trump's team frequently claims that all the news outlets aren't telling the truth, and that this is a bad thing that must be punished. Part of their communication strategy is to bypass the mainstream and go straight to the end user via Twitter, with typical directness.

The inevitable result, like a flamethrower in a dry forest, is a firestorm about "what exactly is truth in news?"

It's a fascinating subject, because it goes to the heart of why we have channels through which we consume such information. In the past, a news organisation was the only way in which news, and opinion about that news, was collected together and then disseminated to its audience. Other than these few news outlets, there was no other meaningful route from the event to the reader.

We had to trust the news organisation because we had no other way to verify or invalidate the stories. Out of this came the underlying belief by news organisations that they were special, or "blessed" to deliver news and opinion. You might think that this view applies to this very organ, but it doesn't – we deliver opinion and insight and analysis, which is a somewhat different thing.

Then along comes the internet and all the rules change. Fortunately for the news organisations, they have huge momentum and infrastructure. But, over the past decade, this momentum has been chipped away. It's not been helped by some news organisations clearly having "agendas", be they political, social, financial or a mix of all three. In attracting those of similar views, they inevitably push away those of dissimilar views. Over time, this leads to a fractured landscape where otherwise reputable organs are viewed as unreliable.

Such an outcome naturally plays straight into the hands of the social media agents. And hence the rise of the "influencers", people who just say (and video) whatever they want and are paid to get a sponsored message over to thousands or millions of consumers.

Unfortunately, the task facing the end user has got a lot harder. Not so many years ago, it was relatively easy to decide over time whether you trusted SMH, News.com, The New York Times, CNN or whatever. Today, when faced with thousands of potential feeds, curation has become impossible due to the sheer volume of "stuff" out there: real-time tweets, posts, blogs, YouTube channels and so forth.

> "Faced with thousands of feeds, curation has become impossible due to the sheer volume of 'stuff' out there"

So we have turned to "platforms", many of which are effectively crowdsourced and crowd-managed. On Facebook, I have many friends, but they are real friends. I keep out "acquaintances" and colleagues because I want to control the flow of information – and to ensure it comes from a relatively reputable source

This works, most of the time. However, it is still far too easy for what appears to be official or trustworthy information to circle the world in a few minutes before anyone has bothered to check if it's real. Trusting sources without verification or validation is the underlying issue.

You might be thinking, post-Mark Zuckerberg's manifesto, that Facebook has the answer. That its mix of machine learning, grandiose thinking and new emphasis on surfacing shared posts after people have actually read them – rather than just the headline – is all you need.

No. We can't rely on Silicon Valley algorithms. We must all apply a little more fact-checking to the things we read, consume and pass on. No amount of "All facts here are checked!" banners and symbols will help. In fact, quite the opposite. Such devices make it even easier for partial truths to be "accredited" and, consequently, gain a reputation of quality that is not deserved.

Maybe there's no such thing as truth. It's entirely possible that there are just opinions at a point in time, and that everything has a spin, a bias or a perspective. It all depends on how you look at things. Which means that everything is a bit like Schrödinger's cat.

So how do you survive? The best solution might just be to ignore it all. That sounds a little drastic, but if I look at the amount of heat, anger, vitriol and other emotions created by the election of Mr Trump on my Facebook feed, it would be hard not to be swept up by the tidal wave of it all. Maybe there is such a thing as too much news – if you can't contain it, trust it, validate it, and make reasoned judgements about it, then why read it at all?

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