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How to bag a great deal with minimal risk p30

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Avoid the gotchas and discover one key piece of software p42

Apple HomePod

Is any speaker worth £319? p62

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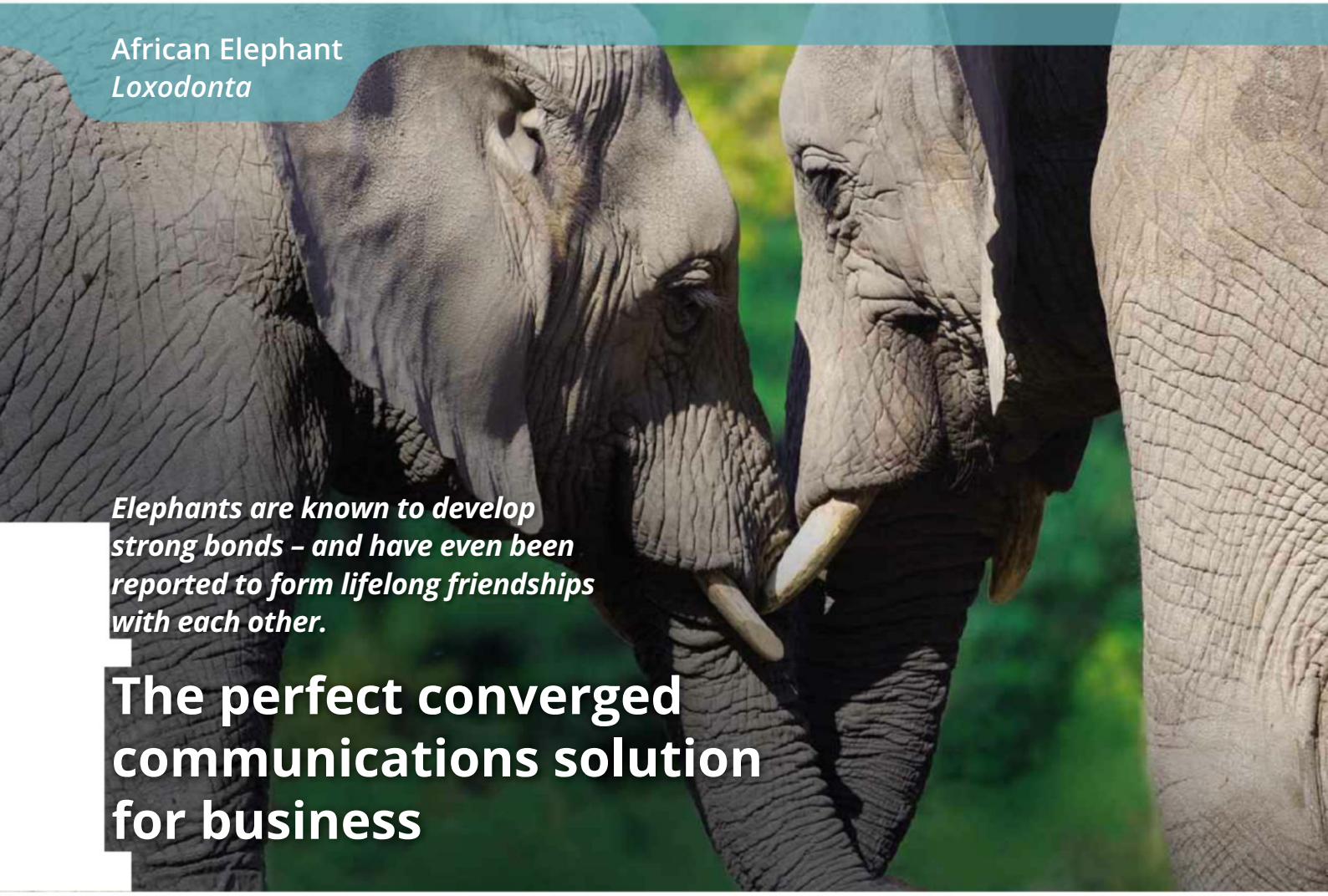

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HIGHLIGHTS THIS MONTH

Full contents overleaf

PRODUCT OF THE MONTH

Apple HomePod

What a curious product the HomePod is: it's stupendously brilliant due to the stunning way it adjusts its output to its surroundings, and the quality of that sound, but it's also stupendously stupid. In particular, Siri on the HomePod looks dim-witted compared to her Amazon and Google rivals, and it doesn't help that Apple hasn't properly thought through real-life security issues – such as anyone being able to send texts via the associated phone. Then there's the fact it costs £319, also known as four Echos. Yet, there's something so brilliant about the HomePod we can't help but like it. See p62 for our verdict.

p62

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UPGRADE OF THE MONTH

If there's one perpetual truth of computing, it's that upgrading your hard disk to a new drive will breathe new life into an old machine – whether desktop PC or laptop. We explain how to do precisely that, including the reinstallation of Windows, from p42.

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SECURITY TIP OF THE MONTH

As governments and hackers snoop on our digital traffic, the case for virtual private networks has never been stronger. So the security tip of the month? Install one. Our feature explains how to pick a winner.

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MIXED REVIEW OF THE MONTH

What's Windows Mixed Reality really like to use – and is it worth investing over £300 in a headset? Editor-in-chief Tim Danton steps into Microsoft's virtual world and puts the four widely available WMR headsets to the test.

PESSIMIST OF THE MONTH

Nicole Kobie

Fed up of the hype around the likes of self-driving cars, virtual reality and Bitcoin, Nicole spoke to the experts who argue that what fuels sensationalist headlines are journalists after a good story – and people wanting to believe.

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THE LABS IN ONE NUMBER

Can you buy a decent laptop for under £300? Lenovo certainly thinks so, with the IdeaPad 320S costing a mere £299, but our Labs suggests you'll need to pay closer to £600...

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£299

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SET THE PAGE FREE

Editor's letter

Am I going Microsoft in my old age?

I'LL MAKE A CONFESSION. Until I pressed Delete a few moments ago, the first sentence of this column wasn't "I'll make a confession" but "It's hard to have sympathy for Microsoft". The column I was going to write would pitch myself on Microsoft's side of the debate that continues to rumble in our Letters pages about the rights and wrongs of the company's handling of Windows Updates.

But then something made me stop and ask myself: why is it so hard to have sympathy with a company? At what point do they stop being people – the founders – and start being a megacorp, which we assume is evil?

Consider how companies start. With rare exceptions, they begin with one or two people (in Microsoft's case, Bill Gates and Paul Allen). They have an amazing idea. The idea takes off. Money rolls in. They hire more people, develop the original idea, have new ideas, and become a sprawling mass that spreads its tendrils across oceans. At that point, they tend to either swallow or be swallowed. Remember Compaq? Digital? ICL? (Skype? LinkedIn? *Minecraft*?)

I admit it's hard to have sympathy for such a behemoth of a company, especially one like Microsoft, which hauled in almost $100 billion in revenue last year. So, let me rephrase the question: why do I, and I suspect many others, still have such an odd sense of solidarity with Microsoft?

Having asked myself the question, I'll admit that it's more nuanced than that. When people criticise the firm for the way it handles updates, I find myself split in two, in a way that biology teachers would find useful while teaching mitosis. When I hear of a laptop going into update mode just before someone is due to go into a meeting, how can I not feel sympathy for them? "Something must be done!" my parent cell shouts, jumping onto a convenient soap box.

But before it's made the leap, another cell materialises that's just as sympathetic and compelling. "Hey," he says, "don't you understand that Microsoft is doing its best? It's got hundreds of millions of boxes running its software, and it doesn't want to control you like [he'd flick his eyes towards the Apple store that somehow appeared nearby] certain other companies. It's just trying to keep you safe."

Because Microsoft could lock us down far more than it does. It could have forced us to stop using old computers many years ago, exerting the power of its effective monopoly to say "you can't use that any more, use this". It could also have followed Apple and taken full control of the hardware and software, leaving no room for anyone else.

I'm not naive enough to believe that Microsoft does this in its role of benevolent uncle – money is always king – but surely the end result is ample reward. For example, let's celebrate the fact that in 2018 a British company such as PC Specialist can create a bespoke computer based on Windows, with no obligation to use anything made by Microsoft other than the operating system (*see p56*). That Scan, another proud British company, can customise a laptop to the exact wishes of its customers (*see p57*).

Yes, we should criticise Microsoft when it gets things wrong, and, yes, we need some people to get angry so that improvements happen. Just occasionally, though, let's congratulate a company for making enough right decisions over the past 40 years to give us the amazing technology we take advantage of today.

Tim Danton
Editor-in-chief

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Stuart Andrews
Head into PC World and you'll drown in allegedly bargain laptops. Stuart explains what to look for, and reviews ten tempting contenders, from p76

Stewart Mitchell
Fancy bagging cheap tech products from China? Stewart's guide explains what you should buy... and what you'd best avoid. Read his advice from p30

Leslie Costar
On the theme of great tech companies, Leslie explains why he and his business partner invested their time and money to buy the then-ailing CIX. See p116

Jon Honeyball
Can it be true? Jon shares some rare words of praise for Microsoft – its Office team, at least – and provides his take on "CPU Armageddon". Turn to p110

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In our pessimist's guide to technology, p124, we look at many promised technologies that haven't yet lived up to the hype. Including VR. So do our experts believe VR will be the next big thing?

"Virtual reality has been the next big thing for 20 years and will likely be for another 20."

"VR will go nowhere for as long as it's encased in ugly wraparound headsets. Only once it's built into regular glasses does it stand a chance."

"It's still no good for us old, astigmatic gits. I get a splitting headache because my eyeballs don't agree with the headset's sleight of hand. VR will be little more than a curiosity until they make the viewing gear a lot better."

"VR is niche – it always will be niche and always has been niche. To make it work, you need a very high res (4K) per eye at a high frame rate. That means lots of GPU power, and lots of connectivity from base computer to headset. AR is a different *steak au poivre*, and will be huge – especially when the micro-resolution displays work well at high res. We haven't begun to see even the start of that revolution yet."

"I agree with Barry. It'll need a delivery mechanism other than a box strapped to your face before it'll ever become mainstream."

"Isn't it pretty mainstream already? I'm quite happy with my Samsung Gear VR hooked up to a Galaxy 8+ and find the tech is good enough – it's the content creation that's slow, which probably means that there's still not enough money to be made..."

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Briefing

Background and analysis on all the important news stories

Is Apple's security slipping?

A series of bugs and patches suggests that the tech giant's quality control isn't what it used to be

APPLE'S SELF-PROCLAIMED reputation for cast-iron security is faltering after tracts of the company's all-important source code were posted online.

Apple has frequently boasted of how secure its operating systems are compared to Windows and Android, but a series of recent embarrassments have tarnished its image.

The company admitted that a key part of the source code for iOS has been posted online after an intern managed to steal the code. Although Apple forced GitHub to remove the post, it's understood to have been widely distributed.

The leak involved iBoot, the part of iOS that's responsible for ensuring a trusted boot of the operating system. Although the code is two years old and from iOS 9, experts believe it could still offer hackers an insight into how phones could be compromised.

"It's an embarrassment for Apple – your code is the crown jewels so to have it leaked is bad news," said Alan Woodward, a security specialist at the University of Surrey's Department of Computer Science. "It gives an insight into the code and might help you work around security aimed at locking the code, rather than providing something such as malware."

BELOW Your Mac devices may not be as secure as you think...

Woodward said the publication of sensitive code might not result in an immediate security breach, but could lead to problems further down the line. "It obviously gives hackers a chance to see more than they might otherwise do and if there is a way of abusing some existing feature, say, they might find it," he said.

"I suspect the real issue is more to do with writing code that might simulate the real code in some way – the big disadvantage hackers have is they don't (as I understand it) have Apple's digital certificates."

Long-term leak

The leak actually took place at least two years ago, but remained in limited circulation among a small group of jailbreakers before being posted anonymously on GitHub. Apple claims that the age of the leaked code and the company's aggressive update release cycle should minimise threats.

"By design, the security of our products doesn't depend on the secrecy of our source code," Apple said in a statement. "There are many layers of hardware and software protections built into our products, and we always encourage customers to update to the newest software releases to benefit from the latest protections."

However, because software is developed incrementally, old code could still be in use in the latest versions of iOS. "The code might be 'old', but code evolves rather than being a completely new set of code each time there is an update," said Woodward. "Old code can reveal quite a lot about the way in which features are typically implemented."

Bug bombs

The news comes as Apple deals with a slew of embarrassing software problems, including "bug bombs" that crashed phones and Macs when a certain character, link or symbol was included in messages to devices. The latest, the "Telugu text bomb", caused devices to freeze when sent a message containing an unsupported character from the Indian language. Word spread and people started to include the character to crash other devices.

Apple has moved to fix the issue (with iOS version 11.2.6 and macOS version 10.13.3), but the fact that so many problem are emerging within active systems is a concern.

> "In the first seven weeks of 2018, Apple has had to release 14 security updates across its stable of products"

At the end of December, the company was alerted to a critical security vulnerability for macOS High Sierra that allowed anyone with physical access to a Mac to gain system administration privileges without even having to enter a password. In the first seven weeks of 2018, the company has been forced to release 14 security updates across its stable of products.

"There is definitely a growing impression that Apple seems to have had a few quality issues," said Woodward. "The volume of updates is quite surprising.

"You would imagine that some of these things would be picked up in simple testing, which is what makes them all the more surprising. This isn't about deliberate attacks by hackers per se, more an indication that Apple is letting things slip through the net into the wild."

Five stories not to miss

1 Snooper's Charter ruled unlawful

The government could be forced to change the way the Data Retention and Investigatory Powers Act 2014 (DRIPA) is enforced after Court of Appeal judges ruled parts of the legislation were inconsistent with EU laws. DRIPA was the predecessor and foundation of the Investigatory Powers Act 2016, or "Snooper's Charter", but the court ruled the legislation lacked safeguards and allowed officials to authorise their own access to personal data.

2 Spotify planning a move into hardware

Spotify could join the smart speaker crowd after plans for a hardware division were revealed via job adverts. In recruitment documents looking for hardware production engineers, Spotify suggested that it was considering making its own speakers, smartwatches and glasses, and that the company was recruiting staff to "create its first physical products and set up an operational organisation for manufacturing, supply chain, sales and marketing".

3 Windows on ARM limitations revealed

Microsoft outlined the limitations of Windows 10 running on ARM processors when a company document was accidentally posted online. Although most apps and programs should work as expected on the 64-bit ARM operating system, there are issues with 32-bit and 64-bit x86 drivers on the 64-bit ARM OS, which may mean older hardware and peripherals won't work with the system.

4 Government launches anti-extremism AI filter

UK officials took the wraps off a tool that uses AI for image matching and language understanding to vet extremist videos before they are uploaded. Designed by the Home Office and ASI Data Science, the system boasts a 94% success rate and false positives of 0.005%, but critics said an uncertain appeals process still raised concerns.

5 Google launches Chrome ad blocker

Google has moved to block what it thinks are the most intrusive adverts – such as pop-ups and audio-driven marketing – from websites in its Chrome browser (*see Barry Collins' column on p25*). Using criteria laid out by the Coalition for Better Ads – of which Google is a member – Chrome will block adverts from websites that create "frustrating experiences".

Unveiled Mobile World

The key details of this month's hot hardware releases

Samsung Galaxy S9

Samsung's Galaxy S9 release was expected to be a highlight when it launched World Mobile Congress, but new features were more incremental than revolutionary.

With any wow factor eliminated by pre-show leaks, Samsung went to town on the quality of the camera in the handset and the tools that make on-camera imaging increasingly interesting. The camera takes a far more prominent place within the software than in previous iterations and there are further improvements to the optics – a throwback to Samsung's time as a camera maker.

The cameras in both the 5.8in S9 and 6.2in S9+ boast a variable mechanical aperture that switches between f1.5 in low light and f2.4 in brighter conditions. This is most useful in the cameras' "Pro" shooting modes as it means users can manually set the aperture to manipulate the depth of field.

Samsung has included two rear-facing lenses, with the second offering a 2x optical zoom, and although the extra lens has a fixed aperture, both of them feature 12-megapixel sensors.

Samsung also showed off improvements for shooting in low light, made possible by tweaks in the sensors that reduce digital noise. Plus, the company has boosted the camera's Super Slow-mo credentials.

Elsewhere, the S9 uses the same-sized battery as its predecessor, although the OS moves from Android 7 to Android 8 and the company has introduced a pair of AKG stereo speakers.

The S9 is powered by the new 2.8GHz Snapdragon 845, which chipmaker Qualcomm claims is 25% faster in general performance compared to the Snapdragon 835.

According to analysts, the lack of huge improvements over the S8 won't impact sales dramatically – a fact that's probably not lost on Samsung. "Despite the striking similarities between the Galaxy S8 and Galaxy S9, it's worth remembering that most people buying this device will be upgrading from a two- or three-year-old phone," said Ben Wood, an analyst at CCS Insight. "For them it will be a significant upgrade."

KEY DIGITS AND DETAILS

Price S9 £739/S9+ £869
Availability Now
OS Android 8 (Oreo)
Memory 4GB RAM
Storage 64GB and a microSD slot (up to 400GB)
Connectivity 802.11ac Wi-Fi, Bluetooth 5, ANT+, USB-C, NFC
Display 5.8in 1,440 x 2,960 (S9)/ 6.2in 1,440 x 2,960 (S9+)
Cameras Rear Super Speed Dual Pixel 12MP AF sensor, front 8MP sensor

BELOW The Galaxy S9 and S9+ have two rear-facing cameras with 12-megapixel sensors

BELOW Oops! Luckily, Lenovo's 100e Chromebook can cope with 330ml spills

Lenovo 100e Chromebook

Lenovo didn't release any new handsets at Mobile World Congress, but the company did deliver a range of laptops, including a trio of life-proof Chromebooks starting from $219.

The 100e, 300e and 500e are principally education-focused Chromebooks, and while they might look like they were designed by a Soviet-era bezel fetishist, parents will appreciate a range of rugged Lenovo laptops targeting schools being made available to the public.

The Chromebooks feature a water-resistant keyboard able to cope with 330ml spillages, according to the company, and with bump protectors the range is also drop-resistant to 75cm. All three machines feature reinforced ports and hinges.

At the bottom of the range, the 100e Chromebook inclues an 11.6in HD anti-glare display with a 1,366 x 768 resolution, an Intel Celeron processor, 4GB of RAM and 32GB of storage, although this can be expanded thanks to a microSD slot. The specs are hardly ground-breaking, but for $219 its durability is its main appeal.

Moving up through the range, the 300e and 500e will retail for $279 and $349 respectively. Hinges allow for tablet or PC modes, and they're both supplied with touchscreens that improve note-taking potential and could appeal to youngsters already accustomed to the touch interface.

KEY DIGITS AND DETAILS

Price $219 (for 100e)
Availability Now
Processor Intel Celeron N3350
Memory 4GB
Storage 32GB eMMC
Connectivity 802.11ac Wi-Fi, Bluetooth 4.2
Ports 2 x USB-C, 2 x USB 3, microSD card reader, combo mic/audio jack
Battery Up to ten hours
Weight 1.25kg

Congress Special

Sony Xperia XZ2 and XZ2 Compact

Sony took the wraps off its eagerly anticipated Xperia XZ2, which sports a fresh design after similarly styled previous models left Sony handsets looking dated.

Both the 5.7in XZ2 and the 5in Compact model are powered by Qualcomm's Snapdragon 845 processor, but Sony was keen to talk about its camera tech.

Not only can the rear cameras on both phones shoot HDR video, they do so at 4K resolution. The camera is also better supported in Super SlowMo mode. The previous version topped out at 720p, but the XZ2 shoots in Full HD.

The Compact includes most of the same features as the XZ2, but it doesn't support wireless charging, which appears for the first time in the range on the XZ2.

It's perhaps surprising that Sony has excluded a 3.5mm audio jack, but the phone supports AptX HD and LDAC codecs for high-quality Bluetooth audio.

The motive behind the decision could be the launch of Sony's Ear Duo buds that are expected to retail for $279 in May. The earbuds allow some external sound into the ear, instead of complete isolation, which might prove appealing for joggers who need to be aware of their surroundings.

KEY DIGITS AND DETAILS
Price TBC
Availability Now
Processor Qualcomm Snapdragon 845
Cameras 19MP rear, 5MP front
OS Android 8
Screens XZ2: 5.7in 1,080 x 2,160; Compact: 5in 1,080 x 2,160
Memory 4GB
Storage 64GB storage, microSD cards up to 400GB

BELOW **The Sony Xperia XZ2 and XZ2 Compact can shoot HDR video at 4K resolution**

Nokia 8110

In a world of identikit smartphone handsets, Nokia again looks to the past with the retro-shaped 8110 – a homage to the Matrix-era banana-phone handset with an old-school sliding keypad cover.

The €79 8110 follows last year's re-release of the 3110, but while that handset was let down by connectivity issues, the 8110 features most of the wireless technology expected in a modern phone.

Among the other Nokia-branded handsets launched by manufacturer HMD Global, the 8110 was clearly intended as a fun throwback, but also worked to raise awareness that the Nokia brand was still alive.

The overall specs are largely pointless, as this is little more than a feature phone running KaiOS, a forked version of the dead Firefox OS.

Nevertheless, the handset could prove useful as a travel device due to its 4G LTE chip, which means it could be turned into a mobile hotspot to connect other devices while travelling. Its 25-day standby battery life adds further appeal.

Although the 8110 might have piqued nostalgic interest, the company is also targeting the top-end handsets with the Nokia 8 Sirocco. The largely glass handset (including a 5.5in 2,560 x 1,440 display) features Qualcomm's Snapdragon 835 processor, 6GB of RAM, 128GB of storage and camera hardware from Zeiss.

KEY DIGITS AND DETAILS
Price €79
Availability Shipping in May
Processor Qualcomm 205
Memory 512GB
Storage 4GB
Battery 11-hour talk time, 25 days standby

Huawei MateBook X Pro

Huawei may not have a reputation as a high-end laptop manufacturer, but it's clearly gunning for Apple's MacBooks and Microsoft's Surface devices with its MateBook X Pro.

It's borrowed the all-aluminium chassis from Apple's playbook, and the MateBook X Pro has the specs of a serious contender. The device tapers from 14mm at its deepest point, while the 13.9in touchscreen has a resolution of 3,000 x 2,000.

The X Pro is powered by an 8th Generation Intel Core i7 processor, a GeForce MX150 GPU with 2GB of GDDR5 memory, and a 57.4Wh battery that Huawei says supports 12 hours of HD video playback.

There's also a fingerprint reader built into the power button and Huawei claims the power-on routine will take just 7.8 seconds.

There's a growing market in security shields to cover webcams and the MateBook has tucked the webcam under a top-row keyboard tile that pops up like a 1980s sports car headlight. This also means that screen's top bezel is a mere 4.4mm.

The prices range from €1,499 for a model with an i5 processor, 8GB of memory and 256GB of storage, to €1,899 with a Core i7, 16GB of RAM and 512GB of storage. Huawei also revealed a flurry of Android tablets under the MediaPad M5 brand – with the devices featuring 8.4in or 10.8in screens and 4GB of memory.

KEY DIGITS AND DETAILS
Price €269
Availability Expected March
Processor Intel Core i5-8250U or Core i7-8550U processor
Memory 8GB/16GB
Storage 256GB/512GB SSD
Ports 3.5mm stereo headset jack, 2 x USB-C with Thunderbolt 3, USB 3.1
OS Windows 10
Screen 13.9in 3,000 x 2,000
Weight 1.33kg

BELOW **Huawei has its sights set on the high-end laptop market with the MateBook X Pro**

EXCLUSIVE

£5,000: the price you pay to influence tech policy?

Want the ear of UK politicians on IT matters? It will cost you £5,000, Stewart Mitchell discovers

Access to dozens of influential MPs – including the prime minister and chancellor – is being sold for £5,000 by a group claiming to be the UK's "policy voice of the internet and technology sector".

The Digital Policy Alliance (DPA) includes among its members 46 MPs, 51 lords and three MEPs. Among them are some of the most technically literate politicians in the UK, as well as prominent figures such as the prime minister, the chancellor of the exchequer and the former minister for culture, communications and creative industries, Ed Vaizey.

However, it's not only politicians who are welcome to join, but companies seeking to influence the UK's IT policy. Corporates can pay a membership fee of £5,000, which gives them access to officials in meetings where decisions are made on how to implement new laws, such as defining age-verification systems for adult websites. Among its members are MindGeek, a company that operates some of the world's biggest porn sites.

"Not a lobby group"

The DPA is the trading name of another organisation called EURIM, which started in 1993 and claims to be a not-for-profit organisation. Despite its role in linking commerce and officials, the DPA insists it is not a lobby group, claiming it "does not advocate positions on behalf of individual members or interest groups".

The DPA did, however, work as an intermediary between companies with vested interests and Department of Culture Media and Sport (DCMS) staff during the creation of the Digital Economy Bill, influencing the way adult sites might be blocked if they didn't include an age-verification system. The DPA claims it has "achieved great success in identifying loopholes in the bill, informing policy, and providing evidence-based advice" and that it had "offered live demonstrations of operational and workable age-verification mechanisms to officials". On the back of the work – which could benefit several of its members – the DPA said it had successfully pushed for two amendments to the bill as it went through parliament.

ABOVE 46 MPs are members of the Digital Policy Alliance – including the prime minister and chancellor of the exchequer

Pornographers in Parliament

PC Pro recently revealed the role of porn giant MindGeek – owner of RedTube, Pornhub and YouPorn – in the age-verification process (*see issue 281, p14*), when experts and rivals questioned why such a major player was involved in setting agendas for government officials.

MindGeek joined the DPA in 2015, shortly after the government proposed introducing mandatory age ID for adult sites. It was a move that put the Canadian company in the same room as staff at the DCMS.

Experts say the DPA was, in this instance, a vehicle for the government to talk to the adult industry without actually looking like it was in open conversation with pornographers, giving credibility to companies that might not usually be invited into Whitehall. "If you're a big company involved in one of these groups, it's probably about trying to gain legitimacy for the cause you're advancing," said Dr Elizabeth David-Barrett, a senior lecturer in politics and a lobbying and corruption specialist at the University of Sussex.

> "Corporates pay a fee of £5,000, which gives them access to officials in meetings where decisions are made"

"For policy makers, they don't like to be seen to be talking to companies – they prefer to be talking

Notable members of the DPA

- Amazon UK
- British American Tobacco
- Equifax
- Gamma (surveillance software)
- MindGeek (pornography)
- NSPCC
- Portland TV (adult broadcaster)
- Symantec

to a civil society organisation of some kind, or at least an industry group."

The DPA did, in fact, seek input from civil liberties groups, including the Open Rights Group (ORG), which have questioned the wisdom of the entire age-verification proposal. However, the ORG wasn't prepared to pay for access to the politicians. Full membership of the DPA costs £5,000 a year, while associate membership costs £1,700, plus VAT.

"It's possible for us to think about paying a few thousand pounds on something like this, but there is a principle here," said ORG boss Jim Killock, whose Freedom of Information request initially highlighted the meetings between the DPA, MindGeek and DCMS officials.

"If this is supposed to be a matter of public policy then it shouldn't cost to participate," he added. "We're not going to start paying out large sums of money to people in order to engage in public policy – it's just not what's meant to happen. Nobody should have to pay to be part of the public policy process."

Lord Erroll, who is chair of the DPA, told *PC Pro* that the organisation wasn't a lobby group and that political members didn't receive payment for their participation in the DPA. "We are more concerned with the social impact of technology than with promoting the technology itself," he said.

"The Digital Policy Alliance alerts EU and UK parliamentarians and policy makers to the potential impacts, implications, and unintended consequences of policies which interact with and leverage online and digital technologies."

ABOVE There are records of the DPA's meetings on its website – but they're not made publicly available

Behind closed doors

The fact that the role of DPA and DCMS officials was only brought to light by an FOI request – which also revealed cosy emails between MindGeek and government officials – highlights the dangers of a closed-door system. If, for example, the outcome of meetings later appear to favour one company or proposal, there's no paper trail to see who was involved and what action was taken.

"Government will engage with groups, but this should be done in a way that is driven by evidence, and ensures that privileged access and influence is not just given to those with the deepest pockets," said David-Barrett.

"There are difficulties in practice – some groups have more resources with which to push their arguments and work out what the evidence is, and there's an issue around transparency and whether you can go back and look at who influenced what afterwards."

The DPA does keep records of its meetings on its website, but they are not made public. "The DPA is funded by the subscriptions paid by its members and this is one of their benefits," said the Earl of Erroll.

Past problems

This isn't the first time questions have been raised about links between the DPA and companies seeking to influence politicians. Back in 2013, *The Sunday Times* reported that Malcolm Harbour, a director of the DPA and at the time also an MEP, had cut-and-pasted industry lobby group suggestions for amendments to privacy law into official EU documents.

According to research, he inserted demands from documents supplied by lobbyists representing firms including Amazon, eBay, IBM, Microsoft and BlackBerry into proposed new European legislation.

"Privacy research revealed that 19 MEPs had copied sections of submissions made by lobbyists on behalf of internet firms," *The Sunday Times* reported. "They were then pasted into amendments to the EU's new data protection regulation paper. Harbour topped the list with more than a quarter of his amendments coming from lobby papers."

Harbour said he acted in good faith and that both his and the tech companies' views were aligned. "The fact that businesses involved in using and protecting personal data agree with amendments is not a reason to discount them or to try to suggest that those who agree with their approach are worthy of censure," he said in a statement.

The price of influence

The DPA is by no means the only group that interfaces between industry and officials in the tech industry.

We found several other groups, such as techUK and Tech London Advocates, which aim to take their members' messages to government. The major companies, meanwhile, have in-house teams that speak to officials. "Companies can do their own lobbying or join a group, so if you're small you can pool resources," said David-Barrett.

Although the tech trade groups can make important contributions on behalf of the industry, and there is no suggestion that anyone involved with the DPA has acted improperly, the lax regulation is open to exploitation.

"On the darker side it could be that officials are getting some kind of perks, such as hospitality, or even that they are thinking about getting a job in the sector via the revolving door," she said.

"There's a risk that someone in public office might try and ingratiate themselves with a company with a view to getting a job there later and for a lawmaker that could be easy, but because it's very hard to get evidence on these things it's speculation."

The A-List

The best products on the market, as picked by our editors

PREMIUM LAPTOPS

Dell XPS 13 (2017)

Ultraportable from £1,149

from dell.co.uk

Dell only needed to refine its brilliant XPS 13 design to keep top spot, and that's what it does: it's slightly quicker and adds more options, but it's the edge-to-edge 13.3in display and compact chassis that lift it above the opposition. Oh, and it's now available in Rose Gold. REVIEW **Issue 270, p54**

ALTERNATIVES — NEW ENTRY

Microsoft Surface Book 2
A unique and versatile laptop with a screen that detaches to become a tablet – the £1,999 version is our pick of the bunch. **From £1,499 from microsoft.com/store** REVIEW **Issue 281, p48**

Lenovo Yoga 920
An ultra-thin convertible from Lenovo that not only looks great, and has supreme power, but lasted for an impressive 12 hours in our battery tests. **£1,350 from lenovo.com** REVIEW **Issue 281, p51**

Scan 3XS LG17 Carbon Extreme
A brilliant 17in, 4K laptop for demanding gamers, with a desktop Core i7-8700 chip, 16GB of RAM and GeForce GTX 1080 graphics. **£2,580 from scan.co.uk/3XS** REVIEW **Issue 283, p57**

SMARTPHONES

Samsung Galaxy S8

Android, 32GB, £689

from samsung.com/uk

The Samsung ads that claim the S8 reinvents the phone may be a little over the top, but it has created something beautiful. With the screen spreading across almost every surface, including the left and right edges, it's stunning to behold. The price is equally stunning, but in return you get an excellent camera, great battery life and chart-topping speed. REVIEW **Issue 273, p74**

ALTERNATIVES — NEW ENTRY

Apple iPhone 7
Despite the launch of the iPhone 8 and iPhone X, the iPhone 7 retains its place as the best-value Apple phone. **32GB, £549 from apple.com/uk** REVIEW **Issue 266, p54**

Honor 9 Lite
A huge 18:9 display and stylish design give this budget phone a high-end look. There's even room for a dual-camera setup on the front. **£200 from store.hihonor.com/uk** REVIEW **Issue 283, p70**

OnePlus 5T
OnePlus upgrades the 5 with an excellent 6in screen, but keeps the top-end performance, battery life, dual-lens camera and price. **64GB, £449 from oneplus.net** REVIEW **Issue 280, p58**

TABLETS

Apple iPad

9.7in tablet from £339

from apple.com/uk

The most basic iPad topped the rest in our huge roundup of tablets. While the iPad Pro models are faster and have nicer screens, the iPad remains slick and is still terrific value – although we would be tempted to pay the extra £90 for 128GB of storage rather than the 32GB version.
REVIEW **Issue 278, p82**

ALTERNATIVES

Apple iPad Pro 10.5
With the Pencil and Smart Keyboard, the Pro is pricey but – for mobile workers – it's worth it. **64GB, £619 from apple.com/uk** REVIEW **Issue 278, p89**

Amazon Fire HD 10
A top-quality tablet for the price, with a 10.1 IPS display and solid turn of pace. Only the cameras disappoint. **32GB, £150 from pcpro.link/279hd10** REVIEW **Issue 279, p71**

Samsung Galaxy Tab S3
Expensive, but the brilliant S Pen, slim design and all-round quality make this our top Android choice. **32GB, £516 from pcpro.link/278tab3** REVIEW **Issue 278, p82**

EVERYDAY LAPTOPS

Asus ZenBook UX410UA

Stunning 14in budget laptop, £600

from pcpro.link/280zenbook

It was always going to take something special to kick the Asus UX330 off the A-List – and it's no surprise that Asus was the one to do it, with the UX410UA having the looks and feel of a much more expensive machine. Consider upgrading to the more expensive version with 8GB of RAM and a 256GB SSD, though. REVIEW **Issue 280, p68**

ALTERNATIVES — NEW ENTRY

HP Chromebook 13 G1
A stylish and high-quality laptop, but with Chrome OS, not Windows. It's fast, has all-day battery life and won't look out of place in a boardroom. **£614 from pcpro.link/271hpc** REVIEW **Issue 271, p54**

Acer Aspire 5 A515-51
This 15.6in laptop lasted 9hrs 8mins in our tests, and packs in plenty of power, too. A superb choice if you're after an all-rounder. **£584 from cclonline.com** REVIEW **Issue 283, p82**

Asus ZenBook UX330UA
A superb 13in laptop with a top quality screen, Core i7-7500U processor, 8GB of RAM and a 512GB SSD. Build quality is great, too. **£858 from laptopsdirect.co.uk** REVIEW **Issue 266, p62**

ENTHUSIAST PCs

Scan 3XS Gamer

Intel Coffee Lake PC, £1,650

from scan.co.uk/3xs

While AMD's Ryzen chips rule the mid-range, Scan shows that a system based on an Intel Coffee Lake CPU (the i7-8700) and fast GTX 1080 graphics can work to tremendous effect. With a high-quality supporting cast, it's a great buy. REVIEW **Issue 280, p69**

NEW ENTRY

PC Specialist Enigma K7

Whether you want to explore virtual worlds, play the latest games at 4K or just get on with some demanding tasks, this well-balanced system – with a Core i5-8600K, 16GB of RAM and 6GB GeForce GTX 1080 graphics – will serve you well. **£999 from pcspecialist.co.uk** REVIEW **Issue 283, p56**

Alienware Area-51 Threadripper Edition

We tested the ridiculous £5,299 version, with dual GeForce GTX 1080 Ti graphics cards, but if that's overkill – and you still want the latest Threadripper processors – you'll find the Area-51 an excellent choice. **From £2,149 from dell.co.uk** REVIEW **Issue 281, p56**

WORKSTATIONS

Scan 3XS WI6000 Viz

i9-7980XE workstation, £4,650

from scan.co.uk

An overclocked Core i9-7980XE processor, together with 64GB of 3GHz DDR memory and Nvidia's Quadro P4000 graphics, ensured this was a great all-rounder. With a 2TB hard disk and 500GB SSD, it's a brilliant showcase for Intel's top-end CPU. REVIEW **Issue 281, p84**

Armari Magnetar S16T-RW1000G2

Armari was the sole workstation in our Labs to use an AMD Threadripper CPU and what a choice this proved – this is a rendering powerhouse. Its choice of GeForce Titan Xp graphics also proved inspirational, with fast results. **£4,799 from armari.com** REVIEW **Issue 281, p82**

PC Specialist Apollo X02

PC Specialist provides a terrific-value alternative with this system based on Intel's eight-core Core i7-7820X. Overclocked to 4.6GHz, with support from 32GB of 3GHz RAM and Nvidia Quadro P4000 graphics, it proved a solid performer in modelling tasks. **£2,500 from pcspecialist.co.uk** REVIEW **Issue 281, p83**

EVERYDAY MONITORS

Eizo FlexScan EV2450

1080p display, £267

from pcpro.link/263eizo

A great-value 24in IPS display that offers more colour-accurate images than you've any right to expect at this price – and a reassuring five-year warranty too. REVIEW **Issue 263, p72**

Samsung C34F791WQU

It may seem expensive, but this is a top-quality 34in 3,440 x 1,440 curved monitor. At 1500R, it's very nearly the same curvature as the human eye, which justifies the term "immersive" whether you're playing games or working. **£780 from pcpro.link/271sam** REVIEW **Issue 271, p61**

Philips 276E7QDAB

The obvious sacrifice you make for a 27in IPS panel at this price is resolution – it's 1,920 x 1,080 – but it offers good all-round image quality and looks attractive on the desk thanks to a slimline design. **£190 from laptopsdirect.co.uk** REVIEW **Issue 272, p75**

PROFESSIONAL MONITORS

Eizo ColorEdge CG277

Professional monitor, £1,599

from wexphotovideo.com

Spectacular image quality; stunning colour accuracy; amazing flexibility. Just three reasons the ColorEdge CG777 won our Labs dedicated to monitors for professionals. REVIEW **Issue 260, p88**

Dell UltraSharp UP2716D

This 27in screen can't match the Eizo CG277 for outright quality, but compared to most screens it offers superb colour accuracy – especially for the price. It supports hardware calibration, has ultra-thin bezels and is packed with connectivity. And you can buy almost three to each CG277. **£491 from pcpro.link/272dell** REVIEW **Issue 272, p74**

NEC MultiSync EX341R

This 34in display is the strongest argument yet for curved technology, making it easy to replace dual- or even triple-monitor setups with a 3,440 x 1,440 resolution. It's expensive but produces a great-quality image that you – or your employees – will love. **£1,020 from nec-display-solutions.com** REVIEW **Issue 273, p70**

WIRELESS NETWORKING

Zyxel Multy X

Mesh networking, £270

from pcpro.link/282multy

Not the smallest nodes, but that's for a reason: each one crams in a dedicated 4x4 antenna array for the backhaul alongside separate 2x2 arrays for connected clients. The result? Lighting-fast Wi-Fi and impressively wide coverage for a reasonable price. REVIEW **Issue 282, p85**

BT Whole Home Wi-Fi

The best-value mesh networking system around thanks to a price drop from £300 to £189. For that, you get three discs and fast, stable speeds throughout your home. Perfect for medium-sized houses, and it can now be expanded with extra discs. **£189 from shop.bt.com** REVIEW **Issue 282, p81**

TP-Link Archer VR2800

A terrific value router, able to beam a powerful signal throughout a medium-sized home. Add strong parental controls and two handy USB 3 ports, and it's our top choice for people who don't want to go the mesh route. **£177 from box.co.uk** REVIEW **Issue 274, p85**

WORKGROUP PRINTERS

Xerox VersaLink C600DN

Colour laser, £720 exc VAT

from printerland.co.uk

The C600DN hit 53ppm speeds in our tests, managing 50ppm double-sided, and produced great results even on cheap 75gsm paper. Low running costs of 1.1p mono and 6.4p colour only add to its attractions. **REVIEW Issue 283, p98**

NEW ENTRY

Brother HL-L9310CDW

If you can't quite afford the C600DN, consider this good-value rival from Brother. This colour laser provides great output quality, low running costs (1.1p/7.8p), speeds of up to 32ppm, and plenty of security features. **£432 exc VAT from printerbase.co.uk**
REVIEW Issue 283, p94

Kyocera Ecosys M5526cdw

Low running costs and easy maintenance are the key factors here, with 1.3p per mono page and 9p for colour. Print quality is great too, even if you're kept waiting a little longer for 600dpi prints.
£353 from printerland.co.uk
REVIEW Issue 279, p101

HOME OFFICE PRINTERS

Brother MFC-J5330DW

All-in-one inkjet, £123

from pcpro.link/273bro

A high-quality and versatile printer – it can even print in A3 – with a tempting price, and it won't cost the earth to run. Provided you have space for it, it's a great choice for home and small office use. **REVIEW Issue 273, p84**

Epson EcoTank ET-4750

If you do lots of printing then this EcoTank is almost certainly going to save you money, with enough ink supplied to last 14,000 black pages and 11,200 in colour. And, unlike previous EcoTank printers, the image quality is pretty good, too. **£398 from pcpro.link/282epson REVIEW Issue 282, p62**

NEW ENTRY

Oki C332dn

If you're looking for a budget-priced A4 colour laser printer, stop your search: you won't find one for less than this network-ready desktop model. With 30ppm mono and 26ppm colour speeds, only high running costs (2p mono/11.4p colour) count against it.
£113 from okidirect.co.uk
REVIEW Issue 283, p97

VIDEOCONFERENCING

Polycom RealPresence Trio 8800 Collaboration Kit

Full VC kit, £1,416 exc VAT

from pcpro.link/275poly

This kit provides everything for a small business, with no need to hook it up to a laptop or mobile. It's flexible when it comes to positioning and won't be beaten for features or audio quality. **REVIEW Issue 275, p98**

Lifesize Icon 450 and Phone HD

The price is steep, but this complete VC solution makes high-quality video conferencing a walk in the park – it's impressively easy to deploy and use, while the audio quality delivered by the four built-in mics was top notch.
£3,462 exc VAT from uk.insight.com
REVIEW Issue 275, p96

Logitech ConferenceCam Connect

If you need a portable solution for smaller rooms, this sleek device can be set up in seconds. Despite its size, it can't be faulted for quality and the price is right too. **£249 exc VAT from pcpro.link/275log**
REVIEW Issue 275, p97

BUSINESS WI-FI

DrayTek Vigor 2860Ln

Secure router, £328 exc VAT

from comms-express.com

A brilliant router for businesses that demand excellent security features, while its VPN support is second to none – the price includes support for 32 IPsec VPN tunnels. It's worth every penny. **REVIEW Issue 258, p95**

WatchGuard AP420

Not cheap, but SMBs wanting enterprise-class wireless security and central management will find it money well spent. The cloud portal is one of the best we've seen, performance is great and WatchGuard's WIPS delivers smart wireless security.
£648 exc VAT from broadbandbuyer.co.uk. REVIEW Issue 281, p97

Cape Networks Wireless Sensor

The perfect wireless monitoring solution for SMBs thanks to a superbly designed cloud portal, packed with information, for a very tempting price. A huge range of network and service monitor features also impress. **£650 exc VAT from irisnetworks.com**
REVIEW Issue 279, p104

SCANNERS

Xerox DocuMate 6440

USB scanner, £395 exc VAT

from printerbase.co.uk

A brilliant choice for heavy workloads, the DocuMate 6440 hit speeds of nearly 70ppm in our tests. It also has a large ADF and versatile software.
REVIEW Issue 278, p98

Brother ADS-3000N

Aimed at mid-sized workgroups, the ADS-3000N is a solid deal: it supports both USB and Gigabit Ethernet network connections, while offering 50ppm scan speeds, a robust 5,000-page daily duty cycle and a generous software package. **£386 exc VAT from pcpro.link/278ads**
REVIEW Issue 278, p94

Plustek SmartOffice PL4080

Looking for a low-cost flatbed scanner? The PL4080 fits the bill nicely, combining a fast 40ppm duplex ADF with an A4 flatbed scanner. With Plustek's intuitive DocAction software thrown in, it's a great buy.
£296 exc VAT from cvpdigital.com
REVIEW Issue 278, p97

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SECURITY SOFTWARE

Bitdefender Internet Security 2018

A stellar selection of extras including ransomware protection, along with rock-solid antivirus protection, makes this our top choice for 2018. **3 devices, 1yr, £25 from bitdfender.co.uk** REVIEW **Issue 279, p85**

Avast Free Antivirus

We recommend dumping Windows Defender, but if you don't want to spend a penny then Avast's superb protection makes it the best choice. Just ignore the inevitable, relentless upsell. **Free from avast.com** REVIEW **Issue 279, p84**

Kaspersky Internet Security 2018

The best choice for power users and tinkerers, with little different from last year's offering – but with so many features already, that's fine by us. **3 devices, 1yr, £25 inc VAT from pcpro.link/279kas** REVIEW **Issue 279, p86**

PRODUCTIVITY SOFTWARE

Microsoft Office 2016

We'll be honest: there's very little here for anyone upgrading from Office 2013. However, this is still the best office suite for professionals. **Home & Student, £90 from pcpro.link/254off** REVIEW **Issue 254, p62**

LibreOffice 5

The interface looks a little dated, and the lack of collaboration features is a shame. But interoperability with Word and Excel is better than ever, making this a fine upgrade if you don't want to pay. **Free from libreoffice.org** REVIEW **alphr.com**

Scrivener

A brilliant package for serious writers: not only a word processor, but a tool that helps you organise your ideas and manage the process of composition from start to finish. Expensive, but a trial is available. **£34 from literatureandlatte.com** REVIEW **alphr.com**

CREATIVITY SOFTWARE

Adobe Creative Cloud

Adobe entrenches its position as an indispensable resource for creative professionals, with useful upgrades to the core print-orientated apps such as Photoshop, and exciting new additions for digital designers too. **Complete plan, £50/mth from adobe.com/uk** REVIEW **Issue 268, p72**

Serif Affinity Photo

Don't be fooled by the low price: this is a serious rival to Adobe Photoshop in terms of features, even if it does require a hefty system to make it fly. Even professionals should give it a look. **£49 from affinity.serif.com** REVIEW **Issue 271, p72**

CyberLink PowerDirector 16 Ultra

An excellent tool for 360 video production and also a fine choice for normal video, with powerful plugins that boost it yet further. Not cheap but worth it. **£43 from pcpro.link/278cyb** REVIEW **Issue 278, p73**

RACK SERVERS

Broadberry CyberServe Xeon SP2-R2224

Broadberry takes full advantage of Intel's new Xeon Scalable family, with a tasty pair of 2.2GHz Xeon Gold 5120 CPUs offering 14 physical cores apiece. Matched with 24 bays for SFF hard disks, this is an impressive 2U rack server. **£8,612 exc VAT from broadberry.co.uk** REVIEW **Issue 280, p100**

HPE ProLiant DL20 Gen 9

HPE packs a powerful hardware configuration into the smallest of rack spaces. It's very affordable and versatile, while its silent running makes the DL20 highly suited to a wide range of deployment scenarios. **£1,273 exc VAT from uk.insight.com** REVIEW **Issue 260, p101**

PEDESTAL SERVERS

Fujitsu Server Primergy TX1320 M3

Fujitsu's smallest ever tower server, the TX1320 M3 will immediately appeal to space-poor SMBs. Despite including a 3GHz Xeon E3-1220 v6 processor and two 1TB cold-swap hard disks, it has a price to match its compact dimensions – and includes plenty of business-friendly features. As reviewed, **£593 exc VAT from lambda-tek.com** REVIEW **Issue 277, p97**

Dell PowerEdge T130

The T130 packs a lot into its compact chassis and won't disturb you even in a small office, with our audio tests measuring a noise level of only 37.9dB. Storage features are basic, but there's room to grow – a fine first server. **£399 exc VAT from dell.co.uk** REVIEW **Issue 265, p98**

SECURITY

WatchGuard Firebox T30-W

Small and medium-sized businesses looking for seriously strong network protection at an affordable price will find WatchGuard's Firebox T30-W ticks all the right boxes. It has all the requisite security features, can be customised to suit and is very easy to deploy. Appliance with 1yr Security Suite, **£942 exc VAT from watchguard-online.co.uk** REVIEW **Issue 273, p102**

Panda Adaptive Defense 360

A clever cloud security solution packed with features and priced right for SMBs. It's easy to deploy and its smart detection and response service hardens malware protection. 25 seats, 1yr subscription, **£1,214 exc VAT from pandasecurity.com** REVIEW **Issue 273, p101**

NAS APPLIANCES NEW ENTRY

Qnap TS-1277

Thought AMD's Ryzen processors were for consumer PCs only? Qnap doesn't, including an eight-core 3GHz Ryzen 7 1700 in this blisteringly fast NAS appliance. The TS-1277 raced through our performance tests, but impressed just as much for deployment, data protection features and cloud backup. **Diskless, £2,514 exc VAT from span.com** REVIEW **Issue 283, p101**

Broadberry CyberStore 224S-WSS

The perfect platform for Windows Storage Server 2016 Standard, the CyberStore offers 24 hot-swap SFF drive bays at a great price. It also provides huge expansion potential, with seven PCI-E slots. **£5,445 exc VAT from broadberry.co.uk** REVIEW **Issue 274, p100**

BACKUP

Tandberg Data RDX QuickStation 8

This speedy RDX IP SAN appliance is a great choice for SMBs that want total control over their backups. With space for eight SATA drives, it has the power to handle multiple backup jobs simultaneously. **£3,262 exc VAT from bechtle.co.uk** REVIEW **Issue 272, p101**

Acronis Backup 12.5

New features include granular Exchange mailbox protection and built-in ransomware protection. With extensive virtualisation support, ease of use and excellent value, it's a superb choice. **3yr licence, £689 exc VAT from acronis.com** REVIEW **Issue 277, p100**

VOIP SERVICES

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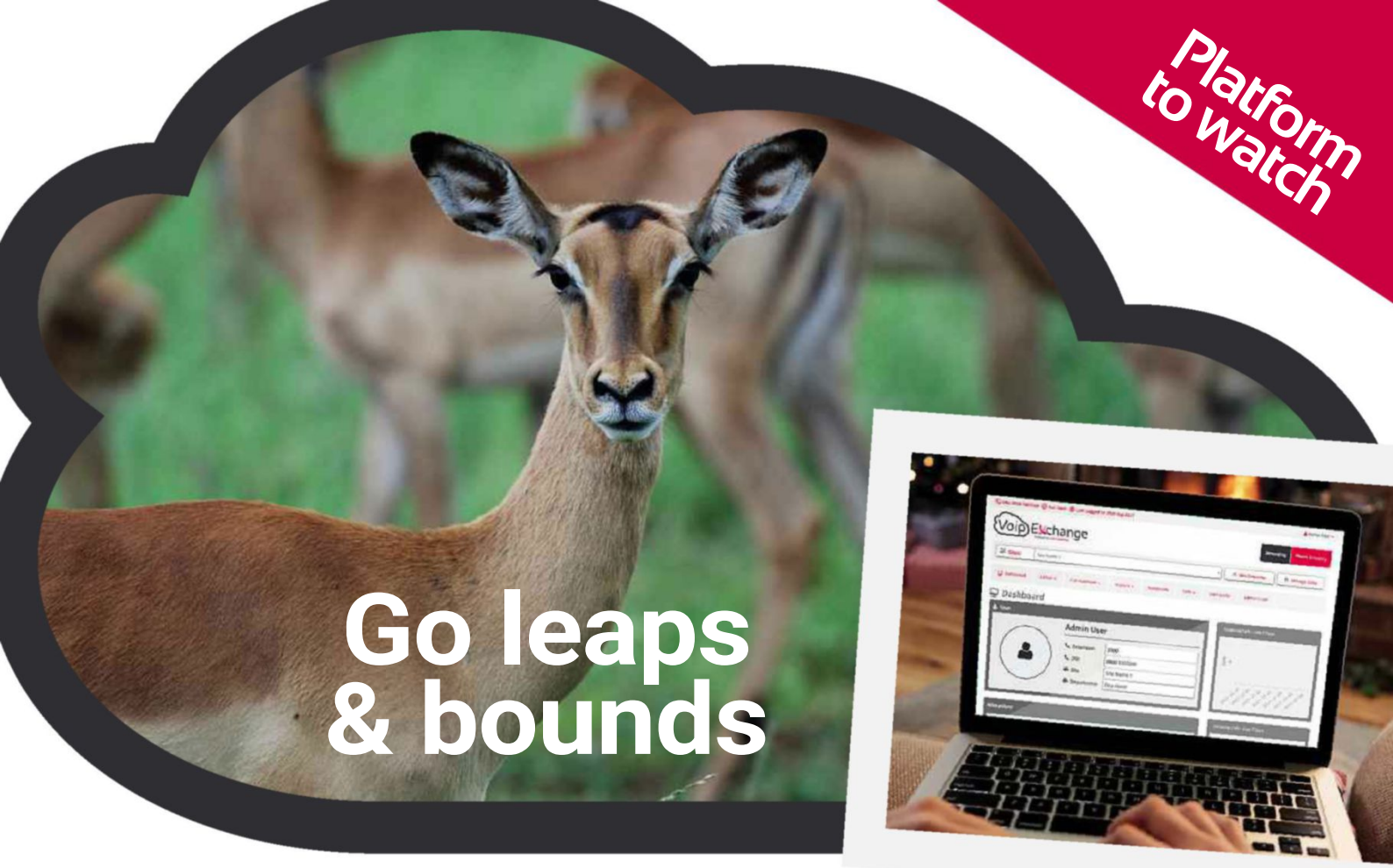

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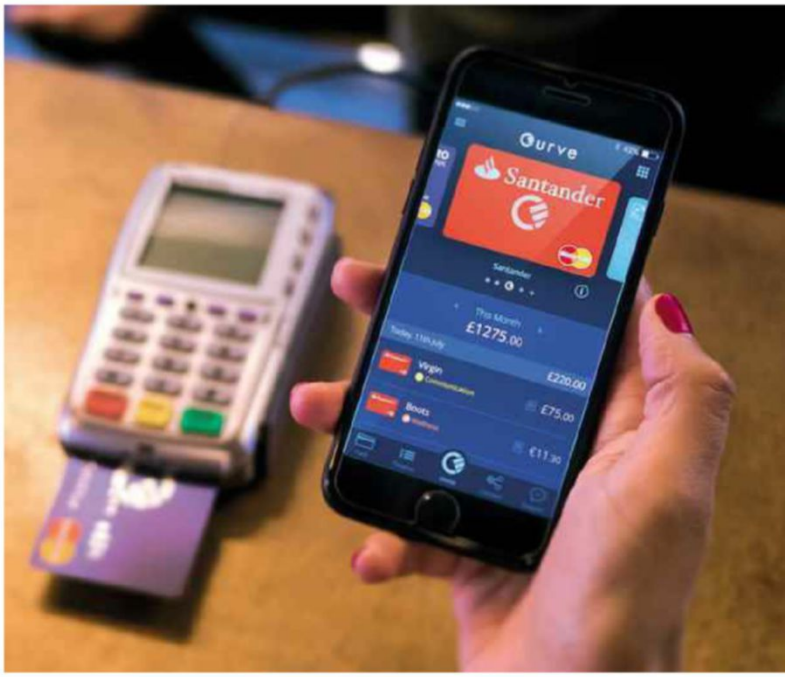


Curve

We meet the British startup that's hoping to become the one place you trust to keep an eye on your money

KEY FACTS

Curve is a financial tech company that hopes to replace the various bank and credit cards in your wallet with a single card and app

FOUNDED 2014

STAFF 45

HEADQUARTERS
Shoreditch, London

WEBSITE
imaginecurve.com

There are few industries as technologically stodgy as personal banking. Retail has been genuinely revolutionised by Amazon, while entertainment is now dominated by Netflix, Spotify, YouTube and other companies that didn't exist pre-internet. Banking, meanwhile, is stuck in the grip of the same companies you probably banked with as a kid: Barclays, Lloyds, Royal Bank of Scotland. If television were run by the bankers, we would still only have four channels and be watching Noel Edmonds on Saturday evenings.

Curve is hoping to elbow its way into a market that is ripe for that horrible but, for once, apt phrase: disruption. In 2006, founder Shachar Bialick came up with an idea for an "operating system for money". Twelve years later, he's made it happen with Curve – a service that lets you combine all of your different bank and credit card accounts into a single card, and operate them from one mobile app. No need to carry five different bank cards and remember five different PIN numbers: just carry your Curve card and pay for everything on that. If you assign a purchase to the wrong account, you can even "go back in time" and re-assign it to a different account. It's perhaps the most innovative banking service ever created. We caught up with the man who is making it happen.

RIGHT **After he co-founded a tech company in Israel, Shachar Bialick moved to London and set up Curve in 2014**

Breaking the banks

Breaking into banking isn't easy. It takes time and no small amount of money – nobody starts a bank from their back bedroom. Bialick describes himself on social media profiles as a "serial entrepreneur". With an MBA in Law and Economics from Tel Aviv University and a BSc in Computer Science, he was almost destined to enter the fintech industry. Having cofounded one technology firm in Israel and then worked as head of product for a fintech firm in London, Shachar finally had the opportunity to make good on his "OS for money" vision with the creation of Curve in September 2014. The fact that the company has only just launched commercially shows you how long it takes to break into the banking market and the care Curve has taken to make sure the service is immaculate before a full launch.

"We launched the first card in May 2016, about 18 months ago, and we launched in beta," Bialick told us. "It's very important it works well and it's reliable. It's people's money and it's a regulated industry. There's one thing we have to do very well, which is work all the time. Which is not easy for a product that has the huge technical challenge of how you make transactions in real-time to different banks, across multiple parties. Now, after about a year and half of work in beta and having the data and seeing everything works well, we feel confident enough to go out to the market."

Technologically challenged?

Curve is quite a difficult concept to get your head around. How can one bank card be used to make payments from a range of different bank accounts? The easiest way to conceptualise it is to compare it to PayPal. There's a credit card sitting behind your PayPal account that money is debited from when you make a transaction. Curve works in a similar fashion, except you get to choose which account you want the money to come out of by preselecting, say, your personal account or your business credit card in the Curve app.

Why then, you might wonder, is such a forward-thinking fintech startup relying on something as outmoded as a plastic bank card? Why can't payments be made using your smartphone, as with Apple or Android Pay, handling everything on the one device rather than relying on app and card?

"If you look at the data, you will see there's a double-digit increase year-on-year in card issuance in Western countries," Bialick said. "Yes, the future will eventually be storing the card information we have on the mobile phone… maybe it will be augmented reality or who knows what… but if you look at the data on Apple Pay, less than 5%

ABOVE LEFT Later this year, Curve will team up with giant Santander to issue co-branded cards

ABOVE Although Curve is still very much a startup, it has already racked up $12 million from venture capital firms

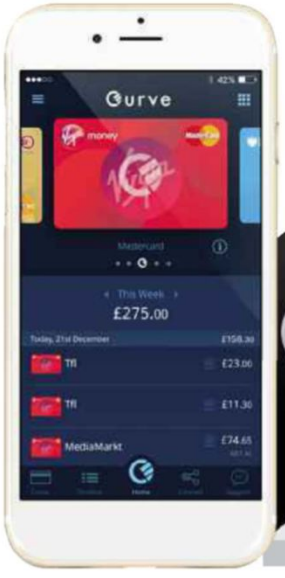
of the shared wallet in the US today goes on Apple Pay. The infrastructure does not allow you to spend everywhere, for any amount, on Apple Pay. Until this technology is completely ubiquitous… you will not be able to form new habits of leaving your card and paying for everything on your phone."

"So, we have two options," Bialick added. "Either we wait for five or six years for this technology to become ubiquitous and new habits start to form, and this new operating system for money starts to be formed by the likes of Apple or Facebook or Google. Or you find a way to bridge the gap." That said, Android users will soon be given the option to make Curve transactions on their mobile phone.

> "Customers will even be able to open new credit cards instantly without having to fill out lengthy forms"

One way in which Curve is undeniably innovative is its ability to pay for something on one account and then, up to 14 days later, decide to switch the transaction to another. No need to return the goods, no need to visit the retailer – it's just a couple of swipes in the Curve app. You might decide to switch a purchase to your credit card if you're running low on funds in a current account, for example, or you may simply have selected the wrong account in the first place and wish to rectify the mistake. If you make that decision within a day, you won't even see the original transaction appear in the statements of the original account – it will be like it never took place.

What do the banks and retailers make of all this money switching? Bialick insists that Curve does nothing the customer couldn't do by going into the shop and asking for a transaction to be put on a different card. It's simply making that process much easier. "Our mission in the world is to simplify and unify the way you spend and save."



RIGHT You can switch a transaction to a different card up to 14 days later

Battle with the banks?

So what do the banks make of this fintech upstart coming in and effectively replacing their bank cards with another? They surely can't be happy that someone is getting between them and their customers. Bialick is initially bullish when I ask whether banks would attempt to block Curve. "The bank has to accommodate this – it has no choice," he insisted.

Later in the conversation, however, he argues that the banks "don't care" about Curve. "They're scared more about Apple Pay," he explained. "Apple is a very strong brand and they have the customer already on the device." What's more, Bialick insisted, Curve is working with the banks. "Our real customer is the bank. Like MasterCard and Visa, we provide technology so that banks can give Curve technology to their users and other users, not even their own." Santander will issue co-branded Curve cards to its customers later this year, Bialick added.

Indeed, one of the ways Curve will make money (the basic version of the card is free) is by offering customers deals from the banks and the credit card companies. Bialick gives the example of someone buying a £1,000 MacBook on their credit card via the Curve app. "We'll see that the card you used has a 40% interest rate. We'll then be able to say to you 'hey, why don't you move this into another credit card that has a 10% APR?' or a new credit card. With one tap, you'll be able to move the money to another card or a new card. So it will save money for the user, we'll make money for the credit providers and we'll take a fee from there."

Customers will even be able to open new credit cards instantly without having to fill out lengthy forms and performing credit checks, because Curve already has all the relevant information on file. "Think about it like MoneySupermarket, but in real-time and without friction," Bialick explained. If the thought of one-tap credit cards doesn't scare you, the idea that your financial data is being hawked to credit companies might, but Bialick insists that no information will be passed to credit companies without the user's permission. "The user is not a product," he said.

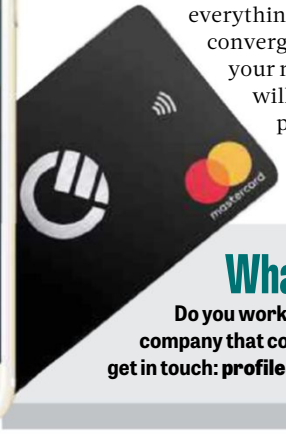
Money on a mission

Curve may be dealing with the big banks, but right now it isn't a bank-sized operation. Based in Shoreditch with around 45 staff, it's still every bit the startup, although Bialick reels off an impressive list of venture capital firms that have financed the business to the tune of $12 million so far.

"Money is dispersed everywhere," he said. "In the past five years, there's been a huge acceleration of fintechs coming in. You can find an investment product or a savings product or a loan from alternative providers who are not banks.

"Our bet is based on what's happened to other industries," he added. "Eventually everything will be funnelled towards convergence. It doesn't matter where your money is parked… everything will be accessible from one platform. Curve is on a mission to become that platform."

BARRY COLLINS



What about you?

Do you work for a British technology company that could be profiled in *PC Pro*? If so, get in touch: profile@pcpro.co.uk

Viewpoints

PC Pro readers and experts give their views on the world of technology

Meet my new laptop; you'll hate it, just like the last one

Techies may demand superfast, highly expandable laptops; how many of us actually need one?

Darien Graham-Smith is *PC Pro*'s associate editor, and he's not ashamed of that either.
@dariengs

You may recall that last month I treated myself to a MacBook Pro, following the untimely demise of my 12in MacBook at the hands of half a bottle of Cabernet Sauvignon. This might not have seemed like a controversial bit of news, but I shared it with a certain trepidation, half-expecting a chorus of told-you-sos from certain quarters.

Because people have been telling me to ditch the MacBook from day one. "It's a toy laptop," declared the naysayers, both online and in the pub. "Its Core M processor is hopelessly underpowered. You can't do any real work on it."

Well, I'm here to say that they were dead wrong. To be sure, there are things to criticise about the MacBook – the single port for both power and peripherals always felt a bit stingy, and although I rather like the ultra-low-travel keyboard, I get that it isn't to everyone's taste.

The processor, however, never once held me back. We all have unhappy memories of those early netbooks that took five minutes to boot and six months to end up on eBay – but today's low-power CPUs are in a different league. On my MacBook, I would regularly open up dozens of tabs in Chrome, touch up holiday snaps in Photoshop and even render the odd video. That wasn't exactly swift, but it was perfectly doable.

The real problem, I suspect, was simply one of perception. We all like to imagine that we need the most powerful processor on the market to cope with all our terribly important and demanding tasks. If someone tells us that we only require a lightweight CPU, it's as if they're calling us a lightweight. It's instinctive to push back.

Indeed, that's something that Intel itself has cottoned onto, and in the past year it's wisely scrapped the maligned Core M brand; the same processors are now obliquely marketed as mere variants of its Core i5 and i7 models. I suspect that plenty of people who'd have run a mile from a Core M are now happily using "Core i7" laptops without batting an eyelid.

For my part, I'd have happily stuck with what I had. I switched chiefly because I found a refurbished MacBook Pro online for several hundred pounds less than the cost of a new MacBook – and since I've been known to dabble in InDesign, the bigger screen and trackpad were a bonus, too.

> "We like to imagine that we need the most powerful processor on the market to cope with all our terribly important tasks"

If I thought this would mean an end to the carping, though, I was sadly mistaken. The MacBook Pro has traditionally been the go-to laptop for professionals and creatives alike, but the current design has had, shall we say, a mixed reception. I'm not talking about the Touch Bar – a creditable bit of blue-sky thinking that's just too expensive to take seriously. No, the real drama is about the move to USB-C.

To be fair, Apple has gone rather gung-ho on the transition. My wife has a 2015 MacBook Pro, and dotted around its sides you'll find an SD card reader, a full-sized HDMI socket, twin USB 3 ports, a pair of Thunderbolt connectors, a headphone socket and Apple's patented MagSafe power connector. On mine, there are two USB-C sockets, a 3.5mm jack socket… and that's your lot.

Is this a problem? For me, no. These days, everything I might conceivably want to connect – be it a mouse, a printer, a camera or a TV – can be reached wirelessly. On the rare occasion that I need to copy something onto a flash drive or an external hard disk, I just plug it into my NAS drive and open it up over Wi-Fi. Frankly, the second USB port feels like overkill.

Yet not everyone shares this view. I recently came across a Reddit discussion in which the modern MacBook Pro's minimal set of physical ports was held up as proof in itself that Apple has lost its way. To be fair, I do think it was a mistake to drop the old MagSafe connector; I appreciate the conceptual elegance of having one universal connector for absolutely everything, but that starts to lose its lustre the third time you trip over the power cable.

This was somewhat tangential to the discussion, however. Most of the outrage focused on the unconscionable inconvenience of having to use one sort of USB port rather than another. I confess that I couldn't resist stepping in to point out that, if you live and work in a moderately up to date environment, the issue is somewhere between small and non-existent.

Alas, my arguments did not carry the day. The consensus appears to be that a laptop is entirely useless unless you can plug multiple monitors, external hard disks, Ethernet adapters and so forth directly into its chassis. I do find myself wondering how many people genuinely use all these connectors on a regular basis. But as with the MacBook, that's not really the point: it's all about self-image. Two little ports might be fine for you, but don't you dare suggest that it's enough for me.

I've no regrets. My old MacBook Air lasted me for six years, and I'm optimistic that the MacBook Pro will be with me for a similar period (assuming it doesn't meet the same alcoholic fate as its predecessor). I can only imagine how useless and outdated those old physical connectors will seem by then.

Meanwhile, having fewer, smaller ports means the laptop itself can be that much more portable – it's more compact than the wife's, and noticeably lighter – and that makes me happy every time I slip it into my satchel. Mock me all you like: frankly, I can't wait for the day when I can buy a laptop with no external connectors at all.

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You will only see what Google wants you to see

Chrome's ad-blocking is an act of enormous self-interest on Google's behalf

Barry Collins is the co-editor of bigtechquestion.com. He's scratching "Google ads" off his list of potential revenue streams.
@bazzacollins

"Well, take a look at what happened. SERIOUSLY. £482,118 in the first month. And I'm simply blown away."

If you've managed to browse the web for longer than five minutes before being confronted with a video of a middle-aged man spouting this baloney, you're a luckier man than I am. I spend half my time writing a *Minecraft* magazine, and this fella pops up on almost every *Minecraft* site I visit, attempting to lure the kids into his get-rich-quick scam. At least, he did until recently. It seems he's been blown away…

Google, the owner of the world's most-used web browser, has said enough is enough. It's decided to root out a dozen of the most hated ad formats to "improve the web for everyone" – chiefly itself. Although my £482,118-earning friend hasn't been explicitly blocked in Chrome, it seems the sites hosting him have felt the chill wind of potentially ending up on Google's blacklist and removed him voluntarily.

How can this be anything but good? Well, as I advise all young investigative reporters, follow the money.

As of mid-February, Chrome stopped "showing all ads on sites that repeatedly display these most disruptive ads after they've been flagged". How is Google defining "most disruptive ads"? Well, it's taking its cue from the Better Ads Standards, which are produced by an organisation called the Coalition for Better Ads.

The Coalition for Better Ads has a wide and varied membership. There's Google itself, which should already set alarm bells ringing for fans of conflicts of interest. Then there's the Interactive Advertising Bureau (IAB), whose members include Google. The American Association of Advertising Agencies, whose "industry partners" include Google. Not forgetting the Data and Marketing Association, which proudly lists Google on its membership list. Can anyone see a pattern emerging here?

Still, not every organisation allied to the Coalition of Better Ads is directly related to Google. Some of them are indirectly related. – such as the European Interactive Digital Advertising Alliance, whose participating associations include the IAB, who we've just established have Google in the tent.

In short, of the 15 organisations identified as board members of the Coalition for Better Ads, seven are either Google itself or list Google among their membership/partners.

The Better Ads Standard lists 12 formats that are the "least preferred" by consumers. On the desktop these include auto-playing video ads with sound, which is the offence my friend trying to make *Minecraft* fans rich has committed. But that list also includes "prestitial ads with countdown" – which as the site further explains, means those ads that "appear before the content of the page has loaded, forcing the user to wait a number of seconds before they can dismiss the ad".

Now, I don't know about you, but I often click on YouTube videos where I have to wait five seconds before I can "skip the ad". Do these not count as the type of ads that are "designed to be disruptive and often stand in the way of people using their browsers for their intended purpose," which Google promises to outlaw in its blog heralding the Chrome ad blocker? It appears not. "Chrome will not block pre-roll adverts on videos for platforms such as YouTube," *The Guardian* reports. How convenient.

The dirty dozen ad formats listed by the Better Ads Standard also includes auto-playing video ads with sound on mobile devices. That's going to be awkward for Google, you might think, because last year Facebook decided to let videos auto-play in its mobile app, declaring that "we're always working to make Facebook a better place to watch videos". Is the Android version of Chrome going to block all ads on Facebook? That would be a no. Facebook's in-stream ads are also exempt. Oh, and guess who is another member of the Coalition for Better Ads? I'll give you a clue. It starts with an F.

It's looking like Google has cooked up a means of protecting its own revenue, and that of its pals, disguised as an altruistic act to better the web. Google's blog even has the temerity to suggest that "some sites affected by this change may also contain Google ads" and that "your experience on the web is a higher priority than the money that these annoying ads may generate – even for us". Google clearly forgot to add the asterisk that said, "excluding all the ads that make us billions".

> **"Google has worked itself into a position where it's the judge, jury and executioner of what ads are allowed to appear"**

Google has worked itself into a position where it's now the judge, jury and executioner of what ads are allowed to appear on the web. Chrome accounts for 60% of web sessions on both mobile and desktop, according to the latest figures from NetMarketShare. Meanwhile, IAB figures show that of the $17.6 billion spent on web advertising in the US in 2016, Google accounts for over half. Follow the money? It's all flowing in one direction.

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Why Facebook could become the next Myspace

Facebook is learning that the network effect works in reverse, too, as the young desert the site

Nicole Kobie is *PC Pro*'s Futures editor. She totally didn't file this column late because she was too busy faffing about on Facebook. (It was Instagram.)
@njkobie

Facebook is getting a bit desperate for attention – "thirsty", as the internet informs me the kids say, probably while on Snapchat. Figures from eMarketer predict that the number of people under 24 using the site will slide by 700,000 in the UK alone this year; those numbers will be mostly replaced by the over-45 crowd, like a bar that's replaced its drum-and-bass club nights with 80s singalongs.

It's no wonder Facebook is starting to fade. Over the past year, it's been criticised for helping spread fake news – contributing to the rise of the alt-right, the Brexit referendum result and Trump's election – while social media has been accused of harming our mental health. *Wired* magazine ran a cover of Zuckerberg Photoshopped to look beaten up, for a feature detailing the social network's "hellish two years".

Zuckerberg himself reacted by revamping the newsfeed algorithm to boost "meaningful social interactions", ditching brand updates and media headlines in favour of pictures and posts from your friends and family. That's not all. Reports suggest that Facebook has started showing some users a poll asking if they agree the site is "good for the world". And users report that Facebook has started spamming them about posts from friends – even sending text messages to the phone number registered for two-factor authentication. Thirsty indeed.

Every time I log in to Facebook – which out of habit is nigh-on daily – I see the same posts as the day before. There's never anything new. And what is posted comes from high-school friends, distant relations and long-forgotten acquaintances.

That's boring for me and a problem for Facebook. The social network taught us all about the power of the network effect, the idea that the more people are using something, the bigger draw it has. If everyone you know is on Facebook, you'll sign up. That's why I did back in 2007 and why, once everyone else signed up, I stayed on for fear of missing a message or an invitation from a friend.

That soon faded, as many friends withstood the draw of social networking, meaning plans still needed to be made over email. But, as a Canadian in London, it sure was lovely to have an entire website dedicated to photos of the friends and family I missed. Most of them don't post on Facebook any more, either.

Instead, I follow my family and friends via Instagram, or they send me photos and updates directly over WhatsApp. No wonder then that Facebook shelled out $1 billion and $19 billion for each respectively.

That may sound like quite the pile of cash when the company is allegedly sliding into irrelevance, but it made $40 billion in revenue last year, despite the disappearance of its younger audience. And those apps have proven worth their price: more and more of my friends are piling onto Instagram, and even my parents have joined WhatsApp now – although they're in the over-55 contingent, so maybe that's not quite what Zuckerberg wants to hear.

But what's fascinating is watching the network effect in reverse. Facebook seemed unstoppable as it hoovered up a third of the population of the world over the course of 14 years. But it's clearly not. As Myspace discovered, the network effect is powerful, but it's all about momentum – and Facebook has lost that.

A friend recently asked me – in person, not over Facebook – whether I thought the site would survive the decade. I think it will, especially with the over-55 set propping it up. And the company itself likely has many years left, thanks in part to smart investments such as Instagram and WhatsApp. But it's a serious reminder to other Silicon Valley giants that there's no such thing as "too big to fail". We might not be able to remember a world without Google, Facebook, Twitter and the rest – but that world is only a few years in the past, and may return a few years in the future, too.

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Is it nearly time to dump Windows for Chrome OS?

Google shows Microsoft how it's done with OS updates, but there's still one thing missing

Dick Pountain is editorial fellow of *PC Pro*. He has his head in the cloud, but his feet in /storage/emulated/0/

A few days ago, my Chromebook told me it would like to reboot in order to update its operating system. I'd just made a cup of tea at the time (Bai Mu Dan if you're interested). I hit the power button and nervously watched the progress bar – a habit picked up from 30 years of Windows use – and it finished updating while the tea was still hot. With the reboot done, a pop-up informed me that I could now download and run Android apps on the Chromebook. That was worth another biscuit (Lotus Biscoff, since you ask).

Running Android apps on the Chromebook had been an ambition of mine for most of the previous year, but up until now it had involved adventures in Developer Mode that I didn't want to attempt. The first driver of this ambition was a need to program in Python on the machine, satisfied instantly by downloading the Android version, QPython3. It compiled and ran everything I've written under Windows, the only change required being to prefix any file paths with "/storage/emulated/0/".

> "As a grizzled pioneer of the personal computer revolution, I'll never be happy having everything in someone else's cloud"

Almost as strong was a desire for certain Android apps I had come to depend upon, including the *PC Pro* Award-winning Citymapper. I had tried the browser-based version for Chrome, but it was so inferior to the Android app in UI terms that I preferred to use it on my phone or tablet. And that brings me to the main point of this column: like Windows' native applications, Android apps exploit the hardware (especially screen real estate) so much better than browser-based versions that there's no contest.

Another app I use every day is Spotify, on which I listen to music at home via Windows or Chrome OS, or while walking on heath and park on my phone. But, until this update, I had three versions of the Spotify client that differed from one another in various ways; some subtle, some downright infuriating. The Windows version is the most complete, as it supports playlist folders to organise my scores of lists, and also drag-and-drop to rearrange these folders and their contents. The Android version has folders that aren't drag-and-drop, but it does support a new UI with a taskbar at the bottom that's easier to use on small phone screens. The browser version I'd been using on the Chromebook is a nightmare that doesn't support folders at all, and steamrollers them into un-navigable flat lists that aren't even complete: the Artists tab only displays a fraction of what's there. Spotify deprecates playlists in favour of its newer, non-hierarchical Your Music (Save| Songs| Artists| Albums) system, hence this bodge that I enjoyed uninstalling.

The combination of Google Contacts, Calendar and the ever-increasingly-wonderful Google Keep ensures that all my appointments, addresses, notes and other important data are always automatically synced between Windows, Chrome and Android machines. I can even do voice dictation on my phone and have it there waiting on the desktop when I get home.

So what about writing? Well, the answer is that I'm writing this column in Google Docs. Running Android means that I could now have Microsoft Word, but in truth I stopped using Office even under Windows several years ago, in favour of LibreOffice. Google Docs does everything I need except for simple macros. Under Windows I used external app Macro Express, plus a few Word Basic scripts. I've found an almost complete replacement in a Chrome extension called ProKeys that stores "snippets" of text, complete with placeholders and automatic date and time stamping, which covers 90% of what I want to do. It can't do my text-editing macros, but I can't be bothered to learn Google Docs' JavaScript API and will do without.

Is there a downside? Well, yes: the confusion of three different file locations, the default My Drive in the cloud, the small local Download drive and a separate local Android drive. Apps mostly hide this from you, but it's time Google completed that long-promised merger of Android and Chrome OS.

As a grizzled pioneer of the personal computer revolution, I'll never be entirely happy having everything in someone else's cloud, and will always want local copies of work and vital data, so here's a suggestion. A merged OS (ChromDroid?) might have a file attribute that takes these three values: l = local only; c = cloud only; s = local first, then sync to cloud. Give me that and Windows would go right, er, out the window.

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More Update woes

Isn't it time *PC Pro* published an article about how appalling Microsoft has been with Windows 10 updates? I find it amazing that a specialist operating system provider can release updates exhibiting major issues with basic functions such as the system time never being correct, new files and folders not appearing until you refresh the window or desktop, or getting locked in a reboot loop… it's simply not good enough. To make it worse, these issues have been around for months and there still seems to be no hope of them being fixed. **Gary Carter**

Defending Updates

In response to James Cadle's letter (*see issue 282, p28*), and a couple of others you have published in recent months, I want to provide a defence of Microsoft. Windows Updates are an essential part of a modern operating system and I'm sure nobody would disagree that for reasons of security and stability they're a good thing.

Microsoft has a well-publicised schedule for releasing important updates, and rarely releases anything "out of band". When updates are ready to install, the user is notified for some days beforehand. The same also goes for feature update packs, where clear notifications are provided for a time period before automatic installation takes place.

This gives people plenty of time to install updates and patches at a time that's convenient for them. I am aware that sometimes, unexpected situations can crop up. For this reason, I always make sure to check my laptop the evening before I leave for an important meeting, presentation, or trip, just in case. This extra check is something I would recommend to everybody who uses their laptop for work because it soon becomes second nature. **Mike Halsey MVP**

Easy money is surprisingly complicated

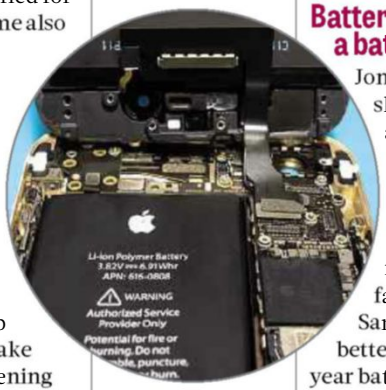
I appreciate Jon Honeyball's computing expertise, but his views on economics rather less. He argues that Bitcoin is valueless because it is a future promise to buy nothing (*see issue 281, p130*).

A currency is a store of value and a means of exchange. A "future" is the obligation to buy an asset at a stated price at some future point. An "option" is the right but not the obligation to do the same.

Conflating these issues isn't an argument, but evidence of confusion. All currencies are intrinsically worthless, as none have been based on gold or anything else since the 1970s. Bitcoin is no different. Jon doesn't like it, and I agree with him, but this isn't the reason for it. **Stephen Prescott**

Batteries taking a battering

Jon Honeyball thinks that Apple slowing down older iPhones is an understandable adaptation to the inevitable deterioration of phone batteries over time (*see issue 282, p110*). I say it's an unacceptable attempt to mitigate a broken-by-design fault in the phone. I use a Samsung phone and have a far better solution. Over the course of a year battery lifetime falls by a third so, once a year, I replace the battery. Non-removable batteries should be considered an inherent fault, and manufacturers required to absorb the cost of replacing them. **Bernard Peek**



ABOVE Should manufacturers be forced to replace batteries if they start to deteriorate?

A mesh mess?

I bought a mesh-based Google Wifi system on the strength of your glowing recommendation in the A-List in issue 281 and previous issues. Then, in issue 282, you describe the system as "a disappointment" in the Labs group test, and say that "it fails at the fundamental task of providing a fast wireless network…"

I can understand that a new device can beat the Google product, but not that your previous second choice becomes far more desirable when neither have changed. The Google Wifi had originally received five stars, but in issue 282 it gets two, despite being the same hardware. The BT Hub hasn't changed, either, but it retains its five-star rating.

As a result, I have lost faith in your A-List. **Kevin Hulmes**

Tim Danton replies: Thanks for writing in Kevin and I completely understand your points. To clarify, the Google product hasn't got worse; but competing products have got better. We still praise the Google Wifi for all the same reasons (including its ease of setup), but criticise it for speed and features compared to those rivals. Also note that the BT Whole Home Wi-Fi has dropped in price by £100 since its initial review and added a number of features (although the hardware is unchanged).

The Google Wifi is still a fine piece of equipment, but for Labs tests we're harsher with our star ratings to try and make the buying decision easier. I hope that helps to explain the difference between the original review and this one, nine months later.

Heads you lose, tails you lose

"I can't recall other warring adversaries deliberately making life more difficult for their own customers to score a cheap point," wrote Barry Collins in his column for issue 281 (*see p25*) on the tit-for-tat between Google and Amazon.

The situation isn't exactly the same, but Adobe used to pay a license fee to Dolby to include its codec in Premiere Pro CC, which is missing

Star letter

I moved into a newly built house on a development of 900 new homes in December and was astonished to discover that fibre broadband isn't available at the property. BT can't tell me when it will be available.

Users on the estate are trying to get together a community-led scheme to have superfast internet installed, but why aren't all new developments being future-proofed? Wouldn't it make sense to install the infrastructure while the roads are up? Dale Connolly

Editor-in-chief Tim Danton replies: It certainly would make sense, and I'm as surprised as you that the infrastructure wasn't in place before the foundations had set: not only would it make the homes more attractive to buyers, but high-speed broadband is essential to encouraging remote working. This in turn reduces traffic and pollution: two things that are very much on councillors' minds when they're debating whether or not to approve a new development.

Is it worth considering your options beyond ADSL? You are effectively starting from a clean slate, and if you can show that several hundred subscribers would be willing to sign up at once, it may well be worth a cable company, which should be able to offer even higher speeds, coming along to survey the development. Good luck.

Our star letter writer wins a copy of Serif Affinity Photo. Five years in the making, it provides sophisticated image-editing tools and a meticulous focus on workflow.

from the 2018 version. By default, updating to a new version uninstalls the old version, and it was easy to do that without being warned of the consequence.

I suspect Adobe stopped licensing Dolby because Windows 10 decodes it natively, and Adobe and Dolby couldn't agree on a reasonable license fee for a codec that is now required by fewer users. Many people are still using Windows 7, often in corporate environments where the individual user can't upgrade, or have older machines with lots of peripherals that might not have drivers for Windows 10. As a result, they'll now have silent video files, as the AC3 Dolby audio is ignored by Premiere Pro and doesn't show up on the timeline.

I've taken to editing on my Windows 10 laptop, which isn't ideal because lots of other resource files are on my desktop. Another option would be to convert the files to a format that Premiere Pro can still deal with, but you either convert to a compressed format, which loses some quality, or an uncompressed format that takes up more space. Either way, it's time-consuming and inconvenient.

> "Many people will now have silent video files, as the AC3 Dolby audio is ignored by Adobe Premiere Pro"

So, not quite the same as Amazon versus Google but an example of two companies disagreeing and the customer losing out. **Steve Smith**

Signed, sealed and delivered

I read the comment from John Hind about digitally signing emails to reduce phishing (*see issue 281, p28*). He's got the right thinking and, in fact, just such a thing exists: DKIM. It was created several years ago and is being steadily adopted by email infrastructure providers worldwide. There are also additional protocols, SPF and DMARC, that sit on top of it.

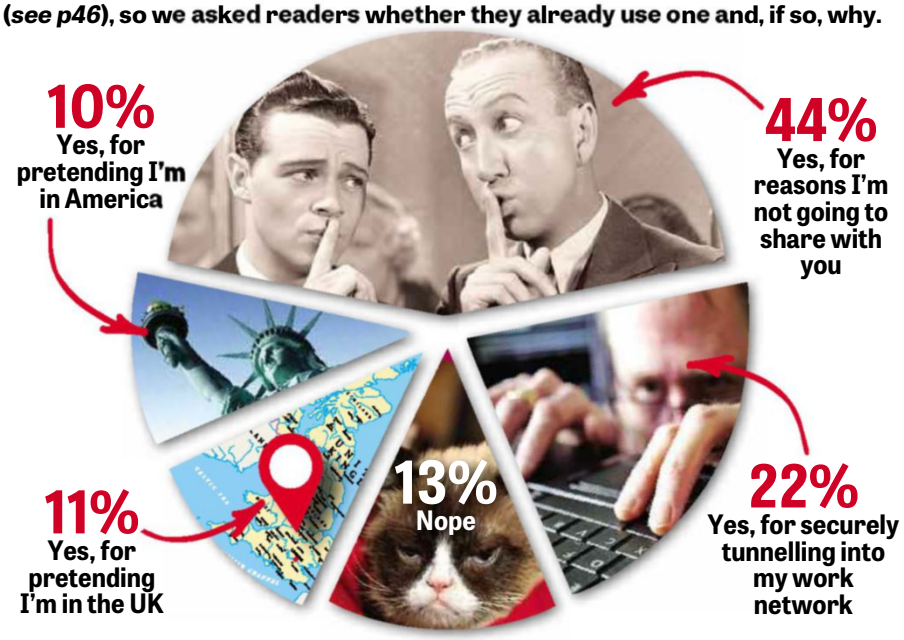
A lot has been happening to make email better in the last years. It's perhaps a good subject for one of your columns (or maybe email technology is too niche?) but while most people use it, almost nobody really knows what technology sits behind it. **Tim Watson**

CORRECTIONS & AMENDMENTS

In issue 282, we accidentally omitted the Recommended logo from our five-star review of NetSupport DNA 4.5. Our apologies for the confusion.

Readers' poll

This month we examine the reasons why you should consider using a VPN (*see p46*), so we asked readers whether they already use one and, if so, why.



One reader got quite angry with our choice of reasons for using a VPN. Dominic said, "Yes [I use one], because I'm not a moron. Why aren't any of your options anything to do with being safer on public networks? Can you not imagine any use of VPNs other than cheating by faking location, for work or looking at porn? Pretty much everyone should use VPNs on public networks, at the very least. The question is whether the VPN is any more trustworthy than the public network." Fair point.

"It's all about privacy for me," said Alex R. "I don't think my ISP, the government or anyone who can fingerprint a browser should know what I do online. Obviously a VPN isn't the full solution, but it's a weapon in my arsenal."

> "I use a VPN to access both client sites and my own servers when out of the office, as well as segregated development environments that aren't directly accessible"
> **Matthew**

> "I've not had any need to so far, but if I incur problems with streaming then I will be looking into VPNs"
> **Paul Thomas**

> "I travel to China a lot so need a VPN to access the rest of the world"
> **Anonymous**

> "VPNs are very slow and I avoid entering sensitive data when connected to a public network so don't believe it is necessary"
> **Anonymous**

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BUY FROM

中國製造

CHINA? Bag a (safe) bargain

MacBook-like laptops for £500 and smartphones for just a couple of hundred quid. Is there any sound reason not to trust the Chinese imports? Stewart Mitchell investigates

ABOVE Products from Chinese factories are often far cheaper than big-brand gear

China is known as the world's factory, but would you buy direct from the factory floor? While global firms such as Apple and Samsung spend millions on branding and pride themselves on innovation and quality, upstart Chinese manufacturers are undercutting them on price, offering tempting bargains that often look similar to the big brands' gear.

"Previously, buying something from China would have been a total gamble," said Dr Jagjit Singh Srai, head of the Centre for International Manufacturing at the University of Cambridge. "But now you have websites where you have more confidence, with operators such as Alibaba having their own rating systems, which means buyers can see how satisfied previous customers have been.

"You end up having electronic confidence and you can start to make a decision from that, which is a new phenomenon," Srai explained.

The bottom line on buying from the Far East is the bottom line. In comparison to the prices paid in mainstream outlets for big-name manufacturers, the technology is temptingly cheap. At the time of writing, GearBest was offering a Xiaomi Notebook Air 13.3 – visually, a MacBook Air clone – running Windows 10 with 4GB of RAM, an Intel Core i5-7200U processor and a 256GB SSD drive for £578. By contrast, a MacBook Air with similar headline specs was listed at £1,099 at Curry's, while an HP Envy with a similar spec costs £899 – although it's hard to know how the quality of the components compares with the Chinese equivalent.

Are these cut-price exports worth the risk? After all, the vast majority of the big brand items roll out of Chinese factories – in some cases, off the very same production line. Is there anything other than a fear of dealing with remote, foreign companies holding us back?

Quality concerns

It's impossible to make blanket claims about the quality of unbranded hardware coming out of China via sites such as GeekBuying, AliExpress, GearBest and Banggood. What is clear, however, is that at least some of the little-known companies on those sites are intending to build a reputation with machines that match the quality of better-known rivals.

"Remember that Lenovo was like those small brands a few years ago," said Professor Rajkumar Roy, director of manufacturing at Cranfield University. "What you see today as a small brand could be a big brand in five years' time – that's how all of them started."

Meanwhile, other manufacturers are willing to cut corners, using components of dubious quality or provenance. Machines may look identical to a MacBook on the website, but only when you actually hold them in your hands do you discover the creaking plastic chassis, the last-generation components or the bleached-out screen.

Trading Standards and other bodies warn about buying Chinese

"Some manufacturers are willing to cut corners, using components of dubious quality or provenance"

imports – particularly for chargers, insisting they lack important safety certification and could be dangerous. Yet, while it's easy to question the quality of products from cheaper brands, it's worth noting that the highest-profile crisis in recent years came from one of the biggest brands. "If you look at the things that hit the headlines – batteries – it was Samsung that had the worst issue recently, so it hits the big brands equally," said Srai.

PC and component manufacturing has become so commoditised that the same factories could be building systems for the largest brands one week and white-label startups the next. "Companies like Flextronics and Foxconn are the major manufacturers in the world with a huge market share," said Srai.

"Contract manufacturing is huge," he continued. "The products you buy – the high-end brands and the low-end brands – could come out of the same manufacturing stable, and the assembly of products has been so commoditised that the only differentials are the components and the brands.

"Some will have more dedicated contract management, so they are better able to control the quality – but some white labels may have quality that's as good as named suppliers."

Will my kit work in the UK?

PCs from China should work anywhere (assuming that they're shipped with the right power supply), but the same can't be said for smartphones. Different countries and networks use different frequencies, which not all handsets accommodate, and phones must be approved by networks before you can be sure they will work.

"Some phones won't work in Europe so it's important to know whether a handset has been certified by networks or not," explained Francisco Jeronimo, research director for European mobile devices with US-based analyst company IDC. "Even if the device is cheaper, what's the point if you're not sure it will work on the network?

"The white-label handsets don't have proper distributors. Xiaomi is having more success as it's a well-known brand where many have bought them via websites, and not through the channel, but otherwise people don't seem to make second purchases," said Jeronimo.

Not only could the hardware be incompatible, but the phones may also be designed for the Chinese market, making them hard to set up. There have been numerous complaints because certain Huawei and Xiaomi handsets don't come with Google Play installed, which is a major weakness. Although there are workarounds, these may require you to decipher Mandarin menus.

Another key consideration is whether a product is allowed in the UK. For example, mobile signal boosters are commonly available from Chinese websites, but they're currently illegal in the UK and could be seized by customs officials on their way to you.

ABOVE
Chinese factories can make big-name products one week and then systems for white-label startups the next

Consumer rights

The biggest argument against buying from China is the lack of consumer protection and customer service that you would expect in the UK. The European Union (and, therefore, the UK) has strict laws laying out how companies should treat customers, providing warranty security, as well as a 14-day cooling off period.

Most of the main Chinese retailers provide a warranty, but without statutory rights in place they are under no obligation to provide a repair, refund or replacement. "If you are buying things online from outside the EU, you should be aware that dealing with a problem with a trader thousands of miles away is likely to be more difficult than in the UK, not least because of the language barriers," said a *Which?* spokesperson.

"You do not have the protection of EU law. Goods could be unsafe and consumers will probably find it almost impossible to get any money back, as the purchase is not covered by the Consumer Rights Act."

Even where sites do provide warranties, many wouldn't pass muster in the UK, because they offer insufficient protection. GeekBuying, for instance, expects consumers to pay round-trip shipping costs for any items that fail after six months and customers only have two days to spot a fault after a product has been delivered. "For items that need to be refunded or replaced, there will be a

When things go wrong

When things go wrong buying from China, they can go spectacularly wrong. Denis Obrul spent £400 with GearBest on a Creality CR-10 3D printer, but it never arrived. Obrul was told the package had been lost, and then delivered to an address in Germany.

Obrul explained that he then entered a Catch-22 nightmare where neither GearBest nor the courier would talk to him, but also weren't communicating with each other. "GearBest made zero effort to help," said Obrul. "I contacted them right away and they didn't even read what I was trying to tell them. I kept getting generic replies with shipping time estimates.

"The main problem was that GearBest had a contract with the carrier prohibiting them from solving the issue with me, the buyer. However, GearBest didn't want to do anything either, so I was going in circles."

After weeks of frustration, Obrul filed a report with the police, at which point PayPal offered a refund. Without arbitration from the payment provider, he could have been left out of pocket. Still, like thousands of others, he had previously brought dozens of items from China without a problem.

We approached GearBest for comment, but the company declined to respond.

"The biggest argument against buying from China is the lack of consumer protection and customer service that you would expect in the UK"

PC Pro @pcpro
Have you bought kit from China? Good/bad experience? Please let us know via reply or email (letters@pcpro.co.uk).

Mike Bookham
@MikeBookham
Replying to @pcpro
I've bought loads of low cost items from China & HK. You can save a lot if you're willing to wait a few weeks to a month or so but I'd never buy mains powered stuff and bin any included USB adaptors.
12:11pm · 12 Feb 2018 · Twitter for Android

2 REPLIES 1 LIKE

PC Pro @pcpro 3d
Replying to @MikeBookham
Why no mains-powered stuff? Simply you don't trust them to match the EU safety regs?

Mike Bookham @MikeBookham 3d
Replying to @MikeBookham @pcpro
Exactly, the China Export (CE) marking doesn't fill me with confidence. I've taken USB adaptors apart which have been delivered from items from China and they don't look safe to me. I dread to think what mains transformers will be like.

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Have you bought kit from China? Good/bad experience? Please let us know via reply or email (letters@pcpro.co.uk).

BPO
@borpin
Replying to @pcpro
Bought bits, PCBs, Orange Pi boards, cables etc. By the time it arrives you've forgotten about it so it is like Christmas!
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"Items passing through customs could be similar enough to branded products to be viewed as counterfeits by officials"

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Have you bought kit from China? Good/bad experience? Please let us know via reply or email (letters@pcpro.co.uk).

Gary Quigley
@quiggles
Replying to @pcpro
Yup, bought loads from the Far East as a whole through eBay, alibaba and banggood, way cheaper than conventional stores here. Need to be aware that some items are counterfeits. But sometimes the counterfeits as good as the real thing, sometimes not...
2:32pm · 12 Feb 2018 · Twitter for iPhone

restocking fee if it is over two days upon receipt of goods," explains the GeekBuying website. "Also if there is any scratch or damage to the item, we will charge the damage fee."

Even if consumer law offers little protection against dodgy dealers, there's still potential to recoup money if you use a credit card. "Use a credit card on purchases over £100 and a debit card for purchases under £100 for greater protection under Section 75 of the Consumer Credit Act 1974," *Which?* told us. "But it must be the person with credit agreement that makes the purchase, not an additional card holder."

PayPal can also arbitrate and possibly claw money back from the company if things go wrong, but using the payment service means you lose your Section 75 consumer credit protection.

Customs costs

Depending on what you're buying, you are likely to be liable for taxes and potentially import duty when buying items from outside the EU. Goods that cost more than £15 will incur VAT of 20%, which could put a dent in savings made buying abroad.

Anecdotally, we've heard that parcels that are not sent by express services are less likely to be stopped and levied, but buyers should budget for VAT.

Many tech products are not liable for import duty and, according to an HMRC spokesperson, "smartphones, tablets and PCs are subject to a zero rate of customs duty when imported into the EU, but VAT remains at standard rate in the UK".

People buying other tech products may, however, be stung for duty at 2.5% or more, and HMRC advises phoning its helpline (0300 200 3700) to check duty rates.

Your package will also be held by the courier until you pay both the tax and an often very high handling fee. Parcelforce, for example, charges a minimum of £11.25 for the privilege of collecting the VAT on HMRC's behalf before agreeing to deliver a parcel – a service for which it's already been paid. Parcelforce justifies the extra charge by saying that it helps "cover the cost of additional handling, administration, collection of monies and provision of facilities for customs clearance of packages".

Only once you have paid both taxman and courier will the goods be released. On top of additional charges, there's also the possibility that tech items passing through customs could be similar enough to branded products to be viewed as counterfeits by customs officials. That might even result in them being destroyed. Under EU law, officials said, "fakes for personal use are exempt if carried as luggage when entering the zone, but purchases bought online are not".

ABOVE By buying from China, you're often avoiding overheads, such as marketing, that the large tech firms have to cover

Delivery and postage

In the age of Amazon Prime, the idea of waiting weeks for something to arrive is antediluvian – but Chinese retailers don't have a warehouse in Reading waiting to put goods in the back of a van (although see Paul Ockenden's tips overleaf). AliExpress, for example, says its free delivery option with China Post Air Mail will take 15-26 days, while GeekBuying takes 20-30 working days, after a three-day processing delay. GearBest says the average UK shipping time is 19.2 days, but admits that 6% of deliveries on its base rate option take between 31 and 45 days.

While some goods have free delivery if you're prepared to wait,

Why so cheap?

If white-label Chinese PC makers can sell laptops for hundreds of pounds cheaper than bigger-name brands, are their costs really that much lower, or are the main manufacturers and retailers simply piling on gratuitous margins?

According to analysts and PC builders, it's a bit of both. "Original manufacturers often have a premium price and that's why the grey market comes up," said Professor Rajkumar Roy from Cardiff University. "OEMs are often inflating the price and it's higher, much higher, than you pay in the grey market, because you pay for the brand."

Some companies can command higher margins than others, with Apple's brand loyalty and desirability allowing it to push prices way above the raw cost of the component parts. According to a teardown from TechInsights, the iPhone X, for example, has a bill of components that amounts to $357.50, but the handset sells for $1,000.

The difference includes manufacturing costs (estimated to be in single figure percentages), research and development, marketing and the costs of running a brand – it's not all profit. "If you look at the breakdown of the costs of a product, it's well reported that it's a few dollars to assemble the product, so all the costs are in the components or in the mark-up, branding and distribution," said Srai. "The high value parts are in the components and the assembly costs can be very small and then there's a lot in marketing sales and distribution."

Selling no-name goods direct from China avoids many of the overheads that companies such as Apple are obliged to cover – from glitzy adverts and product placement campaigns to swanky stores in prime locations and a monumental research, development and design effort.

Samsung and other manufacturers that sell through the channel also have to build margin for retailers into their pricing. "If you have an unbranded product, you save all the branding costs and, depending on your distribution model, you may have some advantages there as well – if you are selling direct, for example," said Srai.

"It's expensive to set up a shop, run research projects, marketing and overheads and only then you have your margin. If you have a business that's not interested in branding, you can compete on price via ecommerce, which has allowed us to engage effectively with these companies."

The fact that many of the upstart manufacturers invest little in design or development is, however, highlighted by criticism of what goes into budget machines and a lack of innovation. "Looking at the China-based sites, there's a lot of very cheap, very limited capability products on sale," said Ben Miles from UK system builder Chillblast. "A lot of these are so cheap because they are underpinned by a single technical component which is then used in hundreds of different end products.

"A lot of the mini PCs and entry-level tablets will be based on the same internal underpinnings that also end up in a wide array of different assembled end goods, simply repurposed with a bespoke outer plastic shell to form a 'new' product."

Paul Ockenden's guide to buying from China safely

I've bought loads of stuff from Chinese vendors over many years, and on the whole my experience has been good. Obviously there are downsides, such as having to wait up to a month for your parcel to arrive, and paying import taxes, VAT, and the annoying handling charge that most couriers add on top. But then sometimes you'll get lucky and the parcel slips through unchecked. Here are my five tips on how to buy safely.

1 Check the EU warehouse

Many of the big Chinese suppliers have optional "EU warehouse" stock available for their better selling lines. It often costs between 5-10% extra, but it's worth it because the goods usually arrive in less than a week, and there are no duties or handling charges to pay. And sometimes the EU price is exactly the same as having the item shipped from China (at the time of writing, for example, GeekBuying charges £377 for the GPD Pocket 7in laptop whether it ships from China, the USA, Germany, Spain or Italy).

2 Limit your spending

I rarely spend more than £300 on Chinese imported goods – most of what I buy is pocket money stuff. I recently bought a slightly unusual USB cable (it needed to be a particular length with angled connectors) for £1.39 including postage, and it arrived within a week. I find that astonishing.

3 Check eBay and Amazon

One thing I've learned is that sites such as GearBest and Banggood aren't the only places to go to if you're looking for cheap Chinese imports – they're also available from sellers on eBay and Amazon. In fact, you may well have bought something there without realising that it's going to ship from the Far East. The benefit of buying via these more established online retailers is that they add a degree of consumer protection should things go wrong.

4 Beware the fakes

When buying branded items I'll often do a quick Google including the term "fake" and possibly "forum" (which is always good for finding user feedback). If I find that there is a problem with counterfeits – such as the Nitecore Digicharger D4 I bought recently – I'll be extra cautious when placing my order.

5 Check phone bands

Finally, a note about phones. Even with handsets labelled as "global" or "EU", look for the term "Band 20" or "B20". This is LTE running at 800MHz, and if the phone doesn't support it, you'll get no 4G at all on the O2 network (or Giffgaff, Lyca and Sky, which all piggyback on O2). You'll get reduced 4G coverage on other networks too, especially in city locations. Many of the cheaper imported phones still have no Band 20 support.

there can be steep charges for other items or speedier shipping. A laptop from GeekBuying, for example, cost $45 for 15-25 business day shipping, while the three-to-five day service from HK-DHL cost $50. A similar parcel from GearBest was free for its 11-22 day service, while the 15-25 day fee was €9.53, but the company recommends buying insurance, which "guarantees your shipment" at €19.91.

If there is a problem with a delivery – such as it being dead on arrival – the process becomes glacial. Most Chinese stores won't offer a refund or ship a replacement device until the original has been received back in their warehouse, leaving the customer to pay the postage and hope to claim it back. The companies will only pay the returns postage for the cheapest tracked method, meaning the return could take weeks. On top of that, carriers often won't ship lithium batteries due to restrictions, making certain products nigh-on impossible to return.

ABOVE If a phone doesn't support "Band 20" (B20), you won't get 4G on the O2, Giffgaff, Lyca and Sky networks

Exchange rate racket

Then there's the problem of dealing in a foreign currency. Sites in China usually bill in US dollars, and although you can pay with sterling credit cards, they can incur charges – either through a poor exchange rate or transaction fees.

"[AliExpress] lets you choose to pay in US dollars or pounds," explained a spokesperson for advice-site Money Saving Expert. "However, paying in pounds means AliExpress is doing the conversion, and rates are poorer than you can get on some cards.

"We analysed the price of ten products in dollars and pounds and found AliExpress adds an average 2% fee when you pay in pounds."

The best currency to pick depends on your card's charges. According to the site, most debit and credit card companies get a good exchange rate from Mastercard or Visa, "but then add around 3% in a 'non-sterling exchange fee', so £100 of US dollars costs you £103".

In the grand scheme of things, it makes little difference, but 3% on top of VAT and delivery narrows the gap between sites in China and those in the UK. Combined with the lack of consumer protection and question marks over the quality of some kit, the idea of bargains galore in China looks less convincing.

"Although you can pay with sterling credit cards, they can incur charges"

pcspecialist

PC Specialist recommends Windows Windows 10

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THE BIGGEST DATA BREACHES OF THE 21ST CENTURY

Davey Winder examines the biggest data blunders of the century to date and the lessons we should learn from them

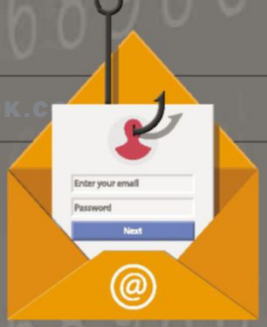
Data breaches have become so commonplace that to make the headlines, they need to be big – really big. But how do you measure size when it comes to a data breach?

The metric might be a dollar value that reflects the cost to the organisation in terms of investigation, brand damage, clearing up and even fines. Or how about the number of users involved or records compromised? For this feature, we decided to opt for the metric that we feel is most relevant to our real-world audience: impact.

We have considered what the impact has been on the organisation concerned, the users involved and the general cyber security landscape. By looking back at the mistakes that have been made, we offer advice on how to avoid repeating them in the future – and that advice is as relevant for the small business as it is to the multinational corporations.

As for our timeline of 21st century breaches, not a lot really happened during the first four years of the millennium – at least not as far as data theft was concerned. The year 2000 got off to an insecure start, though, with the ILOVEYOU worm (also known as the Love Letter or Love Bug) exploding across millions of Windows-powered computers in a matter of hours. The payload was a damaging rather than exfiltrating one: a VBScript overwriting random files on the local machine. More worms followed during the next couple of years and, in 2003, the Anonymous hacking collective was established.

But we have to wait until 2004 for the data breach mayhem to really start...



2004

AOL EMAIL THEFT

In 2004, it was revealed that a software engineer at the then internet behemoth AOL had stolen 92 million email addresses while using another employee's credentials, in a forlorn attempt to cover his tracks.

The email database, thought to impact at least 30 million AOL members, was then sold for £15,000 to a spammer, resulting in an estimated seven billion unsolicited emails that advertised an offshore gambling website flooding AOL inboxes. This makes it into our list not only because the impact on AOL users was huge, but the consequences of getting caught for stealing data were as well.

The rogue employee was ultimately prosecuted under the newly introduced CAN-SPAM legislation in the US and sentenced to 15 months in prison. He was also ordered to pay £46,500 to AOL in restitution. It was the first time that a truly large firm had suffered a data loss such as this, and that breach had been made public.

While there was little relevant legislation to protect data in the cyber realm 14 years ago, things have changed. Ryan Wilk, vice president at NuData Security, told *PC Pro* that organisations can help protect data by limiting both what is collected and how long it is kept. "While we never want to lose data that may one day be helpful, sensitive data should not be stored for no reason," Ryan explained. "Security and data analytics teams should work together to understand what data is actually needed and what data can be deleted. If you only hold what you need, and only hold it for as long as you need it, you greatly limit your risk to exposure."

2005/2006

TJX CREDIT CARD COMPROMISE

In July 2005, systems that processed and stored data related to credit card payments at the TJX group of companies across the US (and TK Maxx stores in the UK) were accessed illegally. The intruders were apparently able to continue accessing these systems unnoticed until mid-December 2006. With 96 million customers affected by credit and debit card information stolen during this period, it was the biggest such compromise ever at the time and is thought to have cost TJX, banks and insurers a total of £150 million.

It has been reported that a "sniffer" was installed on the payment network, allowing the capture of at least 80GB of card data to be siphoned off. This was transferred to a remote server, again undetected, using TJX's own high-speed network. Albert Gonzalez, a well-known hacker working as an informant for the US Secret Service at the time, was eventually convicted as the ringleader in this case and sentenced to 20 years.

The mitigation against such an attack is the same now as it was then: regular security audits to ensure best practice is followed. TJX was culpable for misconfigured wireless networks, inadequate intrusion detection, lax patching strategies and weak login systems. Multilayered protection and some measure of log analysis would have spotted the unusual data flow patterns and alerted TJX to the data exfiltration.

2007

HEARTLAND SQL INJECTION SPYWARE

Heartland Payment Systems, a US payments processing company, took the "biggest card compromise" crown from TJX after another long-undiscovered breach was finally spotted at the start of 2009. Responsible for 100 million card transactions a month, mainly on the behalf of small- to medium-sized traders, the breach compromised 134 million credit cards. Albert Gonzalez (yes, the same one) was convicted for the breach, but how did he do it?

Very easily, using an SQL injection vulnerability to install spyware on the systems. The impact of this one was not dissimilar to the TJX breach, in that it reinforced the reality that criminal organisations will steal your credit card data if possible and that lessons were not being learned by those responsible for processing transactions.

Heartland wasn't compliant with the Payment Card Industry Data Security Standard (PCI DSS) and ended up being prohibited from processing payments until four months later. As well as the reputational damage, Heartland also lost around £105 million in compensation for fraudulent payments. Again, simple things could have prevented this: the SQL vulnerability was well known and a patch had been available for years.

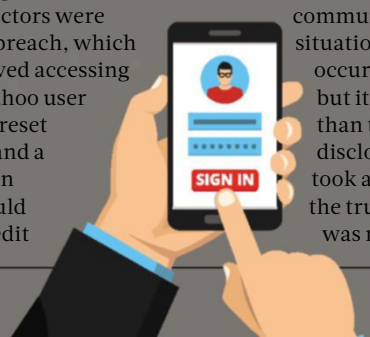
2013

YAHOO SUFFERS BIGGEST BREACH IN HISTORY

Fast forward to 2013 and the "big" label really starts to stick, nowhere more so than at Yahoo. When the firm disclosed, at the end of 2016, that a billion user accounts had been compromised in August 2013, it seemed bad enough. Eventually the true scale of the breach became known: three billion users, or every account at the time.

It is thought that state-sponsored actors were behind the breach, which likely involved accessing a backup Yahoo user database to reset passwords and a Yahoo admin tool that could access and edit information in the user database. The impact on Yahoo was huge, not least as the disclosure occurred during merger negotiations with Verizon. The value of Yahoo fell by £250 million as a result.

Most telling was the reputational damage, as Ondrej Kubovič, a security awareness specialist at Eset explained. "It was a showcase of how not to communicate in such situation. The breach itself occurred in August 2013, but it took Yahoo more than three years to disclose it. Moreover, it took another year until the true extent of the case was revealed."



2013
THE SNOWDEN WIKILEAKS REVELATIONS

In 2012, a contractor working as a systems administrator for the National Security Agency (NSA) started downloading documents containing evidence of how the US intelligence agency was collecting data from emails, text messages and mobile phone calls using the PRISM surveillance program. Edward Snowden went on temporary leave in May 2013 and, whilst in Hong Kong, met with a *Guardian* journalist.

This meeting kickstarted the public exposure of NSA surveillance methods and the publication of the now infamous WikiLeaks documents. The impact hardly needs explaining, as the true extent of nation-state intelligence gathering was a shock to the system for most people. It also damaged the reputation (such as it was) of both government and spy agencies alike.

Matt Middleton-Leal, general manager (EMEA) at Netwrix, told *PC Pro* that Snowden's leak exposes the common insider threat of privilege escalation: "An insider deliberately raises his or her level of permissions to get more access rights," he explained, and for every business the mitigation will include "tightening up access controls and informing staff of the severe consequences of any transgression".

2014
SUPERMARKET DATA SWEEP

Talking of insider threats, the 2014 Morrisons breach makes our biggest breach list not because the 100,000 employee records compromised was so large – but rather because the methodology was so unsophisticated, yet so successful.

Andrew Skelton, who worked for Morrisons in Bradford, uploaded a database of sensitive information about his fellow workers, including bank details and salaries, to an external site. He was able to access the database using the credentials of another employee and was somehow allowed to copy the data and then upload it, unencrypted, to a public file-sharing service. Morrisons was found to be vicariously liable by a High Court judge in the first successful case of a UK data leak class action suit, which was brought by 5,000 staff members.

"The fact that the breach was unsophisticated is actually what makes it so scary," said Egress Software Technologies CEO, Tony Pepper. "This ruling will have sent chills up the spines of many board members, who know that the risks of an employee leaking data are all too high. A recent survey of UK employees showed that one in four workers had maliciously leaked business data, and a further 35% admitted to sending sensitive information over email by accident."

With GDPR around the corner, organisations large and small are going to have to start taking internal access to data more seriously or suffer the financial consequences.

2015
TALKTALK DISCLOSURE FIASCO

If you thought that Yahoo made a fist of disclosing the biggest breach in history, TalkTalk managed to make them look like PR experts. The company fell victim to a SQL injection attack that enabled a cyber attacker to access data on 156,959 customers over a week in October 2015.

The Information Commissioner ruled TalkTalk had failed "to implement the most basic cybersecurity measures" and fined the firm a record-breaking £400,000. But, the real impact of this attack was that it revealed how unprepared in terms of incident response and disclosure TalkTalk had been.

Initially, it claimed the site was unavailable due to technical issues, but it wasn't until 24 hours later that it admitted that a attack may have compromised customers' data. And then things got really weird, with the media being told of a possible distributed denial-of-service (DDoS) attack being responsible for the data compromise (despite this not being possible) and this was followed by TalkTalk CEO Dido Harding insisting that stolen data wasn't encrypted nor was it legally required so to do.

"This breach highlights the importance of planning and preparing your incident response ahead of time," said Steve Lamb, head of cyber consulting for Europe at Rapid7. "Having processes and tech in place to detect the early signs of a breach really come into their own in a crisis. Effective and timely communications are important as misinformation simply makes matters worse."

2016
AUSTRALIA'S SEXUAL HISTORY LEAK

The Australian Red Cross Blood Service admitted in October 2016 that the personal data of 550,000 blood donors had been compromised. Anyone who had completed a form to submit blood between 2010 and 2016 was affected, and in the most egregious way possible. As well as names and addresses, these forms contained details of any "at risk" sexual history.

"The breach occurred due to human error, when an administrator placed a database backup on a publicly facing web server," Linus Chang, the founder and CEO of Scram Software explained. "My advice is that every SME should, at a minimum, encrypt all backup copies of data, whether in the cloud or stored locally. Primary copies of sensitive information should also be encrypted if stored in the cloud. Encryption should be done as early as possible, as copies of data can and do end up in places they shouldn't. It's the cheapest and most reliable way I know to defend against human errors."

2017
WANNACRY

No round-up of breaches could be complete without mention of WannaCry. Even though no data was exfiltrated, it was held to ransom and the impact was pretty much unprecedented.

In May 2017, WannaCry was the biggest ransomware attack ever, hitting organisations across 150 countries, including 50 NHS trusts that in some cases had to cancel non-emergency admissions and routine clinical appointments as systems were taken down. £225 million in ransoms was demanded and 250,000 systems infected.

WannaCry spread rapidly for two key reasons: it used a leaked NSA exploit called EternalBlue that targeted older Windows systems, and the available patch to protect against EternalBlue had not been installed. The real impact was in making news across the world. As Richard Walters, chief security strategist at CensorNet told *PC Pro*: "It exploited a vulnerability for which there had been a patch available since March [2017]. Using a combination of crypto-ransomware and a network worm was hardly a black swan event and, yet, it caught a lot of people out. The lesson to be learnt? Patch systems fast. SMEs need to forget about layering expensive security solutions to protect against zero-day attacks – they account for less than 0.1% of all attacks and it's highly unlikely you'll be a target. Focus on the basics first."

HOW TO AVOID BECOMING A BREACH VICTIM

Identifying what each victim should have done to prevent a breach probably isn't as valuable as looking at what *all* firms could have done to minimise the risk of such breaches.

"What most of these breaches have in common is their lack of visibility into data access," said Terry Ray, CTO at Imperva. "All major breaches, and most middle and minor ones, fail to immediately detect their breach, instead finding out weeks, months, or years after the fact, often from third parties finding breach data online."

Step one to protecting something is, therefore, watching it. "Do we find it surprising that banks have cameras not only in their public areas, but also in their vaults, arguably their most secure locations?" Terry concluded. "They have an explicit zero-trust model. Why do organisations feel the need for implicit trust models for authorised users of their data, because they believe that it's too difficult to watch all data users? It's not."

Monitoring and analytics are beginning to solve the problem, with data collection and machine learning coming together to provide insight that could prevent your business from ending up in *PC Pro*'s next biggest breaches feature...

AN IN-DEPTH GUIDE TO

UPGRADING YOUR HARD DISK

Short on space? Craving that SSD speed boost? Darien Graham-Smith explains how to choose and install your next drive

There are two good reasons to upgrade your hard disk. Perhaps you need more storage – or you want to speed up your PC by switching from a traditional mechanical drive to an SSD.

Unfortunately, upgrading isn't quite as simple as just buying a bigger disk and plugging it in: if you're not au fait with the market, you're liable to end up buying a drive that won't do the job, or that simply can't be used with your computer.

Fortunately, the mysteries of mass storage aren't hard to understand – and this is one of those increasingly rare upgrades that you can, in most cases, do yourself in just a few minutes, armed with nothing more than a screwdriver

CAN YOU UPGRADE?

The first question is whether it's physically possible to replace the hard disk in your computer. If you're using a conventional desktop PC, the answer is almost certainly yes: most systems have mountings for five or six drives.

RIGHT Once you're sure you can upgrade, find out which of the drive technologies and formats are compatible with your system

If you're using a slick all-in-one, or a business laptop, then it's a maybe. Sometimes upgradability is sacrificed in the name of a compact design: check the documentation, or have a look at user forums to see if anyone else has upgraded their hard disk.

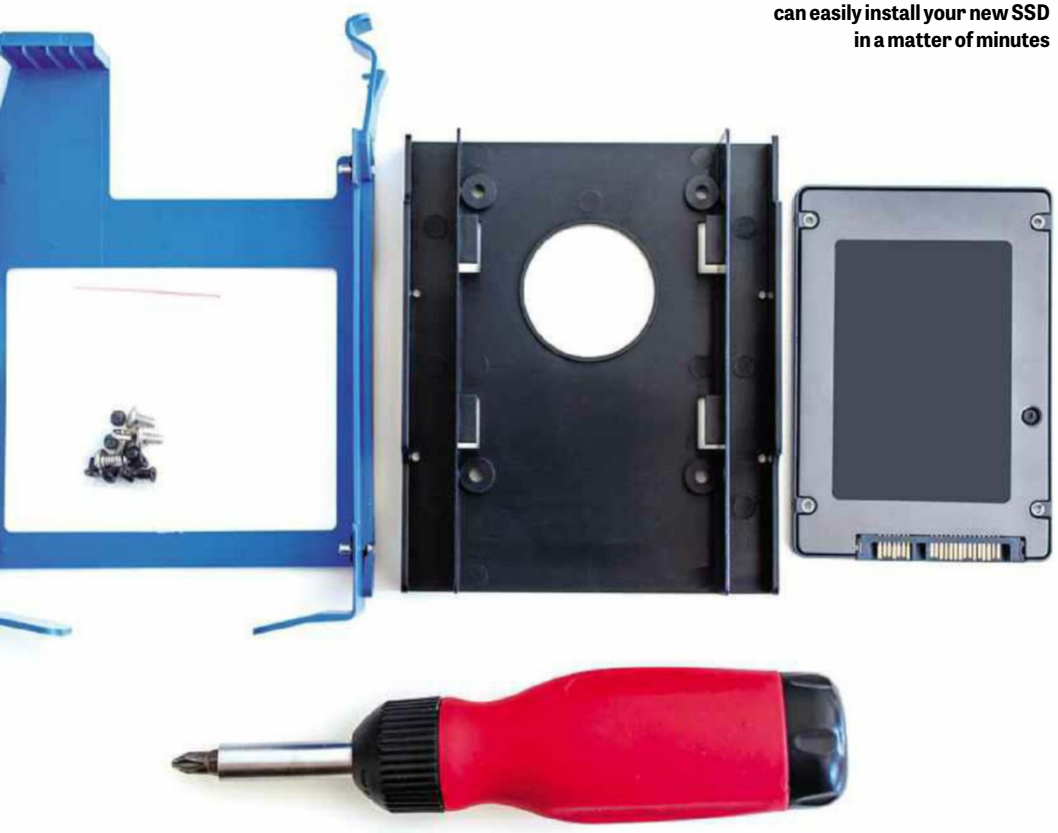
If you're using a slimline laptop or two-in-one hybrid, then alas, it's probably not possible to upgrade the hard disk. You may not even be able to open the case, and the storage may be soldered onto the motherboard, meaning you couldn't replace it anyway. The situation isn't totally hopeless, though: see the "What if you can't upgrade?" boxout opposite.

WHICH DRIVES WORK?

If you can upgrade your system, the next question is what sort of drive is compatible. There are quite a few sorts on the market, so it's worth reminding ourselves oft the various technologies and formats.

The first is the mechanical hard disk. This technology isn't very fashionable these days as it's a lot slower than any SSD. It's a heck of a lot cheaper, though – you're looking at £40 for a 1TB mechanical drive, versus around £220 for a basic SSD of the same size. For this reason, mechanical drives remain very popular as secondary drives in desktop PCs. But we can't recommend that you use one as your main system disk; the performance hit, compared to an SSD, is just too painful.

Turning to SSDs, there are two major formats to choose from. The standard SATA type is the most popular, and will work with a wide range of desktops and laptops. However, newer systems may offer an M.2 slot as well as (or instead of)



BELOW If you've got a screwdriver handy, you can easily install your new SSD in a matter of minutes

WHAT IF YOU CAN'T UPGRADE?

If your laptop has a soldered-in SSD – or if you simply can't get it open to upgrade the disk – then clearly you can't drop in a new drive. However, if there's an SD or microSD slot, you could use this to expand your storage. Buy the fastest media you can though, because the slowest cards are achingly slow – we're talking 4MB/sec, versus the 500MB/sec you'll get from a regular SSD.

Alternatively, USB 3 flash drives are getting impressively compact and capacious. The SanDisk Ultra Fit USB drive, for example, is tiny, and holds a massive 128GB for just £35 (**pcpro.link/283fit**). Remember, though, that SD cards and USB flash drives can very easily be lost or stolen. We would caution against using a device such as this as a permanent home for valuable data: at the least, if you're going this route, make sure everything is duplicated on local storage or in the cloud.

SATA – either on the bottom of a laptop, or tucked away on the motherboard of a desktop. This is effectively a miniature PCI-Express socket, with a theoretical maximum bandwidth of 32Gbits/sec, versus SATA's 6Gbits/sec, so drives using this connector can hit much faster speeds than are possible over SATA. Actual performance varies, but premium M.2 drives use a technology called NVMe that lets them deliver close to four times the speed of a SATA drive.

One last wrinkle to consider is physical size. All M.2 drives have standard dimensions, while SATA disks almost invariably use the long-established 2.5in format. However, a SATA drive might be either 7mm or 9.5mm thick. If you have a desktop system then you don't need to worry about this, but for a laptop it's an issue worth investigating – see the "Physical installation" boxout overleaf.

WHAT TO EXPECT

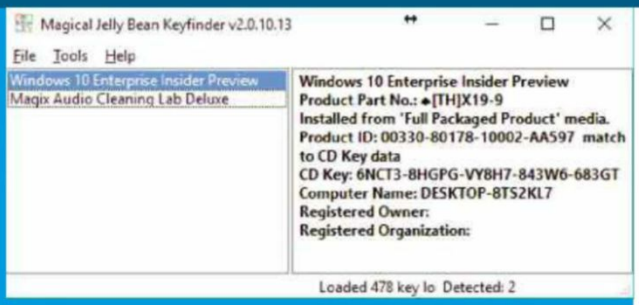
Before we get stuck into the practicalities, let's briefly run through what you can expect from your new disk. If it's connected via SATA then it should broadly be able to read and write files at the full speed of the connector – around 500MB/sec, or around twice as fast as a typical mechanical drive. Spring for a pricey M.2 drive and you can get speeds close to 2GB/sec.

The performance difference between an SSD and a mechanical disk isn't just about transfer speed, however: it has a lot to do with seek time. On a conventional hard drive, the head wastes a lot of time whizzing back and forth between different areas of the disk, as it fetches bits of data for different programs and processes. On an SSD, by contrast, all storage locations are instantly addressable – so things feel perfectly smooth and responsive, even when there are lots of programs running at the same time. The benefit is palpable, regardless of whether you choose a SATA SSD or an M.2 one.

As for capacity: it's possible to buy a 128GB SSD, but unless your needs are very modest – and you're certain that they won't grow over the next few years – a 256GB SSD is a bare minimum for Windows and a typical set of applications.

A 512GB drive is probably a safer bet, especially if you're upgrading a laptop and don't have the option of installing a secondary drive for data storage. With half-terabyte SATA units available for less than £130, it's an affordable bit of future-proofing.

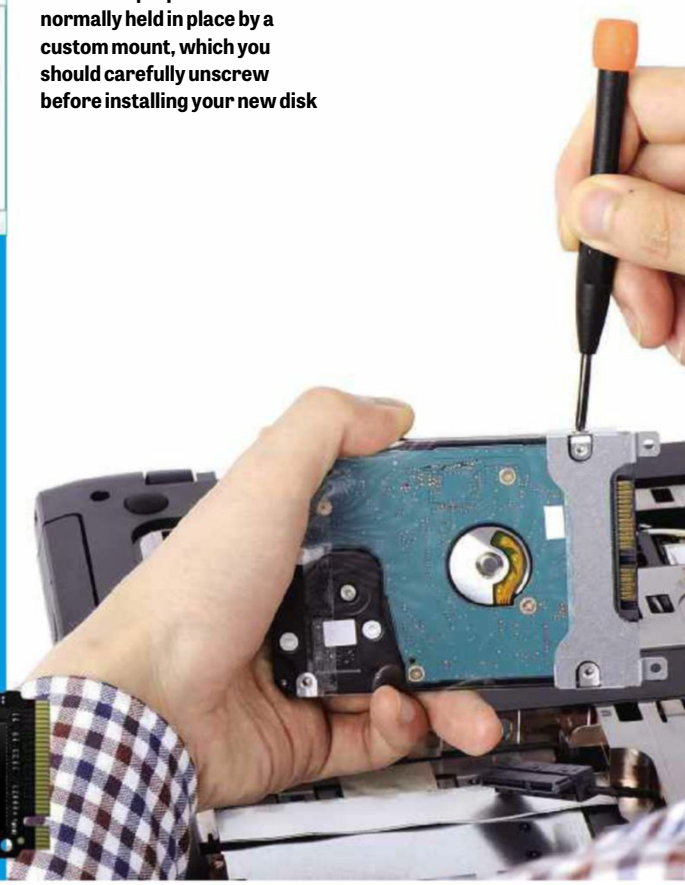
IT'S POSSIBLE TO BUY A 128GB SSD, BUT FOR MOST A 256GB DISK IS A BARE MINIMUM



RIGHT The deadly serious Magical Jelly Bean Keyfinder will discover your Windows product key free of charge...

LEFT ...or you could simply hunt down the product key sticker on your computer to validate a Windows 7/8.1 installation

RIGHT M.2 drives are a cinch to install: just push your drive into the slot and screw the retaining screw at the opposite end into place



BELOW Laptop hard disks are normally held in place by a custom mount, which you should carefully unscrew before installing your new disk

CLEAN INSTALLATION

Some people like to perform a clean reinstallation of Windows from time to time, to clear out old junk and ensure that everything's running smoothly. If that sounds good, a new drive presents the perfect opportunity to make a fresh start. However, before you dive in, there are two important issues to address.

The first is how exactly you're going to install Windows on your new drive. Do you happen to have an installation disc lying around? Didn't think so. Happily, this isn't the problem it used to be, as Microsoft now offers ISO images of Windows 7, Windows 8.1 and Windows 10 on its website for direct download, along with a handy Media Creation tool that can be used to burn the images to a DVD or a USB flash drive (you'll need a capacity of at least 4GB for Windows 7 or 8.1, or 8GB for Windows 10).

If you're reinstalling Windows 10, the installer should automatically recognise that your PC has previously been activated, and reactivate without issue. For Windows 7 or 8.1, you'll need your product key to validate the installation. If this isn't printed on a sticker on your computer, you can discover it using a free tool such as Magical Jelly Bean Keyfinder (**magicaljellybean.com/keyfinder**).

One quick tip for Windows 8 users: if your product key is for the original Windows 8 (rather than Windows 8.1), it might be rejected by the installer. You can get around this by providing a generic key to get through the setup procedure, then changing it to your personal key once Windows is up and running. A list of usable keys can be found at **pcpro.link/283win8**.

With your Windows installation media sorted, the other question is how you're going to get your personal data from the old drive onto the new one. If you have an external hard disk or a NAS appliance, one option is to simply copy everything onto there by hand, then copy it back onto your new disk once it's up and running.

BELOW If it's extra space you need, rather than speed, consider investing £35 in this 128GB USB stick

A more elegant approach is to copy your files directly from the old disk onto the new one. If you're on a desktop, this is easy: connect the old drive to a spare SATA port and it'll pop up as a secondary drive in Windows, so you can drag-and-drop files as you please. If you do take this route, check your BIOS settings to make sure that Windows boots from the new drive and not the old one.

If a spare SATA port isn't available, another possibility is to connect the disk via USB using a cheap external adaptor. For a 2.5in drive, this should cost less than a tenner online – but make sure the model you choose supports USB 3, as your files will take an age to copy over USB 2. Caddies for 3.5in drives are a bit more expensive because this type of drive requires an integrated power supply, but you're still only looking at an outlay of around £20.

CLONING AND IMAGING

If the clean-installation route doesn't appeal, it's time to get cloning –

PHYSICAL INSTALLATION

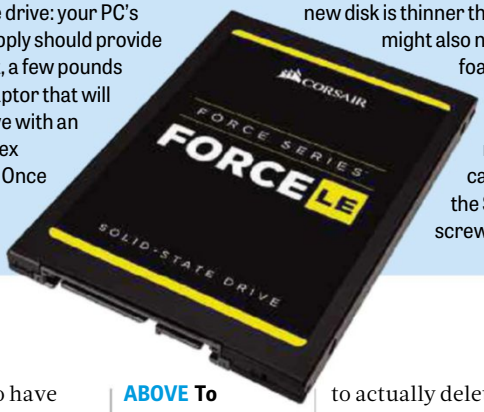
Installing a new hard disk is normally easy, but the specifics vary from case to case. Simplest of all is an M.2 drive: simply push your drive into the slot, and screw the retaining screw at the opposite end into place. M.2 drives are notched, so you physically can't insert them the wrong way around.

To install a 3.5in SATA hard disk in a desktop, you'll need to connect it to the motherboard using a 7-pin SATA data cable; these cables are reversible, and the plugs are L-shaped, so again it's very hard to get wrong. If you're replacing an older disk, it's a good idea to connect the new one to the same SATA port on the motherboard. Steer clear of legacy SATA 2 ports, though, as these are only capable of half the speed of regular sockets.

You'll also need to plug a 15-pin SATA power connector into the drive: your PC's internal power supply should provide one of these. If not, a few pounds will buy you an adaptor that will let you use the drive with an older four-pin Molex power connector. Once you've got both cables hooked up, slide the drive into an available bay in your desktop case and screw it firmly into place from both sides.

With a 2.5in SATA SSD, the procedure depends on what you're putting it into. For a desktop system, it's exactly the same as above. The only difference might be that if your case doesn't have a dedicated 2.5in bay, you'll need an adaptor to make it fit it into a 3.5in bay. Or, you can just screw it into one side of a 3.5in bay and leave it hanging – this should be secure enough, as long as you don't regularly move your PC around.

On a laptop, the hard disk is normally held in place by a custom mounting: unscrew this, then pull the drive carefully away from the SATA data and power connectors to disconnect it. Then, attach the mount to your new drive; if the new disk is thinner than the old one, you might also need to affix plastic or foam spacers – these are often provided with the drive. Finally, drop the new disk into the drive cavity, push it firmly onto the SATA contacts and screw it into place.



ABOVE To install a 3.5in SATA hard disk in a desktop, connect it to the motherboard via a 7-pin SATA data cable – it's a piece of cake

copying everything from your old disk, including your OS, applications and personal data, onto the new drive. You'll need some third-party software to achieve this, but there are reliable tools to choose from – such as O&O DiskImage 11 Professional, which is included with the bonus download edition of this month's *PC Pro*.

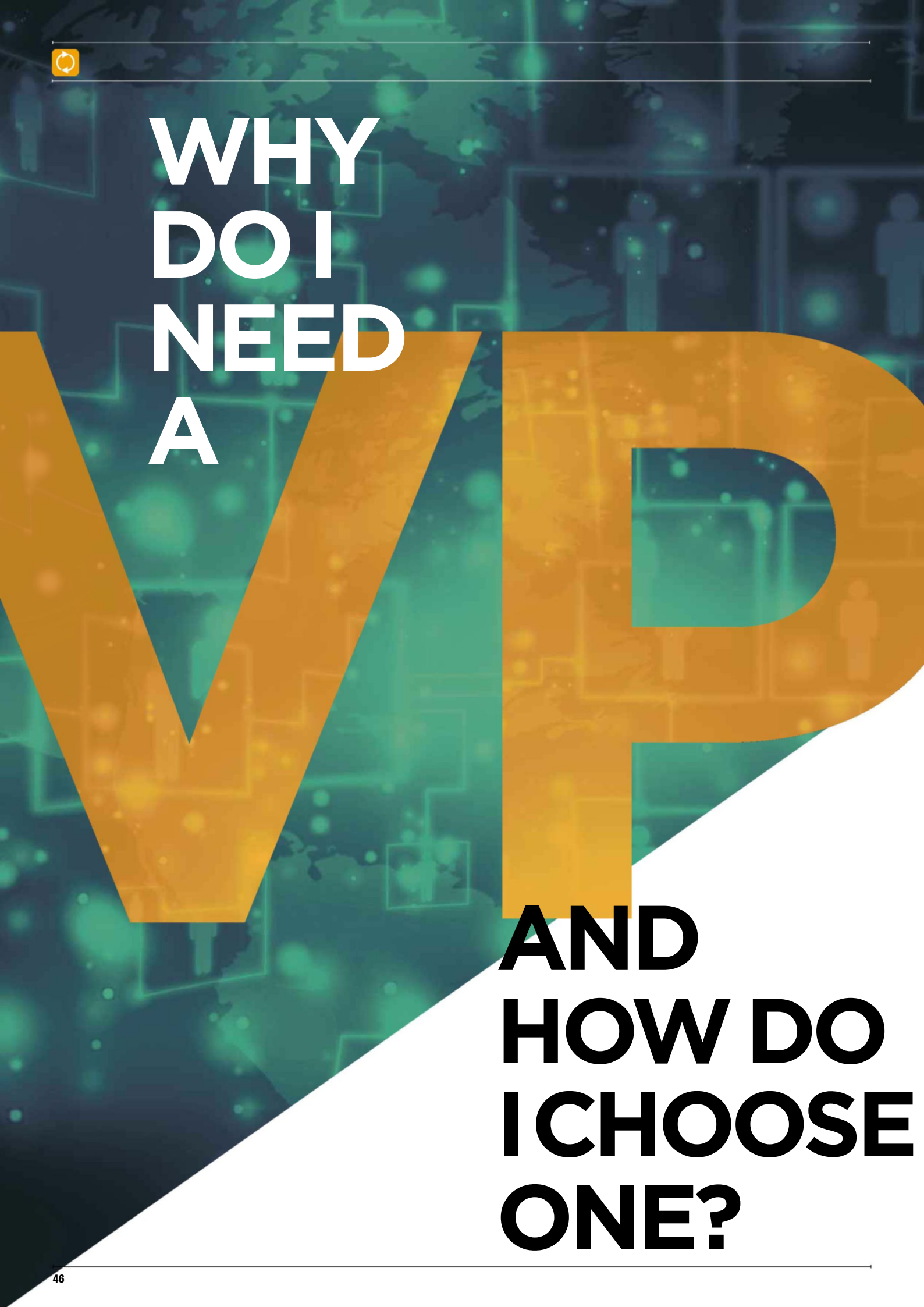
If you're going down this route, there are – once again – just two things you might need to think about. The first is to do with space: if you're upgrading from an old mechanical drive to an SSD, your new disk might be smaller than the old one. Consider clearing out some old files, or moving them off onto remote storage, to ensure that everything fits comfortably onto the new drive.

The other potential gotcha is that cloning requires both the source and destination disks to be connected at the same time. That's no problem if you're using a desktop system, but on a laptop or an all-in-one it may not be possible. You can't hook up your destination drive via USB either, as the cloning software needs to have low-level write access to it.

No need to panic, though – the answer is easy. Rather than directly copying one disk to another, you can simply create a virtual image of your original hard disk, then swap over the drives and write the contents of the image to the blank drive. All you need is an external drive that's big enough to hold the image, and a bootable USB stick or CD containing the imaging software (which you can create with a few clicks from inside O&O DiskImage 11 Professional). The imaging approach also means you can choose which files to include and exclude from the image, to ensure it fits on the destination disk, without having to actually delete them from your source disk.

Once you've imaged the drive, it should work like its predecessor; just make sure you image the entire disk, and not the Windows partition alone, as the correct layout is needed to make it bootable. If you're running Windows 7 and have moved from a mechanical drive to an SSD, open the Windows Experience Index tool and hit "Re-Run Assessment" so Windows recognises that the drive type has changed. This will make it turn off auto-defragmentation and enable TRIM, to prolong the SSD's life and keep it running at peak performance. Later versions of Windows will work this out for themselves.

A NEW DRIVE PRESENTS THE PERFECT OPPORTUNITY TO MAKE A FRESH START


WHY DO I NEED A VP AND HOW DO I CHOOSE ONE?

VPNs

Protecting your privacy online – it's not just for criminals and hackers. Nik Rawlinson explains why we should all take steps to cover our tracks

Virtual Private Network (VPN) technology is perhaps best known as a sneaky way of spoofing your location so you can watch Netflix US in the UK. It's also a valuable tool for any business with a mobile workforce, allowing employees to access the company network without having to worry about remote security.

But even if you're not trying to hide your location, or log into a corporate server, installing VPN software and subscribing to a reputable service is a must – because the number of threats to your online security is growing.

For example, it's alarmingly easy easy for criminals to spoof a Wi-Fi network, setting up a dummy hotspot that looks like the real deal, but which allows them to spy on any data that passes between the computer and the net. Your passwords, credit card information and more could be at risk – and if you're working remotely, sensitive customer information could also leak. That can be disastrous for your business, and it could leave you open to blackmail, or punitive fines for failing to uphold your data protection obligations.

VPNs reduce your exposure enormously, by encrypting your connection from end to end. The data that passes between your laptop, tablet or phone and the public access point is secured, and immune to even sophisticated eavesdropping. It goes without saying, however, that you do need to trust your VPN provider. And with so many to choose from, how you do pick the right one?

YOU (OFTEN) GET WHAT YOU PAY FOR

When choosing a VPN, price is an obvious comparison point – but the cheapest option almost certainly isn't the best. It costs money to operate a VPN, so if you find a provider offering free or very cheap services, ask yourself how they're paying the bills.

Because let's be clear: although the connection between your laptop and the VPN is secure, the provider can see everything you're doing, and can even interfere with your traffic. We haven't heard of a reputable VPN provider actively snooping on its users' data, but unscrupulous providers could insert their own content (such as adverts) into the download stream, or selectively throttle access to certain sites and services.

For these reasons, we would always recommend signing up with a paid service. You're buying peace of mind, and an expectation of support when required.

LOCATION, LOCATION, LOCATION

Consumer VPNs often advertise the availability of exit nodes in a wide variety of countries. This is useful for accessing sites or streaming services that might not be available in the UK.

In a business context, that probably isn't such a concern – but geographic reach is still an important issue. If you work with sensitive data that you don't want to slip outside the legal jurisdiction of your home country, a VPN allows your staff to work from anywhere in the world, without a risk of the data being intercepted by local agencies. It's vital to ensure your provider has access points where you need them.

A related issue is capacity. VPNs are becoming more and more popular as users become aware of the dangers of going online unprotected, so a provider that doesn't have plenty of servers in the right places is likely to be slow today and slower tomorrow.

Since different providers have different numbers of subscribers to accommodate, it's impossible to say how many servers is "enough" – but ask your chosen provider about load and availability, and don't be swayed by companies that advertise thousands of servers without saying how many users they're shared between.

PRIVACY AND THE LAW

When it comes to jurisdiction, it's not only the outlets that are important: you also need to consider the national base of your chosen provider. The UK, US, Canada, Australia and New Zealand all operate under the "Five Eyes" (FVEY) agreement – described by Edward Snowden as a "supra-national intelligence organisation that doesn't answer to the known laws of its own countries". In short, these countries routinely share surveillance data – and have been known to help one another out by spying on each others' citizens.

So, if you choose a VPN provider based in the US, your online activities might not be immediately recorded within the UK. But if the British authorities want to know what you've been up to, they can easily ask their US counterparts to subpoena the provider's records and pass them back to the UK authorities.

FVEY isn't the only formal data sharing agreement in operation. There are additional "Nine Eyes" and "Fourteen Eyes" arrangements involving Belgium, Denmark, France, Germany, Italy, the Netherlands, Norway, Spain and Sweden. And while close allies such as Japan, Israel and South Korea might not have a legal obligation to share surveillance information, they may choose to do it anyway.

In short, if you really want to keep your browsing habits to yourself, you'll need to find a provider based in one of the world's more obscure jurisfictions – such as NordVPN in Panama, Perfect Privacy in Switzerland or ExpressVPN in the British Virgin Islands, all of which operate beyond Fourteen-Eyes territory.

THE ISSUE WITH LOGS

While the standard advice is to steer clear of FVEY countries, there may be benefits to choosing a provider that co-operates with the law. Back in 2011, UK-based VPN provider Hide My Ass (**hidemyass.com**) was forced to hand over logs relating to the online activity of a user who had been been implicated in several major hacking operations. Some users were outraged at what they saw as a betrayal of their trust, and declared their intention to switch to a service that didn't store such logs.

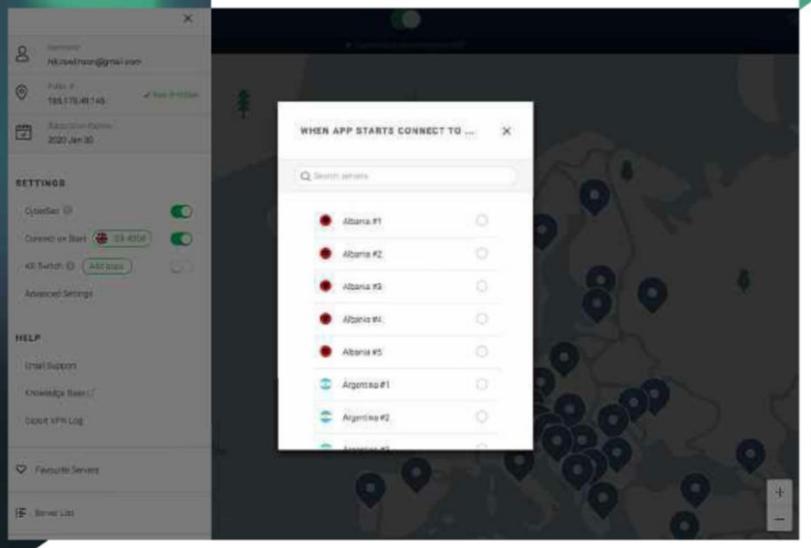
Yet, as the company made clear on its blog (**blog.hidemyass.com/lulzsec-fiasco**), no-one ever promised that using a VPN would make you untouchable. "It is very naive to think that by paying a subscription fee to a VPN service you are free to break the law without any consequences," it explained. More significantly, HMA pointed out that services claiming to keep no records at all "are more likely to have their entire VPN network monitored and tapped by law enforcement, thus affecting all legitimate customers".

For the record, Hide My Ass states that it only logs the times at which users connect to and disconnect from its service – purely for the sake of identifying abusive users – and doesn't store any details of what you're actually looking at.

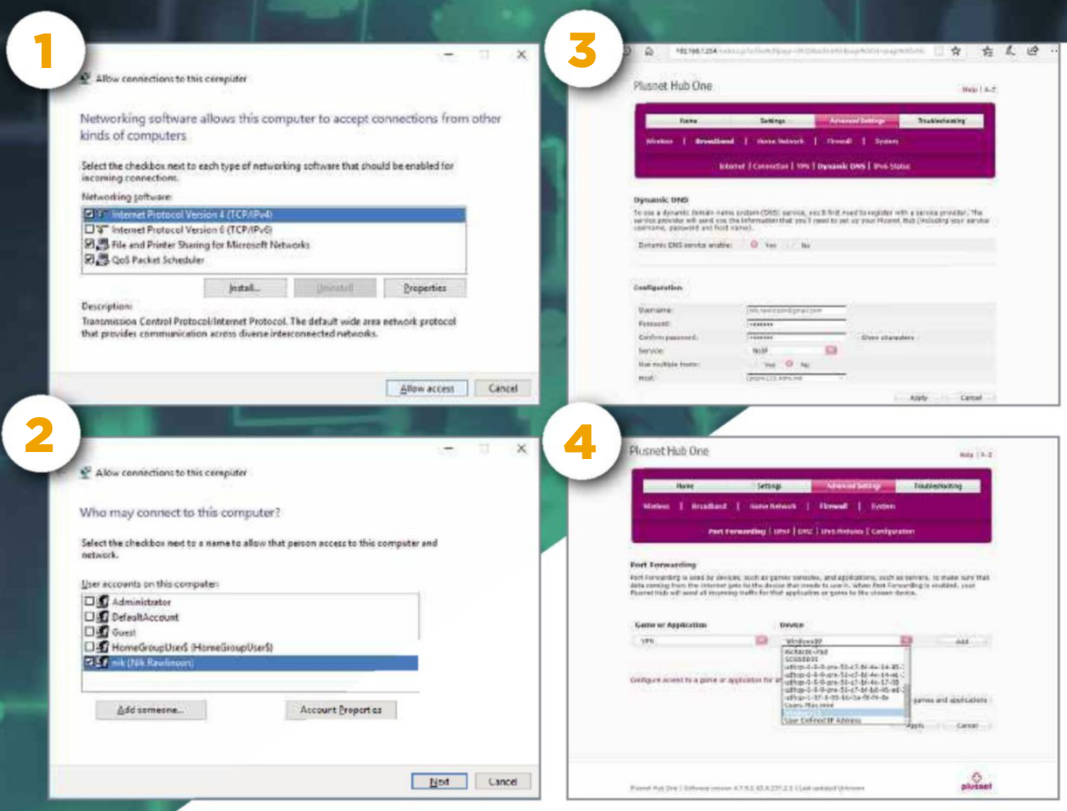
ADDITIONAL SECURITY

If you're concerned that the VPN service you're using isn't entirely secure, or you want the highest possible degree of anonymity, it's possible to connect to multiple VPNs in sequence, feeding their data through each other and heavily obfuscating your location and identity.

You can do this manually, by signing up with several providers and connecting to each one in turn without disconnecting any that are already active. A more elegant solution is to use a dedicated multi-hop (or "cascade") service, which will automatically route your traffic through a series of anonymising servers. Anybody wanting to intercept your data would need to compromsie multiple different networks to obtain anything useful. Romanian provider VPN.ac implements double hops, while Switzerland's Perfect Privacy can route your connection through up to four servers in sequence.



BELOW Ensure your provider has enough servers to cope with its subscriber base



powerful VPN, offers a dedicated IP address and dedicated server on its Business Cloud service, which starts at £320 per year.

It's also possible to set up your own VPN server: the feature is conveniently built into Windows 10, and can be configured in just a few simple steps:

1 Open Control Panel and use the search box to find Network Connections. Pick "New Incoming Connection…" from the File menu and, on the pane that launches, choose which users should be able to use the VPN server you're setting up.

2 Click Next, confirm that you want connections to come over the internet, then click Next again. Choose which networking options should be accessible remotely (leave at least TCP/IPv4 ticked), then click Allow Access. Your VPN is now active.

BEYOND THE VPN

While a VPN prevents outsiders from spying on your active connections, it offers only partial protection against services that track you using cookies, or by analysing your system configuration. After all, if the sites you visit can positively identify you, that negates some of the privacy benefits of running a VPN in the first place.

VPN providers often provide additional security features to close off such tracking methods. NordVPN incorporates an optional service called CyberSec, which not only intercepts cookies, it also blocks ads and malware. Even better, it can cut the link between DDoS command servers and an infected PC, by checking a list of servers found to be hosting malware or DDoS control points, before passing on a user's domain look-up request to the DNS server. Any positives will throw up a warning, and unless the feature is disabled through the VPN settings, you won't be able to proceed any further. This gives you an opportunity to deal with the infection, and saves bandwidth too.

BUSINESS VPN ADMINISTRATION

Several VPN providers offer packages tailored for business users, which simplify onboarding staff and managing both billing and use.

One popular choice is Tunnelbear (**tunnelbear.com/teams**), as recommended by privacy-focused search engine DuckDuckGo (**spreadprivacy.com/how-to-choose-a-vpn**). Team subscriptions offer centralised billing, easy user management and flat pricing, at $69 per user per year. Each user can connect up to five devices simultaneously.

VyprVPN, which bills itself as the world's most

ANONYMOUS PAYMENTS

If you don't want anyone to know you're using a VPN, some providers accept anonymous payments using gift cards. Private Internet Access accepts Top Shop, House of Fraser and Dorothy Perkins vouchers, among others – an option that may appeal to self-employed and one-person businesses. A £32 Top Shop voucher gets you 309 days of service.

3 To make it easier to connect to your VPN server, it's a good idea to sign up for a free dynamic IP address. These days this feature is likely to be built into your router, so you can configure it from there. For example, on BT and Plusnet hubs you'll find the relevant settings in the Advanced Settings section.

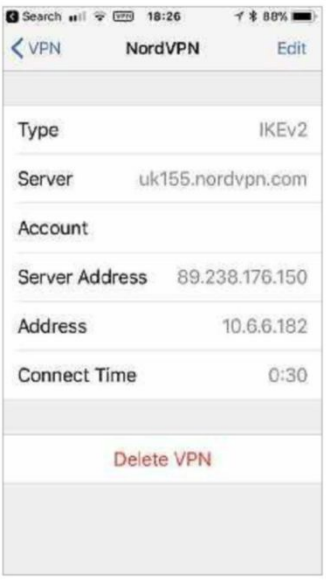
4 Finally, you need to tell your router to forward incoming connections to the VPN server. If there isn't a predefined VPN option, you'll need to create a new rule to forward incoming connections on port 1723 (Point-to-Point Tunnelling Protocol) to the machine hosting your VPN.

ALL-ROUND PROTECTION

Don't make the mistake of thinking that a VPN is only for your PC. Most VPN providers allow you to make at least two simultaneous connections, so you can also use it on your phone or tablet when you want to connect to a public Wi-Fi hotspot.

You don't even need to download an app: both iOS and Android have VPN support built-in. On iOS, you can find it under Settings | General | VPN; on Android it will be in your Wireless and Networks settings, although the precise location varies on different devices. Once you find it, just enter the server and login settings – and perhaps download and install a security certificate if prompted – and you're ready to browse in safety.

BELOW iOS and Android both have VPN clients built in, so there's often no need to use a dedicated app



Reviews

The biggest, best, most exciting products in tech – tested, evaluated and reviewed

Windows Mixed Reality

Now six months old, is there enough to recommend Microsoft's version of virtual reality versus the rest?

SCORE ★★★★☆

PRICE Free with Windows (software only)

When Facebook bought Oculus Rift for $2 billion back in 2014, I suspect it set off familiar "we've missed the boat" ripples in the Microsoft boardroom. While January 2015 saw the announcement of its futuristic HoloLens, it took a further two-and-a-half years before consumers could enter Microsoft's virtual realm: Windows Mixed Reality (WMR).

It's a bit of a shame, then, that the launch was more of a pfftt than an explosion. WMR was released as part of the Windows 10 Fall Creators Update in October 2017, when Microsoft also announced "a range" of Windows Mixed Reality headsets. It was easier to grab Lord Lucan for a chat than to get hold of a headset to test, though, and when it came to content it was all jam tomorrow.

That jam looked very tempting indeed, though, with the promise of support for Steam VR games to accompany the native VR apps and games that would surely arrive soon in the Windows Store. We waited. And waited. The jam began to look crusty.

Over the "holiday" period of late 2017, however, things started to change. The headsets arrived, even if we Brits only have access to four compared to five in the US (Samsung introduced a high-end version, equipped with an OLED rather than LCD screens, to partner its Windows laptops, but these aren't sold in the UK). As promised, Steam added support for WMR. And, slowly, more apps and games started dripping into the Windows Store.

Now, with the scent of spring in the 2018 air, it's time to ask whether we should be taking Windows Mixed Reality seriously. In this in-depth review, we not only look at the WMR experience, but assesss the four available headsets, plus a PC and laptop that are perfect for VR.

First steps

This brings some obvious questions: what is Windows Mixed Reality anyway? How does it differ from virtual reality and augmented reality? What does it offer over Oculus Rift and the HTC Vive?

In many ways, it's identical to both of those offerings. Right now, unless you can afford a HoloLens (*see p53*) along with your second Learjet, Windows Mixed Reality is virtual reality within a Microsoft environment. It is, in fact, a Windows Store app like any other. It's just that

Anatomy of the WMR controllers

While you can theoretically use Windows Mixed Reality without the Bluetooth controllers, that's only true in the same way that you could, theoretically, use Windows without a keyboard.

Little wonder, then, that if you buy a WMR headset from the Microsoft Store then they all come bundled with controllers. And, aside from the manufacturer's logos, they're all identical. That's fine, because they're comfortable to hold and look suitably futuristic, with the dots of light sprinkled around the edges lighting up to show they're on and connected.

In contrast to the simple console-style controllers of the Oculus, there's a panopoly of controls here. There's a touchpad, a thumbstick, plus various buttons at the back and side.

All these controls shift function depending upon the game and environment you're in, which should make them deeply confusing to use, but in practice they're surprisingly intuitive. It helps that the trigger is sensibly mounted at the rear.

What's universally annoying, though, is the way the controllers chew through batteries. Microsoft supplies four AA batteries, two per controller, but they'll need replacing within a few hours of use.

this particular app requires the use of an approved WMR headset (*see p54*).

These are all based on a reference Microsoft design. The colours and contours may be different, but fundamentally all four headsets are more like identical quadruplets than brothers. It's just that they're wearing different clothing.

So they all share the same core ingredients. That's a pair of circular, 90Hz 1,440 x 1,400 LCD panels (one for each eye); HDMI inputs; a 3.5mm jack for connecting earphones; an adjustable headstrap; and a flip-up mechanism, so you can check your real-life environs without unstrapping the headset.

Plug any of these devices into a USB 3 port and HDMI output, and the WMR app will start. Or at least, that's the theory. Your computer will need to be running the Fall Creators Update of Windows 10, and you may find you need to unplug your chosen headset a couple of times to persuade it to be recognised. You'll also need to pair the Bluetooth controllers (*see above right*) with your system.

Assuming success, you'll be asked whether you want the "full" experience, where you can walk around, or a sitting-down version – with the former obviously being preferable. On selection, you're asked to walk around the available space you have to play in, to create a virtual boundary. During play, a wireframe wall will appear whenever you step too close.

The headset experience

With all the headsets being based on the same Microsoft design, it's no surprise that the experience of wearing them is almost identical.

They all include enough space to accommodate glasses, which I wore throughout testing. You might expect things to get uncomfortable, but I found it was possible to wear the lightest headsets (from Acer and Lenovo) for half an hour without really noticing them. The only annoyances were pressure on my nose, which meant I occasionally had to fiddle with the headset to make it comfortable, and that sometimes my glasses were pushed down so text looked out of focus.

The big plus of WMR headsets, compared to the Vive or Oculus Rift, is that you don't need external sensors to avoid bumping into objects in your room. Along with the boundary area you set up, a pair of low-resolution cameras keep a look-out for obstacles (it's called "inside out tracking" in VR parlance). Naturally, you're also bound by wires, but a generous 4m cable means you can have a large rectangular area to work within.

ABOVE Meet Cliff House, Microsoft's VR environment that includes a big-screen den for watching films

"Unless you can afford a HoloLens along with your second Learjet, WMR is virtual reality within a Microsoft environment"

All the currently available headsets include a 3.5mm jack for adding your own earphones or headphones (the latter should slip easily over the top strap), with the promise of spatial awareness via sound – but I never found this to be very effective.

Cliff House

With your headset on, and your real-world boundary set, the Mixed Reality app takes you through a couple of basic orientation steps – for example, introducing the controller-mounted buttons that you use to fire weapons, select objects and activate controls in VR apps. Then you'll hear the tweeting of birds: you have arrived in Cliff House.

I think of this as a Windows desktop translated into 3D, because you can place shortcuts (say, for the Edge browser or Windows Store) in a similar way to how Windows has always worked. It's much slicker, though, and also offers options to add decorations, objets d'art and weird "live" holograms such as mime artists.

It's a polished offering, but it won't be long before you grow bored and wonder what else you can do in Windows Mixed Reality other than explore your virtual home.

What to do

Thankfully, there's an easy way to find out. Pressing the Windows button on either controller – usefully, you can glance down and "see" the controllers in the virtual world – will bring up a menu for shortcuts such as Edge, Cortana and Skype. The one we're interested in here, though, is the Windows Store, because this is the gateway to the Microsoft-sanctioned VR activities on offer.

Browse through the available Mixed Reality apps – there's a separate category within the store – and you can download them directly (or, if you prefer, via the Windows Store in its normal guise). Once installed, you can add a shortcut to your house and click on it. And then, rather surreally, the Cliff House world will fade to black, as a new 3D environment appears.

Exactly what this is depends on the app you choose. For instance, *Galaxy Explorer* – made by Microsoft – places you in the midst of space. A short demo helps you place Earth as your home, and then you're considered ready to explore this weird galaxy in which we live. You can shoot off to Alpha Centauri, for instance, and see planets spinning in front of you while a narrator provides an overview of what we know.

The majority of the apps aren't as slick, however. For example, there's an app called *Walk the World*, which promises that you can "explore anywhere in the world" using OpenStreetMap, Bing Maps and Google Maps. It's clunky, though, with the one current review describing it as the "poor man's Google Maps VR".

At least *Walk the World* is free. Many cost over £10 for no discernible reason, with few offering a trial option so you can check whether they're worth the price. And because Windows Mixed Reality is yet to hit the big time in terms of numbers, you'll be extremely fortunate if you can find any reviews from buyers.

To start with, then, you may find yourself watching one of the free short 360-degree animations. For example, *Asteroids! VR* is a cute 11-minute tale of aliens struggling to avoid asteroids in deep space. Or there's The Rose and I, which allows you to explore the lonely moon where she resides.

And, naturally, there are games. I've shared a couple of my favourites from the Windows Store in 3 starter games for Windows Mixed Reality (*see right*), but, with rare exceptions, the same caveat applies about needing to pay before you find out how good a game is. Which is why the inclusion of Steam is such good news.

ABOVE Decorate Cliff House how you see fit, right down to mime artist holograms

Steamy Windows

If you have a couple of minutes to while away, check the available VR games from the Windows Store. Then check what's available on Steam. You'll soon realise why it's such good news that you can download and run games directly from Steam that will work on your Windows Mixed Reality headset.

I would be lying, though, if I suggested it was a seamless

BELOW There's something oddly compelling about playing pinball in VR

3 starter games for WMR

Pinball FX2 VR

£10.99 from Steam

This is the one game that keeps drawing me back into virtual reality. While standing in front of a 3D pinball machine is never going to be quite the same as the real thing, it's surprisingly close – and also allows for added atmosphere, such as an underwater feel in one of the sea-themed machines. You can buy an extension pack for £20, but £11 buys access to three machines, which is plenty to start off with. I'm still trying to get to grips with the fiendish Epic Quest machine...

Tiny Town VR

£10.99 from Steam

This is one for the kids. It's a weird mix between Minecraft (which is also available in VR, but isn't as well implemented), Lego and Sim City, allowing you to design your own, well, tiny town. Add buildings, create roads, build an airport, a farm – whatever your brain thinks of.

One of my sons decided to create an odd tribute to King Kong, with a giant clutching a hostage while being attacked by planes. As this indicates, Tiny Town VR may sound like a simple game, but it has the potential to keep children occupied and their imaginations active.

Serious Sam VR: The Last Hope

£29.99 from Steam

If there's one game that demonstrated to me just how much more visceral VR is compared to normal gaming, it's *Serious Sam VR*. Obviously, I was aware that this was a game – the clue being my transportation to a different world and the stream of alien creatures attacking me – but there's something about looking down and seeing something biting your ankles that makes everything feel more real than on a normal screen. My heartbeat leapt up to over 150 whilst I was playing: if you need an adrenalin blast, this is a great game.

experience. Assuming you have a Steam account, and the software already on your system, you now need to download "Windows Mixed Reality for SteamVR" via Steam itself. After installing it, you'll then need to run the Windows Mixed Reality environment as normal, and then load the game. Even then it won't always work and you'll need to restart WMR.

It's a pain, but it's worth jumping through the hoops to gain access to the games. If the game supports Windows Mixed Reality – and the vast majority do, as indicated by a small Windows icon – then you should be able to run them without fuss. The sole exception I found was *LA Noire: The VR Files*, which I couldn't persuade to run. Microsoft has much to thank Oculus Rift and HTC for: it's inherited a ready-made VR gaming platform.

Valve also appears keen to make the experience slicker, with a couple of bugs fixed via an update during the time I was conducting this review. I particularly like the way it has built a virtual extension to Cliff House, where you're transported when you load SteamVR for Windows from within Microsoft's environment. From here you can check out all your downloaded Steam games.

Need for speed?

One thing that distinguishes Windows Mixed Reality from Oculus Rift and HTC is that Microsoft has lowered the bar when it comes to PC requirements. You don't even need a dedicated graphics card to take advantage: if your computer can run the not-terribly-demanding Cliff House environment at 60fps then it will be deemed to pass muster. You can test it for yourself by downloading the Windows Mixed Reality PC Check from the Windows Store.

Not unusually for Microsoft, it then muddies the waters by creating a class of Windows Mixed Reality Ultra. You'll need a discrete graphics chip for this, because it must be able to run a VR environment at 90fps – while 60fps should be enough to avoid nausea, the increase to 90fps adds certainty.

Really, though, you're not going to have a pleasant VR life unless your computer can hit the green "Ready" mark in the SteamVR Performance Test (downloadable from Steam). For example, our PC Specialist system (*see p56*), with a desktop GeForce GTX 1060 equipped with 6GB of RAM, hit 7.9 in the test – that equates to a "High" quality rating. The Scan laptop managed a "Very High" 11 while the Surface Book 2 15in, with its mobile GeForce GTX 1060, was deemed "Ready" with a High rating of 7.

So how much speed you need will depend on how demanding the apps you use are. As with any "normal" demanding 3D game, you'll need a fast pairing of processor and graphics chip to get the most enjoyable experience. The difference here is that frame rates are never sacrificed, so image quality is dropped instead.

BELOW Mixed Reality isn't just for adults, with child-friendly games such as Tiny Town VR on offer

Is WMR ready for the mainstream?

Despite the many pluses, I fear for the future of Windows Mixed Reality. Microsoft is sending out mixed signals to developers, with blogs focusing on the HoloLens rather than the WMR environment for consumers. Indeed, you have to search quite hard to find much talk about WMR on Microsoft's websites as a whole.

This makes me suspect WMR will fade into the background in time, but what it has done is given the big PC makers – Acer, Dell, HP, Lenovo and Samsung – a foothold in the consumer VR world, which until now was dominated by HTC and Oculus. (It's worth distinguishing consumer from corporate here, because HP in particular has created VR-focused workstations for some time.)

In doing so, it's also driven down prices. The Oculus Rift is now £399, as is the HTC Vive, and I look forward to seeing what price (and how good) the HTC Vive Pro will be when that's released later this year.

The question then becomes whether WMR is ready for the mainstream, and whether it's worth forking out somewhere between £300 and £400 for any sort of headset.

I certainly wouldn't pay £400. If you look on the Microsoft Store at any one time (or head to Amazon) then you're likely to find a headset on offer. And, as my mini-reviews of headsets overleaf shows, there's little to choose between them.

In actual reality, if you buy now you'll be an early adopter – with all that entails. First-generation hardware that's likely to be improved, probably within the year; an uncertain future for Windows Mixed Reality as a platform; a thin, albeit growing, selection of things to do with the new product from the Windows Store.

But, on the other side, you're an early adopter. You'll get to play with a developing platform as it grows, and due to the compatibility with Steam you can gain access to the latest games as they're released. Worth a £300 gamble? I'm virtually certain the answer is yes. **TIM DANTON**

What about HoloLens?

Big companies and developers can already buy early editions of Microsoft's HoloLens. This is a true augmented reality device, with all the computing power built into the glasses.

I've tried HoloLens – under strict supervision from Microsoft – and in many ways was impressed by the way it overlaid reality in specific apps. The best example was an architectural project, where you could zoom into the building, add or remove walls, and generally get an idea of what the final build would be like. The narrow field of view (the amount of viewable area you can see with digital images projected upon it) limits its use, though.

It doesn't help that Microsoft set unrealistic expectations at the launch of HoloLens, with an on-stage demo showing what it would be like to play Minecraft using this augmented reality technology. It looked slick, with no sign of the restricted field of view that I saw in my hands-on demo. HoloLens is a great, promising technology – but it's not available in the mainstream yet, and currently appears to have industrial rather than leisure applications.

If you're tempted, however, then you can buy the HoloLens Development Edition for £2,719 from **pcpro.link/283holo**.

Mixed Reality headsets

There are four Windows Mixed Reality headsets available in the UK. **Tim Danton** puts them all through their virtual paces

Acer Windows Mixed Reality Headset

SCORE ★★★☆☆
PRICE £333 (£400 inc VAT)
from microsoft.com

This is the cheapest-looking WMR headset, with a striking blue design that's positively in-your-face compared to the futuristic HP. It's quite light, feeling identical to the Lenovo Explorer when worn. Indeed, the only way I could tell the difference with my eyes closed was by feeling the texture of the cushioning fabric on the headband.

It seems highly likely that both headsets are made in the same factory, with the same design of foam around the side of the goggles. Don't worry about this coming off, though, because it's designed to strip away and perhaps even be replaced in the future: it unpeels like Velcro, so that's easy enough to do.

With all these WMR headsets sharing nigh-on identical internal components, the Acer is a fine choice so long as you're happy with the colour. Especially as it's the only headset that bundles any games: two VR twists on *Ghostbusters*.

Dell Visor Windows Mixed Reality Headset

SCORE ★★★☆☆
PRICE £358 (£430 inc VAT)
from microsoft.com

The Dell Visor feels like a step up compared to the Acer and Lenovo headsets, with a durable feel to the white plastic and solid hinges. The drawback is that it's heavier than both those rivals, which you start to notice after half an hour of wear.

Everything about the Visor feels top-quality, though, and that even stretches to relatively minor aspects of its design, such as the adjustable dial and the faux leather protectors for the front and back of your head. Just like the HP, this WMR headset feels like it could last a few demo days on a stand.

The problem for Dell is precisely the same as faced by the Lenovo: there's little reason to buy this headset over its key rival (in this case the equally rugged HP) unless you can find it on offer – or if you particularly like its all-white design.

That said, do hunt around for prices. While the Visor has a "list price" of £430, it's often discounted on Amazon and Microsoft Store.

HP Windows Mixed Reality Headset

SCORE ★★★★☆
PRICE £317 (£380 inc VAT)
from microsoft.com

The HP is a masculine headset, complete with a non-removable engraving on the side that says 1440² SPATIAL COMPUTING. It's heavier than the others but feels well-made, and according to a sticker on the inside of the headband includes a two-year warranty – all the rest only have one. If you were to run a VR stand at an expo, you'd feel more confident with the HP than the other three.

PC PRO RECOMMENDED

Despite its weight, it's comfortable to wear for prolonged periods. I'm not a fan of its flip-up mechanism – I ended up taking the headset off if I needed to check what was happening around me – but one nice design touch is that the cable detaches from the headset, whereas all the others are fixed. That makes for tidier storage: you can loop the cable out of the way, or file the headset neatly in a drawer.

It's close, but the HP is my pick of the WMR headsets.

Lenovo Explorer Windows Mixed Reality Headset

SCORE ★★★☆☆
PRICE £333 (£400 inc VAT)
from microsoft.com

If you like the sound of the Acer but aren't fond of its glossy blue finish, then I have excellent news: the Lenovo Explorer is essentially the same headset but with different livery. That means it shares all the same positives and all the same negatives: it's light and comfortable to wear, but doesn't have the ruggedity of the HP or Dell.

While the matte black finish means that it's arguably more stylish than the Acer, Lenovo undermines some of the Explorer's visual appeal by placing its logo bang in the middle of the visor. It should have taken its cues from Dell and HP, both of which place their logos modestly on the side.

The Lenovo Explorer isn't a bad Windows Mixed Reality headset at all, but with no software bundle (unlike the Acer) or compelling design advantage, it needs to be discounted to a lower price than rivals to provide people with a good reason to buy it.

How we test

Laptops and PCs

We run our own benchmarks on every Windows and macOS system we test. These are based around image editing, video editing and multitasking (where we run the video editing benchmark while simultaneously playing back a 4K video). At the bottom of each laptop and PC review you'll find the system's score in each of these tests, plus an Overall score.

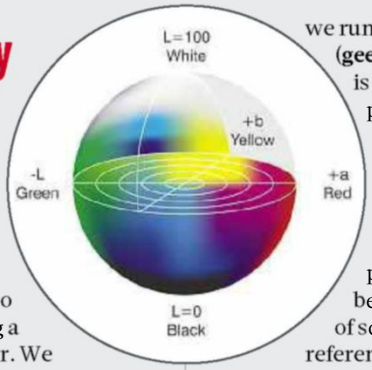
If a laptop scores 70, say, then it's 30% slower than our reference system – a PC with a Core i7-4670K and 8GB of RAM. If it scores 160, then it's 60% faster.

We test laptop battery life by playing back a full-screen video until the battery runs out. We set the screen brightness to 170cd/m², or as close as we can get using its settings, and switch to Flight mode.

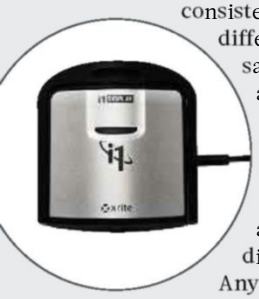
ABOVE We put PCs and laptops through intensive benchmarks and test laptops for battery life

Screen quality

In each laptop, phone, tablet and monitor review you will see our conclusions about the screen quality. Some of this will be subjective, but we also test each screen using a Display i1 Colorimeter. We measure for maximum brightness, colour accuracy and consistency – there may be a difference in brightness, say, from the middle and the edges of the panel.



LEFT & FAR LEFT To measure a screen's sRGB gamut coverage and Delta E, we use a Display i1 Colorimeter



We also measure Delta E, which gives a guide as to how accurately the panel displays a colour. Anything under 1 is excellent and likely to be difficult for the human eye to distinguish; 1-2 is still strong; above this suggests a panel that you shouldn't trust for colour-accurate photo editing.

Phones and tablets

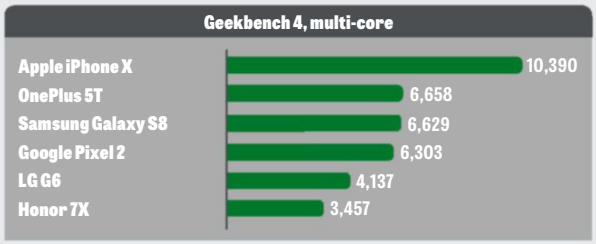
We run a selection of publicly available benchmarks on all the phones and tablets we test. First, we run Geekbench 4 (**geekbench.com**). This is a good test of the processor and memory in particular, and includes both a test for single-core and multi-core performance. See below for a selection of scores to provide a reference of what's good... and what's not so good.

We also run the graphics-intensive GFXBench (**gfxbench.com**) to see how well the phones and tablets are likely to perform in games.

As with laptops, we test smartphone and tablet battery life by playing back a full-screen video until the battery runs out. We set the screen brightness to 170cd/m², or as close as we can get using its settings.

BELOW We play back a video, setting the screen to 170cd/m², until the battery runs out to test battery life

Geekbench 4, multi-core



What our awards mean

Recommended
This, quite simply, is a product we would recommend you buy – if it meets your needs.

A-List
The best buy in its category right now. The product will also feature on our A-List, starting on p16, updated each month.

Labs Winner
Each month we run a group test, or Labs. This product has managed to beat all others to top position.

The pcpro.link

Throughout the magazine you'll see pcpro.link shortcuts. Enter these into the address bar of your browser and it will take you to a particular page, which will either be too long or awkward for us to publish or will take you to the precise shop from which to buy. If it's Amazon, note that we have an affiliate deal in place so we will receive a commission from each sale. This will never affect our verdict of a product, and if another reputable vendor is selling the product cheaper then we will use them instead.

Prices will vary

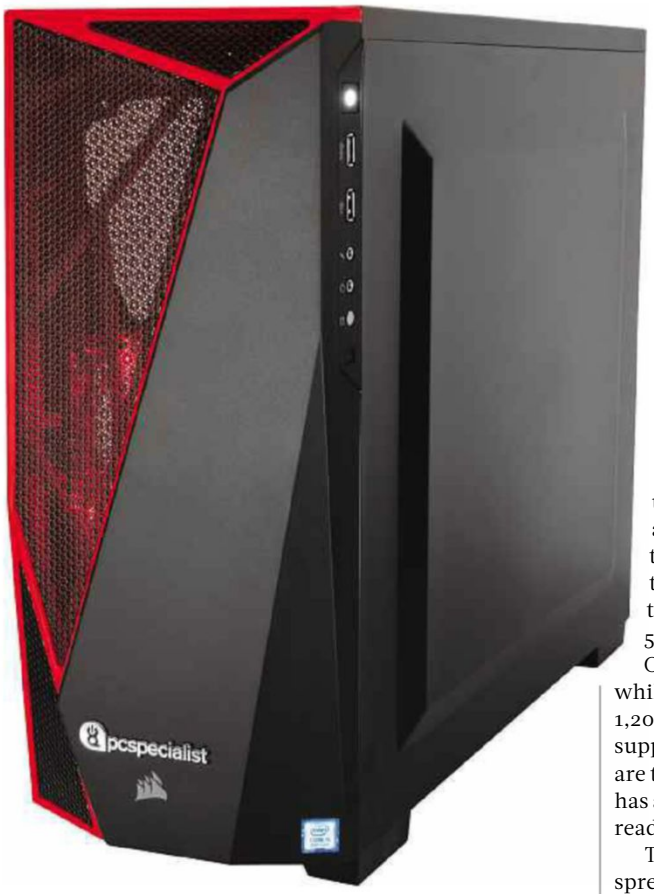
Prices we publish are correct on the day we publish, but we often see prices change – especially on sites such as Amazon. However, we do work with British PC retailers to ensure the prices we quote for their systems are correct. If the price isn't being honoured, contact us via letters@pcpro.co.uk.

PC Specialist Enigma K7

A well-balanced machine that offers plenty of virtual reality power now, yet room to grow in the future

SCORE ★★★★½

PRICE £833 (£999 inc VAT)
from pcspecialist.co.uk



While Microsoft has tried to ensure Windows Mixed Reality (WMR) works well on all modern computers, I invited PC Specialist to send in a sub-£1,000 system that might tempt people to upgrade to a bells-and-whistles VR experience. Its response is a supremely well-balanced desktop that offers plentiful power today, but has one eye on the future too.

Crucially, right now the Enigma K7 can tackle any VR game around. It scored 7.9 in the SteamVR Performance Test, which means that image quality remained "High" consistently throughout. Examining its performance more closely revealed that the Engima was in the "Very High" zone for roughly a quarter of the time, while the Scan opposite didn't drop for a moment.

The reason it didn't perform even better is that PC Specialist balances its £999 budget to include a 6GB GeForce GTX 1060 graphics card rather than a meatier 1070 or 1080. That's a sensible move: the 1070 would add £130 to the price, while a 8GB GeForce GTX 1080 card would raise it by £250. And while more speed is always welcome, I question whether or not you'd notice the difference in practice.

Arguably, the only area where the difference is obvious right now is gaming benchmarks. Here, the Enigma K7 again trailed the Scan laptop in *Dirt Showdown* and *Rise of the Tomb Raider*. For example, at 4K with the top settings, the Enigma scored 51fps and 40fps in those two games, versus 92fps and 70fps for the Scan. But let's not get distracted: the Enigma's frame rates are still superb.

Away from gaming, the Enigma proved an excellent performer in our own benchmarks. The Intel Core i5-8600K is already a fast chip, with six physical cores and a base frequency of 3.6GHz, but PC Specialist supplies it pre-overclocked to 4.1GHz. That, together with the 16GB of Corsair RAM across two DIMM sockets, pushed the Enigma to an overall result of 193.

That shows the immediate advantage of a desktop PC versus a laptop; it's a whisker away from the Scan despite that system containing a faster desktop processor. Scan doesn't have the thermal leeway to overclock that PC Specialist does - that's why it upgrades the standard Intel CPU cooler to a CoolerMaster Hyper 212X. The result, together with the output from the LED-lit fan at the front of the case, is low-level fan noise that's always there but never irritating.

The Enigma's other obvious advantage is that you can upgrade almost every component in the box - either at the time of ordering or when finances allow in the future. The Asus Prime Z370-P motherboard offers a great foundation thanks to its eponymous chipset, and with four 1x PCIe slots free there's room to add more expansion cards - plus a second graphics card via the empty PCIe x4 slot. If you do intend to use WMR, you'll need to add Bluetooth for the Mixed Reality controllers.

Adding more memory may mean replacing the heatsink, though, because this overhangs one of the two spare DIMM sockets. Fortunately, it's easier to upgrade the 128GB M.2 SSD. While a solid-state drive will boost boot times and general responsiveness, the SATA-based BiWin SSD isn't the fastest around - it only reached 535MB/sec sequential reads in CrystalDiskMark, for instance, while a NVMe M.2 SSD will hit over 1,200MB/sec. Should you fill the supplied 1TB hard disk, fear not: there are three spare bays and PC Specialist has already put the cables in place, ready to be used.

This neat attention to detail spreads through the rest of the build, with cables tucked neatly out of sight where possible. There are two things you should note about this Corsair Red Carbide SPEC-04 chassis' design, though. First is that the front-mounted USB ports are to the right-hand side of the case as you look at it (along with a power button, mic and headphone jack), so make sure that suits your desk arrangement. And second, there's no way to add an internal optical drive.

If you tot up the cost of all the components inside the Enigma, you'll reach a figure of around £1,050 - and that's without Windows. For PC Specialist to provide all this, pre-overclocked and with such strong build quality, makes it something of a VR bargain. **TIM DANTON**

ABOVE **The heatsink and chassis fans create a low hum, but it isn't obtrusive**

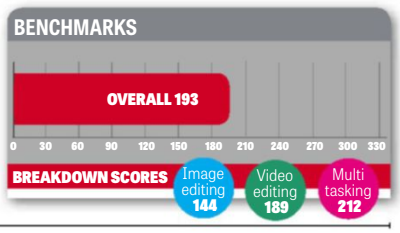
PC PRO RECOMMENDED

"Tot up the cost of all the components inside the Enigma and you reach a figure of around £1,050 – without Windows"

LEFT **There's plenty of room for expansion, with cables neatly placed to help**

SPECIFICATIONS

Six-core 3.6GHz Intel Core i5-8600K (overclocked to 4.1GHz) ● Asus Prime Z370-P motherboard ● 16GB Corsair DDR4 RAM ● 6GB Nvidia GeForce GTX 1060 graphics ● 128GB M.2 SSD ● 1TB hard disk ● Windows 10 Home ● 210 x 433 x 492mm (WDH) ● 3yr warranty (1mth C&R, 1yr parts, 3yr labour)



Scan 3XS LG17 Carbon Extreme

With brutal power to match its hulking design, this laptop will excel at VR, gaming and all number-crunching tasks

SCORE ★★★★★

PRICE £2,150 (£2,580 inc VAT)
from scan.co.uk/3XS

It's difficult to imagine two more different laptops than this Scan and the Microsoft Surface Book 2 15in (*see p60*). To put them side by side would be to compare a tank to a sports car. Yet they do bear some comparison: because they're both brilliant at what they do.

Clearly, top of the 3XS's agenda is gaming. While I could spend the rest of this review going through its speed results, these shouldn't be surprising (just look at the price!). It romped through *Tomb Raider* with an average of 70fps at the screen's native 4K resolution, with all quality settings set to max. Even *Metro: Last Light Redux* at 4K posed no problems, with an average 50.6fps framerate - until I turned anti-aliasing on, at which point it crumbled to 23.2fps.

Likewise, the 3XS excelled in the VR benchmarks. A score of 11 in the SteamVR Performance Test puts it at the very top of the scale, not dropping in quality one iota, and it was reassuring to put it through its paces in a demanding VR game such as *Serious Sam VR* and see top-quality visuals throughout.

The reason I don't want to dwell on these figures, or even the stunning result of 196 overall in the *PC Pro* benchmarks, is that such performance is obvious from the specifications. A trio of a desktop Intel Core i7-8700 processor, 16GB of Corsair Vengeance DDR4 2,400MHz RAM and an 8GB GeForce GTX 1080 graphics chip will pack a potent punch, especially when the laptop is designed to minimise thermal throttling. Indeed, as soon you start pushing the Carbon Extreme with demanding tasks, the fan kicks in with gusto.

What really lifts the Scan 3XS above so many gaming laptops is the quality on offer. Starting with the screen. It isn't as bright as Microsoft's, peaking at 361cd/m², but it actually outperformed the Surface Book by covering 99.8% of the sRGB gamut. Delta E was excellent, too, averaging at 0.47. That's the kind of figure we'd expect from a hardware-calibrated monitor, not a gaming laptop.

This quality is evident in general use and in games. You'll always be able to see evil lurking in the shadows, but if this is also your main system then you'll be equally happy gazing at it all day. Part of that is due to its sheer size: a 17.3in diagonal feels luxurious compared to conventional laptops, while a 3,840 x 2,160 resolution means there's plenty of room to place windows side by side when you need to.

The downside, inevitably, is weight. At 4.3kg this is a laptop designed for moving from room to room at most, and even that's a task you'll want to avoid. I struggled to hold it one-handed, with the 40.9mm depth and 418mm width only adding to the awkwardness. This lack of portability is emphasised by a battery life of 1hr 51mins in our video-rundown tests – and the sheer size of the power brick.

Then again, this is a laptop worthy of the phrase "desktop replacement". There are four USB 3 ports, two USB-C ports (USB 3.1 not Thunderbolt), an RJ-45 socket, plus a trio of video outputs: two mini-DisplayPort, one full-size HDMI. Audio is generously catered for too, with an S/PDIF out, headphone out, line in and mic in. The meaty looking speakers sitting below the screen are also worthy of their Sound Blaster branding, with plenty of power on offer without distortion. When it comes to vocal clarity, they're among the best I've heard from a laptop, and ensure you'll enjoy atmospherics from games too.

What I was most surprised by, though, was the quality of the keyboard. Naturally, this is a fully programmable RGB affair, but the feel and feedback of the keys will delight even keyboard nerds such as myself. My only criticism is that there isn't a gap between the main keys and the numeric keyboard to the right, but this didn't prove an issue in practice.

Scan supplied our review sample with an excellent 250GB Samsung 960 Evo NVMe M.2 SSD, which helps to minimise boot times. With a 2TB hard disk for storage duties, there's little danger of running out of space either.

It's possible to tweak the spec. Downgrading the screen to Full HD drops the price by £380, or you can double the RAM and SSD for £240. And, because it uses a desktop CPU, you can specify whichever Core chip you like. If you're after an incredibly powerful laptop then the Scan 3XS LG17 Carbon Extreme is a brilliant choice. **TIM DANTON**

ABOVE **This may be a gaming laptop, but the screen, keyboard and speakers are superb**

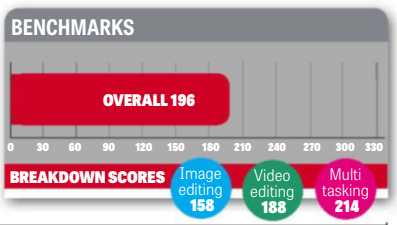
PC PRO RECOMMENDED

"A score of 11 in the SteamVR Performance Test puts it at the very top of the scale, not dropping in quality one iota"

LEFT **The inevitable consequence of the desktop processor inside: this is one bulky machine**

SPECIFICATIONS

Six-core 3.2GHz Intel Core i7-8700 processor • 8GB Nvidia GeForce GTX 1080 graphics • 17.3in 3,240 x 2,160 touchscreen display • 16GB 2,400MHz DDR4 RAM • 250GB M.2 PCIe SSD • 2TB hard disk • 2x2 MIMO 802.11ac Wi-Fi • Bluetooth 4 • 2 x USB-C 3.1 • 4 x USB 3 • SDXC slot • RJ-45 • 2 x DisplayPort 1.2 • HDMI • Windows 10 Home • 418 x 295 x 40.9mm (WDH) • 4.3kg • 2yr RTB warranty



3XS SYSTEMS PRO GRAPHICS

"An immensely powerful workstation"

- PC Pro, March issue 2018

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- 8GB NVIDIA Quadro P4000
- 250GB SSD & 2TB HDD
- 3 Year Premium Warranty

£5,419.99 INC VAT

Microsoft Surface Book 2 15in

A versatile and powerful 2-in-1 laptop that also offers all-day battery life – but it needs better support

SCORE ★★★★½

PRICE 256GB, £1,958 (£2,349 inc VAT)
from johnlewis.com

It isn't Marmite; you won't either love the Surface Book 2 or hate it. But you will fall one side of a divide: you'll either see the point of a laptop with a detachable screen or you won't. That was true of the 13.5in version and applies equally to this 15in spin.

When I say "spin", though, I may be exaggerating things. The 15in Surface Book 2 is essentially the same machine as its smaller sibling, right down to the weird fulcrum hinge and magnificent electromagnet system that locks the screen in place. One second it's a 15in laptop and no amount of yanking will remove the screen, but with a press of a button you'll hear a clunk and the screen can be easily removed.

The only difference between the two models is that the screen and chassis are proportionally larger here. Naturally, this translates into weight too. The 15in Book 2 weighs 1.91kg with the keyboard, the 13.5in weighs 1.53kg. Used as a tablet alone, that's 820g versus 720g.

Extra grunt

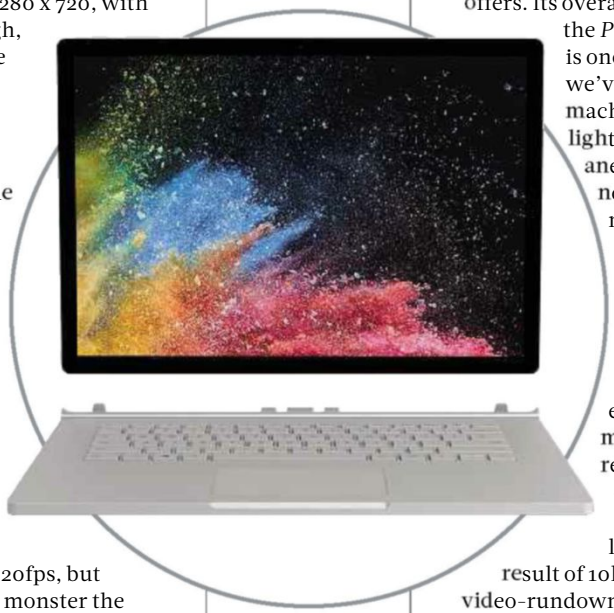
Where things diverge are inside. Evidently, Microsoft believes that those people who want a 15in laptop will also demand more power. So while you can order the 13.5in Surface Book 2 with a Core i5 processor and 8GB of RAM, its big brother only comes with a Core i7-8650U and 16GB of RAM. You can then choose from 256GB, 512GB and 1TB of storage, with each storage upgrade causing a £400 hop in price and a wider smile from Microsoft's accountants. Note there's no way to access this laptop's innards, so you're stuck with the amount you choose at time of purchase.

The 15in version also comes with a discrete GeForce 1060 chip built into the keyboard base, with the tablet reverting to the CPU's integrated Intel graphics when undocked. In laptop mode, you can expect a fine turn of pace in games: at 1,280 x 720, with settings turn to High, it scored an average 93fps in *Dirt Showdown*. That compares to 145fps from the Scan 3XS (*see p57*) at the same settings. Even at its native resolution, with quality upped to Ultra, the Book 2 averaged 50fps.

It coped just as well in *Rise of the Tomb Raider*, hitting 94fps at 1080p, Ultimate quality. Again, that's some way behind the Scan's 220fps, but unlike that gaming monster the Surface Book reaches those scores with a low-level fan whirr. In general use, the only noise you'll hear from the Surface Book 2 is the tap of your fingers against the keyboard. This is one indication that Microsoft veers towards power-saving over all-out-grunt, but that makes sense for a machine like this.

Nor should you underestimate what it can do. I put it through its paces in VR environments – both Microsoft's and Steam's, not to mention a few VR games – and it performed admirably. It scored 7 in Steam's own VR Performance tests, which translates into "VR Ready". If you want more power than this, you'll need a gaming laptop.

ABOVE Don't get excited – the Surface Pen isn't included, despite this laptop's astronomical price



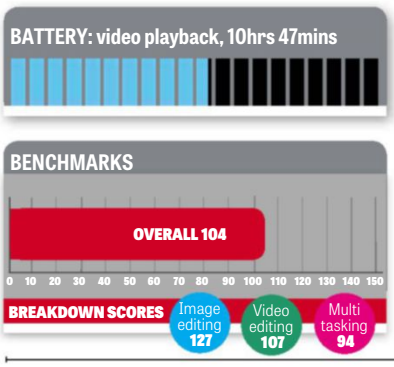
ABOVE The Surface Book's stunning party trick: to transform from laptop to tablet at the flick of a switch

Everyday performance

Few people will need any more everyday speed than this laptop offers. Its overall score of 104 in the *PC Pro* benchmarks is one of the highest we've seen from a machine this thin and light, and on a more anecdotal basis I noticed it was much more responsive in Adobe InDesign – a highly demanding application – than the 13.5in Surface Book 2.

Microsoft's emphasis on power management pays respectable dividends when it comes to battery life, too, with a result of 10hrs 47mins in our video-rundown tests. That falls short of the "up to 17 hours" that Microsoft claims, but is a laudable result when you consider the power demands of the screen.

The crucial thing is that you don't need to worry about carrying around the 102W power brick during a working day. That's fortunate, because this isn't the smallest unit in the world. It weighs around 200g and is roughly the size of an iPhone 5 – but triple the thickness.



If you're using the tablet alone, you can expect around three hours of life based on our video-rundown tests, which may not sound great compared to the ten-plus hours of a modern iPad but in reality shouldn't be an issue. Most scenarios will see you using the Surface Book in laptop mode at least 80% of the time.

A 15in tablet

Despite its 15in screen, in tablet mode the Book 2 feels well-balanced in the hand. Even at 820g, I doubt many people will struggle to hold it for extended periods of time. If you're watching TV then it's an exceptional second screen, but in such situations it felt like overkill – I found it more natural to reach for my phone.

It seems more likely that people will use the Surface Book in tablet mode for professional or artistic reasons. Here, though, the £100 Surface Pen is absolutely necessary, and I find it irritating that Microsoft doesn't bundle it with such an expensive device.

Still, once you've bought the Pen, it's a pleasure to write on and create drawings. As with the 13.5in Surface Book 2, it offers 4,096 pressure levels, which is approximately 4,090 more than I need but is a boon for artists. It supports the Surface Dial on-screen too, but I'm not convinced that it's worth £90.

Big screen hit

Then we come to the quality of the screen. It's to Microsoft's credit that, even before I took the Surface Book 2 from the box, I knew what to expect. Fantastic colour accuracy, vibrant photos and an excellent range of brightness across all 3,240 x 2,160 pixels (the same 3:2 ratio as the 13.5in version, but with a few more pixels to play with).

And so it proved – almost. With our trusty colorimeter in place, the 15in display romped through most of our tests. A Delta E of 1.32 is a fine result, likewise its 1,534:1 contrast ratio. But, given that Microsoft calibrates screens before they leave the factory, I was expecting near-perfection in our colour-accuracy tests as well.

You can choose between two colour modes - Enhanced or sRGB - and it achieved a 88% coverage of the sRGB colour gamut in the former and 91% in the latter - both strong results, just not quite as high as I expected.

I love the fact that the screen brightness is so adjustable, ranging from a low of 3.9cd/m² to 442cd/m² through ten presses of the brightness button (F2) on the keyboard.

The F7/keyboard backlight button is equally handy in dark conditions, cycling through three levels of brightness (and off). This laptop is a pleasure to type on too. While I prefer the more precise feel of, say, a typical ThinkPad, there's nothing to irritate the touch-typist here, with plenty of space between the large keys.

With a large Backspace, Enter and spacebar, there's only one reason I found my eyes flicking down to the keyboard to see what I was hitting: the up/down cursor keys are half-height. If that's the biggest criticism, though, you know Microsoft's designers have got things right.

The same is true of the touchpad, which is not only large (albeit no larger than the 13.5in Surface Book 2) but covered in a layer of glass that ensures fingers glide across the surface. If you can master Windows 10's gestures then you'll grow to love it.

Missed connections

In fact, there's only one major criticism I have of the 15in Surface Book 2: the lack of ports. On the right, there's a USB-C 3.1 port and Microsoft's proprietary Surface Connect power and data connector. On the left, two traditional USB 3.1 ports and an SDXC slot that supports fast UHS-II cards. There are no ports on the screen itself.

To get around this lack of connectivity for my 13.5in Surface Book 2, I invested in the Surface Dock power supply and docking station - even at £190, a much wiser buy than the Surface Dial. That not only widens the number of display connections available and provides a ready supply of USB ports when at my desk, but also compensates for the lack of Thunderbolt support. USB-C 3.1 has a maximum bandwitdth of 10Mbits/sec to Thunderbolt 3's 40Gbits/sec, and lacks the ability to daisy-chain devices.

The Marvell Avastar wireless chip provides Bluetooth 4.1 and 2x2 MIMO 802.11ac Wi-Fi, both of which proved reliable and fast during testing, and Xbox owners should note the inclusion of an Xbox Wireless Adapter too. This means you can use your Xbox wireless controller on the Surface Book 2, without needing to plug in an ugly dongle.

Price of success

So to the big question: is the 15in Surface Book 2 worth the high price Microsoft demands? For some people, the answer will be a clear yes. If you have good reasons to opt for a 15in screen, and want the extra power on offer, and you love the Surface Book 2's unique form factor, then close your eyes and press the Buy Now button.

It falls short of a full-on *PC Pro* recommendation for one reason, however. I can live with high prices for high-quality computer equipment, and the Surface Book 2 is undeniably that. What I find harder to swallow is the combination of poor fixability - the 13.5in Book 2 scored the lowest possible score in iFixit's tests, and I suspect this 15in verson will do too - and a one-year manufacturer warranty. When a company is charging this much for a laptop that's clearly targeted at enthusiasts and professionals, it should back it up with a two- or even three-year warranty.

BELOW **Microsoft will happily sell you the Surface Dial, but a docking station is a better investment**

"Given that Microsoft calibrates screens before they leave the factory, it was no surprise to see high colour-accuracy scores"

That's why the supplier listed above isn't Microsoft's own store but John Lewis: at least it doubles the warranty to two years as standard.

TIM DANTON

SPECIFICATIONS

Quad-core 1.9GHz Intel Core i7-8650U processor • switchable Nvidia GeForce 1060/Intel UHD Graphics 620 • 3,240 x 2,160 touchscreen display • 512GB PCIe SSD • 16GB 1,866MHz LPDDR3 RAM • 2x2 MIMO 802.11ac Wi-Fi • Bluetooth 4.1 • Xbox Wireless controller • Surface Connect power/data connector • USB-C 3.1 • 2 x USB 3.1 Type-A • SDXC slot • Windows 10 Pro • 343 x 251 x 23mm (WDH) • 1.91kg • 1yr RTB warranty

Apple HomePod

The Apple HomePod sounds incredible – but it's not as intelligent as its rivals

SCORE ★★★★½

PRICE £266 (£319 inc VAT)
from apple.com/uk

What's the definition of "smart" when talking about smart speakers? This isn't a rhetorical question, because in some ways the Apple HomePod is the smartest of them all; and in some ways it's the dumbest.

In the context of Amazon's Echo and Google's Home, smart means responding to voice commands to play music or radio. It means controlling your home's smart lights and thermostats, making voice and video calls, and asking about the weather. It means setting up timers and alarms and telling jokes on request. And, according to this definition of "smart", the Apple HomePod falls a long way short.

But that's not the only meaning of the word and, in other ways, Apple's answer to the Echo and Home is streets ahead.

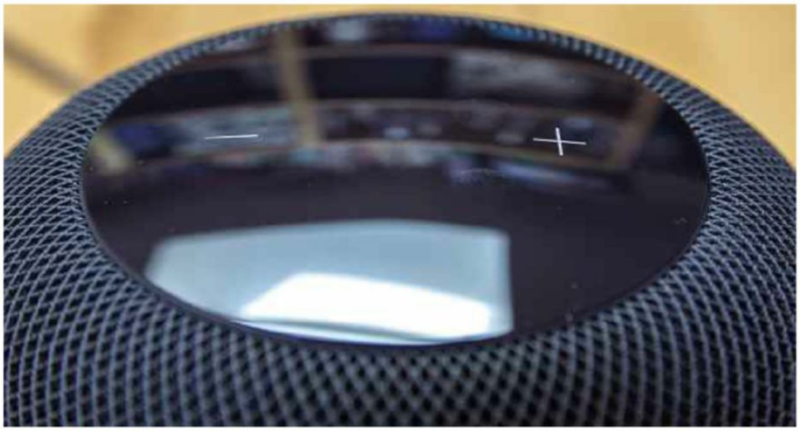
Sound design

Apple's biggest weapon in the smart speaker wars is its ingenious audio engineering. Beneath that attractive yet unassuming exterior – a softly curved, 7in cylinder, all clad in spongy mesh fabric – is an incredibly complex arrangement of tweeters, woofers and microphones.

At the top of the speaker's housing is an upwards-firing 4in woofer, which Apple tells me has a peak-to-peak cone "excursion" of 20mm. That's no traditional speaker driver specification. Normally, one would talk about parameters such as QTS, XMAX and VD when discussing the physical characteristics of a speaker driver before excursion distances. However, it's still a lot for such a small driver and it goes some way towards explaining how the HomePod can reproduce such prodigious bass.

"A speaker this size simply has no right to sound this good, with crisp sweetness that most small speakers struggle to reproduce"

The trouble is that with more excursion can come a lack of control and definition. If you push the driver to the edge of its performance, there's also a greater risk of "bottoming out", or distortion. More expensive speaker drivers combat this by using huge magnets, which allow for more exacting control. The weight of the HomePod (2.4kg) tells you there's almost certainly a beefy one here, but Apple complements this with its own clever technology. Using a microphone, it continually monitors the position of the woofer and its



LEFT When it comes to smarts, the HomePod has both pluses and minuses

output to prevent over-extension and thus distortion, while at the same time maximising performance.

That's not all, though. The HomePod is also aware of its environment. Pick it up and accelerometers inside tell the speaker to start a scan as soon as you put it down again. Sonos' TruePlay does a similar thing but it's a slow and manual process where you wave your iPhone around the room to scan your surroundings and optimise the sound. The HomePod carries out this process automatically, while the music is playing, and the amazing thing is you can actually hear it working.

While playing Beck's latest single, *Colors*, I moved the HomePod from the kitchen table onto an enclosed shelf; with most speakers, a recipe for muddy sound and overbearing bass. That's what I got at first. Almost miraculously, though, after ten seconds the HomePod sorted itself out, rebalanced the treble, mids and bass and sounded great once again. I moved the speaker back onto the table and initially the music sounded thin and lacking in body; but before long the bass was back, injecting the track with much-needed energy.

With seven tweeters surrounding the bottom of the speaker in a ring, the HomePod is also capable of directional sound. With each one working together with the speaker's room-scanning tech, the HomePod can spread the sound so that music has both a sense of space and coherence.

Sound quality

The question is, how does this speaker sound in real-world use? The answer: preposterously good.

It's better the £200 Sonos Play One, which sounds flat and boring in comparison, and in a different league to Google Home and the second generation Amazon Echo. It produces a fuller, deeper, more three-dimensional and broader sound than Amazon's best-sounding speaker, the Echo Show, with much more bass.

A speaker this size simply has no right to sound this good. In the mids and highs there's a crisp sweetness to audio reproduction that most small speakers struggle to reproduce. And at the bottom end a surprising amount of low-down thump and richness.

Still, it isn't perfect. It's not as warm in the mids as I'd like it to be, and can take on a harsh edge with tracks when you crank the volume all the way up. But most of the time I've spent with the HomePod has seen me gleefully exploring the full range of its sonic capabilities, and I can report that it has very few weaknesses.

The only negative is that there's no way to take the output of the HomePod and send it to another audio system or speaker via a 3.5mm output (it doesn't have one) or Bluetooth transmission.

But with sound quality this good, who would want to?

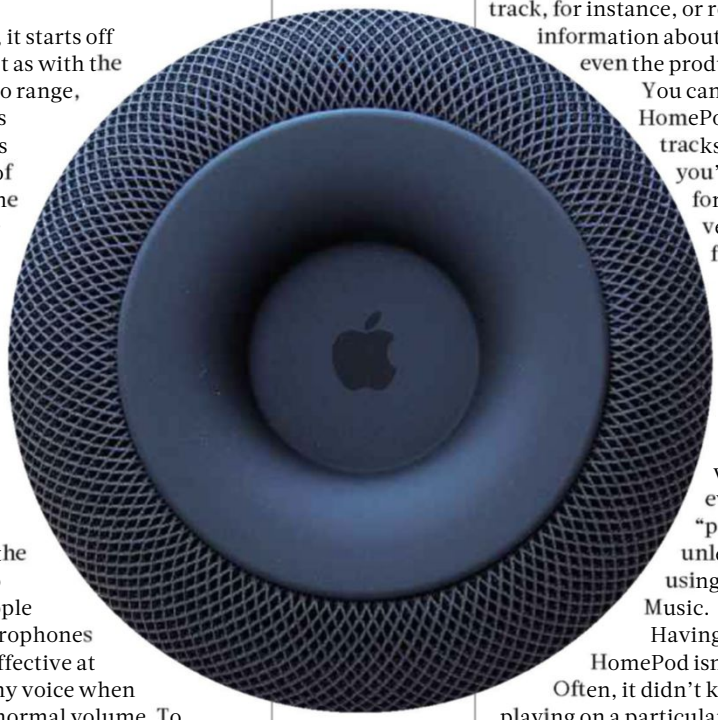
Sounds smart

This isn't only a speaker for listening to music, though. It's intended to take on the best Amazon has to offer in the smart speaker business, and this is where things start to unravel for the HomePod.

That said, it starts off strongly. Just as with the Amazon Echo range, the speaker's microphones are capable of picking up the wake phrase – "Hey Siri" – from across the room.

I lined up the HomePod next to an Amazon Echo Show and found that, across the room and up close, the Apple device's microphones were more effective at picking up my voice when speaking at normal volume. To be fair, this isn't the Show's strongest suit; the Echo Plus is much more effective and matches the HomePod stride for stride in recognising voice commands spoken quietly against a background of moderately loud music.

BELOW We suspect a rather large magnet is hidden inside to combat distortion



BELOW Apple isn't afraid to lay bare the technology inside the HomePod

Still, it goes to show that Apple has this essential part of smart speaker design nailed. I found the microphone array could pick up voice commands from a few metres away no matter what was playing: even with the music turned up to room-filling volume, you don't have to shout.

The things it can tell you about the music on offer are impressive, too, particularly the way you can ask about what's playing right now. You can ask Siri who the drummer is on a track, for instance, or request more information about the album or even the producer.

You can ask the HomePod to play more tracks like the one you're listening to, for different versions of it – or for something completely different. These are capabilities missing from Amazon's Echo speakers which won't even let you "play it again" unless you're using Amazon Music.

Having said that, the HomePod isn't perfect. Often, it didn't know who was playing on a particular track, instead opting to inform me who has played the drums/guitars/bongos for the band in the past.

And it has a problem with distinguishing between singers and bands. When asked, "who's singing?" while LCD Soundsystem's *Oh baby* was playing, "LCD Soundsystem" came the rather obviously incorrect answer. Thanks, Siri. Only if you ask – very slowly and very clearly – "tell me more about the singer" will you get that information.

Sounds stupid

This is symptomatic of the smart speaker experience on the Apple HomePod. Indeed, Siri on the HomePod is very much like Siri on the iPhone: occasionally useful, prescriptive about the phrases you must use, and not nearly as accomplished as

either Alexa or Google Assistant in interpreting the naturally spoken word.

Nor is that the end of the HomePod's quirks. Next on my personal hit list is its inability to set up more than one timer simultaneously. You can set up plenty of alarms, but it offers to cancel your existing timer if you try to set up a second. If you're juggling dishes in the kitchen, that's very frustrating.

Of greater importance to non-chefs, there's no voice-controlled way of listening to radio stations, other than Beats 1 (which is Siri's "favourite radio station on Earth") or other streaming services. You can pick up your phone and stream radio from BBC iPlayer Radio, Spotify, Tidal and so on via Apple AirPlay, but without an Apple Music subscription you'll be missing out on whole point of HomePod. True, the Echo is similarly biased towards Amazon Music Unlimited (as shown by my earlier example about playing a track again), but it does at least let you pick and choose songs with your voice.

You can't also yet associate the HomePod with different Apple Music accounts. With Apple Music constantly monitoring what you listen to so it can build its famed personalised playlists, this could be a problem if the little people in your house insist on listening to *Pink Fluffy Unicorns Dancing on Rainbows* when you're not at home. Fortunately, you can prevent this from influencing your music recommendations via Apple Music by flicking a switch in the settings.

Another thing you might want to disable is the HomePod's ability to send and read out text messages. Since Apple's smart speaker doesn't distinguish between voices, anyone can use the speaker to send texts via your phone and read them out, even if you or your phone aren't in the room.

ABOVE There are no extra outputs, but with quality like this there's no need

I wouldn't go as far as to say it's barely worth having the HomePod's smart facilities, though, as some critics have.

After all, the HomePod can do some of the things just as well as its rivals. It can read out the news and, helpfully, you can switch sources on the fly – between Sky News, BBC Radio 5 Live and LBC.

It can advise on traffic conditions on your daily commute and carry out various actions with a single trigger phrase using HomeKit's Scenes capability. "Hey Siri, good morning" can trigger an action that turns on the kitchen lights and starts the kettle boiling, for instance.

HomeKit's location awareness is another neat feature that plays nicely with HomePod. Set the target device's location so it's the same as the speaker, and you can carry out certain actions without having to spell them out. "Hey Siri, turn on the lights", for instance, will switch on all the smart lights in the room the speaker is in; you don't have to tell it where.

This all works well, but your smart home gear has to be HomeKit capable to work with HomePod, and it's another area in which Apple cedes the advantage to Amazon. Not only can Amazon's Echo Plus speaker support devices natively via its embedded Zigbee wireless chip, but all of Amazon's smart speakers currently support a much broader range of smart devices than HomeKit does via Alexa's third-party "Skills".

Sound advice

The Apple HomePod arrives late to the smart speaker party and it's considerably more expensive than its rivals, so it needs to offer something extra over and above the competition.

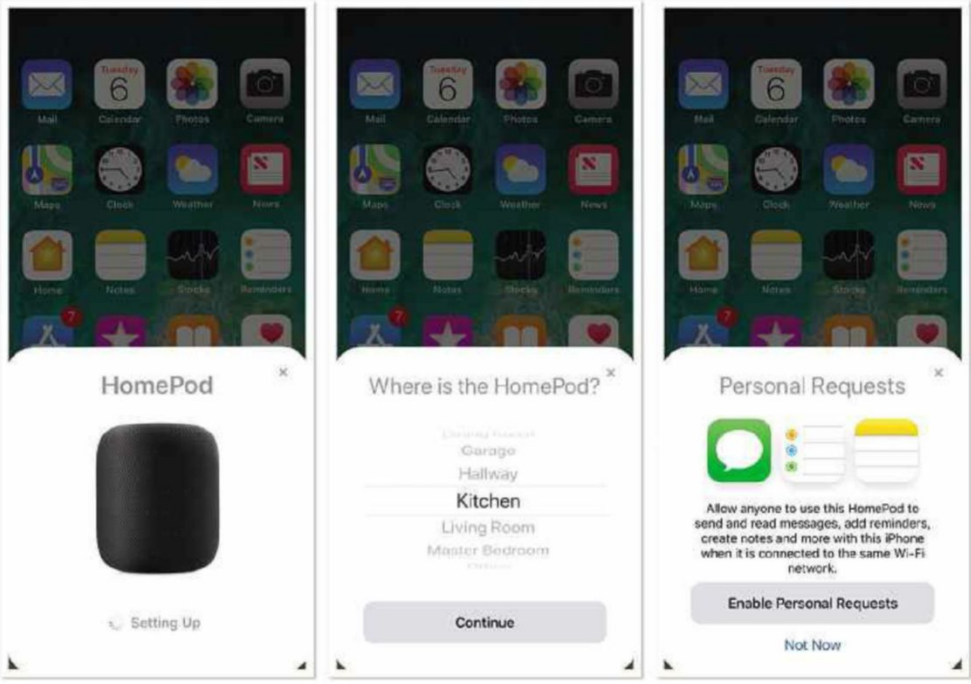
"Since Apple's smart speaker doesn't distinguish between voices, anyone can use the speaker to send texts and read them out"

In some ways it does just that. It's a phenomenal speaker, packed with exciting engineering and innovative technology. It blows every other smart speaker out of the water when it comes to audio quality – and it will do so wherever you happen to put it.

It isn't as "smart" as Amazon's Echo or Google Home, bafflingly omitting radio playback, Spotify support and basic things such as multiple timers. Unless you've already invested in HomeKit equipment, support for home automation is limited. And although she can hear you clearly across a room, Siri isn't as good at interpreting what you say.

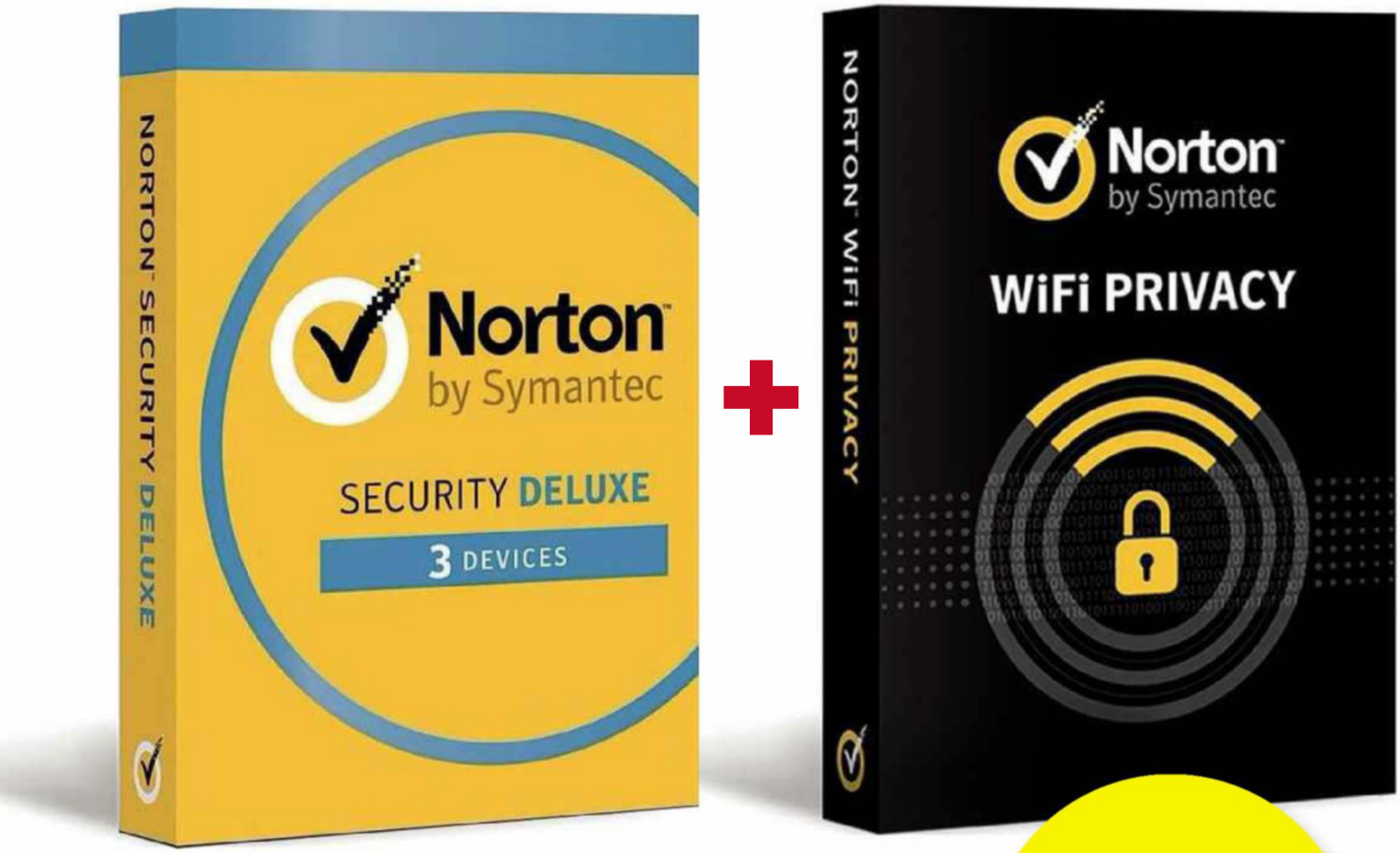
If all you've been waiting for is a great-sounding speaker that you can control with your voice, and money is no object, then you'll grow to adore the Apple HomePod. But this isn't the transformative, market-leading product that Apple probably hoped it would be. **JONATHAN BRAY**

BELOW Setting up the HomePod is as easy as you might expect



SPECIFICATIONS

High-excursion woofer with custom amplifier • seven horn-loaded tweeters • six-microphone array • internal low-frequency calibration microphone for automatic bass correction • direct and ambient audio beamforming • 802.11ac Wi-Fi • Bluetooth 5 • 142 x 142 x 172mm (WDH) • 2.5kg • 1yr RTB warranty



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Your bonus software

We scour the globe to negotiate the best software deals for our readers, from extended licences to full programs you don't need to pay a penny for. Here's this month's lineup

Total value this month £153

Ashampoo Photo Commander 15

Full product worth £40
ashampoo.com

PHOTO COMMANDER IS your one-stop tool for organising, browsing, editing and sharing digital images. It's built around a powerful browser that supports all the most common formats, and lets you name, tag or rate pictures and organise them into virtual albums so they're easier to find.

The software also features several automatic optimisation tools, which can fix contrast and colours, remove noise, reduce compression artefacts and more – and you can apply the whole lot in a couple of clicks. Manual editing tools, meanwhile, let you crop or resize an image, straighten horizons and remove red-eye.

With smart use of hardware acceleration for a slick experience, full support for Windows 10 and a redesigned image browser with multiple monitor support, it's the perfect application for perfecting your pictures.

REQUIRES **Windows 7 or later; 300MB hard drive space; in-application registration**

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ABOVE **If you've bought the Bonus Software edition of *PC Pro*, it will include this card between the current pages**

1 Visit the *PC Pro* download site at **pcprodownload.co.uk.** You'll need to enter the coupon code printed on the card, along with your email address. We'll send you an email to confirm that your code has been registered. On subsequent visits, you'll be able to access the download area by entering only your email address.

2 Once you're into the download area, you can access this month's bonus software by navigating to the relevant product page and clicking the red Install button. For trial software, freeware and other downloads, click the Install button below the product description, or follow the onscreen instructions (please read these carefully).

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Remember to claim your software by 30 April 2018

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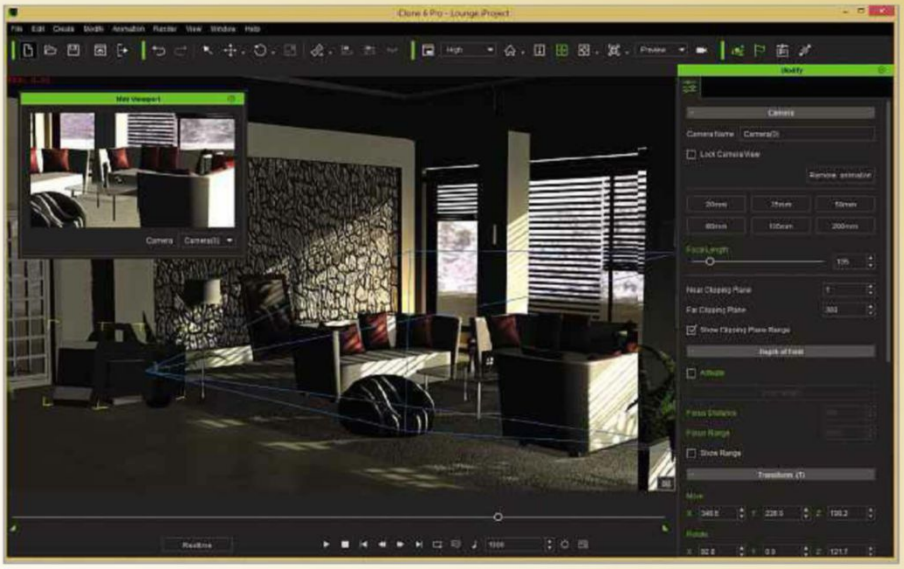
iClone 6 Standard

- Full product worth £37
- reallusion.com

THIS POWERFUL 3D animation suite has a stack of professional features. You can import 3D figures from templates, capture your own body movements with Kinect hardware – or, just select an actor and use the cursor keys to control it.

Beginners can work from templates to get started right away, while experts can combine iClone with other 3D applications, such as Blender, SketchUp and 3DS max. There's a full community on hand and a host of valuable resources – for example, you can use millions of royalty-free objects from Google's 3D warehouse at no charge.

Every aspect of your project can be previewed at any time, and once you're happy, you can export it as a video. You can even create 3D movies, with support for various 3D standards.



REQUIRES Windows 7 or later; 10GB hard drive space; online registration

Abelssoft Tagman 2018

- Full product worth £26
- abelssoft.com

REQUIRES Windows 7 or later; 30MB hard drive space; in-application registration

- Organise your MP3s and make them easier to find, with accurate tags and filenames
- Tagman's automated process creates a digital fingerprint of each file and uses this to fill in missing metadata
- Batch renaming lets you specify how your files should be organised – sort by artist name, title, album and more

Iolo System Mechanic 17

- Full product worth £20
- iolo.com

REQUIRES Windows XP or later; 50MB hard drive space; online registration

- All the tools you need to clean and speed up your PC, fix system problems and protect your privacy
- Defragment your hard drive, optimise your internet connection for faster downloads, tweak the boot sequence and more
- AcceleWrite technology helps improve drive performance, with a dedicated SSD accelerator for solid-state drives

Panda Internet Security

- Six-month trial
- pandasecurity.com

REQUIRES Windows 7 or later; 200MB hard drive space

- An all-in-one security suite with antivirus, browser protection, a firewall and Wi-Fi protection to detect and block intruders
- Integrated Data Shield prevents sensitive information falling into the wrong hands, while parental controls keep your kids safe online
- Virtual keyboard replaces standard peripherals to bypass keyloggers and keep your passwords and payment details secure

O&O DiskImage 11 Pro

- Full product worth £30
- oo-software.com

REQUIRES Windows Vista or later; 200MB hard drive space; online registration

- All the tools you need to back up and image individual files and folders, complete partitions or whole hard drives
- Integrated file explorer makes it easy to configure incremental, complete or differential backups
- Create bootable disk images, ensuring you can recover from even a total disk failure

Sony Xperia XA2 Ultra

The best phone Sony has produced in years. It's big, but you get a lot of phone for your money

SCORE ★★★★☆

PRICE £316 (£379 inc VAT)
from pcpro.link/283xa2

ABOVE **At first glance, it's not at all obvious what sacrifices Sony makes to keep this phone under £400**

The Sony Xperia XA2 has one key attraction: its price. At £379, it costs the same as the excellent Honor 9 at launch (it's now around £300) and is £70 less than the OnePlus 5T. What you get for your money is impressive, starting with the phone's most obvious feature: an enormous 6in screen. When Sony says Ultra, it means Ultra.

There's no trendy 18:9 aspect-ratio display. Sony sticks with 16:9 and, while the bezels to the left and right are suitably thin, its forehead and chin bezels are chunky by modern standards. The resolution is a conservative 1,080 x 1,920, too.

Still, if you watch Netflix, iPlayer or Amazon Video on your commute, you'll find 1080p on a 6in screen isn't a bad thing at all. Graphics look crisp and sharp-edged with no visible pixellation, while 1080p displays usually require less power to run than screens with more pixels.

Beastly design

The downside is that the Sony Xperia XA2 Ultra is a beast of a phone. In fact, this is the largest handset I've tried to slide into my pocket recently. It's 163mm tall, 9.5mm thick and weighs a positively obese 221g. The £270 Honor 7X has an 18:9 aspect ratio screen, the same 6in diagonal and is much slimmer and lighter.

Still, you can just about hold the thing in one hand, and the phone looks good and feels well put together. There's Gorilla Glass 4 on the front so it doesn't pick up fingerprints too readily while the rear is matte-finish plastic, so that's greasy-digit-proof as well. It's available in silver, gold, blue and black, and looks nice in all but the gold, which has an odd sheen of green when it catches the light.

The Sony Xperia XA2 Ultra is also stuffed with features. A fingerprint reader sits in the centre of the rear panel, just below the camera, while NFC means you can use it for contactless credit-card payments. The microSD slot will take cards of up to 256GB and you get a 3.5mm headphone jack, USB-C for data transfer and charging, and even a dedicated, two-stage shutter button for the camera on the right edge.

What the Xperia XA2 doesn't offer is dust or water resistance. I also wish Sony would round off the corners; unless you line your pockets with Kevlar, it won't take long before the XA2 wears a hole in your trousers.

Vivid display

Sony was effusive about the Ultra's display when it first announced the phone, saying it was its most vibrant screen yet. And, despite my initial scepticism, I'm impressed.

You can choose from three colour profiles: Ultra Vivid, Standard and (enhancements) Off. First, I flipped to Ultra Vivid and fired up the opening sequence to *Altered Carbon* on Netflix. I was immediately struck by how deep and rich its dark background looked, and how vibrant and HDR-like other colours were. Yet the screen somehow manages to look balanced, with no overly ruddy skin tones, for example.

It's the same story elsewhere in the user interface – which is Android Oreo, overlaid with Sony's usual launcher software. Although graphics and wallpapers stand out in almost neon colours, there's no sense that colours are unnatural when you browse your photo library.

In testing, the XA2 performed well, but with some weaknesses. The Ultra Vivid mode returned a coverage rate of 92.3% of the DCI-P3 colour gamut. With "enhancements off", you get 87.2% of sRGB, which explains why the screen looks a touch dull in this mode. The enhancements "Off" mode turned out to be the least colour-accurate of the three modes on offer, and Ultra Vivid also garnered the best colour-accuracy score (average Delta E) – still, at 3.7 this is nothing to be proud of.

There are still plenty of positives, though, not least the display's high peak brightness of 616cd/m² and its fantastic contrast ratio of 1,607:1. Both of these results go some way towards explaining why, in Super Vivid mode at least, the XA2 Ultra's display looks so good to the eye.

"I was immediately struck by how deep and rich dark backgrounds looked, and how vibrant and HDR-like other colours were"

Solid performance

With such good build, design and screen performance, there has to be some give and, for the XA2, that comes in the phone's performance. An octa-core Snapdragon 630 processor, Adreno 508 GPU and 4GB of RAM means that, when compared with the Honor 9 and OnePlus 5T, it's positively sluggish. You can feel it in everyday use, too, and although the 1080p display keeps things smooth in casual games such as *Threes* and *Candy Crush*, you'll have to play more demanding titles like *Asphalt* with the quality dialled right down. At least it's better for gaming than the Honor 7X.

The battery life is predictably pretty good, though, with the phone's 3,580mAh battery comfortably lasting a day to a day and a half with moderate use and stretching to 16hrs 54mins in our video-rundown test.

BELOW **The XA2 Ultra is available in a range of colours, but we're not fans of the gold**

Nifty selfies

If the price and size of the Sony Xperia XA2 Ultra grabs all the headlines, it's the camera tech that's most interesting. For once, not the rear: this is a 23-megapixel camera with an f/2.0 aperture, a decent-sized 1/2.3in sensor, phase-detect autofocus and a single-tone LED flash.

What's curious is the front arrangement, which includes two cameras. One has a resolution of 16 megapixels, an aperture of f/2.0, optical image stabilisation and a 1/2.6in sensor. The other is an 8-megapixel snapper with an f/2.4 aperture and a smaller 1/4in sensor. There's also a single LED flash.

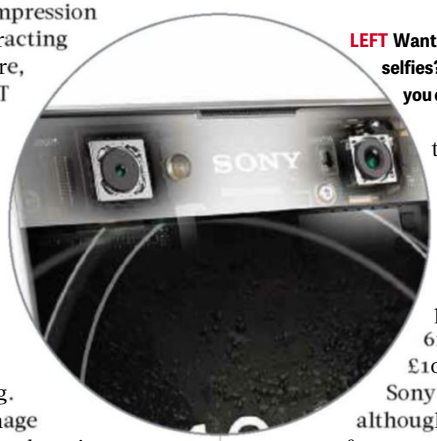
These allow you to capture regular selfies with the 16-megapixel camera and wide-angle shots with the 8-megapixel one, useful when you want to capture a small group of three or four friends. You'll still have to squeeze pretty tightly together, and be prepared for a little fish-eye effect. I wasn't impressed with the quality of either camera, especially in low light – both softened skin tones unflatteringly, and the results were so oversaturated that it looked like I'd been at the gin – but it's nice to have the extra option nonetheless.

The rear camera, on the other hand, is seriously impressive. At sunset, pitched against the excellent OnePlus 5T, the Sony's camera consistently outperformed the OnePlus, especially with HDR mode enabled. It reproduced the golden light cast by the winter sun superbly, while exposing the foreground with just enough brightness to avoid looking unnatural.

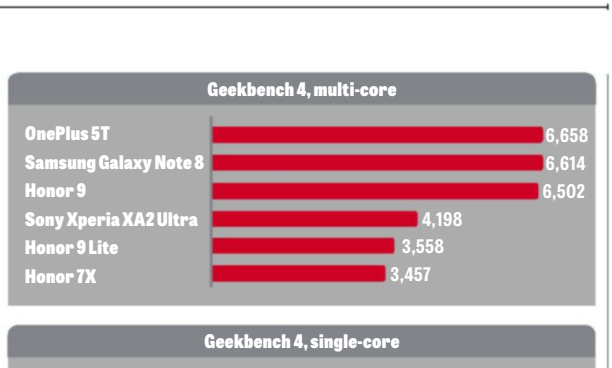
It falls down in low light without the flash enabled, though, and my test shots were rife with compression artefacts and distracting chroma noise. Here, it's the OnePlus 5T that does better, capturing cleaner, less blotchy images.

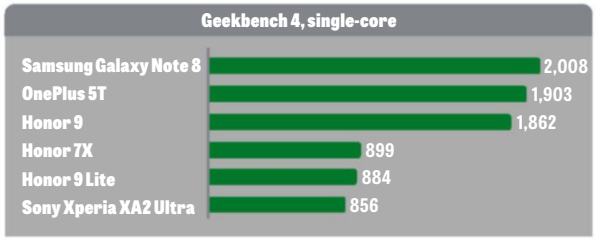
As for video, 4K capture is possible, but not in the main part of the video recording app, which is annoying. There's also no image stabilisation in the phone's 1080p 60fps mode, but you do get HDR video at 1080p and very good stabilisation.

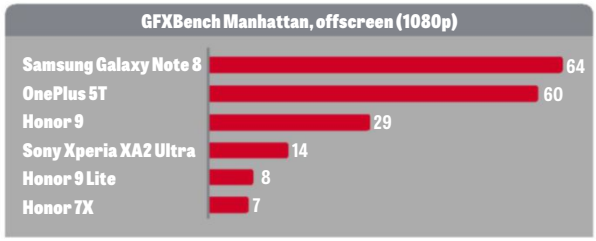
Overall, the Sony Xperia XA2 has an excellent sets of cameras for the money, adding to the phone's all-round appeal.

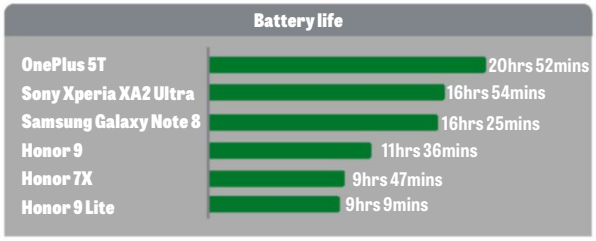


LEFT Want to take wide-angle selfies? The XA2 Ultra has you covered









Easy decision?

In fact, there's very little to complain about with the XA2 Ultra aside from its sheer size. The screen is great to look at; the phone itself looks good; the rear camera produces excellent-quality stills and video; and the battery life is great too.

This is the best phone Sony has produced in years – the only thing that might give you pause is the competition.

The awkward fact is that, in the 7X, Honor produces an 18:9, 6in smartphone for £100 less than the Sony XA2 Ultra and, although battery life and performance isn't quite as good, it's slimmer, lighter and generally a slightly better buy.

Choosing a phone is a personal decision, though, and while the XA2 Ultra isn't perfect it makes a pleasant change to say that this Sony is a genuine contender. **JONATHAN BRAY**

SPECIFICATIONS

Octa-core 2.2GHz Qualcomm Snapdragon 630 processor • 4GB RAM • Adreno 508 graphics • 6in IPS screen, 1,080 x 1,920 resolution • 32GB storage • microSDXC slot (up to 256GB) • 23MP rear camera • dual 16MP/8MP front camera • 802.11n Wi-Fi • Bluetooth 5 • NFC • USB-C connector • 3,580mAh battery • Android 8 • 80 x 9.5 x 163mm (WDH) • 221g • 1yr warranty

Honor 9 Lite

With high-end features for a low-end price, the Honor 9 Lite is a tempting budget smartphone

SCORE ★★★★★

PRICE £167 (£200 inc VAT)
from store.hihonor.com/uk

Honor, an offshoot of Huawei, is doing an excellent job of producing low-cost handsets that don't make hideous compromises. Last year we saw the terrific-value Honor 9 for £300, and now it appends the word Lite and chops £100 off the price. It does so with no immediately obvious compromises: it uses the same octa-core HiSilicon Kirin 659 chip we saw in the Honor 7X, and includes 3GB of RAM and 32GB of storage.

There are even a couple of upgrades. Unlike its pricier predecessor, it has dual 13- and 2-megapixel front-facing cameras, plus a bigger 18:9 display with a super-sharp 2,160 x 1,080 resolution. Not bad for £200.

The handset itself has a similar design to the Honor 9, incorporating a mirrored "2.5D" curved glass rear. It's certainly glitzy – launching in Sapphire Blue, Midnight Black and Glacier Grey – and it gives the immediate impression of a phone selling for twice the price. You don't get waterproofing or NFC, but that shouldn't be a shock in a £200 phone.

One unexpected change is that the fingerprint reader, integrated into the home button on the Honor 9, has been moved back to its old position at the rear of the phone. This works in a snap, too, with Honor claiming unlock times of under a quarter of a second. The volume rocker and power button sit side-by-side on the right edge, with a microSD card and nano-SIM tray on the left. Cast your eyes downward and you'll spot a micro-USB port and 3.5mm headphone jack.

As soon as you switch the Honor 9 Lite on, the 2,160 x 1,080, 5.65in IPS display makes a statement. This is the first time Honor has launched an all-display handset, and although it's the cheapest 18:9 smartphone on the market, it looks great. Its pixel density of 428ppi is sharp enough to satisfy the most exacting eyes, and a high contrast ratio results in punchy images. Peak brightness hits a sunlight-friendly 504cd/m².

Don't expect stunning colour balance and accuracy: the Honor 9 Lite oversaturates certain colour tones. Our X-Rite colour calibrator reported an sRGB coverage of 83.8%, which isn't abysmal but could be better, while an average Delta E of 3.71 is some way adrift of the sub-2 result we always look for.

The specification promises decent but unexceptional performance – and so it proved. In the Geekbench 4 and GFXBench tests, the Honor 9 Lite matched the scores of the Honor 7X and Moto G5S. In short, performance is solid, but a step behind the more expensive Honor 9 (*see p69 for a graph of its results vs competitors*).

Disappointingly, the Honor 9 Lite's 3,000mAh battery doesn't last as long as I expected. Typically, low-powered internals such as the Kirin 659 used here promise healthy battery life, but in our video rundown test (with Airplane mode engaged) the Honor 9 Lite plummeted to zero in only 9hrs 9mins. That's poor: the Honor 9 lasted for over 11 hours in the same test, and the Motorola Moto G5S kept going beyond 12 hours.

The Honor 9 Lite also falls behind more expensive rivals when it comes to photography, but the 13- and 2-megapixel rear-facing cameras are fine for taking quick pics and Instagram snaps. Indeed, provided you have plenty of light, you can take some impressive shots. It picked up plenty of detail in our tests, correctly reproducing neighbouring brickwork and tricky window reflections, and capturing natural-looking colours.

However, once the light dims, the Honor 9 Lite's sensors start to struggle: washed-out colours and lots of visual noise become apparent. Our test low-light scenes lacked definition and vibrancy.

Where the Honor 9 Lite does stand out is the inclusion of a very similar dual-camera arrangement on the front as on the back. I found selfie shots were well-exposed, with crisp details. There's even a background-blurring bokeh mode, which does a commendable job of bringing finer foreground details into relief. It's not quite up there with the Pixel 2, but at this price it's much closer than you might expect.

And that's the key to the Honor 9 Lite: its price. This may not be the fastest phone on the market, nor longest lasting, but for £200 it's an outright bargain. With its excellent 18:9 display, stylish design and decent set of cameras, it's already a contender for best budget smartphone of 2018.

NATHAN SPENDELOW

LEFT The 5.65in screen and curved, classy design lend this low-end phone a high-end look

PC PRO RECOMMENDED

"The Honor stands out for its dual-camera setup on the front. Selfie shots were well-exposed, and there's even a bokeh mode"

LEFT The fingerprint reader sits on the phone's rear and is blisteringly quick

SPECIFICATIONS

Octa-core 2.36GHz/1.7GHz HiSilicon Kirin 659 processor • 3GB RAM • Mali-T830 graphics • 5.65in IPS screen, 1,080 x 2,160 resolution • 32GB storage • microSDXC slot (up to 256GB) • dual 13MP/2MP rear camera • dual 13MP/2MP front camera • 802.11n Wi-Fi • Bluetooth 4.2 • micro-USB connector • 3,000mAh battery • Android 8 • 71.9 x 7.6 x 151mm (WDH) • 149g • 2yr warranty

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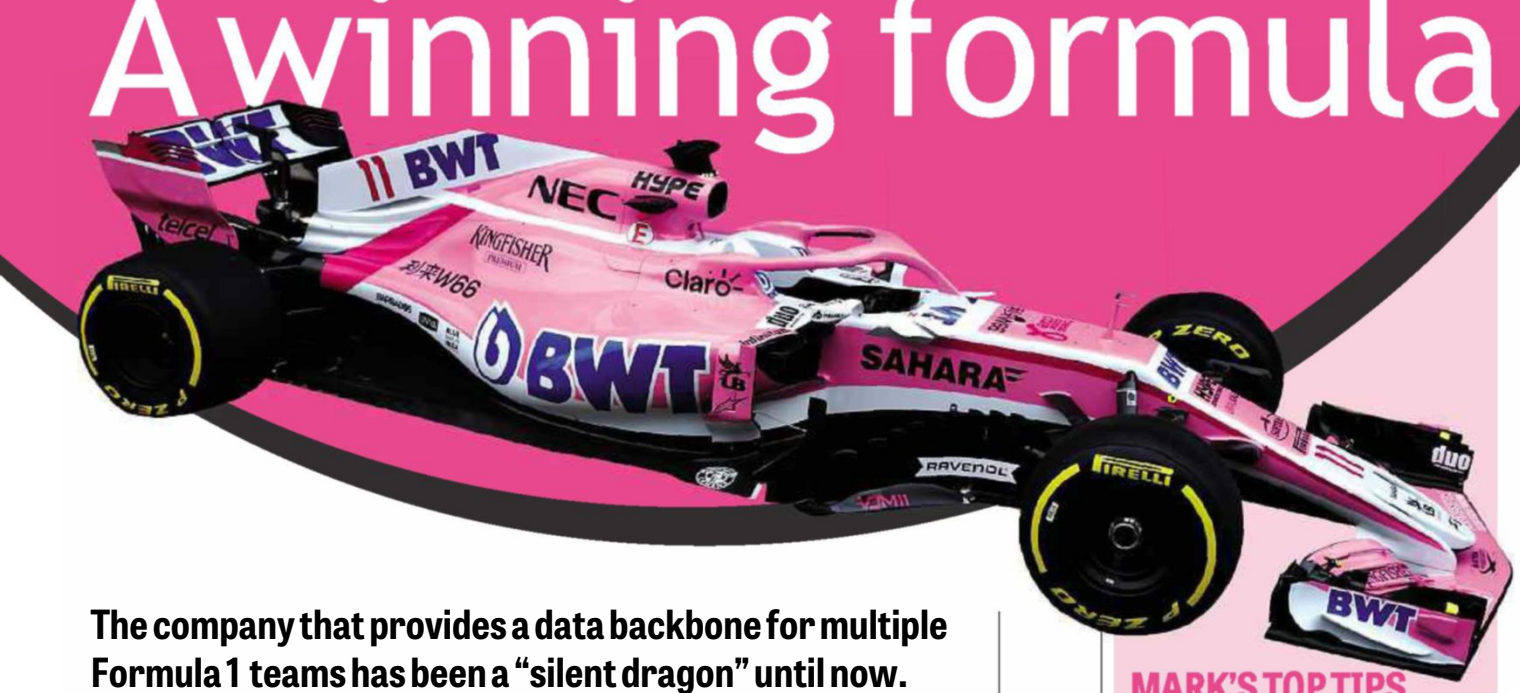


The company that provides a data backbone for multiple Formula 1 teams has been a "silent dragon" until now. We find out why it's poised to hit the mainstream

Laser-like focus on quality. Fanatical eye for detail. Winning mentality. All phrases that could describe an F1 driver, but speak to Voip Unlimited's Mark Pillow and you'll hear the same focus – this time, though, applied to creating a winning VoIP solution.

"I come from an aviation background," he told *PC Pro*. "If it didn't fly, people die. I take comms just as seriously." This, he explains, is why he decided to create the company's own technology platform rather than adapting what was already on the market, and why the company must continue to innovate.

It's a motivation that's driven Voip Unlimited to be a "silent dragon" in the industry up until now, having built up a reputation for quality and reliability over the past 12 years. It already provides the infrastructure for resellers of VoIP systems around the UK – but Mark believes it's time for the silent dragon to make some noise. "Since launching Voip Exchange, our cloud platform, we've begun to unveil the brand behind the brains."

Why should businesses choose his technology? Partly because it's so quick and easy to use, but primarily because "it just works," said Mark. "I've never been more confident in a network, platform or infrastructure than I am of Voip Unlimited's. From day dot, we bought and built to perfect standards to future-proof the business's reputation."

It's a reputation that attracted one of their Formula 1 clients, Force India F1 team, into the fold. "Formula 1's requirements are specific and critical on a granular level, but businesses should be just as picky. Don't settle for an off-the-shelf product. You know your business and should find technology to enable you to succeed above all others in that space."

There's that winning mentality again. "We've learned from other people's mistakes. When we started creating Voip Exchange, our cloud telphony system, we learned what to avoid to keep the costs down for businesses, what features clients really valued. We saw so many providers who white-labelled third-party solutions and lost power over its flexibility."

So that's the journey so far. What's next? "We have to continue to build the most reliable comms products to enable flawless results. If you have an unreliable, domestic connection into your building then the whole thing falls down. That's why we provide an end-to-end solution: there is nothing worse than one supplier blaming another when something isn't working." Just like an F1 team, you're only as strong as your weakest link.

MARK'S TOP TIPS FOR A SUCCESSFUL VOIP ROLLOUT

1 "Ideally, **bundle your connectivity** with the company providing the platform so you can avoid going over third-party networks. Also, make sure your connectivity has a business SLA: consider the revenue you would lose if you lost connectivity."

2 "**Keep your life simple!** Look at providers who can offer a consolidated solution under their control. You want one person to raise support queries with."

3 "Find out what disaster recovery options you need, **what security is there** to protect from fraud? Ideally, choose a cloud phone system where all of this is included."

4 "**Do your research**. What company growth are you planning for? Would OPEX or CAPEX be better? Do your staff want to control their own out of office, voicemail, call forwarding and more? Find out."

5 "**Avoid smoke and mirrors** – don't get drowned by jargon. Your supplier should tailor the solution to you, and you should understand how it works."

6 "**Look for value** not the lowest price. The cheapest solution won't be the most flexible: are you going to get penalised if your business gets bigger?"

7 "Lastly, **protect yourself**! "Make sure your provider adheres to Ofcom guidelines for having an independent arbitration service."

Call Voip Unlimited on 01202 612000 or visit voip-unlimited.net

Fossil Q Control

Fossil moves with the times to include a heart-rate monitor, but it lacks other essential fitness features

SCORE ★★☆☆☆

PRICE £233 (£279 inc VAT) from fossil.com

The Q Control is Fossil's first watch to include a heart-rate monitor, which is enough for the company to label this Android Wear device a Sport Smartwatch on its website. And it looks a winner. Its chunky steel metal casing exudes style and sophistication, just as you'd expect from a brand associated with fashion accessories.

Once on my wrist, however, I was less enthusiastic: it feels both weighty and uncomfortable. More worryingly, every time I checked the watch on a brisk bike ride across London, I was surprised to see my pulse at around 90bpm; the Garmin Vivosport on my other wrist showed much more believable figures of around 110bpm. At the end of the workout, I was even more astonished to see the watch claim my heart rate peaked at 200bpm. Really?

Checking your resting heart rate is also a chore compared to rivals, because there's no dedicated heart-rate widget – in fact, in Android Wear there are no widgets at all. Instead, each time you want to check your heart-rate stats, you need to scroll down to open the Google Fit app.

The watch also lacks a barometric altimeter, so you won't know how many steps you climb throughout the day. NFC? Nope. And then we come to the weirdest omission: no GPS chip. One of the main perks of a fitness-orientated watch is that you can accurately track runs and bike rides without needing to bring your phone.

A forgivable omission, perhaps, if battery life had been amazing, but instead the Q Control can only last a waking day. Fossil claims the watch uses wireless charging, but in reality what you get is a small four-pin magnetic charging pad that you perch the watch on top of. Not having to connect a cable might sound like a perk, but it isn't. I thought I'd left the device charging on three different occasions, only to come back and find its battery empty.

ABOVE **The vibrant OLED screen and Android Wear are two obvious plus points**

One thing the Q Control does have going for it is Android Wear. Agenda, Contacts, Fit, Keep Reminders and Weather are useful preinstalled apps that help you keep on top of daily tasks without having to always reach for your phone. The Android Wear Play Store is also much better stocked with third-party apps than Samsung's Galaxy Apps store, so you can install Telegram, Messenger, Strava and Runtastic among many others.

That's not to say that Android Wear is flawless. The music controls worked well when playing Spotify from my phone, and I could even start browsing my library with the right combination of taps and swipes, but whenever I tried opening it from the app drawer the Spotify app wouldn't play ball. The Q Control's 4GB of built-in storage will let you store music offline, but only from Google Play Music.

Google Assistant is an undoubted boon. Long-press the watch's button and you can use the virtual assistant to send a text or WhatsApp message, get directions with Google Maps, or check your agenda. You can even start tracking your run, or check your step count and heart rate with simple voice commands. You can also set specific fitness goals in Google Fit.

Another thing in this watch's favour is that it's waterproof to 5ATM – approximately 50m – which, along with its switchable 20mm silicone strap, means you can wear it in the pool. There's no swimming mode in the Fit app, but you can keep track of your pool workouts with the third-party app MySwimPro.

When you want to log a workout manually, you just open the aptly named Fit Workout, which lets you choose from an enormous list of activities, from cycling and running to strength training and downhill skiing.

To control the smartwatch, there's a vibrant 1.4in colour OLED touchscreen and a button on the right side, which lets you hop between the app drawer and the homescreen. The screen's 450 x 450-pixel resolution looks good, but an air gap between the front glass panel and the display means it falls short of greatness.

Another method of navigation comes via the watch's "virtual touch bezel", which lets you scroll through apps, notifications or emails without swiping up and down on the touchscreen. In practice, I rarely used it, not least because my hand sometimes obscured the screen. Garmin solved this with the Vivoactive 3 by placing a touch panel on the side of the casing.

"This is a great-looking smartwatch and – no, that's where the praise ends. This sports-focused watch is of little use to the sporty"

The Q Control is a great-looking watch and – no, that's where the praise ends. It lacks GPS and an altimeter, while its heart-rate sensor is highly inaccurate. In other words, this sports-focused smartwatch is of little use to the sporty. Android Wear offers plenty of great smart features and a strong range of third-party apps, but to compete with sports smartwatches in 2018, the Fossil Q Control needs some serious upgrades.

EDWARD MUNN

LEFT **Compared to its rivals, this is a bulky and uncomfortable sports watch**

SPECIFICATIONS

1.4in 450 x 450 AMOLED display • quad-core 1.1GHz Qualcomm Snapdragon Wear 2100 processor • 4GB memory • 768MB RAM • Bluetooth 4.1 • optical heart rate sensor • ambient light sensor • IP67 (water resistant to 5ATM) • Android Wear 2 • 45 x 14 x 45mm (WDH) • 40g • 2yr RTB warranty

Adobe Premiere Elements 2018

Adobe Premiere Elements 2018 provides yet more tools to help newcomers edit and create sophisticated videos

SCORE ★★★★★

PRICE £63 (£75 inc VAT)
from pcpro.link/283prem

In this, the sixteenth iteration of Premiere Elements, Adobe majors on enhancements to its "guided edit" tools – think of these as interactive tutorials where you work with your own footage. There are four new guided edits, with the most notable aimed at action camera fans and their wide-angle footage.

One of this tool's key features, apart from snipping out what it thinks are the best bits, is correcting the distortion associated with a wide-angle lens. Action cam footage also tends to be shot with the camera in motion, so the guided edit suggests you use the image stabilisation tool to take the shakes out of the footage (although it doesn't guide you through this directly).

Adobe also focuses on the rise of social media. Premiere Elements has supported outputs in social-media-friendly formats for a while, but the new social media guided edit helps you add titles with motion animation to your clips. It can add subtitles, too, which is all the rage now that so many people watch videos with the sound turned down.

The other two guided edits aim to make advanced effects easier to create. These sit inside the Fun Edits section. The "freeze frame with motion title" would be great for an opening sequence where you introduce individuals or locations, stopping the action for a title each time one of them appears in the frame. The other one offers a "bounce back effect", where you take a short motion clip, speed it up, then add a reversed copy afterwards.

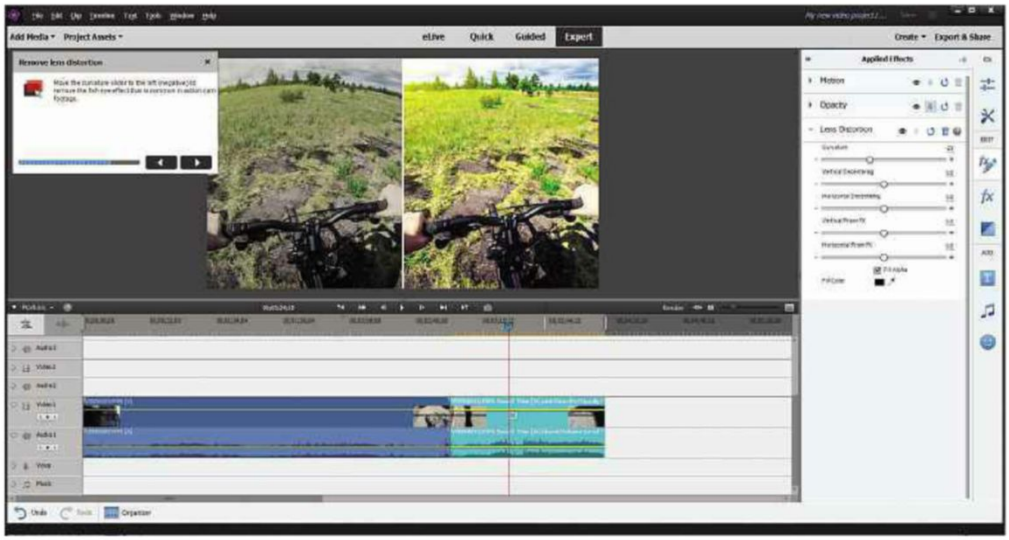
You're then prompted to output your bounce as an Animated GIF, which is a new and useful option. It could have been even better as a guided edit on its own, although Adobe does recommend an optimum length (5-10 seconds) for GIFs. The resolution options are 852 x 480 or 320 x 240, but beware of exploding file sizes: I found that a five-second GIF at the top resolution was over 12MB, which is a bit big to share with friends.

There are now 18 guided edits available. They're not perfect idiot-proof tools – sometimes you have to try again when things don't quite work – but are one of Premiere Elements' key advantages over rivals. Even consumer-grade video editing software has many hidden capabilities that the novice may not find, and guided editing helps discover more of the software's hidden power.

The other notable new features include Candid Moments and Smart Trim tools. The former scans a video clip for frames containing faces that you can then export to the desktop as still images, or create a slideshow from. It isn't perfect. The choices it makes seem random, and you may find stills you like better by extracting them manually. But if you shoot hours of family video footage and want to grab a few stills to share quickly, it has some value.

The Smart Trim tool is like the "magic editing" facilities found elsewhere, scanning a clip for the best sections. You can set it to look for sequences including people, action, or a mixture, and extract more or less of the original footage. Like the Candid Moments tool, Smart Trim is something for those who are short of time or don't like video editing much – they just want to get it done. If you're in either of these categories, you may find Smart Trim extremely useful.

Strangely, considering how well the professional-grade Adobe Premiere Pro CC now supports 360-degree video, Elements doesn't have any support for this at all. Sure, 360 is still a niche, but Elements' competitors support it. Still, if you aren't planning to venture into VR anytime soon, all the other handy features in Adobe Premiere Elements 2018 make it a great choice if you're new to video editing. **JAMES MORRIS**



ABOVE **One new guided edit helps fix action camera footage, including the removal of lens distortion**

What's new?

- Candid Moments
- Smart Trim
- Four new guided edits, including social media and action cam footage
- Project-specific online presets
- Animated GIF export

PC PRO RECOMMENDED

"There are now 18 guided edits available. They're not perfect idiot-proof tools, but are one of Premiere Elements' key advantages"

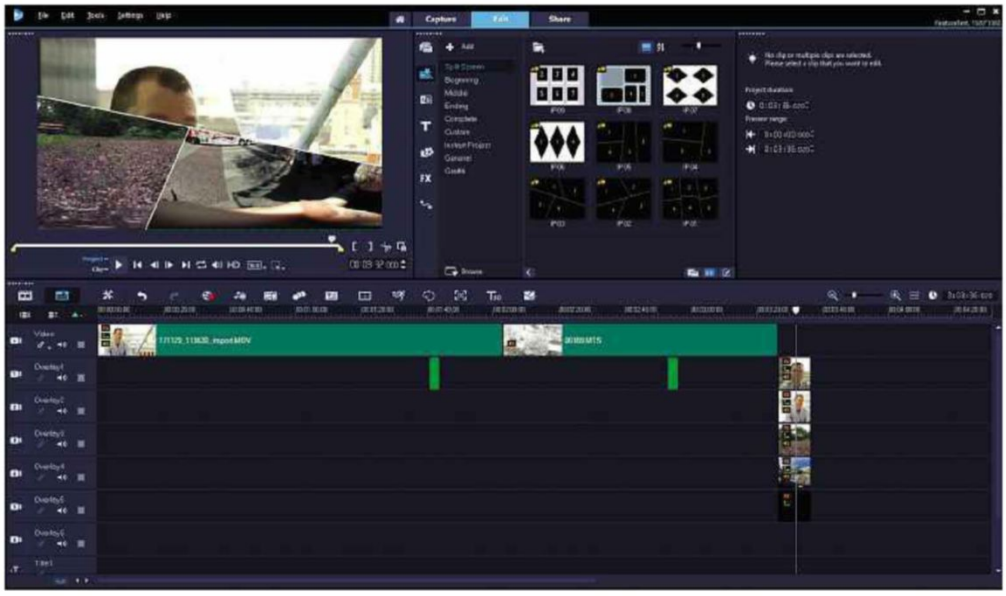
LEFT **Want your social media videos to look like this? Premiere Elements 2018 has a guided edit for that...**

Corel VideoStudio Ultimate 2018

Corel VideoStudio Ultimate 2018 focuses on usability, but there are some nifty new effects as well

SCORE ★★★★☆

PRICE £75 (£90 inc VAT)
from pcpro.link/283cor



Although there are plenty of new tools and enhanced effects, VisualStudio 2018's big improvements focus on usability rather than major new features.

The basic workflow is still divided into three stages – Capture, Edit and Share – but there are subtle tweaks to the Edit stage to streamline activities. Take the small tool beneath the video preview window that can be used to select scaling or cropping. Rather than launch a new window, this now takes place within the preview itself. However, you can't keyframe using this interface, just create static picture-in-picture effects. You still need the separate path effect to add motion, which also allows the animation of scaling and rotation.

VideoStudio's ability to create snazzy video effects has been improved too. The split-screen video templates are one highlight: drag one of these templates to the timeline and it sets up a series of overlay layers. You can then drag your clips over each layer whilst holding down Control to replace them. This then slices your clips according to the geometric split in the template. The nice thing here is that each video is still a layer, so you can add separate filters, effects, and even animations to each one.

There's a new Pan and Zoom editor that allows you to create those Ken Burns-style effects so beloved of documentary filmmakers, although this works just as well with video as it does with still images. You can use this tool to reframe the action or to add motion to a still image – panning across a family photo as you discuss who is contained within it in a voiceover, for example. The cropping, motion and rotation can all be keyframed.

Similar to the Premiere Elements guided edit opposite, Corel touts the new Lens Correction filter as a tool for removing the fisheye from wide-angle action camera footage. There are presets included, but you may need to use the manual adjustments to get the correction just right for your action camera, as the presets aren't for specific models. You can then save your own presets for future use. There are also a number of presets for adding in lens distortion as a creative effect, rather than removing it, which extends the value of this tool.

What's new?

- Split-screen video and template creator
- Lens correction tools
- 3D title editor
- Pan and zoom controls
- 360 video editing (enhanced)
- Stop motion animation (enhanced)

The support for 360-degree video has been improved since the previous version, but it's still behind CyberLink PowerDirector 16 (*see issue 278, p73*). For a start, the software only supports footage up to 4K resolution, so the 5.7K footage of Garmin's VIRB 360 and 5.2K footage of GoPro's Fusion can't be imported. However, I imported 4K equirectangular footage from my Garmin VIRB 360 without issue.

There's not much you can do with 360 footage, though. You can convert spherical to equirectangular, and extract a 2D frame from a sphere, but you can't edit the perspective, set the initial view direction, or stabilise, which is where PowerDirector wins.

ABOVE A pan and zoom tool animates motion around a frame, working with both video and stills

Most consumer video editing packages add value by offering versions with loads of bundled extras, and VideoStudio Ultimate 2018 is no different. There were already were tools from proDAD, Boris FX and NewBlue FX, but these are now augmented with templates from NewBlue Titler Pro 5, and an enhanced Boris Title Studio. However, these both act as filters that you add to a clip, and with the 2D and new 3D Title Editors that are built into VideoStudio, there are now at least four different ways to add titles. This is a bit of a mess.

"There's a new Pan and Zoom editor that allows you to create those Ken Burns-style effects so beloved of filmmakers"

The 3D Title Editor lets you add truly three-dimensional text over your video, with powerful design and animation abilities. You can add colour and texture, change the bevel and extrusion shape, and animate most attributes with time, allowing the creation of elaborate motion graphics intros. Just beware these kinds of titles can look old-fashioned.

Corel VideoStudio Ultimate 2018 is packed with features, and even at £90 it's good value considering the bundled effects. However, Premiere Elements wins for usability and PowerDirector 16 edges it on handling 360-degree video. This is a worthy upgrade for existing users of VideoStudio, but newcomers to video editing will find Premiere Elements easier to use and more focused.

JAMES MORRIS

BELOW Scale and crop footage right in the preview window – although this doesn't include animation


Lunch with
Barbra
Café
11:00 AM
Thursday 30
10
Photos
Store
XBOX
HALO
ASUS

BARGAIN LAPTOPS

No need to splash out thousands on a laptop. We round up ten multi-talented machines that cost between £299 and £599

Where does the budget laptop end and the mid-range begin? The laptops in this month's Labs are solid, affordable PCs, without the compromises you have to live with when you buy a bargain basement model – but without the extras you expect on a high-end machine. You're not going to get the thinnest, lightest, fastest, most stylish or best-equipped laptop for under £600, but you can buy a machine that will work as your main computer.

In fact, you could be surprised what you get for your money in 2018. The last few years have seen the old Ultrabook form factor work its way down towards the budget end of the market, along with what used to be luxury design features such as an all-aluminium shell.

And buying an affordable laptop no longer means living with a Celeron processor or a sub-par screen. To prove it, we've pulled together some of the choicest laptops you can buy for under £600, with designs ranging from 13.3in ultraportables to big-screen 15.6in bruisers. There are even versatile convertibles and laptops with superb Full HD screens.

Our only stipulation was that the laptop had to be suitable to be somebody's main home or work PC. Read on and you'll discover that you can have most of what you want without blowing your budget – and get a brilliant laptop that will last you for years.

CONTRIBUTOR: Stuart Andrews

Contents

BUYER'S GUIDE:
PICK YOUR PERFECT MID-RANGE LAPTOP

Making sacrifices is inevitable when you're spending less than a grand on a laptop, but make sure you cut your cloth in the right places

This month's laptops aren't the very cheapest each manufacturer has to offer – the low-end cheapies you'll often find in supermarkets. Instead, they typically represent a basic configuration of their mid-range models. For this money, you're not getting the fastest Intel processors, dedicated graphics chips or a massive solid-state drive, but you should also expect decent build quality and a laptop that will last a few years.

So why spend £600 when you could get away with £299? Buying at this price is all about priorities, working out what you must demand from your laptop, then the features that are must-haves, nice-to-haves and plain non-necessities.

1 Choose your screen size

Your first and most important decision is what size and style of laptop you need. If you're planning to use the laptop on the move, around campus or between several locations, then you should buy something that's compact and light; a 13in or 14in laptop that weighs less than 1.7kg is worth a sacrifice in terms of all-day working comfort or speed.

If you're looking for a laptop for use in the home or in the office, then going larger should net you more performance along with a larger keyboard and screen. If you need a laptop that handles either scenario on different days, a 14in laptop is the best balance between the two.

2 Is a convertible right for you?

Two-in-one convertibles are no longer the preserve of top-end laptops. These transform between a conventional clamshell design and a touch-oriented tablet PC, which can work well if you want something for casual sofa surfing and entertainment, but a more traditional laptop when there's work to be done.

Be aware that you may need an optional stylus – if one is available – to get any serious productivity benefits, partly because Windows and most Windows apps still aren't all that touch-friendly.

ABOVE Flippable convertible designs add versatility, along with weight and cost

Also note that a convertible will be heavier than an equivalent clamshell design. Don't make sacrifices for a more versatile device than you'll actually use.

3 How much power do you need?

It's with performance that the trade-offs start kicking in. At this price level, it's impossible to find a laptop with a high-powered spec, an excellent screen and a stylish, slimline design, so you have to work out how important performance is to the applications you run.

You can, for example, find thin and light Microsoft Surface Pro-style devices for under £600, but they will have low-power, low-speed Core M and Pentium CPUs. The more traditional laptops we're looking at here cover the range between dual-core and quad-core Core i3 and i5 chips, with 4GB to 8GB of RAM.

Navigating Intel's processor is a challenge. To maximise battery life, most laptops at this price use a processor with a U (for ultra-low power) suffix rather than an HQ (with high-performance graphics, quad-core) suffix. To illustrate the difference, the Core i5-7200U has two cores running at a base frequency of 2.5GHz, Turbo-Boost to 3.1GHz. The Core i5-7300HQ has four cores running at 2.5GHz to 3.5GHz, plus more powerful Intel HD 630 graphics.

Or compare the Core i5-7200U to the Core i3-7100U. Very little separates these two, bar the cheaper chip's locked 2.4GHz frequency.

What's more, while eighth-generation Intel Core processors are beginning to emerge, Intel has yet to replace some of its seventh generation mobile CPUs (you can spot the generation via the model number – the 7200U is the seventh-gen, the 8200U is eighth-gen). This makes a significant difference when the Core i5-8250U packs in four cores running eight threads at between 1.6GHz and 3.4GHz. It's dramatically faster in multitasking scenarios. If you plan to spend a lot of time with more

BELOW At this price, you're more likely to find a sixth-generation Core chip inside your laptop than eighth gen – but that's fine

intensive image-editing or video-editing apps, then prioritise accordingly and push for a seventh or eighth-generation Core i5 processor with an HQ suffix. If not, a Core i3 runs mainstream applications at perfectly good speeds.

Discrete graphics processors will, if even available, be an optional upgrade on these machines. These laptops will cope with some games at low detail levels, but if you want serious gaming performance, you will need to reset your expectations. See our article about mid-range gaming on p90.

4 How important is battery life?

If you're buying a lightweight laptop for use on the move, make battery life a key priority. Smaller, more energy-efficient processors, better screen tech and SSDs have dramatically increased the battery life of high-end laptops, and the same benefits have now come down to the mid-range. There's no need to put up with a laptop that putters out after just five hours when the best on test will last for nine hours or more.

5 Take a good look at the screen

Purchasing a laptop below £600 used to mean a dull, low-contrast 1,366 x 768 resolution screen. There's still plenty of those around, but we're seeing more Full HD (1,920 x 1,080) screens – and some of these are getting pretty good. You won't often get the widest colour gamut – photographers looking for close to 100% sRGB or Adobe RGB coverage will need to spend more – but you can get close, along with high levels of brightness and contrast and rich colours.

ABOVE Don't ignore the basics of a laptop: you'll tap on that keyboard thousands of times per month

Whatever kind of laptop you're buying, make the screen a major factor in the final decision. It can make or break the whole experience. Sound isn't quite so crucial, but some sub-£600 laptops dish out powerful audio with a surprisingly wide soundstage. We're certainly not talking Sonos quality, but for watching Netflix? Fine.

"If you can get away with a 128GB SSD and put up with the lack of storage, that's preferable to a noisy and less reliable 1TB hard disk"

6 Don't forget the basics

It's very easy to forget about the keyboard, but a bad one will drive you crazy over the laptop's lifespan. You will face a variety of keyboards in the £400 to £600 market: the chiclet or "Scrabble-tile" format is nigh-on universal, but such keyboards range from lightweight efforts with a nasty, spongy action to solid and well-designed units that have the feel of a premium model.

It's a sign of the times that we don't criticise the touchpads on any of the laptops on test this month. As a rule, they're both responsive and big. If you opt for a cheaper model, check before you buy: some lag or struggle with multitouch gestures.

On connectivity, we've reached the point where 802.11ac Wi-Fi is near-ubiquitous, and you'll struggle to find a laptop at this price that doesn't support at least the base 433Mbits/sec version over the 5GHz band. Likewise, Bluetooth 4.1 or above is a given. Otherwise, your physical connectivity will be directly linked to the form factor. Expect an HDMI video output, one or two USB 3 or 3.1 ports supplemented by one or two USB 2 ports. USB-C ports are also becoming more common, while some of the larger models still have a Gigabit Ethernet port.

Finally, there's storage. As ever, we have the perpetual battle between noisy and less reliable hard disks, and their sleek, quiet and expensive solid-state disk (SSD) cousins. If you can get way with a 128GB SSD and put up with the lack of storage, that's still preferable to a 1TB hard disk. However, it's best to aim for an SSD that's 250GB or larger if you can find room in your budget.

How we test

We asked manufacturers to provide laptops costing £300 to £600, with the one proviso that they had to be usable as the main computer in a home or business. We ran each laptop through our standard *PC Pro* benchmark tests, looking at how they coped in common business and creating scenarios, and how they handled our bruising multitasking test: this mixes 4K video playback with other processor-intensive tasks.

We also assess display quality, using not just our subjective judgement but a colorimeter to test brightness and contrast levels, colour accuracy and ability to reproduce the full gamut of colours in the sRGB standard. To test battery life, we set the screen brightness to 170cd/m², prevent the screen from dimming and the laptop from sleeping, then play a video clip on loop until the battery runs out.

With the formal testing over, we then use the laptop in a range of everyday scenarios, including document editing, video streaming, browsing the web and using web-based applications – and we do so both on a desk and on our laps. This gives us a good feel for its audio-visual capabilities, real-world performance and the quality of the screen, keyboard, touchpad and sound. We then take the design, features and connectivity into account before arriving at a final score and verdict.

Our thanks to CCL for its help in supplying laptops when manufacturers couldn't!





			LABS WINNER		
	Acer Aspire 5 A515-51	**Acer Swift 3**	**Asus ZenBook UX410**	**Dell Vostro 15 3568**	**HP 250 G6 15**
OVERALL	★★★★☆	★★★☆☆	★★★★★	★★★☆☆	★★★★☆
Purchase information					
Part code	NX.GSYEK.004	NX.GPJEK.001	UX410UA-GV158T	CD4Y7	1WY59EA#ABU
Price (inc VAT)	£487 (£584 inc VAT)	£500 (£600 inc VAT)	£499 (£599 inc VAT)	£391 (£469 inc VAT)	£475 (£570 inc VAT)
Supplier	cclonline.com	uk-store.acer.com	johnlewis.com	cclonline.com	cclonline.com
Dimensions (WDH, including feet)	381 x 263 x 21.6mm	338 x 234 x 18mm	323 x 223 x 19mm	380 x 260 x 23.6mm	380 x 254 x 23.8mm
Weight (with charger)	2.2kg (2.56kg)	1.8kg (2.08kg)	1.4kg (1.58kg)	2.18kg (2.47kg)	1.99kg (2.31kg)
Service & support					
Warranty [1]	2yr RTB	2yr RTB	1yr RTB	1yr C&R	1yr RTB
Manufacturer reliability/support score [2]	72%/81%	72%/81%	82%/89%	78%/84%	74%/83%
Core components					
Processor	Intel Core i5-8250U	Intel Core i3-7100U	Intel Core i3-7100U	Intel Core i3-7100U	Intel Core i5-7200U
Number of cores/ threads	4/8	2/4	2/4	2/4	2/4
Base frequency	1.6GHz	2.4GHz	2.4GHz	2.4GHz	2.5GHz
Max Turbo frequency	3.4GHz	N/A	N/A	N/A	3.1GHz
RAM fitted	8GB DDR4	4GB DDR4	4GB DDR4	4GB DDR4	8GB DDR4
Display					
Display size and finish	15.6in matte	14in gloss	14in matte	15.6in matte	15.6in matte
Resolution	1,920 x 1,080	1,920 x 1,080	1,920 x 1,080	1,366 x 768	1,920 x 1,080
Touchscreen (type)	✗	✗	✗	✗	✗
Graphics chipset	Intel UHD Graphics 620	Intel HD Graphics 620	Intel HD Graphics 620	Intel HD Graphics 620	Intel HD Graphics 620
Video outputs	HDMI	HDMI	HDMI	HDMI, D-SUB	HDMI, D-SUB
Drives					
Storage capacity	1TB	128GB	128GB	128GB	256GB
Storage type	Hard disk	SSD	SSD	SSD	SSD
Optical drive?	✗	✗	✗	DVD writer	DVD writer
Battery					
Battery type (capacity)	Lithium polymer (3,220mAh)	Lithium polymer (3,220mAh)	Lithium ion (48Wh)	Lithium ion (40Wh)	Lithium ion (41Wh)
Ports & connections					
Wireless connectivity	802.11ac	802.11ac	802.11ac	802.11ac	802.11ac
Gigabit Ethernet	✓	✗	✗	✓	✓
Memory card reader	SD/SDHC/SDXC	SD/SDHC/SDXC	SD/SDHC/SDXC	SD/SDHC/SDXC	SD/SDHC/SDXC
USB ports	2 x USB 2, USB 3, USB-C	USB 2, 2 x USB 3, USB-C	USB 3, 2 x USB 2, USB-C	2 x USB 3, USB 2	2 x USB 3.1, USB 2
Other features					
Webcam	✓	✓	✓	✓	✓
Backlit keyboard	✗	✗	✓	✗	✗
Touchpad toggle on/off	✓	✓	✓	✓	✓
Software					
Operating system	Windows 10 Home	Windows 10 Home	Windows 10 Home	Windows 10 Pro	Windows 10 Pro

1. Parts and labour, UK mainland, unless otherwise stated. **2.** Laptop reliability/support rating in reader-voted *PC Pro* Excellence Awards 2017. Higher score = better. Where N/A, companies didn't receive enough feedback to be rated. See issue 278, p32





	HP Pavilion x360 14	Lenovo IdeaPad 320S	Lenovo IdeaPad 520S	Medion Akoya S3409	PC Specialist UltraNote IV
	★★★★½	★★★½☆	★★★½☆	★★★★½	★★★½☆
	14-ba016na	80X2005LUK	80X2005LUK	MD-60377	N/A
	£482 (£578 inc VAT)	£249 (£299 inc VAT)	£499 (£599 inc VAT)	£499 (£599 inc VAT)	£482 (£578 inc VAT)
	amazon.co.uk	lenovo.com/gb	lenovo.com/gb	pcworld.co.uk	pcspecialist.co.uk
	335 x 227 x 19.9mm	338 x 249 x 17mm	327 x 237 x 19.3mm	327 x 221 x 16.9mm	340 x 244 x 22.2mm
	1.63kg (1.91kg)	1.7kg (1.88kg)	1.7kg (1.88kg)	1.41kg (1.72kg)	1.8kg (2.09kg)
	1yr RTB	1yr RTB	1yr RTB	1yr RTB	1mth C&R, 2yr RTB (year 2 labour-only)
	74%/83%	74%/83%	74%/83%	N/A	N/A
	Intel Core i3-7100U	Intel Pentium 4415U	Intel Core i3-7100U	Intel Core i5-7200U	Intel Core i5-8250U
	2/4	2/4	2/4	2/4	4/8
	2.4GHz	2.3GHz	2.4GHz	2.5GHz	1.6GHz
	N/A	N/A	N/A	3.1GHz	3.4GHz
	8GB DDR4	4GB DDR4	8GB DDR4	8GB DDR3L	8GB DDR4
	14in gloss	14in matte	14in matte	13.3in matte	14in matte
	1,920 x 1,080	1,366 x 768	1,920 x 1,080	1,920 x 1,080	1,920 x 1,080
	✘	✘	✘	✘	✘
	Intel HD Graphics 620	Intel HD Graphics 610	Intel HD Graphics 620	Intel HD Graphics 620	Intel UHD Graphics 620
	HDMI	HDMI	HDMI	HDMI	HDMI
	128GB	128GB	128GB	256GB	1TB
	SSD	SSD	SSD	SSD	SSHD
	✘	✘	✘	✘	✘
	Lithium ion (41Wh)	Lithium polymer (30Wh)	Lithium polymer (52.5Wh)	Lithium polymer (45.14Wh)	Lithium ion (44Wh)
	802.11ac	802.11ac	802.11ac	802.11ac	802.11ac
	✘	✘	✘	✘	✓
	SD/SDHC/SDXC	SD/SDHC/SDXC	SD/SDHC/SDXC	SD/SDHC/SDXC	SD/SDHC/SDXC
	2 x USB 3.1, USB-C	USB 3, USB 2, USB-C	USB 3, USB 2, USB-C	2 x USB 3, USB-C	USB 3, USB 2, USB-C
	✓	✓	✓	✓	✓
	✘	✘	✘	✓	✘
	✓	✓	✓	✓	✓
	Windows 10 Home	Windows 10 Home	Windows 10 Home	Windows 10 Home	Windows 10 Home

Acer Aspire 5 A515-51

A powerful big-screen laptop with staying power, Acer makes compromises but in sensible places

SCORE ★★★★☆

PRICE £487 (£584 inc VAT)
from cclonline.com

It might not have the glamour of its Acer stablemate, the aluminium-shelled Swift 3, but the Aspire 5 is every bit as remarkable. It packs an eighth-generation Intel Core i5-8250 processor and 15.6in screen inside a chassis that's still relatively thin and light – and all for under £600.

There are some compromises involved, but Acer has been smart in where these are and how they appear. For instance, while the construction is predominantly plastic, that's well disguised by an aluminium keyboard surround, silver accents and a ridged pattern on the surface of the lid. Unlike some other part-aluminium laptops, there are no noticeable rough edges. And while no 15.6in laptop is ever going to be described as ultraportable, the 2.2kg Aspire 5 doesn't actually feel that heavy. It's a weighty presence on your lap or in your bag, but not uncomfortable.

There's more good news in terms of ergonomics. The touchpad is large, smooth and unerringly accurate, while there's enough space in the chassis for something close to a standard keyboard layout – plus a separate numeric pad. The profile and spacious surround make for a comfortable typing position, and while the keys themselves only have a shallow movement, they have a pleasant feel. You could get some proper work done if you needed to.

The Aspire 5 doesn't fare quite so well on connectivity, but it has all the basics covered. It's great to see a USB-C port on a larger mid-range laptop, and while it's a shame that two of the three Type-A USB ports (the older style) are USB 2, you can use these to connect less bandwidth-hungry peripherals and keep the faster ports back for external storage. The 802.11ac Wi-Fi support is limited by a 1x1 configuration, which limits downloads to a theoretical 433Mbits/sec maximum. However, a clever space-saving, flip-out RJ-45 socket gives you Gigabit Ethernet where you have a wired network.

It's the screen and sound where Acer makes the biggest compromises. In isolation, the TN panel isn't bad; 256cd/m² is bright enough for use in conditions that don't involve direct sunlight, viewing angles are relatively wide and colours vibrant. Put the Aspire next to the Asus or Medion laptops, however, and it doesn't have the same depth of colour, with just 55.5% of the sRGB colour gamut covered. This isn't a big deal unless you're an enthusiast photographer, and in most mainstream applications you probably wouldn't notice anything amiss.

Audio is a different story. There's an awful lot of volume here, but not so much clarity or finesse. Drums clang like a miked-up biscuit tin while vocals sound rough and brash. The output's good enough for Skype or a Netflix binge at lower volumes, but even when streaming you'll want to plug some headphones in.

So far, the Aspire 5 sounds like it only has an outside chance of a recommendation, but the generous specification puts it back in the running. That four-core, eight-thread Core i5-8250U processor puts it comfortably ahead of any laptop with the equivalent seventh-generation Core i5, partly because it has the multi-threaded performance to steam through video-processing and multitasking apps. Basically, there's enough power here for Ultra HD video editing, high-resolution, multi-layer photo-editing and just about anything else you can think of.

ABOVE No all-metal finish, but the Aspire 5 has the look and feel of a high-quality laptop

PC PRO RECOMMENDED

"There's enough power for Ultra HD video editing, high-resolution, multi-layer, photo-editing, and anything else you can think of"

What's even more surprising is that neither the performance nor the larger form factor come at the expense of battery life. We squeezed over nine hours of looping video out of the Aspire 5 before the screen went blank. Keep the brightness levels below the maximum and there's no reason why you'd need to find a power outlet before the end of the day.

You might not need the Aspire 5's level of performance, or you might want something smaller and lighter, but this is a great value laptop for use in and around the home. Given the chance, we would wish for a better screen and a backlit keyboard, but for the price we'll live with what we've got.

BELOW The Aspire 5 isn't sleek or sexy, but inside the chunky chassis lies a powerful specification

BENCHMARKS

112	Photo editing
91	Video editing
80	Multitasking
89	Overall

Battery life **9hrs 8mins**

Asus ZenBook UX410

A fantastic 14in laptop in an ultra-compact chassis – the UX410 is a clear winner, despite tough competition

SCORE ★★★★★
PRICE £499 (£599 inc VAT)
from johnlewis.com

Looking for a premium, slimline ultraportable at a mid-range price is a little like planning to buy a luxury sports saloon for the price of a family runabout. Yet the Asus ZenBook UX410 comes close to the mark, delivering the kind of experience we would expect from a laptop costing over £1,000.

It's compact for a 14in model, with the ultra-slim 6mm bezel allowing the screen to sit in a chassis the size of an average 13.3in ultraportable. It's actually a few millimetres shorter on its longest axis than the 13.3in Medion Akoya S3409 and 15mm shorter than the hardly chunky Acer Swift 3. Thicker bezels above and below the screen mean we're not quite in the territory of the Infinity screens on Dell's high-end XPS machines, but it's an impressive feat of engineering for a mid-range model.

That chassis, meanwhile, is gorgeous. It's all aluminium, from the shiny lid to the keyboard surround to the base, and while there's some movement if you try to bend the lid, it feels well-built and robust. The edge of the surround plate fits neatly over each side of the base, meaning there are no uncomfortable edges, and the working position is comfortable whether you're sitting at your desk or working on your lap.

The keyboard is again fantastic for a mid-range laptop. Some may grumble over the shrunken Shift key on the left-hand side, but otherwise the keyboard feels larger and more spaced-out than it actually is. The typing action is light, not demanding much pressure, but with a crisp response as you tap each key down. The trackpad handles small motions, sweeping moves and multitouch gestures with high levels of accuracy, making the laptop as a whole a pleasure to use. At just 1.4kg you could comfortably carry it all day long, yet the screen and keyboard are sizable enough to keep you going through a working day without complaints.

Those slim lines don't come at the expense of connectivity: you get the full suite of USB 3 and HDMI ports, plus an SD card reader and a USB-C port. This isn't used for charging – you're stuck with a tablet-style wall wart charger with a short 1.2m cable instead – but it's welcome addition nonetheless. There's also dual-band 802.11ac Wi-Fi, with a 2x2 configuration for a maximum 866Mbits/sec connection speed. In short, you're well-equipped.

The one thing you have cause to gripe about is the core specification – Asus uses a seventh-generation Core i3-7100U with just 4GB of RAM and a 128GB SSD. In our benchmark results, this means a mid-table placing, but in general use running mainstream office applications (and even many professional graphics and design apps) you'll be fine. If you need more horsepower then there's a higher-end variant with a Core i5 and double the storage and RAM, not to mention a fingerprint reader. However, this will set you back another £150, so you may prefer to add more RAM and a SATA SSD manually yourself. They're just a few Torx screws away.

ABOVE Slim bezels mean this 14in screen fits into an unusually compact chassis

PC PRO LABS WINNER

Yet we haven't even touched on the UX410's strongest feature: the quality of its screen. Much as the 200-plus ppi screens of the MacBook Pro or Surface Laptop look incredibly sharp, 1,920 x 1,080 can still look beautifully clear on a good 14in display. This one is a cracker, too, with the best colour accuracy of any on test, high levels of brightness and contrast (362cd/m² and 1,189:1 respectively) and a stellar 92% coverage of the sRGB gamut. You could happily edit DSLR photos on this laptop – or just stream Netflix and enjoy a great, vibrant picture. The sound is a tad harsh with the volume up high, but set it just loud enough to drown out the occasional whine from the cooling system, and it's fine for casual listening.

"The chassis is gorgeous. It's all aluminium, from the shiny lid to the keyboard surround to the base, and it feels well-built and robust"

This isn't the most powerful laptop on test, and battery life is one area where Acer comes out on top – the Asus only just made it to eight hours of video playback where the Acer lasted for nine. All the same, the ZenBook UX410 feels a cut above the competition. Looking for a premium, slimline ultraportable at a mid-range price? Look no further.

BELOW Slender dimensions and a 1.4kg weight means this is a fine machine for commuters

BENCHMARKS

62 Photo editing	44 Video editing
22 Multitasking	36 Overall

Battery life **8hrs 12mins**

HP 250 G6 15

A well-balanced spec and solid build quality means there's much here to appeal to business buyers

SCORE ★★★★☆

PRICE £475 (£570 inc VAT)
from cclonline.com

HP loves to showcase the stylish premium laptops of its EliteBook and Spectre lines, but it's still a major player in the corporate and small business markets – and that's where you'll find the catchily named HP 250 G6 14.

With its glossy silver casing and faux-aluminium keyboard surround, a little of the style of HP's slimline models seems to have trickled down, but this is an all-plastic unit designed around practicality rather than dashing looks. This isn't necessarily a criticism. While there's a little too much flex in the lid, the 250 G6 feels impressively robust, with a beefy hinge that should stand many years of use. Just shy of 2kg, it's a little too weighty to work as a take-anywhere, do-anything device, but as a tool for primarily deskbound workers, it has a lot in its favour.

That starts with the screen. It's a 15.6in, matte finish display, but unlike the Dell Vostro, it has a Full HD 1,920 x 1,080 resolution. This makes an enormous difference if you spend a lot of time working in Excel spreadsheets or pulling information from multiple sources, and simply makes the 250 G6 more comfortable to use.

It's not a great screen across the board: the limited maximum brightness of 234cd/m² restricts visibility if you're sitting near a sunny window, while both colour and contrast look subdued. As coverage of the sRGB gamut is just 53.4%, this would be a rubbish choice for creative professionals. Yet, for mainstream business use or an after-hours Netflix binge, it's perfectly fine. Audio isn't bad either – it may be a little low on bass and harsh in the mid-range, but it's still clear enough for Skype calls and videoconferencing.

Another advantage of the larger form factor is that it allows for such a comfortable, expansive keyboard. While the function keys are small, there's little to fault the layout, with no signs of the undersized Shift keys or spacebar that you'll find on some smaller laptops. What's more, you get a full numeric pad. And while the touchpad is smaller than on some more compact models, that's partly because it incorporates physical buttons. It's also sensitive without being over-sensitive, so you don't really notice the loss of area.

Elsewhere, there's a sense that HP is catering for users with legacy tech to support. With two USB 3.1 ports and one USB 2, you're well-equipped to connect mice, printers and external storage, but how many businesses need a VGA output when there's HDMI onboard? Isn't a DVD writer surplus to most users' requirements, while adding to the cost and weight?

Still, it's good to see a Gigabit Ethernet port for a physical internet connection, plus 802.11ac wireless support – albeit for a base-level 1x1 configuration with a maximum speed of 433Mbits/sec. Again, given the kinds of uses and applications that apply, that's not a serious complaint.

The 250 G6 can be found with a bewildering variety of specs, but the one we tested featured a seventh-generation Core i5-7200U, 8GB of RAM and a 250GB SSD. That's an effective balance for a work PC, giving you performance to run demanding applications, speedy boot times and enough storage space to hold media files and plenty of business data. While laptops featuring the newer eighth-generation Core i5 CPUs outperform the HP, it's hardly left in the dust, and it's comfortably faster than the lower-end Core i3 laptops on test.

ABOVE A Full HD 15.6in panel makes it easier to work on two programs side by side

"The HP is too weighty to work as a take-anywhere, do-anything device, but it's a great choice for primarily deskbound workers"

15.6in laptops aren't known for great battery life, but the 250 G6 surprised us by surviving nearly seven hours of video playback before conking out. A full working day of lighter use isn't out of the question. Better still, the battery is removable and available to order.

A laptop such as this is always going to struggle with the "wow factor", but the 250 G6 is the kind of practical, durable laptop that small businesses should invest in, offering great value thanks to its performance, usability, battery life and Full HD screen. Let other laptops steal the glory; this one's got some work to do.

BELOW Own some old kit? Still using DVDs? Then this HP has all the connectors and drives you'll need

BENCHMARKS

80	Photo editing
57	Video editing
34	Multitasking
49	Overall

Battery life **6hrs 59mins**

Medion Akoya S3409

Battery life isn't brilliant, but everything else about this 13.3in ultraportable screams excellent value

SCORE ★★★★☆

PRICE £499 (£599 inc VAT)
from pcworld.co.uk

Medion doesn't have the kind of reputation in the UK that it enjoys in its native Germany, but it's a brand that generally competes in terms of bang for buck. And that's the MO with the Akoya S3409, which packs a generous spec inside a slimline aluminium chassis with a 13.3in Full HD screen. You're getting something that looks like a high-end ultraportable, but at under two-thirds the price of the equivalent Dell XPS 13 or MacBook.

We say "looks like" because this isn't quite as slick or polished a design as the photographs make it appear, with signs of cost-cutting easy to spot once you see it in the flesh. The most obvious is that it isn't actually all metal, with an aluminium lid and an aluminium baseplate slipping over the keyboard and the sides. This all but conceals the kind of silver plastic base that was ubiquitous in budget laptops a few years ago. The Akoya still feels solid and looks more expensive than it is, but where the Acer Swift 3 and Asus ZenBook UX410 are rocking all-aluminium designs, Medion's doesn't hold up quite as well.

That lack of finesse shows up elsewhere, with a tiny power button on the right-hand side that's initially hard to find, plus ports crammed together next door: that makes it difficult to get some cables and/or USB memory sticks plugged in at the same time. The Akoya can also be surprisingly noisy. It's eerily quiet one minute, but a low, whining tone kicks in as soon as it's pushed – and even sometimes when it's not.

Yet, there are also many good things about the Akoya S3409. At 1.4kg, it's the kind of laptop you'll be happy to sling in a bag and drag from a coffee shop to a client's office and then back home. It has a good lineup of connections, including a USB-C and two USB 3 ports, but note the former can't be used for charging: the Medion still requires a proprietary power cable. There's no Ethernet port, but the Akoya offers 802.11ac Wi-Fi in a 2x2 configuration, giving you speeds of up to 866Mbits/sec if your router supports them.

Importantly, it's also nice to use. The keyboard is illuminated with a gentle background glow, and while the keys are smaller than on the 14in and 15.6in laptops here, the layout makes it feel more spacious than it is. Even the undersized Shift key didn't pose any touch-typing issues. The typing action is crisp and consistent across the width of the keyboard, while the large trackpad has a smooth surface, responsive integral buttons and enough finesse for multitouch gestures and fine control.

The screen is equally good and, after the Asus, the second best on test. The 13.3in size and Full HD resolution is great for browsing the web or streaming Netflix, while there's a depth of tone and colour that's rarely seen on sub-£600 laptop displays. While colour accuracy isn't quite up there with the Asus – we measured the average Delta E at 6.79 – the maximum brightness levels of 376cd/m² and sRGB coverage of 81% are quite impressive.

ABOVE A laptop of two halves: there's much that's brilliant here, and much that's distinctly mediocre

The news isn't quite so good when we get to sound, however. Despite a Dolby Audio Premium badge, we found it tinny and congested, getting harsher as you push the volume up. Fans of dustbin-lid drums and screechy vocals might disagree, but we wouldn't want to spend too long listening before plugging some headphones in.

Battery life is the Medion's biggest weakness – we eked just under six-and-a-half hours of looping video playback out of a charge, while some of its 14in rivals can last for another three hours or more.

"At 1.4kg, this is the kind of laptop you'll be happy to sling in a bag and drag from a coffee shop to a client's office and then back home"

Luckily, the Akoya makes up for it on performance. With a Core i5-7200U processor, 8GB of RAM and a 256GB SSD, it's something of a pocket rocket, sitting towards the top of this month's result table. As long as you're not looking to play games, run high-end 3D design packages or edit Ultra HD video, there's little the Akoya won't do.

Live with the mediocre battery life and a few rough edges, and you get a lot of power in a very compact chassis at a cut-down price.

BELOW Quite why Medion decided to put the power button at the rear of the side is beyond us

BENCHMARKS

83 Photo editing	50 Video editing
31 Multitasking	46 Overall

Battery life **6hrs 27mins**

Acer Swift 3

A premium laptop without the price tag, but the screen is a disappointment

SCORE ★★★★☆

PRICE £500 (£600 inc VAT)
from uk-store.acer.com

It's hard to believe that a laptop as luxurious as the Acer Swift 3 is available for £600. The aluminium design belongs to a premium laptop, and at 18mm it's about as slim as 14in laptops get. We went hunting for signs of cost-cutting in the build quality, but returned almost empty-handed. The Swift 3's only (and literal) rough edge is where the keyboard surround meets the base at the chassis' front.

It's not style over substance, either. A comprehensive lineup of Type-A USB ports complement the single USB-C connector, along with an HDMI output, SD card reader and a combo audio jack. 802.11ac Wi-Fi is included in the faster 2x2 configuration, maxing out at 866Mbits/sec.

The touchpad is enormous and extremely accurate, and while the keyboard has a few layout oddities, such as the weird, split left-Shift-meets-backslash key, there's a nice spring to the typing action. Acer also fits in a fingerprint reader, which delivered instant, accurate sign-ons once in use.

£600 will nets you the base level Swift 3 with a Core i3-7100U chip, 8GB of RAM and a 256GB SSD. This delivers more than adequate performance for mainstream applications, but those looking for serious horsepower should choose the £749 variant with an eighth-generation Core i5-8250U. Results in our benchmark tests put the Swift 3 in the middle of the slower Core i3 pack. Battery life, however, is anything but mediocre: the Swift 3 can keep working for over ten hours from a single charge.

ABOVE Brilliant battery life makes this a fine alternative to the award winners

BELOW When it comes to USB ports, the Swift 3 spoils you for choice

Why, then, isn't the Swift 3 going home with an award? Well, it's a close match for the Asus ZenBook UX410, but it falls behind on screen quality. sRGB gamut coverage sits at under 60% where the Asus hits 92%, while brightness levels top out at a mediocre 267cd/m². Sound is a less important factor – the Swift 3 goes loud but rather tinny – but as good as the Acer is, the similar ZenBook UX410 comes out slightly stronger overall.

There's little in it, though, so if you're swayed by the fingerprint reader, superior battery life and 8GB of RAM, the Acer is fine choice.

BENCHMARKS

57 Photo editing	41 Video editing
25 Multitasking	36 Overall

Battery life **10hrs 9mins**

Dell Vostro 15 3568

A good-value office laptop that's let down by its screen and outclassed by the HP

SCORE ★★★☆☆

PRICE £391 (£469 inc VAT)
from cclonline.com

The Vostro 15 3568 hails from Dell's small business range, and that's reflected in an old-school design. Yet, while it's heavy at 2.1kg, the design yields some positives. The large keyboard surround gives plenty of space to rest your wrists while typing and it's impressively robust.

That size also means there's plenty of room for the keyboard, and we liked the large, flat-topped keys and their light, clicky action. There's room for a separate numeric pad, too. The trackpad is just as sizable, and works well both for precise work and multitouch gestures. Connectivity isn't cutting-edge, with no USB-C port, but you still get 802.11ac Wi-Fi and built-in Gigabit Ethernet. The Vostro is also one of only two laptops on test with a DVD writer.

While the Vostro 15 we tested came with a seventh-gen Core i3-7100U and 4GB of RAM, an extra £33 will net you a Core i5-7200U. It's worth thinking about, as our review model lagged behind laptops with the faster CPU.

Our battery life test saw the Vostro looping video for nearly seven hours, so it could last an average working day. It's more likely to spend most of its time sitting on a desk than on the move, anyway, so the compact charger won't be too far away.

ABOVE This 15.6in laptop is neither light nor compact, but its keyboard is a keeper

BELOW As with HP's 250 G5, a DVD writer and VGA port are present if required

So there's much to like, but the Vostro has two flaws. The first – rather brutish audio – isn't much of an issue, and both the microphone and speakers hold up well in Skype conversations. The screen, however, lets it down. The combination of the 15.6in screen size and a 1,366 x 768 resolution means the display has a grainy, pixelated look, and with a peak brightness of 239cd/m², you don't get the brightness or vibrant colour of the screens on the Medion or Asus laptops. Colour accuracy is again below par, while the panel can only handle 52.4% of the sRGB gamut. The final nail: viewing angles are poor.

The Vostro still offers good value to small business users, but its biggest problem is out of Dell's hands: spend a little more on the HP 250 G5, and you get a faster laptop that's just as usable – and with a better, Full HD screen.

BENCHMARKS

62 Photo editing	44 Video editing
19 Multitasking	35 Overall

Battery life **6hrs 45mins**

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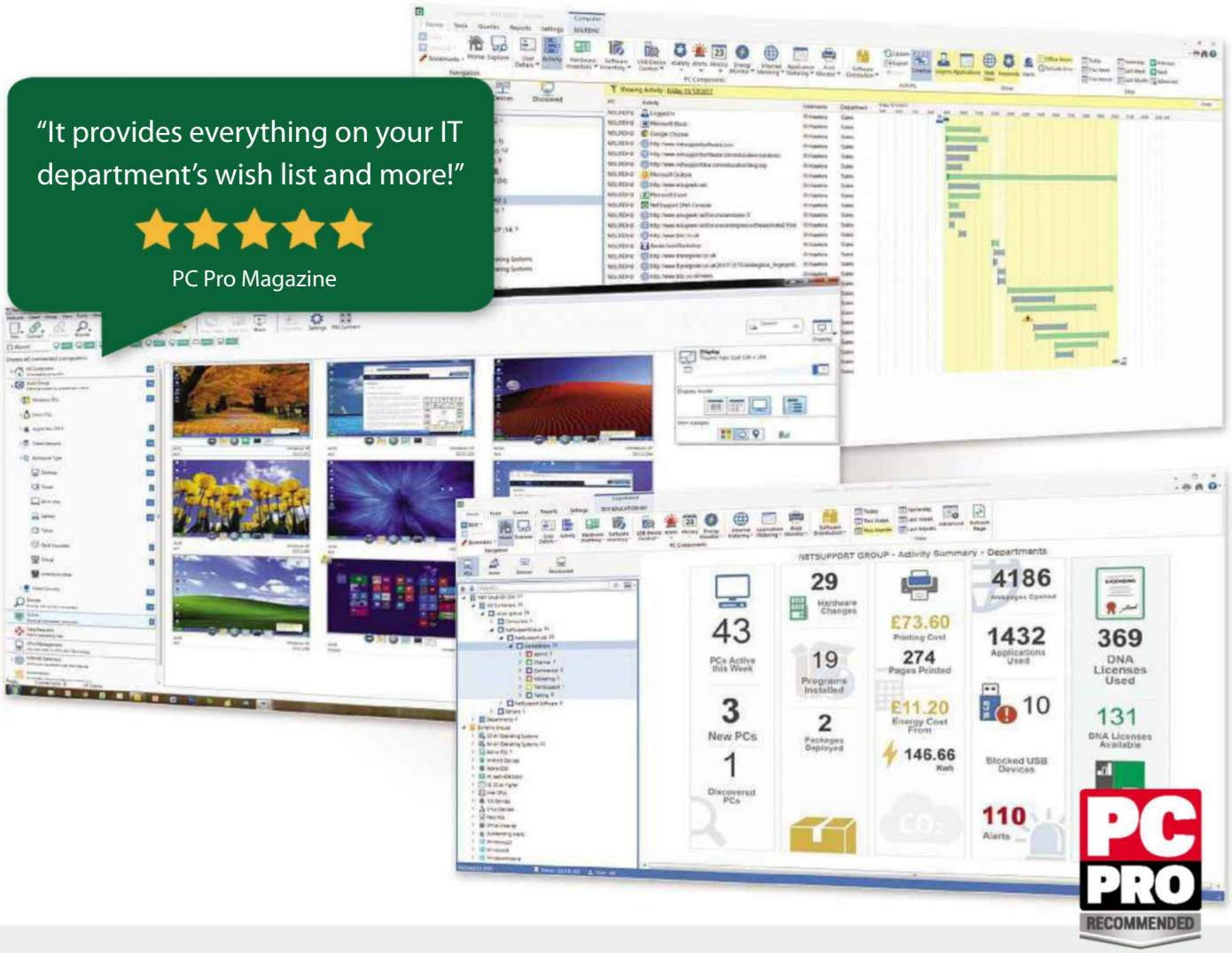

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HP Pavilion x360 14

A stylish convertible that falls just short of the award winners

SCORE ★★★★☆

PRICE £482 (£578 inc VAT)
from amazon.co.uk

The stylish Pavilion x360 14 comes in a choice of champagne gold and silver finishes, although the materials are plastic rather than brushed aluminium. HP's tried-and-tested hinge design allows you to fold the screen back flat against the base for use as an oversized tablet, or in a tent configuration for watching video. At 1.63kg, it won't replace your iPad, but by 14in laptop standards it's very manageable indeed.

In fact, a 14in screen is a good option for a 2-in-1 convertible, giving you a bigger, more comfortable display than a 13.3in model without the added bulk of a 15.6in laptop. The Full HD screen itself, sadly, isn't much of a highlight. Brightness levels max out at an underwhelming 242cd/m² and while colour accuracy isn't awful, with an average Delta E of 5.26, it covers just 58.3% of the SRGB gamut.

The keyboard is excellent, with large, flat-topped keys that have a light but positive feel. The touchpad is smooth and flawlessly responsive, and the same goes for the touchscreen. This supports an active stylus, but HP doesn't provide one or even recommend which one to buy.

Nearly all the connectivity is on the right-hand side, bar the power socket and 3.5mm audio jack, with two USB 3.1 ports, a single USB-C port and an HDMI video output. As well as a webcam, HP supplies the depth-sensing camera required for facial recognition using Windows Hello.

ABOVE HP brings a splash of style to its budget range of laptops

BELOW Oddly, HP includes most of the connectivity on the right-hand side

There are variants of the Pavilion x360 with more powerful chips, but we tested a model with a Core i3-7100U and 8GB of DDR4 RAM. You'll want extra horsepower for high-end video-editing applications, but there's enough performance for a mix of web browsing, entertainment and Office use. Given the form factor, battery life is a little disappointing. We got more than six hours of video playback from the Pavilion x360, but when rivals exceed ten hours, this isn't so impressive.

The HP is a fine convertible and could have been an awards contender, but when rivals beat it on the spec, screen and battery life, it just falls short of the mark.

BENCHMARKS

63 Photo editing	45 Video editing
21 Multitasking	36 Overall

Battery life **6hrs 24mins**

Lenovo IdeaPad 320S

A solid low-cost laptop, but there are big compromises made on overall usability

SCORE ★★★☆☆

PRICE £249 (£299 inc VAT)
from lenovo.com/gb

The cheapest model on test, the IdeaPad 320S still manages to look and feel a cut above your basic budget laptop. Particularly with our test version's "snow white" finish. It might not have the metallic shell of more expensive rivals, but the mixed aluminium and plastic chassis feels solid, with a thick, robust hinge. This doesn't provide the convertible options of Lenovo's Yoga range, but it will allow the screen to fold back flat against your desk. At 1.7kg, it's light enough to be lugged around, but you still get a 14in screen and decent connectivity, including a USB-C port. Note you can't charge through this – you'll need the proprietary charger.

It's not long, however, before you spot the signs of that lower price. The keyboard layout is classic Lenovo – spacious and with everything just where you expect – but the key action is soft and keystrokes don't always register. The touchpad is big, but not quite as smooth or responsive as on Lenovo's own 520S. Our biggest concern, however, is the TN screen. We can live with the 1,366 x 768 resolution, but it's dim, with a maximum brightness of 217cd/m². Colour accuracy is similarly weak, and it only covers 55.3% of the sRGB spectrum. It's fine for watching Netflix on the sofa – and the audio from the Harman Kardon speakers is powerful, if brash – but it isn't a screen you'd want to work on all day.

ABOVE Judged by looks alone, this is a stonking laptop for under £300

BELOW At 17mm thick and weighing 1.7kg, this is a reasonably portable machine

Battery life is another indicator of this laptop's budget origins, and the 320S survived just five hours and eight minutes in our looping video test.

You can find the 320S in a range of configurations, from the Pentium 4515U model tested here to Core i3-7100U and Core i5-7200U variants. Performance from the Pentium 4515U is predictably weak, and any efforts at using more demanding applications may be hampered by having just 4GB of RAM. Moving up the scale would be a wise investment, particularly as the Core i5 model can be bought with a Full HD screen, but expect to pay over our £600 budget for that. We would recommend moving instead to the IdeaPad 520S or – better still – one of this month's award winners.

BENCHMARKS

53 Photo editing	28 Video editing
17 Multitasking	27 Overall

Battery life **5hrs 8mins**

Lenovo IdeaPad 520S

A versatile all-rounder with a premium design, but not leader of the pack

SCORE ★★★★☆

PRICE £499 (£599 inc VAT)
from lenovo.com/gb

The thin-and-light design, plus clever use of aluminium where you're most likely to see it – on the lid and keyboard surround – help the IdeaPad 520S do an excellent impersonation of a high-end laptop. It's well-built, too, with a strong hinge and little give anywhere in the chassis.

What's more, this is a very usable machine. The keyboard has a classic, spacious Lenovo layout with the feel to match, with a crisp action that helps you hit excellent typing speeds. The huge trackpad has a smooth surface and accurate tracking, responding well to taps, multitouch gestures and clicks of the integral buttons. At 1.7kg, it's comfortable on the lap and easy on the shoulder, dishing out neither excessive heat nor noise. Lenovo even crams in a fingerprint reader, which proved easy to set up and flawless in use.

ABOVE The IdeaPad looks great, partly due to Lenovo's strategic use of aluminium

The screen is an improvement on the HD resolution display on the IdeaPad 320S, simply because it has a Full HD resolution, higher brightness levels and richer, more vibrant colours. All the same, it's not the best on offer. Maximum brightness is still relatively limited at 252cd/m², colour accuracy is mediocre and you only have 60.6% of the sRGB colour gamut covered. Subjectively, it's fine for watching video, browsing the web or office work, and the sound from the Harman Kardon speakers is richer and more detailed than you might expect, but if you want a display with real punch, choose the Asus.

BELOW There's a fine selection of ports and connectors, but note the 128GB SSD

The IdeaPad 520S comes in configurations ranging from a Core i3-7100U with built-in Intel HD graphics to a high-end version with an eighth-generation Core i7 and discrete Nvidia graphics chips. £599 will only stretch to the base model, but it's still speedy enough for anything bar video editing and new 3D games, with 8GB of RAM and a (slightly stingy) 128GB SSD. You also get 2x2 802.11ac Wi-Fi and a USB-C port, along with one USB 2 and one Type-A USB 3.

This is an effective laptop with good performance, reasonable battery life and a decent screen. Its only issue is that some competitors offer just that bit more for the same money.

BENCHMARKS

Photo editing	Video editing	Battery life
58	42	
Multitasking	Overall	6hrs 56mins
18	33	

PC Specialist UltraNote IV

The UltraNote IV delivers high-end performance in a budget-feeling chassis

SCORE ★★★☆☆

PRICE £482 (£578 inc VAT)
from pcspecialist.co.uk

On first impressions, this laptop isn't a strong contender. It's based on a plastic 14in Clevo chassis, lending the UltraNote IV a budget feel. It's a noisy little devil, too, even when idle. Give it something hard to do and it's quite obtrusive.

None of this means it's unusable. The removable battery lifts the base up at a comfortable typing angle, and the keyboard boasts large, flat-topped keys, a standard layout and a solid action. The touchpad isn't the most sensitive, but it works reliably and doesn't falter with multitouch gestures. The connectivity is a weird mix of the retro and the cutting-edge, with a USB-C port on one side, a VGA output on the other, but all the HDMI and USB 3 basics are covered along with a Gigabit Ethernet port.

ABOVE The grey and black plastic chassis lends this laptop a budget feel

The screen is the biggest disappointment, despite its Full HD resolution. With a maximum brightness of just 212cd/m² ,it's too dim for work in bright conditions, and there isn't enough contrast to produce a punchy image. sRGB coverage is just 58.1%, which is bog-standard for a mid-range laptop panel. As for the sound, just grab some headphones. You don't want to hear the tinny racket this little laptop pumps out.

BELOW The battery lifts up the rear, which makes typing more comfortable

Battery life could also be better. Five hours of looping video isn't a terrible performance, but it puts the UltraNote IV well behind the pack.

But the UltraNote IV has one big point in its favour; not only do you get a quad-core Core i5-8250 processor, but 8GB of RAM along with a 1TB SSHD (solid-state hybrid drive). The latter isn't as fast as a straight SSD, with read speeds topping out at around 130MB/sec where an SSD typically gets 500MB/sec or more, but it still boots within a few seconds and you have a lot more storage space to play with. The UltraNote was the fastest laptop in our benchmarks, excelling in our multitasking test.

That's a lot of performance for the money, meaning it's a shame for PC Specialist that the similarly-specced Acer Aspire 5 has just a bit more class.

BENCHMARKS

Photo editing	Video editing	Battery life
109	91	
Multitasking	Overall	5hrs 4mins
72	85	

CAN YOU GAME ON A MID-RANGE LAPTOP?

Avid gamer Stuart Andrews puts the combination of mobile processor and integrated Intel GPU to the test in four games

Laptop manufacturers love to make big claims about performance, and that often involves the ability to play PC games. Gaming laptops have entered the mainstream over the past few years, and if you see one with an Intel processor with an HQ suffix and a discrete mobile GPU, you can be confident it will play the latest games. But what about our fleet of bargain laptops, all of which feature an Intel processor with a U at the end – denoting power efficiency rather than power – and Intel's integrated GPU. Can you expect any action at all?

The answer is a big, fat "it depends". We tested four games on four laptops, covering the range of Intel processors you're likely to see in a mid-range laptop. All of these use an Intel HD 620 integrated graphics unit, except for the eighth-generation Core i5-8250U with its UHD 620 integrated GPU. This has a slight advantage because it can boost up to 1,150MHz rather than 1,050MHz.

One of the most common questions I'm asked by potential laptop buyers is "will it play *Minecraft*?" The good news is that most modern laptops can. Even a lowly Core i3-7100U can run the Mojang classic at a 1,920 x 1,080 resolution with the frame rate rarely dropping below 30fps (*see the graph below*). Move up to a Core i5 and you're nearing 60fps at times, with occasional drops below 50fps. With the new Core i5-8250U you're laughing; frame rates of 60fps (the maximum refresh rate of the panels) are easily yours for the asking.

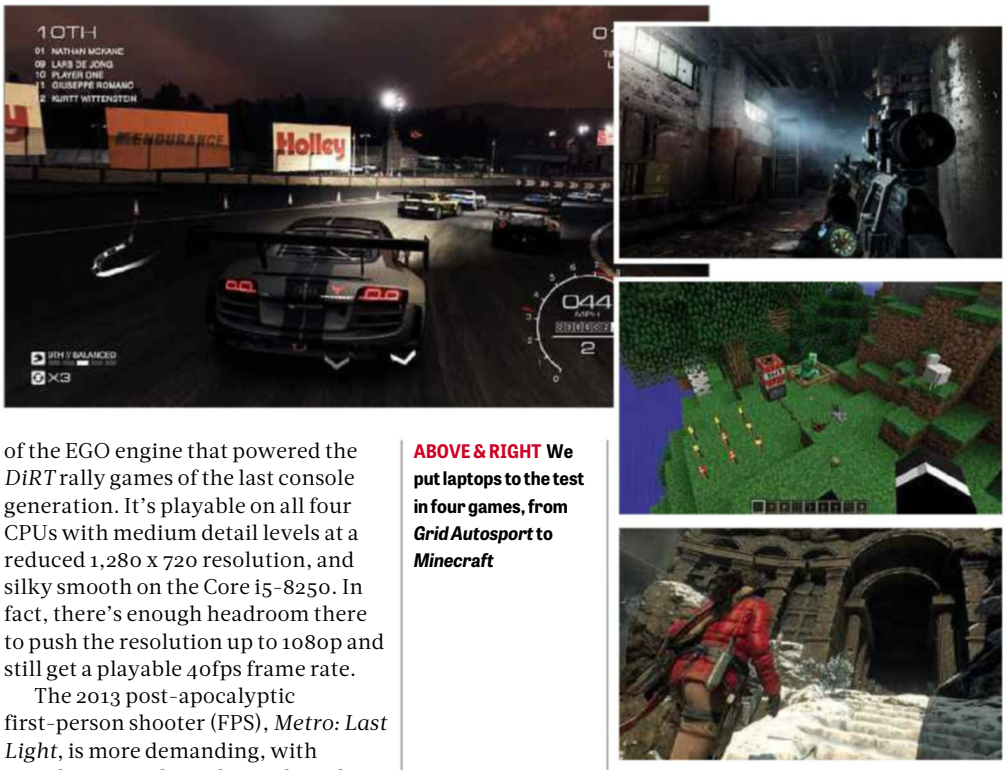
Our second title, *Grid Autosport*, gives a good feel for how the CPUs handle older and less demanding 3D games. The Codemasters racing game came out in 2014 and still looks good, thanks to a heavily optimised version of the EGO engine that powered the *DiRT* rally games of the last console generation. It's playable on all four CPUs with medium detail levels at a reduced 1,280 x 720 resolution, and silky smooth on the Core i5-8250. In fact, there's enough headroom there to push the resolution up to 1080p and still get a playable 40fps frame rate.

The 2013 post-apocalyptic first-person shooter (FPS), *Metro: Last Light*, is more demanding, with visuals approaching the quality of a modern console FPS. Even at 1,366 x 768 with low detail settings, none of the seventh-generation Core CPUs can deliver a playable 30fps frame rate, but the Core i5-8250 just about manages it.

What about a more recent, more demanding title? *Rise of the Tomb Raider* came out at the tail end of 2015 but remains one of the best-looking games around. Sadly, it's too much for any of our mid-range laptops. Even at 1,366 x 768 on the lowest setting, none of them can push the frame rate much beyond 17fps. When we tested (rather optimistically) at 1080p/Low, none could exceed 10fps.

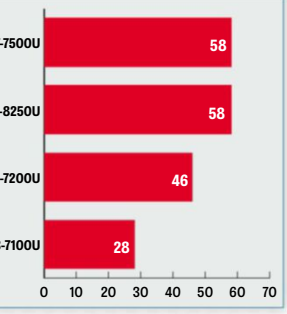
This doesn't mean that you can't game on a mid-range laptop. Some genres demand neither cutting-edge visuals or flawless, fluid motion, and if you want to play action RPGs such as *Diablo 3*, strategy games such as *Civilization VI* or *Endless Space 2*, or even MMORPGs such as *World of Warcraft* and *Guild Wars 2*, then most mid-range laptops will accommodate you. Just be prepared to tweak a few settings here and there.

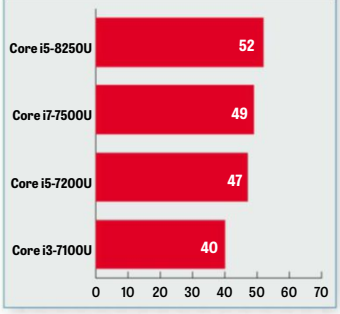
If you want to play today's blockbusters, then you're out of luck. You'll either need to buy a proper gaming laptop or divide your budget between a laptop and a console; you can pick up an Xbox One S for under £230.

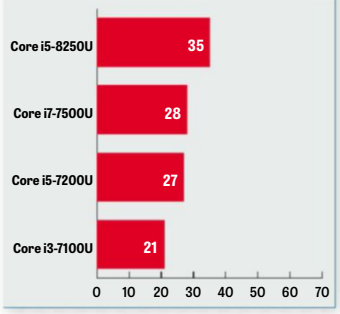


ABOVE & RIGHT **We put laptops to the test in four games, from *Grid Autosport* to *Minecraft***

"One of the most common questions I'm asked is 'will it play *Minecraft*?' The good news is that most modern laptops can"







VIEW FROM THE LABS

Stuart is hoping that his friends and family will stop nagging him about which laptop to buy and simply plump for a certain award winner

As someone who tests and writes about PCs I get asked a lot for purchase advice. Twenty years ago my friends and family just wanted to know which brand I recommended, or whether it was worth splashing out on the latest Intel processor. For the past few years, however, the question I've been asked the most is "what's the best affordable laptop?"

Generally, I find that premium laptop buyers already know that they want a MacBook Pro, a Microsoft Surface or the nearest Dell XPS or HP EliteBook equivalent. They've got something in mind and the money to invest. Yet, there are more people out there for whom a new laptop isn't their core work machine, a key creative tool or a major lifestyle choice; they just want something decent to surf the web, work or get a little photo-editing done.

This doesn't mean they all want the same thing. Sometimes they're looking for a laptop to run a small business from, or one to use in the living room at home. Sometimes they want something a little more stylish or a laptop that's portable enough to take just about anywhere. Whatever their requirements, I'd feel pretty confident recommending something from this Labs.

Stuart Andrews is a former reviews editor of *PC Pro* and has tested too many laptops to count

The HP 250 G5 isn't the most exciting machine, but it's a rock-solid option for the deskbound small business user. The PC Specialist UltraNote IV and the Acer Aspire 5 aren't perfect, but they have got the power to run some serious applications in a portable PC that shouldn't break the bank. The Medion Akoya and Acer Swift 3 are great, lightweight laptops that pack in more than you have any right to expect for their price.

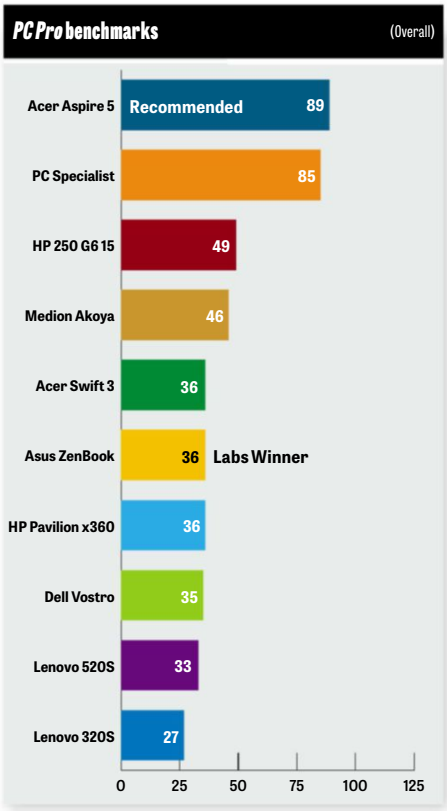
"When you can get something this good for this kind of money, why on earth would you want to spend more?"

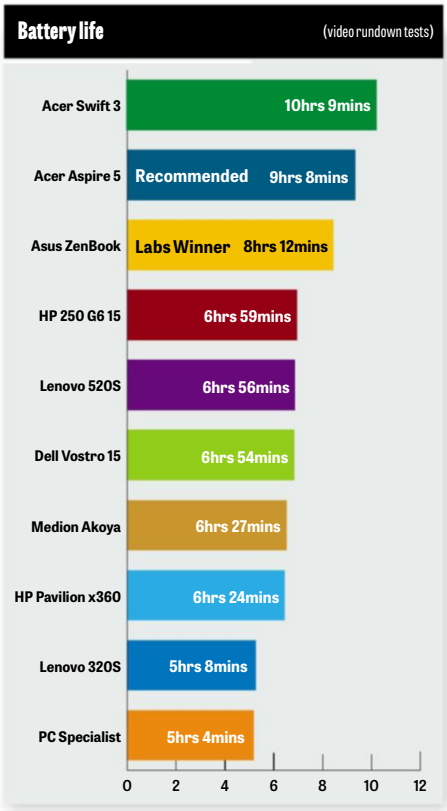
Yet, it's the Asus ZenBook UX410 that I keep coming back to, just because it fits so many people's needs. It's lightweight and compact enough to go in a bag and get lugged around, yet Asus has packed in the big screen and ergonomics to make it an effective working tool. It looks slick and feels polished, delivering the kind of experience that used to be the preserve of well-heeled enthusiasts and corporate execs.

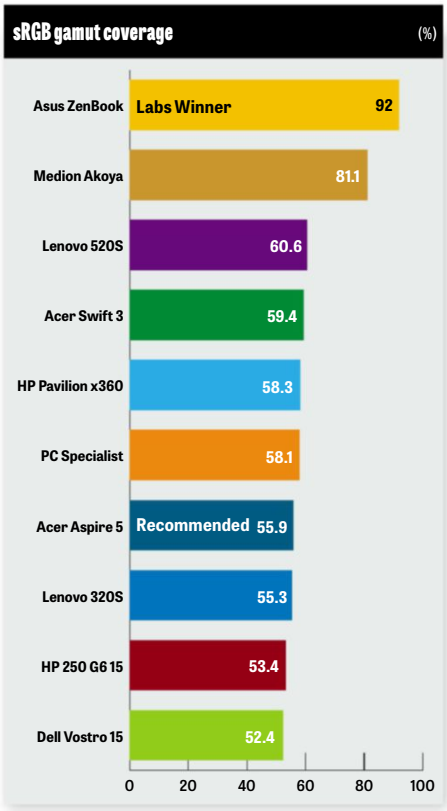
ABOVE Which budget laptop should you buy? More often than not, this one

Sure, the ZenBook isn't the world's most innovative product – its killer features have been seen before – but at its heart is a fairly radical question: when you can get something this good for this kind of money, why on earth would you want to spend more?

Test results







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5 reasons you're insecure
Davey Winder lists the gotchas that can affect SMBs p102

The Business Question
How can you ensure your files remain viewable forever? p106

BUSINESS FOCUS

Buy the perfect colour printer

You don't need to spend a fortune on a colour printer. Dave Mitchell examines your options and explores the various technologies on offer

Printers were supposed to be dead by now. The "paperless office" has been a buzz phrase for almost as long as computers have been in the workplace – and to be fair, emails have to a large extent usurped written memos, while digital databases have replaced bulky filing cabinets.

Even so, the vast majority of businesses still need to print. Many processes revolve around producing hard copies of invoices and reports; documents need signing or proofing, shipments need consignment notes; and so forth.

That doesn't necessarily mean you need to do all your printing in-house. There's a solid business case for using external print shops for specialist jobs like marketing brochures. But for short print runs, this can be costly, and turnaround time is a factor too. So you might prefer to handle *all* your own printing – and good-quality colour printers are nowadays almost as affordable as their mono cousins.

That doesn't mean the buying decision becomes an easy one. There's a range of different technologies and feature sets on offer. In this month's buyer's guide, we pick through a selection of colour inkjets, lasers and LEDs from some of the biggest names in the industry – Brother, Epson, Oki and Xerox – to help you make the right buying decision.

We can work it out

A printer is a long-term investment, and the purchase price pales into insignificance compared to cumulative running costs over its lifetime. This isn't exactly a "hidden" cost – the price of consumables is no secret – but you do need to do a bit of maths up front, or you could end up wasting many thousands of pounds. The only tricky part is predicting your future print volumes. If you identify an occasional need for colour then it might make sense to choose a cheap printer that takes relatively pricey cartridges – but if demand goes up, that calculation could turn out to be costly.

"The price of consumables is no secret – but you do need to do a bit of maths, or you could end up wasting many thousands of pounds"

BELOW Brother's driver allows print jobs to be secured with a PIN

Let's put some example figures on that: the Oki C332dn, as tested this month, costs less than £100, and produces mono and colour pages for 2p and 11.4p respectively. The Xerox VersaLink C600DN costs over seven times as much, but prints cost just 1.1p and 6.4p. If you only print a couple of black-and-white pages a day, the total cost of the Oki will remain lower for nearly three years, before the Xerox gradually starts to pull ahead. But if you print 50 colour pages every day for a year, you'll have paid £2,080 in consumables for the Oki, versus a total outlay of £1,168 over the year for the Xerox.

Print technology

Lasers are still the best choice for high-volume printing. They're fast, they aren't particular about paper quality and they tend to be very reliable. They produce professional results, too: you can expect razor-sharp text, and even lower-cost models can deliver colour quality that's good enough for presentations and business reports.

LED printers are very similar to lasers but have fewer moving parts, so they're slightly cheaper to manufacture. Speed and quality are just as good; the only catch is that some cheaper models can leave a slight but noticeable cross-hatch pattern on areas of single colour.

This doesn't mean you should discount inkjet options, though. The latest business-grade models combine high-capacity ink tanks with big duty cycles, and when it comes to bright, colourful photos and graphics, they're still the champions.

Historically, the trade-off with inkjet technology has been high printing costs, but that blanket rule no longer applies: this month, the Epson WorkForce Pro WF-6090DW works out cheaper on a per-page basis than any other printer. However, inkjets do prefer higher-grade paper, which increases running costs. Be aware too that the print speeds quoted by manufacturers are often based on low-resolution draft prints; full-quality printing may be much slower.

One final point in inkjets' favour is that they consume far less power than laser printers, which makes them a greener choice. The Epson WorkForce printer we tested consumed no more than 36W when printing – while the laser and LED models peaked as high as 1.1kW during their warm-up phase.

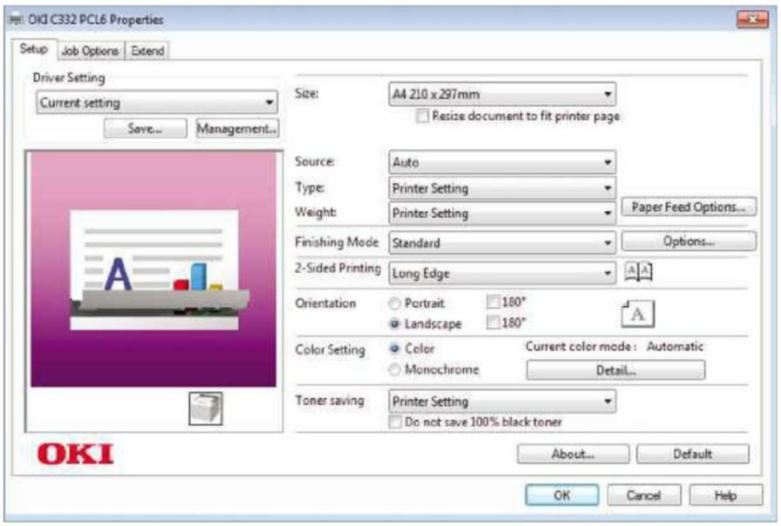
Set the controls

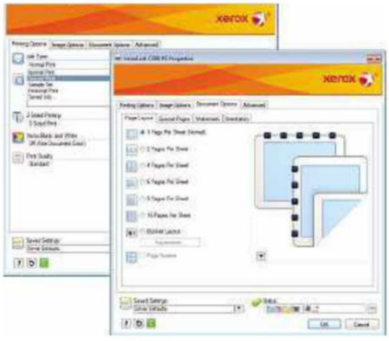
Once you've invested in a high-quality colour printer, your staff may be tempted to make liberal use of it, for both work and personal printing. So before you buy, it's a good idea to investigate what sort of access controls a printer offers. Some have features in their web management console that allow you to create lists of users and assign them colour permissions or daily page limits; others can use NFC ID tags for local authentication.

It's also a good idea to educate your staff about appropriate use of printing resources. By default, emails and document copies should be printed in monochrome draft mode, which will keep toner or ink costs to a minimum.

Further savings can be made by using cheap 75gsm paper for draft documents. It's unrealistic to expect employees to keep feeding in different paper types, however: look for a printer that has (or can be expanded with) more than one paper tray, so it's easy to select the appropriate media.

A final way to keep costs down is to encourage double-sided printing: all the printers reviewed here have an integrated duplex unit, and you can often set this as the default print mode – although we've yet to see a printer that allows you to make it mandatory.





TOP There's a range of connection options to suit different office configurations

ABOVE Double-sided printing is a standard feature on modern business printers

"It may be unrealistic to expect employees to keep feeding in different paper types: look for a printer with more than one tray"

LEFT It's well worth exploring the options in your printer driver – they could slash your running costs

Networking and security

All business-class printers have an integrated Ethernet port; if your workforce is largely mobile, then Wi-Fi services are highly desirable too. Two of the printers we've tested this month offer both wired and wireless capabilities, but you'll have to pick one or the other, as they won't both work at once.

If you have a lot of remote or travelling workers then it's also worth looking at internet services: many vendors offer a free email service that allows staff to print from anywhere, by simply emailing attachments to the printer.

If you're going to make your printer available over the internet, however, security becomes even more important than usual. Change the default administrative password immediately, keep the firmware up to date and disable any features you aren't using such as SNMP, FTP access or internal email services.

Don't be daunted by all these options: professional in-house colour printing is easy to set up, and affordable for any small business. Read on for our reviews of four quite different printers, showcasing the range of features, options and prices.

Brother HL-L9310CDW

A good value colour printing factory with great output quality, low running costs and easily managed security

SCORE ★★★★☆

PRICE £432 exc VAT
from printerbase.co.uk

Looking for a printer that will slot into a diverse working environment? Brother's flagship A4 colour laser has you covered. There's both Ethernet and 802.11n wireless (although you can't run both at the same time), plus Wi-Fi Direct and AirPrint services – *and* NFC for secure tap-to-print operations.

Outwardly, it looks very similar to Brother's cheaper HL-L8360CDW, and offers the same 31ppm colour and mono print speeds. Inside, though, it's more of a workhorse, with twice the memory and a 6,000-page monthly duty cycle (a full third higher than its cheaper sibling). The price difference is also mitigated by a set of huge 6,500-page starter toner cartridges – over three times as capacious as the ones you get with the HL-L8360CDW.

Real-world print speeds are bang on the money when it comes to everyday business fare. Our 31-page Word document emerged in precisely 60 seconds at the driver's standard 600dpi mode, and switching to the interpolated 2,400 x 600dpi Fine mode didn't slow it down a jot. Printing the same document double-sided halved the speed to an easy-to-live-with 15.5ppm, and the time to first page from ready status was never more than 12 seconds.

When we tried printing our challenging 24-page colour DTP document, speeds did drop a little, to 27ppm in regular mode and 25ppm in Fine. If you want the maximum print rate, you can download Brother's GDI driver, which does the rasterising on your PC rather than on the printer. This boosted print speeds to 32ppm at both resolutions, and aside from making your PC work slightly harder, has no real downside: print quality remained excellent, with razor-sharp text down to sizes as small as 6pt.

One thing we did note was that mono photos looked best at the Fine driver setting, with more detail visible in darker areas. Colour photos are impressive in any mode, with good contrast and bright colours translating to punchy marketing reports with almost no banding in large colour areas such as skies.

Since this printer is aimed at high-volume printing environments, there's no messing around with different toner sizes: your only option is Brother's 9,000-page ultra-high yield toner cartridges. Other consumables comprise the image drum tray, transfer belt and toner waste box, which represent overall running costs of 1.1p and 7.8p for mono and colour pages – which isn't bad at all.

The high-volume approach is also reflected in the paper-handling provision: while the base unit only comes with a single 250-sheet drawer, you can add a further three 250-sheet trays or two 500-sheet trays – or go for the high-capacity base unit with four 520-sheet cassettes for an enormous total capacity of 2,330 sheets – plus a 50-sheet fold-out multipurpose tray.

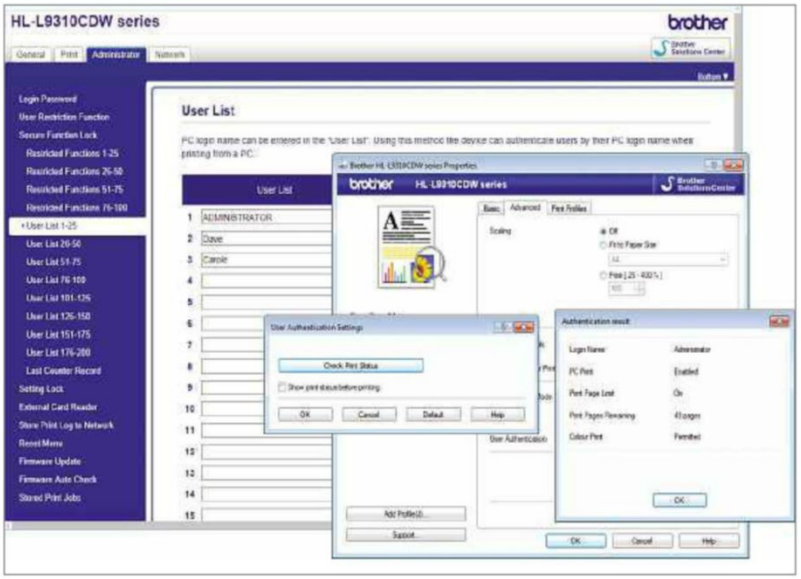
ABOVE **It may look like cheaper printers, but the HL-L9310CDW is a powerful beast**

As for security, the drivers let you assign a username and PIN to documents, which must then be entered at the printer to release the job. Access and usage can be precisely controlled with Brother's Secure Function Lock 3, which lets you limit public access, create lists of local users and assign privileges: among other things, you can allow or deny access to colour printing and limit the number of pages that can be printed. Up to 200 accounts are supported, using the logged-in username at each connected PC to enforce security.

For mobile users, we had no problems using AirPrint on our iPad, and Brother's iPrint&Scan iOS app discovered the printer and allowed us to access it directly. We could also log into our iCloud, Google Drive, Evernote, OneDrive and Dropbox accounts and print selected files.

"For the maximum print rate, you can download the GDI driver, which does the rasterising on your PC rather than on the printer"

In all, Brother's versatile HL-L9310CDW is ideal for hectic businesses; it combines a respectable duty cycle with a wide range of connection options, reasonable running costs and great output quality.



LEFT **Brother's Secure Function Lock provides flexible printing control features**

SPECIFICATIONS

600dpi A4 colour laser • 31ppm colour/mono • 800MHz CPU • 1GB RAM • 6.8cm colour touchscreen • Gigabit Ethernet • 802.11n wireless • NFC • 2 x USB 2 • duplex • 250-sheet drawer • 50-sheet MPT • rec monthly duty cycle, 6,000 pages • 441 x 486 x 313mm (WDH) • 22.2kg • 1yr limited warranty. Options: 2yr warranty extension, £302 • 4 x 520-sheet input tray, £523 (all exc VAT)

RUNNING COSTS

Ultra-high-yield: K toner (9K), £73 • C, M, Y toner (9K), £202 each • drum unit, (50K), £90 • transfer unit (130K), £39 • waste cartridge (50K), £15. Overall cost per A4 page: mono, 1.1p; colour 7.8p

Synology®

DS1517+ | DS1817+ | DX517

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iOS apps

Cloud Service

Productivity

Extended warranty available

DS1517+

DS1817+

The all-new and updated 5 and 8 bay NAS devices from Synology both feature:

- Intel Atom Quad Core CPU
- 4 x USB 3.0 and 2 x eSATA ports
- 1 x PCIe 2.0 slot for 10GbE network card or M.2 SATA SSD adapter card support
- Available in two memory configurations: 2GB or 8GB, upgradable to 16GB
- Expandable to 15 or 18 bays with DX517
- 3 year free warranty and an additional 2 years availble to purchase

Expandable with DX517

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PC PRO BEST NAS BRAND 2017

Epson WorkForce Pro WF-6090DW

Access controls are limited, but this big inkjet delivers good quality – plus laser-bashing running costs

SCORE ★★★☆☆

PRICE £365 exc VAT
from printerbase.co.uk

ABOVE **The chunky WF-6090DW does a fair impersonation of a business laser**

Inkjets have a reputation for slow, expensive prints – but Epson's WorkForce Pro WF-6090DW turns that on its head, with good print speeds and the lowest running costs in town. With XXL ink cartridges, mono pages cost just 0.75p each, and even colour prints are only 4.3p per page.

This doesn't look much like your typical inkjet either – it looks more like a laser, and it's just as capable of heavy duties. For example, the built-in 500-sheet drawer can be supplemented with up to two more 500-sheet trays, while the maximum monthly duty cycle of 65,000 pages implies a recommended monthly output of at least 5,000 pages.

Another thing inkjets are known for is cartridges that run out at the worst possible moment – but Epson's high-capacity ink cartridges have great longevity, with mono and colour ones lasting an impressive 10,000 pages and 7,000 pages respectively. The only other consumable you need to worry about is a maintenance box, which costs a modest £23 to replace after 75,000 pages.

All the connection choices you could ask for are here: you can choose either Gigabit Ethernet or 802.11n wireless, and there's also support for AirPrint, Wi-Fi Direct and NFC. We opted to go wireless, and found all services could be configured from either the local control panel or web console. You can tell the printer to search for nearby SSIDs to connect to, or use WPS to connect with zero fuss.

Epson's driver install routine includes firmware and software update utilities, and you also get a network status monitor, a browser plugin for printing web pages and Epson's elderly Easy Photo Print utility. If you want to enable remote printing by email, that's quick to set up too: another wizard registered our printer with our Epson Connect cloud account and immediately assigned it a customisable email address. From the Connect web portal we could view printer usage logs, decide who was allowed to print email attachments and optionally block photo printing.

Local security options, sadly, are limited. Confidential prints can be PIN-protected, but apart from remotely locking the control panel from the separate EpsonNet utility, there are no other access controls provided; you can't restrict colour usage or enforce page limits for individual users.

In use, the printer came close to its quoted ISO speeds of 24ppm, but we couldn't get near to the claimed maximum speed of 34ppm: in both Draft and Normal mode our 34-page Word document was delivered at 23ppm, tumbling to 12ppm in High Quality mode. Our 24-page colour DTP document was even slower, emerging at 21ppm in Standard mode and 11ppm in High mode.

As you'd expect, switching to duplex printing causes speeds to drop further. A double-sided copy of our document printed at Normal quality at 16.5ppm – and it's a noisy process too. We measured a peak volume of 66dB at 1m.

What of print quality? Text was sharp enough for everyday use, but we noticed a slight dusting around characters when using cheap 75gsm paper. Switching to heavier 100gsm paper yielded cleaner results, but this will increase running costs.

On the upside, colour graphics and photos were excellent: reports were bold and punchy, with no banding in large single-colour areas. And one area where inkjets always beat lasers is photo printing, thanks partly to their ability to use glossy stock; on 160gsm semi-gloss paper, our test images looked fantastic, with masses of detail and no bleeding.

"One area where inkjets always beat lasers is photo printing; on 160gsm semi-gloss paper, our test images looked fantastic"

Another area where the WF-6090DW excels is power consumption. We measured it using no more than 36W, where most A4 lasers consume 500-600W when printing.

The WorkForce Pro WF-6090DW isn't as fast as a mid-price laser, and access controls are disappointing. However, its tiny power draw, long-life ink cartridges and low running costs will be music to the ears of budget-conscious businesses.

LEFT **Epson provides a simple web console and easy registration with its Connect email printing service**

SPECIFICATIONS

4,800 x 1,200dpi A4 inkjet printer, 24ppm mono/colour • 1GB RAM • 5.6cm LCD mono screen • USB 2 • Gigabit Ethernet • 802.11n wireless • NFC (Android only) • duplex • 500-sheet drawer • 80-sheet MPT • max monthly duty cycle, 65,000 pages • 478 x 522 x 404mm (WDH) • 28kg • 3yr on-site warranty

RUNNING COSTS

XXL ink cartridges • mono (10K), £72 • C, M, Y (7K), £82 each • maintenance box (75K), £23. Overall cost per A4 page: mono, 0.75p; colour, 4.3p

Oki C332dn

A functional printer that's great for occasional use, turning out fast, sharp prints at an amazing price

SCORE ★★★★☆

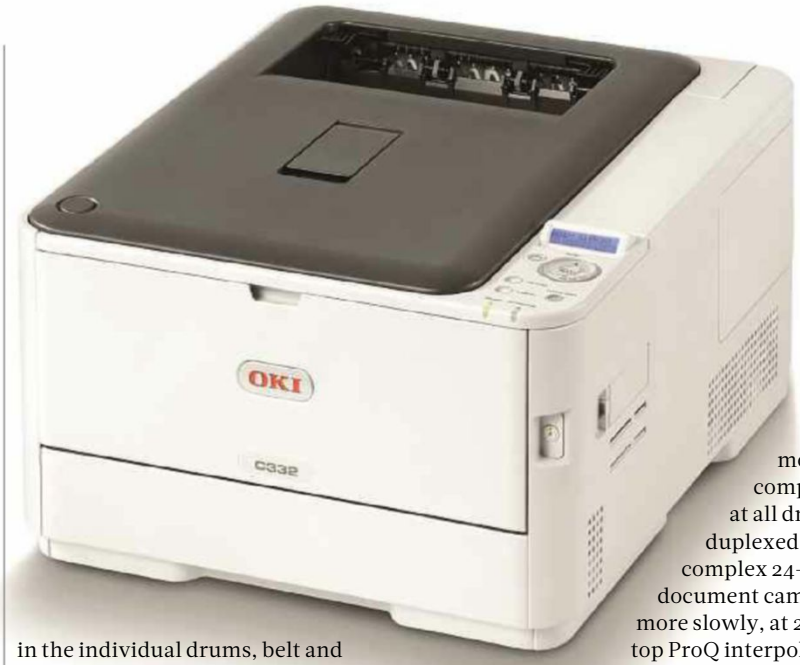
PRICE £94 exc VAT
from okidirect.co.uk

If you're looking for a budget-priced A4 colour laser printer, avert your gaze no more: you won't find one for less than Oki's C332dn. Costing a mere £94, this network-ready desktop model offers respectable mono and colour print speeds of 30ppm and 26ppm, a more than ample 1GB of memory and even an internal duplex unit.

Strictly speaking, this isn't a laser, but an LED printer. The technology is very similar, but one difference here is that the paper follows a flat path past the print mechanism. This means the C332dn can handle heavyweight 220gsm stationery via the multipurpose tray at the front – and a rear paper slot allows you to print banners up to 1.3m long.

Despite the price, the C332dn is clearly designed for a middleweight office role, with a standard 250-sheet paper tray that can be supplemented with a second lower 530-sheet tray. There's Gigabit Ethernet as standard, and if you need wireless then Oki offers an optional 802.11n Wi-FI module that costs £31 and snaps in behind a small panel at the side.

While the C332dn's asking price is extremely low, that's offset by steep running costs. Oki's high-yield colour toner cartridges each cost as much as the printer itself, and once you factor in the individual drums, belt and fuser, you're looking at an overall cost of 2p per mono page and 11.4p for colour. Depending on how you use it, when the bundled 1,000-page starter cartridges run out, you might actually be better off buying a whole new printer, rather than paying for those pricey cartridges.



ABOVE A straight paper path means the C332dn can print on all sorts of media

The printer is easy to install, with most functions accessible via its basic web interface – although, slightly irritatingly, AirPrint and Google Cloud Print must be configured from the printer's two-line LCD panel. Still, you only have to do this once, and we then had no problems printing via the cloud or directly over AirPrint.

After installing Oki's drivers on our Windows 10 desktops, we dipped into the supplied toolbox of desktop utilities; these include a clever remote configuration manager, which lets you upload custom forms and fonts to the printer's onboard flash memory. You won't find much in the way of access control tools, but Oki's free PrintSuperVision (sPSV) web server takes care of that. After installing this on a Windows Server 2012 R2 system, we were able to review the print log and restrict colour printing by user, application, hostname and document name.

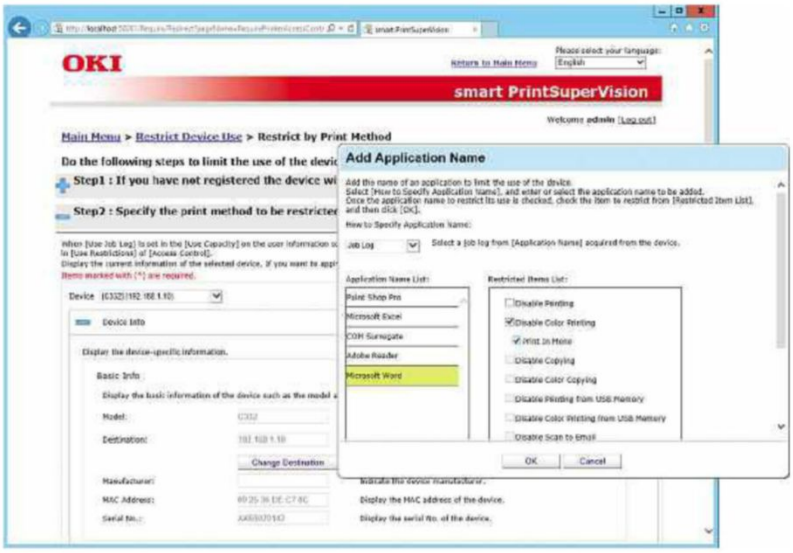
Speed-wise, the C332dn lives up to its manufacturer's claims: our 30-page mono Word document completed in 60 seconds at all driver resolutions, and duplexed at 16.5ppm. Our complex 24-page colour DTP document came out only slightly more slowly, at 27ppm – even at the top ProQ interpolated 2,400dpi resolution. You won't have to wait around for shorter documents, thanks to a time-to-first-page of under ten seconds from a ready state. It's not too noisy either: we recorded tolerable peak sound levels of 63dB at a distance of 1m.

Output quality is more than good enough for general office printing, with pin-sharp text even at tiny sizes. Mono photos look good too, with a nice neutral tone, although a lack of detail in darker areas left them looking a tad murky. Colour photos and reports benefit from good contrast and detail, while the driver's Photo Enhance setting makes visible improvements by increasing sharpness and contrast.

Our only real issue with output quality is that large areas of single colours exhibit a slight cross-hatching effect – something we've come to associate with low-cost LED printers.

"You won't have to wait around for documents, thanks to a time-to-first-page of under ten seconds from a ready state"

For the price, the C332dn has a heck of a lot to offer. Its high running costs mean it's not the right choice if you need to do a lot of colour printing, but for the odd page here and there it's a fast, high-quality option.



LEFT Oki's free, smart PrintSuperVision portal lets you control printing access and colour usage

SPECIFICATIONS

600dpi colour A4 LED ● 26/30ppm colour/mono ● 667MHz CPU ● 1GB RAM ● Gigabit Ethernet ● USB 2 ● 250-sheet input tray ● 100-sheet MPT ● rec monthly duty cycle, 3,000 pages ● 410 x 504 x 242mm WDH ● 22kg ● 3yr on-site warranty (on registration). Options: 802.11n wireless module, £31 ● 530-sheet lower tray, £184 (all exc VAT)

RUNNING COSTS

High-yield toner: K (3.5K), £46; C, Y, M (3K), £94 each ● image drum (30K max), £97 ● fuser (60K), £54 ● transfer belt (60K), £53. Overall cost per A4 page: mono, 2p; colour, 11.4p

Xerox VersaLink C600DN

A big LED printer that makes printing a pleasure, with top performance, great output and ConnectKey app support

SCORE ★★★★★

PRICE £720 exc VAT
from printerland.co.uk

The Xerox VersaLink C600DN is perfect for a print-hungry workforce. It claims fast 53ppm print speeds for colour and mono, and boasts a heavy-duty 15,000 page recommended monthly duty cycle. Max out the paper trays and you can also benefit from a huge total capacity of 3,250 sheets.

Inside, it employs Xerox's Hi-Q LED print engine and comes with USB 3 and Gigabit Ethernet ports as standard. Simultaneous 802.11n wireless services can be added via a £46 module that snaps in at the back.

What really sets the VersaLink range apart is Xerox's ConnectKey technology – effectively an app store for your printer. On first contact, the C600DN gets you started with four preinstalled apps, providing quick access to printer settings, job status and USB device printing.

Want more? Simply create a cloud account and you can start browsing the App Gallery directly from the large 5in colour touchscreen. There's a great selection to choose from: cloud printing apps for Google Drive, Dropbox, OneDrive and Box are all free, as is the @PrintByXerox app, which creates a password-protected account on the printer that you can use to view and release documents. If the touchscreen feels a little cramped, you can also access the App Gallery via a web browser: after we'd configured the printer's IP address, we had no problem installing apps remotely, seeing them pop up on the touchscreen in seconds.

Access controls are another strength of the VersaLink C600DN, allowing you to decide exactly which apps each user is allowed to use. Local and LDAP user authentication is supported, and the printer driver also exposes security features such as print and hold and PIN-secured prints.

While many apps are free, one thing you do have to pay for is the Xerox Print Management and Mobile Service (XPMMS). You can license this either by device or by job credit, with a 3,600-job credit costing £245. After we'd loaded its agent service on one PC on the LAN, we were able to provision remote printing for desktops and mobiles and enforce strict access controls.

From the user's perspective, remote printing is as close to transparent as you could ask for: we simply used the iOS PrintPortal app on our iPad to login in to our XPMMS portal account, then added the C600DN as a favourite printer. With this done, we could print files and photos remotely, and send files to it directly from our iCloud Drive account.

Xerox's print-speed claims may seem quite ambitious, but the C600DN made good on them: our 53-page Word document printed in 60 seconds at both standard 600dpi and enhanced 1,200 x 2,400dpi resolutions. Large colour prints slowed it down a little, though: our 24-page DTP document printed at 53ppm at 600dpi, but only 44ppm in enhanced mode. Duplexing, on the other hand, was surprisingly fast: our 53-page Word document came out double-sided at an impressive 50ppm.

It's a winner when it comes to output quality too. The C600DN produced pin-sharp text and detailed mono photos, even on cheap 75gsm paper. Colour photos and graphics are very pleasing to the eye, with the driver's "Vivid RGB" setting adding extra pizazz to our reports and marketing material. And while the purchase price may be high, use the extra-high yield cartridges and you'll be paying a mere 1.1p per mono page, and 6.4p for colour.

Busy SMBs that want a fast A4 colour printer with all the trimmings will find the VersaLink C600DN the perfect choice. It's fast, feature-packed and terrifically versatile, thanks to the ConnectKey app store. Factor in Xerox's lifetime warranty with an annual toner purchase and it's an almost irresistible deal.

ABOVE The 5in touchscreen makes the C600DN a breeze to interact with

PC PRO ★★★★★ A-LIST

"While the purchase price may be high, use the extra-high yield cartridges and you'll be paying a mere 1.1p per mono page"

LEFT Along with the slick App Gallery, Xerox offers great mobile support and driver security

SPECIFICATIONS

600dpi A4 colour LED • 53ppm A4 mono/colour • 1.05GHz dual-core CPU • 2GB RAM • 5in colour touchscreen • Gigabit Ethernet • NFC (Android only) • USB 3 • duplex • 550-sheet paper tray • 150-sheet bypass tray • Rec. monthly duty cycle, 15,000 pages • 427 x 466 x 443mm (WDH) • 29.4kg • lifetime on-site warranty (with yearly toner purchase). Options: 802.11n wireless, £47 • productivity kit, £181 (all exc VAT)

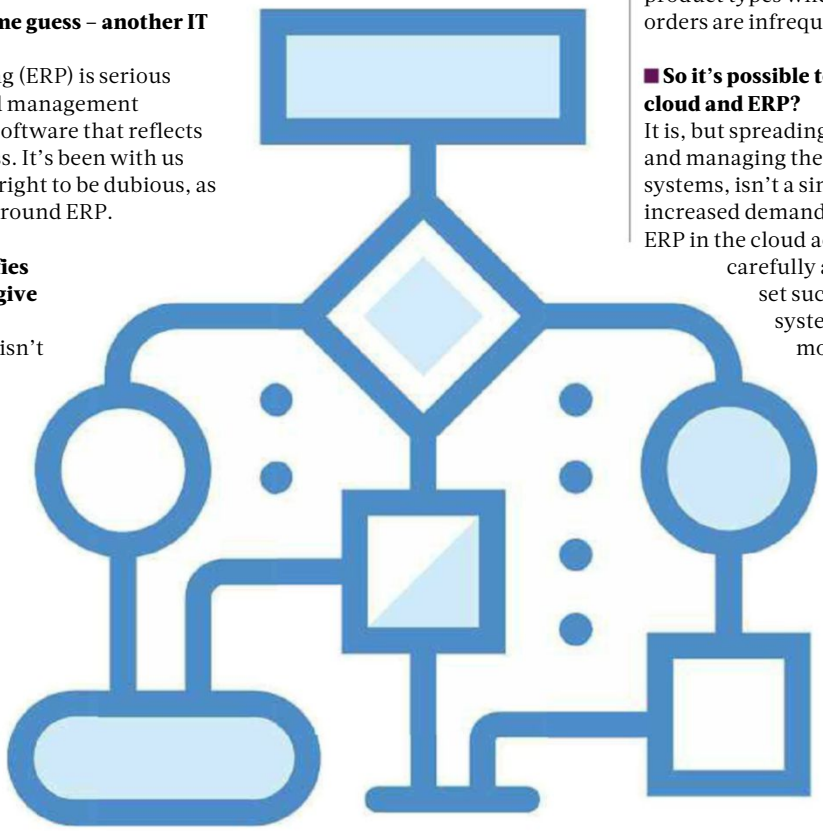
RUNNING COSTS

Extra-high toner: K (16.9K), £145 • C, Y, M (16.8K), £270 each • K, C, Y, M drum units, (40K), £62 each. Overall cost per A4 page: mono, 1.1p; colour, 6.4p

What is ERP?

Enterprise resource planning could be a huge benefit to your business – or a huge expense. Steve Cassidy explores the costs and rewards

Ah, the dreaded TLA. Let me guess – another IT fad of no real-world value?
Enterprise resource planning (ERP) is serious business: it's a planning and management approach based on custom software that reflects the specifics of your business. It's been with us for many years – but you're right to be dubious, as there's an element of hype around ERP.



My business hardly qualifies as an "enterprise", so we'll give this one a miss, thanks.
Here, the term "enterprise" isn't to do with headcount or turnover. It's more about being a producer. If your company makes things, which people turn up more or less at random to buy from you, then ERP can help keep your wheels turning smoothly across all your industry-specific disciplines – plus the more general ones that apply to all businesses.

A single piece of software to automate our whole business?
That's the promise. If you can explain your workflow to an ERP chap – with some airy title like "consultant" or "business integrator" – then, after a bit of a delay for coding and other sundry bits of work, you should in principle end up with an integrated system that handles your stock, manages your finances, keeps track of raw materials and so on.

But of course, it's one heck of a stretch. The few people I've seen who have tried to implement each part of an ERP system like that have nearly bankrupted themselves doing it. Representing every last procedure, quirk and cheat of a business is a gargantuan task. Even defining the requirements in sufficient detail is a huge challenge.

So how is anyone ever supposed to take advantage of ERP?
Rather than trying to feed your entire business into ERP in one go, it's usual to take a modular approach. You start out with some forward-order modelling, then add a bit of stock control, which then gets hooked up to the order book… and a roadmap begins to emerge, in which you add further modules as the years go by.

If it's going to take that long, is it a smart investment? I've heard that Internet of Things-based stock control is the future.
IoT in enterprises is largely about monitoring the widgets in your warehouse, and in the wider world. This does feed into the same areas of interest as ERP – but while IoT is great for inventory tracking, you still need to analyse and respond to that data. Most IoT deployments are an addendum to an existing ERP data model.

In these days of cloud computing, this ERP stuff all sounds rather old-fashioned.
It is. ERP was earning IT specialists good money long before the cloud came along, and you could argue that the two philosophies are antithetical: ERP emphasises forward planning, while the cloud supports a flexible, reactive approach.

That doesn't mean the two worlds can't coexist. Large software houses such as SAP, Logica and Lakeview will happily provide cloud-resident apps on which you can run your business. This might not make sense for high-volume businesses, but it's well suited to product types where value-per-item is high and orders are infrequent but pricey.

So it's possible to combine the benefits of cloud and ERP?
It is, but spreading across on-premise and off, and managing the different lifecycles of all those systems, isn't a simple undertaking. Expect increased demand for IT resources in making ERP in the cloud actually work, and think very carefully about scale. It's all too easy to set such ambitious targets for ERP systems that you blow through far more money than you'll ever save, either in licensing and consulting time, or in business time lost to computer work instead of actually building widgets.

This is sounding like a can of worms. Are the benefits really worth it?
By design, everyone's ERP experience is different. Some projects are almost invisible: others drive a root-and-branch overhaul of every other system in the company, from servers to telephones, and even lead to the restructuring of workforces and premises. That's arguably the biggest vote of confidence you could ask for – allowing the IT system to define the entirety of the business, right down to the bricks and mortar. ●

"It's very possible to set such ambitious targets for ERP systems that you blow through far more money than you'll ever save"

Custom computing: one size fits one

The essence of ERP is that it's tailored to your specific needs – and the customisation business is an absolute mainstay of many sectors in the UK's IT industry. But the bespoke approach brings its own challenges, which call for a particular sort of management. On one occasion, a client ended up paying me to drive to the Alps with a box of paper, which called for some thoughtful justification. It's not just about agreeing on standards and objectives: fundamental values such as professional conduct and honesty come into play too.

It's quite possible that the adoption model of cloud computing partly reflects a growing number of companies that didn't get on with the old-school ERP approach. Certainly the stereotype of the internal enterprise rebel, leaping into the cloud armed with a credit card and almost no data security whatsoever, can be understood as a reaction against (old and poorly adapted) ERP systems.

D-Link DWL-3610AP

A business AP that's impressively versatile thanks to D-Link's central management solutions

SCORE ★★★☆☆

PRICE £89 exc VAT
from uk.insight.com

The DWL-3610AP wireless access point is all about flexibility. It works on either the 2.4GHz or 5GHz band, and can be used in standalone mode or in one of three centrally managed configurations.

It's affordable too, at just £89 – but note that it's not the fastest AP in town. D-Link classes it as an AC1200 AP, but this isn't strictly true as it doesn't have two radios. It will either support up to 300Mbits/sec on the 2.4GHz band, or 867Mbits/sec on the 5GHz band – but you can't use both bands at the same time. The AP's web interface exposes options to turn the single radio on or off, and to switch between 2.4GHz 802.11n and 5GHz 802.11ac operations.

Where the DWL-3610AP does excel is in business-class features. It supports up to 16 VAPs (virtual access points), each with its own SSID, encryption key and authentication scheme. Out of the box, the AP has its root VAP enabled on an open SSID, which isn't ideal – but this is easy to change, and it took less than a minute to secure our test unit with WPA2 encryption. You can also apply MAC address filtering, SSID masking and L2 isolation to stop wireless clients from seeing each other.

There's a useful set of bandwidth-management options too: you can enforce upstream and downstream limits on individual VAPs, and apply quality of service (QoS) for prioritising voice and video traffic. A scheduler allows selected VAPs to be turned off at scheduled times such as evenings, weekends and holidays.

Real-world wireless performance on the 5GHz band is more than acceptable. With a Windows 10 Pro desktop connected over 802.11ac via a Netgear AC1200 USB 3 adapter, we saw close-range file copies to a LAN system averaging 50MB/sec, falling only slightly to 47MB/sec at 10m. Coverage is pretty decent too; the SweetSpots app on our iPad only registered a connection dropout once we'd wandered 40m away, with five other offices and numerous walls between us and the AP.

The clustering feature allows up to eight identical APs to be grouped together and all present the same wireless services. It's a very convenient way to work: a cluster can be managed via a single IP address, with any configuration changes or firmware upgrades automatically propagated to all members.

For those with even bigger needs, D-Link's DWS-3160 L2 switches can manage up to 48 individual APs, stretching to 192 when they're placed in peer groups. Registering a DWL-3610AP for management is as easy as entering up to four switch interfaces into its web interface.

We also tested D-Link's DWC-1000 controller appliance, which costs around £350, including a licence for six APs (which can be doubled to 12 for an additional charge). Our sample didn't support the DWL-3610AP out of the box, but a firmware upgrade quickly sorted that out.

ABOVE **The AC1200 designation is a bit misleading, as this AP only has a single radio**

The controller's web interface opens with an informative dashboard; APs are automatically discovered by the controller and can be quickly provisioned. It uses AP profiles to link together radio, SSID, encryption and QoS parameters, which it pushes to selected APs.

There's a pleasing range of security features too; you can use approved MAC address lists, enforce wireless client logins and link up with external RADIUS, LDAP and Active Directory authentication servers. The controller can provide wireless hotspot services using time-limited guest accounts, and presents customisable captive portals on selected SSID and login profiles. For even more flexibility, the VPN licence (which costs around £250) also activates a firewall, which can apply custom rules to wireless traffic.

"A cluster can be managed via a single IP address, with any configuration changes automatically propagated to all members"

BELOW **You can power the unit via PoE, or with an external adapter**

Our only gripe is that we couldn't customise the dashboard layout: it's supposed to be possible, but in multiple browsers we were simply met with a "bad parameter" error message. Hopefully that will be fixed before long.

As a standalone AP, the DWL-3610AP isn't particularly exceptional – but partnered with the DWC-1000 controller it's a great, affordable option for those seeking a secure, expandable, centrally managed wireless network. **DAVE MITCHELL**

SPECIFICATIONS

Ceiling/wall mount AP • 802.11ac • 2.4GHz or 5GHz radio • Gigabit PoE port • RJ-45 console port • power adapter • mounting backplate and T-rail clips • 160 x 160 x 45mm (WDH) • 0.26kg • limited lifetime warranty

Qnap TS-1277

The first Ryzen-powered NAS appliance delivers top performance – and great data protection features

SCORE ★★★★★

PRICE Diskless TS-1277-1700-16GB, £2,514 exc VAT from span.com

AMD's Ryzen processors have been a big success in the desktop PC market, but they haven't thus far made their presence felt in the world of business appliances. That changes now, with Qnap's TS-1277 – the world's first Ryzen-powered desktop NAS appliance. Aside from the powerful CPU, this big golden box offers eight hot-swap LFF drive bays for general data storage, plus four SFF bays for performance-enhancing cache duties, dual internal M.2 SSD slots and three PCI-Express expansion slots.

Connectivity is just as generous. Round the back you'll find four Gigabit Ethernet sockets, six standard USB 3 ports and even two 10Gbits/sec USB 3.1 ports, presented as Type-A and Type-C sockets. On our review model, it's all powered by an eight-core 3GHz Ryzen 7 1700 CPU and 16GB of DDR4 memory, expandable to 64GB; if that sounds like overkill, you can save over £400 by stepping down to the six-core Ryzen 5 1600 edition, which comes with 8GB of memory.

A meaty processor naturally needs appropriate cooling, and that's handled here by a passive heatsink partnered by two blower modules, along with three chassis fans at the rear. That may sound like a lot of spinning parts, but it's all very quiet; the SPLnFFT iOS app on our iPad reported sound levels of only 38dB at 1m in front.

For testing, we fitted four 10TB Seagate IronWolf NAS drives into the tool-free carriers and installed an Emulex dual-port 10GBase-T adapter. It's worth noting that this 167mm card would only fit in the innermost expansion slot – the CPU cooler restricts the outer two slots to 150mm.

Deployment was a cinch. Qnap's QFinder utility discovered the appliance on our network and immediately offered to set it up. We opted for a big 27TB RAID5 thin-storage pool, and were shortly greeted by Qnap's QTS 4.3.4 software.

One great strength of this platform is its wealth of data protection features, including smart IP SAN snapshot services. These are a step ahead of the competition, as they support standard EXT4 file systems and don't require BTRFS.

It's all very easy to configure too, thanks to the new Storage and Snapshots app. We had no problem selecting NAS shares and iSCSI LUNs, taking snapshots on demand and scheduling them for regular intervals. When it's time for recovery, you can restore entire NAS shares and iSCSI LUNs, or dip into your snapshots and recover individual files as needed.

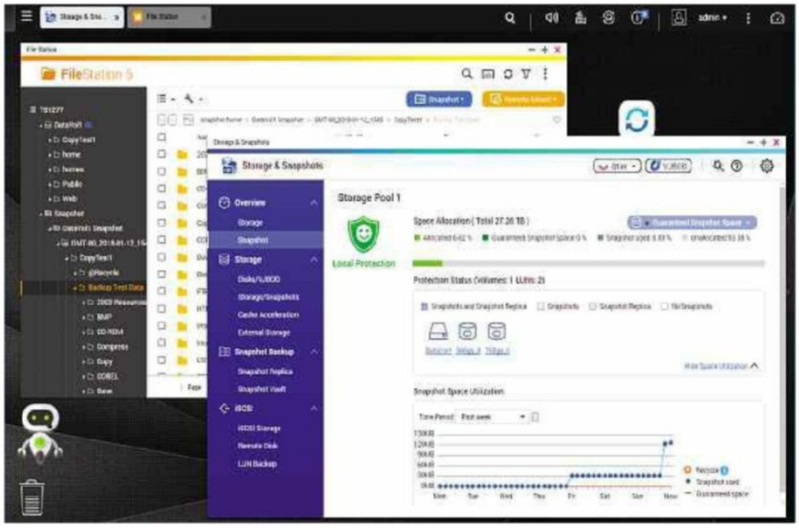
Cloud support is superb as well: the Cloud Backup Sync app supports for 12 different providers, while Qsync Central handles file syncing with remote clients. The Connect to Cloud Drive app also let us browse our cloud storage accounts directly from the web console.

So much for the features: what about performance? As you'd hope, this too was top notch. A share mapped to a Dell PowerEdge R640 Xeon Scalable server delivered superb sequential Iometer read and write rates of 9.2Gbits/sec and 8.9Gbits/sec. And when we upped the pressure with a dual 10GbE MPIO link, read and write speeds ramped up to 17.7Gbits/sec and 16.8Gbits/sec – with the Ryzen CPU registering only 11% utilisation.

In all, the TS-1277 is an immensely capable NAS appliance. Its Ryzen CPU delivers excellent performance, there's plenty of room for growth – and Qnap's QTS software delivers a superb range of data protection features. **DAVE MITCHELL**

ABOVE The fancy chassis is only appropriate – this is the gold standard for desktop NAS

"You can restore entire NAS shares and iSCSI LUNs, or dip into your snapshots and recover individual files as needed"



LEFT Qnap's QTS software provides state-of-the-art snapshot services and recovery features

SPECIFICATIONS

Desktop chassis • 3GHz AMD Ryzen 7 1700 CPU • 16GB DDR4 (max 64GB) • 8 x LFF/4 x SFF hot-swap SATA drive bays • 2 x M.2 22110 SSD slot • supports RAID0, 1, 5, 6, 10, 50, 60 • 4 x Gigabit Ethernet • 6 x USB 3 • 2 x USB 3.1 • 3 x PCI-Express • 3.5mm audio in/out • 550W internal PSU • 370 x 320 x 235mm (WDH) • 3yr RTB warranty

5 reasons your business data isn't secure

Think your precious data can't be lost, stolen or leaked? Think again. Steve Cassidy explores the loopholes, gotchas and misconceptions that can put you at risk

Those General Data Protection Regulation (GDPR) regulations are coming into effect soon – and there's still a lot of uncertainty over what they'll really mean. That means the time is now to apply some scrutiny to your whole relationship with data – not just personal customer details, but also any sort of data that's important to your business, and which would cause serious trouble if it were to leak or get lost.

Of course, that's a big ask. With the specific demands of GDPR already taxing your resources, you might question if you want to make the job any bigger than is strictly required. But the philosophy that underpins GDPR isn't just about customer protections, but about information security in general – and this might be the first time you've had to take a proper look at your practices and processes through that lens. Indeed, you might be alarmed by what you find. Even if GDPR didn't exist, it ought to be a priority to properly figure out if your data is actually secure, and what risks you face.

And, by the way, if you're worried about the stringent demands of GDPR and data security in general, don't feel too anxious. The day I sat down to write this piece, the news broke that the Information Commissioner's Office (ICO) website had been compromised, to download a cryptocurrency-mining script onto visitors' PCs. That might not sound encouraging, but it illustrates an important fact – that nobody's security is perfect. With new threats emerging constantly, it's simply not possible to guarantee that you won't ever be hacked or caught out by a bug, no matter how much that reality might frustrate irascible chief execs.

Rather, the focus should be on understanding how to identify and neutralise threats, and having contingencies in place to recover quickly and cleanly from any problems. And you can at least reduce your exposure by identifying the biggest risk to your data security, and addressing that – until you reach the point where something else is a bigger liability. In practice, that's likely to be not strictly a technical vulnerability, but something more philosophical.

1 "We're not important enough to hack"

I hear this all the time – and not just from one-man bands, but multi-million-pound enterprises. It might seem obvious to you that the data you're working with is of limited value to the wider world. But do you want to bet your company on the idea that hackers go about carefully benchmarking the value of their targets, and if they find it's not high enough, they simply stop their misdemeanours, tidy up behind them and politely leave?

No matter how humble you may feel your own situation is, hackers can find a way to exploit it. That might involve stealing valuable data, but it's still a stretch to imagine that most hackers are interested in analysing and hawking esoteric data. More likely, they're simply looking to blindly assimilate your machines into a botnet, and then rent out or sell access to idiots.

"With new threats emerging constantly, it's simply not possible to guarantee that you won't ever be hacked or caught out by a bug"

Once one of these idiots gets into your network, it's often only then that they will try to work out if they have landed a minnow or a whale. In fact, if they conclude that you're not worth the effort, that could work out worse for you. High-value targets are more likely to be kept in good working order, while less valuable systems may become hosts for various kinds of malware system testing, or just goofing around – which brings the concomitant risk of your "worthless" data being leaked or sabotaged.

In short, while GDPR encourages us to think about security in terms of the intrinsic value of our data, to the bad guys, that's often an incidental consideration. It may be that your data really is of no value or interest to anyone outside your own company. But when the ICO comes calling, asking how it ended up strewn all over the internet, that's not going to be a satisfactory defence.

2 "It's not our concern – we've outsourced"

Outsourcing can be a smart way to handle certain areas of your business. But the term is dangerously loose; there is, for example, a big difference between outsourcing your delivery and fulfilment to a third party, and outsourcing your email to Google. It's tempting to think you've entirely washed your hands of certain functions, when in reality you've merely made yourself responsible for a process you don't own. Unless you handle absolutely everything in-house, it might be a good idea to draw up a "balance sheet" that details the benefits and liabilities of each outsourcing decision.

If you want to skip that exercise, I can give you a basic summary now: any form of outsourcing that takes your data out of your control has the potential to turn into a disaster.

Why is that? It may be okay for you to run a bit of a messy shop at home, with a few security groups and some standard office PCs, but once you're in outsourcing land, the whole approach has to be different. I'm talking about blocking off USB ports, to ensure that outsourced workers can't access your address list or leak your proprietary data. I'm talking about banning personal smartphones inside the packing centre, to ensure that delivery addresses don't get shared around. If there's web access at all, it must only be via a strictly managed and filtered VPN.

To a paper-moving head office, all of this might sound ridiculous. But if you're entrusting business-critical roles to staff who aren't your own, you need to recognise the risk of names, addresses and other handy bits of digital identity being either deliberately stolen or carelessly exposed. It doesn't take much for an attacker to compile an in-depth profile of someone they want to either impersonate or defraud.

Things are, perhaps, a bit more straightforward for pure IT outsourced environments, as these come ready-loaded with industry-tested small print. This covers some key issues such as who owns the data on the servers, and what the outsourcer might do when presented with legal papers by an apparently relevant law enforcement agency. What it often doesn't cover, however, is nitty-gritty issues such as whether the entire software stack, right from the bootloader all the way through to your files, can provide a reportable, usable output that – for example – shows that someone has successfully exercised their right to be forgotten. If it doesn't, you could have some difficult questions to answer in the event of a dispute.

At the end of the day, the problem with outsourcing is that it hasn't caught up to the realities of business computing in 2018 – and because of the strictly prescriptive nature of the business, it seems destined to perpetually lag behind emergent needs and ways of doing things. Way back in 1994, I was contracting at a bank when the job of distributing laser printer toner was outsourced to the same company that already supplied the business with fresh toilet roll. This was fine until the first time a cartridge threw up an obscure error and knocked a busy printer out of action. Do you think the toilet-roll dispensers knew how to help, or wanted to?

These days, that sort of issue is more urgent still: even the simplest failure can cost a whole day's revenue, and most businesses can't afford that kind of risk. Hence the classic "cloud service adoption curve": at first, there's an upward leap of enthusiasm as the boring, tricky jobs are waved away into the ether. Then the merciless logic of the finance director applies the brakes, and the really important jobs start to come back in-house, as the company undergoes the long, grumbling transformation into a hybrid environment where visiblity and accountability reign once more.

"At the end of the day, the problem with outsourcing is that it hasn't caught up to the realities of business computing in 2018"

3 "Don't worry, we're fully backed up"

Who said that you were fully backed up? Because the very last person you should be trusting with this sort of life-or-death responsibility is your IT services supplier. Perhaps the logic of "one throat to choke" made sense when your relationship with the whizzy consultants was mostly limited to web hosting. But, as we come to rely on third-party providers for a wider range of services and advice, so we give them more opportunities to let us down, in ever more catastrophic ways – and it becomes ever more vital to

maintain a healthy distrust of them. In the case of backups, you can engage a third-party as part of your strategy, but putting all your eggs in one basket is an extremely bad idea – and you should be suspicious of any consultant that allows you to do it.

On a side note, certain suppliers also get a black mark for allowing clients to use dangerously outdated systems. Windows Server 2003 was a respectable platform, to be sure, and a good match for the simple needs and outlook of most companies that were looking to get into a networked compute environment around that time. But it's now 2018. When I hear one of those IT service companies asking around for an install CD or activation key for Server 2003 – as I still do from time to time – it makes me wonder in what other ways they're behind the curve.

It's a similar situation with hardware. Only last week, I saw a machine equipped with six 72GB 3.5in drives, mounted proudly in an air-conditioned server room rack. Running such ancient machines so far beyond their best-before date isn't just dangerous in terms of software vulnerabilities: it means that as and when one of those hard disks goes kaput, the chances of finding a replacement of the same make and model are effectively zero. So from a RAID perspective, this arrangement makes no sense at all.

4 "We empower our employees to use their own devices"

"Bring your own device" (BYOD) has become very fashionable in recent years and, if you really want to, it is possible to run a business solely on your staff's personal phones and tablets, using mainstream apps.

But that's not the whole story. It's not just about trusting your staff and your MDM solution. Most of the apps they're relying on – that your business is relying on – are cosmetic front-ends to massive, invisible cloud compute farms. You can bet that the owners and developers don't have your best interests at heart.

This isn't to say that every business needs to be run on some sort of vastly powerful public platform. You can deliver planks of wood on remarkably little compute power and make a profit. That's what business is about. Even so, the emphasis has gradually shifted away from processing and over to the value of information. To deliver a plank of wood might require a truck, which might not fit under all the bridges in your town, and therefore might need a smarter routing algorithm.

One relevant case study here is the open-source satnav app Waze, which has been fighting a steady rearguard action against requests for a "truck mode" for at least the last two to three years. The reason is a classic critique of mass-market logic: reportedly, the developers didn't originally build the ability to capture bridge heights into the data model, so now that data hasn't been collected, and indeed their database lacks the necessary structure for storing it.

So, as a rule, you should expect public platforms to provide only an approximate fit for your needs. This applies to free email services as much as free satnav apps, or free anything – and then when a revenue model does emerge, you're likely to find your crucial data is heavily tied into a service that you don't control, must pay to continue using and may not be able to easily extricate it from. It's important to remember that a breach isn't the only way you can lose control of your data.

5 "We're all going wireless because that's the future"

Allow me to recount a conversation I had a week ago – standing outside a building so secure that you can't get in if you don't have photo ID, preferably your passport, and where the internal staff must keep you within line of sight at all times. This organisation took the view that there was no need to supply Ethernet connections to people's desks, because the future was wireless. So I asked them how confident they were about signal footprints – and whether they had done any building evaluation for the forthcoming 5G cellular rollout.

Of course, almost no-one has. 5G is – at first, at least – being deployed on crazy things such as hydrogen blimps, to provide a temporary bandwidth boost at big sporting events and the like. Technically speaking, it has more in common with supercharged Wi-Fi than with previous generations of "G" cellular signals.

One thing that's important to know is that phones able to make use of 5G will be bandwidth-hopping like mad. Your typing might be going up via 2G, while you watch a video over 4G and download an OS update over 5G. Diverse routing for cellular data is touted as an advantage, but I can't shake the suspicion that any phone that can actually do this will need a trolley loaded with batteries.

Not only is this wireless future complicated, it's very far from being secure. It's been calculated that it would take much more than the lifetime of the universe to decrypt secure Wi-Fi – well into the lifetime of several universes – but that's an assessment that forgets an important lesson about the start of computing as a serious tool. It dates back to the days when Bletchley Park was working to develop Alan Turing's concepts into a workable device with a specific job to do – cracking the codes used by the German Enigma machines during the Second World War.

As you surely know, it was a task at which those pioneers eventually succeeded, but they were helped along by the Germans' unfortunate habit of repeating the same phrase at the end of their encrytped messages – "Heil Hitler". This consistent pattern in the flow of messages massively reduced the amount of thinking time or pencil work that was needed to establish the rest of the cryptological alphabet in use that day – from the lifetime of the universe to an afternoon.

"As a rule, you should expect public platforms to provide only an approximate fit for your needs. This applies to free email services as much as free apps"

Roll forward to the internet, and you can be sure that a fair proportion of web traffic is going to involve repetition and consistency. It won't be anything as simple as "https://www/", but think along those lines.

So let's not place our faith in the wireless future. Businesses will still want the convenience of a wireless connection, but when the business owner needs to prove to regulators and the public that their data is being securely handled, the answer isn't hiding in the technical specifications of the protocol. Regardless of the transport, it's your job to monitor and manage the flow. ●

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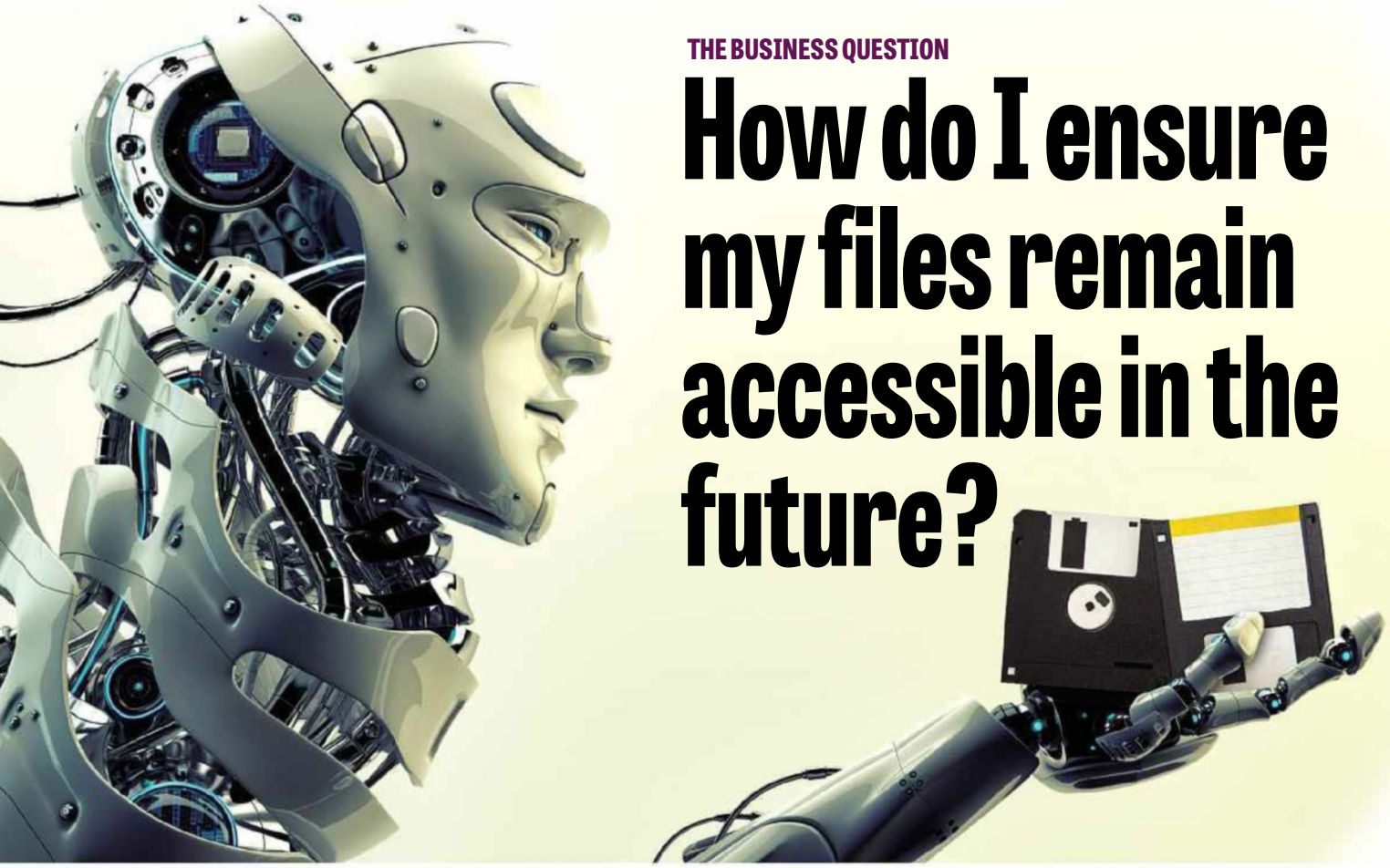


THE BUSINESS QUESTION

How do I ensure my files remain accessible in the future?

Valuable information is effectively becoming extinct as old formats die. To find out how to prevent it happening to you, Nik Rawlinson speaks to the experts

The BBC made an expensive mistake in the 1980s. It spent £2.5 million (£7.1 million in today's money) building one of the first computer encyclopaedias. The massively ambitious Domesday Project, in commemoration of the 900th anniversary of the *Domesday Book*, shipped on a pair of LaserDiscs, a standard that's largely disappeared. It was programmed using BCPL, a 51-year old language that's no longer in common use, and used analogue video stills layered on top of the interface where it needed to show a photo. This was, after all, the pre-JPEG era.

Even the hardware on which it ran – the BBC Micro and a LaserDisc player – was bespoke, and cost £5,000. Inevitably, much of the data was lost as the discs degraded, formats moved on and the hardware came to the end of its useful life. Work is still ongoing to try and recover the contents, some of which have been posted online (**bbc.co.uk/history/domesday**).

It's hard to imagine the same thing happening now. Today, we have ubiquitous formats, and everything lives in the cloud. Doesn't it?

Backups aren't archives

In 2015, Google's "chief internet evangelist", Vint Cerf, warned that we face a "forgotten generation or even a forgotten century" as formats fall out of favour and hardware degrades. "We digitise things because we think we will preserve them, but what we don't understand is that unless we take other steps, those digital versions may not be any better, and may even be worse, than the artefacts that we digitised."

It's a theme picked up by Arkivum's Paula Keogh, who makes a clear distinction between archiving and backup – two allied fields that people who don't work in digital preservation frequently confuse.

"A backup won't be migrating the infrastructure or file format over time," she said. "You're locking your data in a metaphorical room, throwing away the key and hoping it will still be there in the future."

Arkivum's clients sign 25-year contracts for the preservation of their data which, in Keogh's words, "is a lifetime in IT, but a drop in the ocean for an archive".

Critically, they need their data to be not only secured, but also accessible. "Life science organisations [and others] want to be able to double-click a file in a couple of decades and open it... so media is one lifecycle management process that we undertake. The other is file format preservation. It's not backup, scanning or digitisation, all of which can – and does – get confused with the term digital preservation. It's about migrating the file formats into the most preservable version at that point."

"You are locking your data in a metaphorical room, throwing away the key and hoping it will still be there in the future"

Format deprecation

It seems almost inconceivable that industry standards such as Word and Excel might disappear, but this is precisely what the data archiving standards body, the Association for Information and Image Management (AIIM), is planning for.

"The industry has decided that [archival-focused] PDF/A is going to be a future-proof format," said

Howard Frear of Easy Software, which sits on the body's board. "It contains all of the data and metadata within the document itself, so you don't necessarily need an application to open it, as there will always be an industry standard viewer."

This will be more important to certain industries than others. Easy Software works with pensions providers, for example, who maintain their records for the life of each subscriber, plus 20 years, and need to know that the records they produce will still be accessible, potentially, 100 years from now.

That's not guaranteed with proprietary formats. "With Microsoft Word, older and newer versions, they aren't that compatible," Frear said. "Backwards compatibility has been problematic but looking at forwards compatibility is nigh-on impossible unless you have a standard."

However, if PDF/A is the way ahead, when should the file actually be generated? At the point when we save our assets, or when they're added to an archive?

"It should be a problem for Apple, Microsoft, IBM and Amazon, but it's not," explained Keogh. "For us to be looking after our data well, when we're creating the data in whatever format, that's when you should have the option to make it as future-proof as possible."

"To some degree, it's down to the user to put in some extra effort," Frear said, explaining that Microsoft Word can output PDF/A using an add-in. "Perhaps developers could do a little bit more and store both copies as part of the single save function, but then everybody is battling against the volume of data that creates."

Keeping data alive

It's easy to forget when we have become so used to the idea of putting our assets in the cloud that it, like your local hard drive, is still a limited resource backed by fallible hardware. That's why taking responsibility for your own archive is essential.

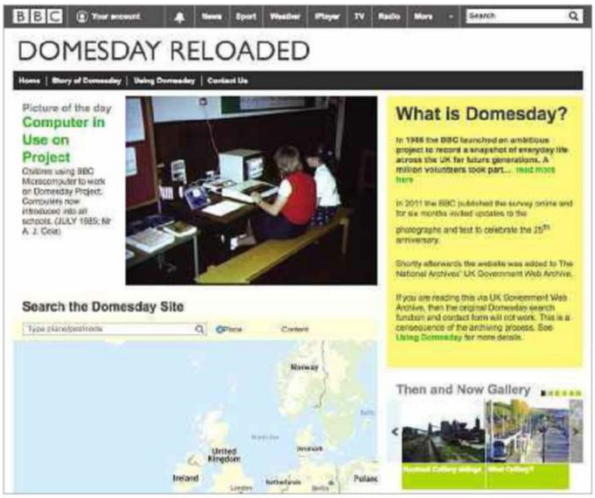
"Cloud providers perhaps aren't as mindful as the software community is," Frear said. "Software and records management communities are driving the standards and we need to remind cloud vendors that it's all very well bringing in new hardware, but that they have a responsibility to ensure that the data we put up to the cloud lives beyond the hardware's usable life, and that as they move on to different hardware they have a responsibility to move the data across smoothly," he continued.

If that archive remains usable, so much the better. PDF/A looks like the best compromise, preserving both the final look of the archived document, and extractable content for reuse.

"Could you read a WordPerfect file?" Keogh asked. "I couldn't, not without an emulator, and that's only from the 1990s, which from a data protection point of view, for something like the deeds of a house, someone's pension scheme, a clinical trial or the research that meant you could bring a drug to market, is no time at all."

Yet, despite warnings like this, a study published by the journal *Current Biology* found that only a fifth of all the research published in the early 1990s remains accessible.

The Digital Preservation Coalition, founded by the British Library and JISC (Joint Information Systems Committee), published a list of the world's endangered digital species at the end of 2017 (**dpconline.org/our-work/bit-list**). It classified data from marginalised sub-groups and the photo archives of SMEs as critically endangered, requiring urgent action and assessment within 12 months. Even documents stored on Google Drive and Dropbox, where access is restricted to specific users, were listed as endangered, along with digital images with no analogue equivalent posted to social networks.



ABOVE Much of the BBC's Domesday Project data was lost as the 1980s discs degraded, but some has been recovered and posted online

Archives and the right to be forgotten

The implementation of GDPR this May will have implications for archive-keeping, which Freer described as "another piece of the puzzle". Keogh sees potential conflicts – particularly over the question of what should and shouldn't be removed on request.

"There's a lot still to be ironed out," she said. "When you talk about things like [archived] genome sequencing or thumbprints you need to start asking what is identifiable about an individual. Is it their NI number, their first and last name, their DNA sequence? You can't take an individual out of [a study] because it skews the figures. Yet, they still have the right to be forgotten, so how do those two conflicting things work in reality?"

"Even documents stored on Google Drive and Dropbox, where access is restricted to specific users, were listed as endangered"

It's likely the answer will become clear in the months following GDPR coming into force through trial cases and legal guidance. It illustrates once again, though, the crucial difference between a static backup that rots with age, and a live, accessible archive, which remains an asset for the organisation that created it years or even decades into the future. ●

The expert view Jon Honeyball

The old adage of "save often, and save in lots of places and formats" really comes home to roost when you look at archival.

There are some cheats, though. If you are storing documents in Word format, then having a functional macro that goes through the document store, opening each document, and saving it to text, might be a good idea – even if it's a least common denominator format.

Modern Office documents are relatively safe anyway, because they're stored as XML (within a ZIP file). However, even if the days of highly proprietary formats are somewhat gone, there are always wrinkles to contend with.

The key question you must ask is "what do I need to access, and do I have to prove it is unchanged?" Gaining access to a file format in 40 years' time will be possible, but will involve format conversion. Proving the veracity of the document, that it hasn't been touched or changed, is going to be open to legal challenge when you have to admit that you used some tool to extract the contents. WORM drives can help here, along with long-term archiving to LTO tape. But even that will require careful handling moving forward.

My advice: save in multiple document formats and on multiple storage formats. Then, at least, you have a change of recovering something from one of them, and may be able to demonstrate to a judge that what you have retrieved is a reasonable representation of what was stored.

But I don't need to tell you this, do I? Any decent archive process is going to have multiple formats, multiple technologies, and multiple locations, if you're doing this properly.

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JON HONEYBALL

"The days of Ballmer-esque hatred of anything that isn't Windows are definitely over"

Jon gives a high-five to the Office team as it finally converges on a common codebase, and provides advice on surviving the CPU Armageddon

Big news from the Office team at Microsoft! It has finally converged all versions of Office onto a common codebase. This has long been a goal of Microsoft, and it's tried before and failed.

The codebase for Mac Office was forked off in 1997. That ties in with the creation of the Mac Business Unit at Microsoft in 1997, when it famously made a $150 million investment in Apple, and promised to keep developing Office for Mac. So I guess the new MBU just took the code and went its own way. No doubt the experience of getting Office for Windows 97 out of the door was sufficiently painful that much internal harmonisation effort had already fallen by the wayside.

Obviously, having multiple codebases for a product that ostensibly claims to be compatible will result in pain and hardship for all concerned. And Mac Office has certainly had its woes over the past decade and more. For instance, the move to Intel CPUs meant the next version of Office had no Visual Basic for Applications, because Microsoft hadn't ported that in time.

In recent years things have been somewhat better, although the compatibility has still had rough edges, especially if you push a product such as Excel hard. However, over the past year or so, it's clear that the Mac Office team has been working hard, and releasing new versions to the Office Insider group of advanced testers. Some of these have been plain weird – my favourite memory was the bug that top/bottom inverted your Excel sheet in its entirety. There was also a nasty repaint bug that meant the sheet wouldn't update – that lasted for months. But it's been coming together nicely, and with the release of Mac Office 2016 Version 16 on 18 January, it was happy to announce code convergence.

What does this mean in practice? Well it means that the vast majority of the core codebase (written in C++) is common to Mac, Windows, iOS and Android. There's a relatively thin layer of platform-specific code that interfaces with the host device, and which has to be customised to that platform. So that's C++ for Windows, Objective C for Mac and iOS, and Java for Android.

Having a common codebase means more common functionality, and also the ability to launch new features across platforms in closer time alignment. For too long, the "Not Windows" version of Office, especially the Mac one, has been the weak cousin of the Windows version. But this is changing as part of Microsoft's cloud-first approach. The days of Ballmer-esque hatred of anything that isn't Windows are definitely over. And congratulations to Erik Schwiebert, the Microsoft principal software engineer on the Mac team, for helping to bring this together.

Jon is the MD of an IT consultancy that specialises in testing and deploying hardware
@jonhoneyball

Rode mics and software

Congratulations are also in order for Rode Microphones from Australia. This is a market-leading company that makes top-flight microphones at sensible prices.

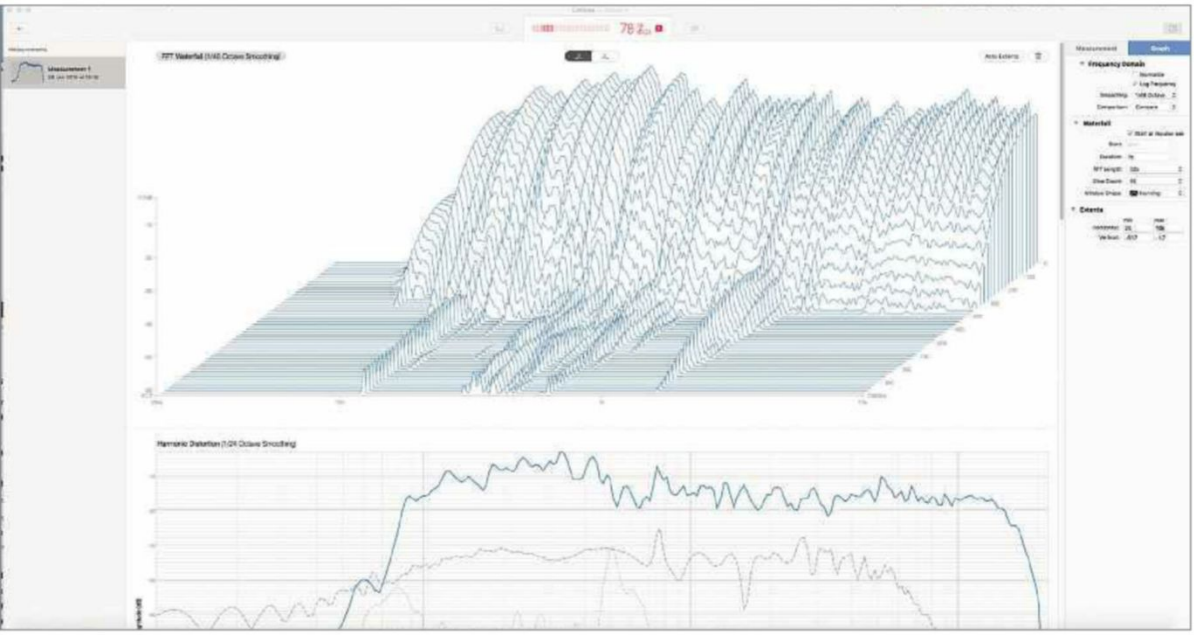
If you look around at any trade fair, you'll see a Rode microphone on top of almost every camera. The company really has sewn up that market, and it's down to the wisdom and savvy of the founder, Peter Freedman, who has steadily invested in all the technology to ensure everything is made in-house. It has given Rode an edge to rapidly bring products to market, and to explore new and disruptive price points. As I mentioned at the time, it bought the SoundField brand from the UK a year ago – which is close to my heart – and I can't wait to see its forthcoming interpretation of that.

I was intrigued to read a few days ago that Rode is moving into the measurement mic market too. This has long been the province of companies such as Brüel & Kjær, GRAS and others. It's a small market if you're talking about laboratory-grade reference microphones, where a price tag of thousands of pounds per item isn't unusual. Even a calibrator can cost that much.

With the arrival of RodeTest, it looks like Peter is on a mission to shake up that market. It's bringing out a range of reference test microphones, and I'm hoping the price will be a fraction of the established players. Rode has bought FuzzMeasure, too, which is excellent acoustics measurement software for macOS.

You might think there isn't much of a market for such esoteric technologies

BELOW After years of trying, Office is now running off the same core codebase no matter which OS you're using



and tools, but you'd be wrong. The reason it's been so niche until now is the high cost of the microphones and test hardware. Even the excellent Audiomatica Clio system will run to a couple of grand once you have its cheap and cheerful measurement mic added to the invoice. Once you drop the price so it hits the commodity marketplace, sales expand. And anywhere you have music, playback, recording or any kind of place where acoustics matter, it's so much better to actually measure it than take a half-informed guess.

I can't wait to see what Rode brings to market, and to compare the results to the big boys. Disruption is good, especially when it results in capabilities at lower prices for a greater number of people.

Why is it so hard to set up digital signing of email?

I've been wondering about digitally signing email. It's something that I almost never see, either personally or professionally, and that worries me. I accept that full encrypted email is quite a step. Large organisations can roll out such a solution, together with full encrypted document control, and make it mandatory on every desktop, laptop and mobile device. Things aren't so simple for the small-business owner, though.

I looked up various Microsoft documents on how to implement this on Office 365 – and rapidly found myself in a maze of twisting passages. The documentation assumed my laptop was running Windows; in particular, documentation for the Mac version of Office was strangely absent.

It's too much like hard work; there ought to be a simple routine here. Various Microsoft literature points to places in the admin pages where I can set up a digital certificate, but this doesn't appear to have been updated for a while, and certainly doesn't reflect the new UI that I see on the Office 365 administration screen.

Surely there's a business case for having digitally signed emails? It would give confidence to the recipient that something hadn't gone awry in the transmission chain, and would also allow us to have a somewhat stronger capability in the war against spam.

ABOVE Rode has bought the firm behind FuzzMeasure, which can only drive down prices

"The Synology NVR1218 does what it says on the tin – and it's a cracking solution"

Fun with the Synology NVR

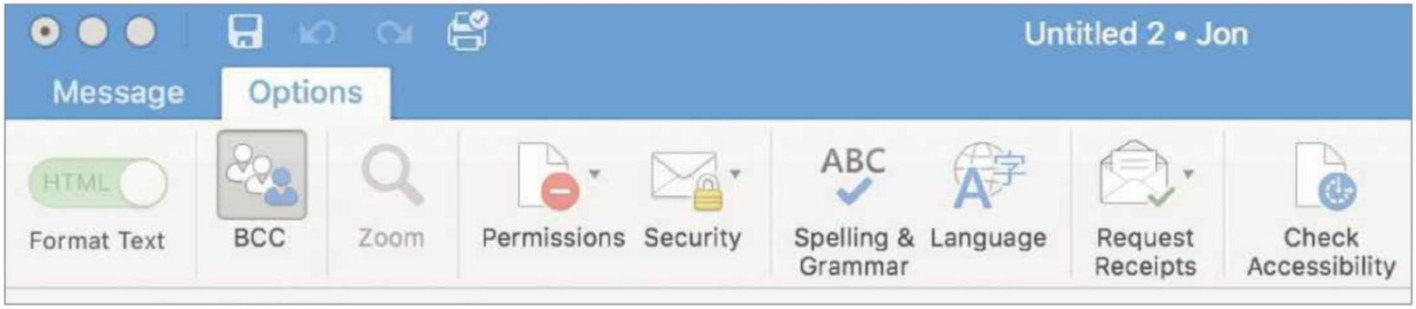
I've been having fun with the new Synology NVR1218 I mentioned last month. It's basically a two-drive NAS box that has the excellent Surveillance Station software built in. Add some hard disks and IP cameras and you're good to go. Even better, it has an HDMI output on the back so you can plug in a monitor or spare TV to keep an eye on what's happening. And when you need more storage, there's an additional box that plugs in to increase the number of disks.

It does what it says on the tin, and I think it's a cracking solution. I recommended it to my mate Tim for one of his clients, and he was knocked sideways by it. The only problem I experience was at setup.

When you set up a standard Synology NAS, you have to connect over the network because the NAS has no UI. This isn't the case with the NVR1218, because I had plugged in a monitor. I got the Surveillance Station desktop, and as administrator I could do what I needed, and then set up a user account for day-to-day operation. Everything seemed fine – but I couldn't find a way to join it to my cloud Synology account, and thus allow remote login.

It didn't matter which bit of the UI I dug into, it simply wasn't there. I asked Synology reps at CES, and they scratched their collective heads and were confused. They put me in touch with the UK office, where folk were similarly bemused. Then the light dawned: if I connected over the network to the NVR1218, I got the normal Synology NAS administration desktop, where I could set up everything I need.

My fault entirely, and I feel a bit of an idiot for not thinking of it first. But



BELOW Where's the simple option to digitally sign emails in Office?

it's a tribute to the ease of use of the box that I thought I'd done everything I needed through the Surveillance Station desktop interface. If you get one of these boxes, then remember to do the full setup!

CPU Armageddon?

You can't have missed the news about the CPU problem that's plaguing almost every chip that's shipped for a very long time. Some are claiming that it isn't really a big deal; that exploits for it will be obscure and unlikely; and that we should all just chill out and have a gin and tonic.

Some say that the fixes being released will be just fine, but the rate at which they're being issued and then withdrawn due to all sorts of unpleasantness indicates this is unlikely to be the case. And others are proclaiming it's somewhere on the journey to CPU Armageddon – that the world has just stopped rotating.

What is crystal clear to me, however, is that we're just at the start of this process. Intel has announced that it's going to be many months before it can ship new CPUs that are clear of the various design flaws. That's no comfort for those of us with existing devices, who must hope that a sticking-plaster approach of new firmware and core driver patches will somehow make things better. It certainly doesn't fill me with the same reassurance of "go to bed dear, it will be better tomorrow" spoken by your mother when you were a child.

Have we been taken for a ride by the companies? This is a critical question and, undoubtedly, it will underpin many of the attempts at litigation that are already underway – or will start shortly. These cases will take years to play out. And I'm certain that there are many American lawyers already planning their new yachts on the back of the expected workload.

What strikes me as odd is that this has affected not only Intel but AMD too. And ARM, which is an entirely different platform and architecture. I could understand some design thinking becoming enshrined years ago at Intel, and it just cranking the handle, reusing the old design every time it came up with a new CPU. After all, it worked before, it will work now, and the performance boost is coming from the underlying silicon and fabrication capabilities at the foundries.

ABOVE **If you buy the excellent Synology NVR1218, don't assume you can set up everything via the Surveillance Station software**

But for AMD and ARM to have the same issue makes me scratch my head. Has there been a *Big Boys' Book Of How To Design A CPU* that everyone has followed religiously? Or are there genuinely only a few engineers who really understand this stuff, and they've worked on all the platforms over the years? Or is this just a case of "well – it's not ideal, but the performance boost is worth it, and no-one will ever know", applied across an entire industry.

I'm not sure. Certainly, something doesn't feel quite right here. CPUs have problems – they have in the past, and they will in the future. The problem here is that in today's world, these devices are strongly nailed down onto the motherboard. Back in the days of socketed CPUs, you could have registered your duff Pentium Pro with Intel, and it would send you out a replacement. After a fiddly ten minutes, armed with that sticky white heat paste to get the heatsink and fan reattached, you'd be up and running.

But what are we to do today? How do I physically change the CPU in my Dell XPS 13? Or my MacBook Pro? Or inside my iPhone or Samsung S8? The micro-miniaturisation that the industry has been perfecting means that a quick and dirty swap-out is no longer on the table.

We'll have to rely on firmware and code to try to mitigate this – which may or may not be enough. Worse still, we can't buy new computers with truly fixed hardware for the best part of a year, even longer. This puts a lot of companies in a difficult position, especially in the data centre. And by goodness, you're in a sticky position if you're providing hosted VM capabilities, where it apparently might be possible for one VM to be able to read into the memory space of another VM.

What to do? Well, on the assumption that we can't go out and wave the corporate credit card because hard-fixed CPUs aren't

BELOW **The CPU Armageddon is coming! But why did it happen at all?**

available and won't be for a long time, we have to mitigate the risk. The first thing to do is to ensure that everything is patched up to date. That you have every possible driver from your hardware vendor, and that you're religiously checking for firmware and UEFI updates. Don't assume it will land in a friendly Windows Update; it's now time to go digging.

This also means that it really is time to have a long, hard look at your hardware estate. What do you have, how old is it, and are you applying a realistic replacement timescale? Although you might expect me to suggest changing to newer hardware, there is a case to hold off until fixed CPUs are available. Or, conversely, you might decide that you have a three-year replacement policy, whereby you retire one-third of your hardware base every year.

In this scenario, you need new hardware this year, so you continue to buy. However, you do so in the knowledge that the hardware is compromised and that you get absolutely rock-solid ongoing support from your vendor. If I was running a large organisation, I'd be having very polite words with my Dell representative, preferably in front of my corporate legal team, to ensure that you're kept totally in the loop about what is coming out and when.

This is a huge opportunity for the vendors, both software and hardware, to step up to the plate. For too long, support has been the grubby cost centre within these suppliers, and now they have to realise that this simply won't work. For example, if you have a large estate of VMware, then you'll be significantly judging your ongoing commitment to that platform based upon how VMware reacts, moves forward and treats you as a valued customer.

I wish I could give better advice. As always, knowledge is king. What do you have, what is it running, what firmware/OS/drivers are loaded? If you're not 100% on top of those issues, then it's time to sort things out. Get in outside help, even for a one-day sanity check, where someone keeps saying "why?" and "no, but..." at you until there are no dirty secrets left.

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PAUL OCKENDEN

"The way the industry quotes mAh values for battery capacity is totally bonkers"

Paul Ockenden checks out misleading phone specs, a hefty battery pack, and some wireless and not-so-wireless cameras

There's a common misconception when it comes to the batteries inside smartphones, tablets and other gadgets. When you read the marketing blurb, or scan through the reviews of the latest phone, you might discover that it has a 3,000mAh battery powering it. Quite why they can't say 3Ah is beyond me – perhaps they think people will be suckered in by the bigger-looking number.

So for a completely exhausted phone it will take 3,000mAh to completely recharge it, right? Wrong. And even if we discount the fact that a phone battery won't ever be completely flat, and the inefficiencies involved in the charging process, it's still wrong.

You see, the battery in your phone may well be rated at 3,000mAh, but being based on some kind of lithium chemistry (you can no longer just say lithium ion – there are many variants), the average voltage of the battery will be around 3.7V. A little more when fully charged and a little less when just about to die; but 3.7V is a good ballpark. The real power capacity of your phone battery is 3.7 x 3 = 11.1Wh (Watt hours).

So quoting mAh is pretty silly. Why? Well forget phone batteries for a moment. Just think of a typical AA alkaline battery. One battery will have a voltage of 1.5V, and a rated capacity of 2,500mAh. But what happens if we introduce three more batteries? Put them in series and the voltage increases to 6V, but the capacity remains 2,500mAh. Put the units in parallel and the voltage remains at 1.5V, but the capacity quadruples to 10,000mAh. This is the reason that the industry quoting mAh values for battery capacity is bonkers. In those two series and parallel configurations, the power capacity in Wh – or even mWh, if you prefer – remains the same: volts x amps = watts.

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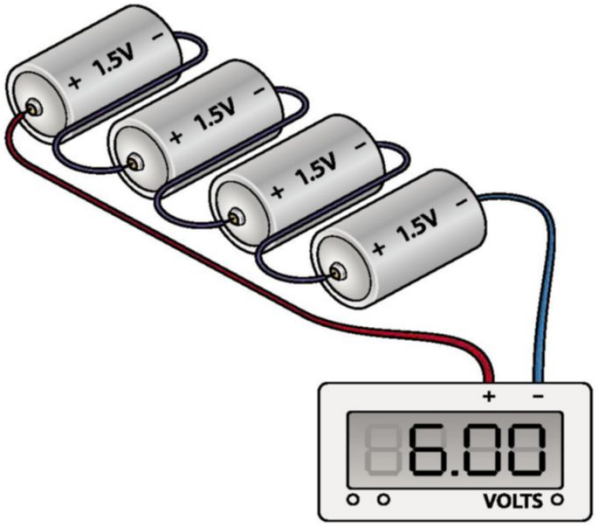


BELOW When gauging our gadgets' battery capacity, it helps to go back to the basics of physics

So, the phone with the 11.1Wh battery inside, charged using a bog-standard 5V charger, will be fully charged after 2,220mAh. Not the 3,000mAh stated in the reviews. And if the phone negotiates a 9V feed from the charger then it will be full after 1,233mAh. It appears that the battery is smaller, but it isn't.

For this reason, I'd much rather see Wh used for capacity. And I'd refer to the Ah or mAh figure as "capability" instead. However, I doubt things will change in the near future. Although, strangely, laptops generally refer to watt-hours in their specs for battery capacity.

Things are confusing when dealing with phones and tablets then. But it becomes even more so with external power-bank devices, which are becoming ever more popular. Again, they'll feature a mAh rating – usually in the product name.

I've tested dozens of the devices and, very often, the quoted capacity is a pure work of fiction. Some of the cheaper kit provides less than half the stated capacity, even if we assume it's based on the internal 3.7V battery voltage rather than the 5V output. But, of course, because mAh is actually quite a meaningless measure of capacity, manufacturers can get away with it. They could simply say that would be the capacity at 1.2V.

Some of the bigger brands do quote more realistic capacity figures. Anker

seems pretty good, especially with its more recent devices. But my favourite power bank at the moment is the Mrcool USB Type C Power Bank 24,000mAh. At the time of writing, it costs £36 on Amazon (**pcpro.link/283power**).

It's a beast of a power bank – not too huge, but solid and heavy: just under half a kilo, according to my kitchen scales. That's a good sign: kit that doesn't live up to the advertised capacity often feels lightweight.

A unit of 24,000mAh at 3.7V gives a power capacity of 88.8Wh – and in my tests, this was almost spot on. But what sets the Mrcool power bank apart from competing devices isn't its capacity or weight. It's the input and output options. There are three outputs available, two are USB and they both provide full Qualcomm Quick Charge 3 support.

I've verified that both work totally independently, too – I've seen one of these outputs delivering 5V at 3A, while the other transfers 9V at 2A. They also support 12V at 1.5A, should your phone or tablet request that. Incidentally, that 88.8Wh rating is just under the 100Wh that most airlines use when determining whether batteries can be carried into the cabin, which is great news for frequent flyers.

If you find all of these numbers confusing, the important thing to note is that it will charge a modern phone super-quickly. As fast as the supplied wall charger, or even faster with some phones!

There's a third output on the Mrcool power bank in the form of a USB-C socket. From my tests I think it supports a subset of the PD (Power Delivery) standard. The USB-C port is also used for charging the unit – it takes around eight hours to charge to full from empty. This may sound like a long time, but it's actually remarkable given the huge capacity on offer here.

ABOVE **This power bank is one of my favourites. It even has my name emblazoned on it!**

To put that capacity into context, I'm currently using a Samsung Galaxy S8 as my daily workhorse phone, and by the time I go to bed, the battery is normally showing somewhere around 25% remaining. I fully charged the Mrcool and then used that as the exclusive power source for my phone, to see how long it would last. It made it to around a week and a half.

That's astonishing, and makes the device ideal for holidays or business trips. Or it might prove useful in instances where there isn't a convenient power point to plug in a conventional charger. It could also be used to power devices that use USB-type power supplies, such as cameras – more on that later.

Most other power banks will have a few LEDs to show the charge state, with some displaying a single warning light when the charge runs low. The Mrcool has an LCD panel that not only shows the exact percentage of charge remaining, but it also displays the input and output voltage and current, and lets you know whether Quick Charge is being used. It really is a fantastic bit of kit.

"Fully charged, I used the Mrcool as the exclusive power source for my phone. It lasted a week and a half"

Camera obscurer

Some people hate the idea of security cameras in their home and/or business, feeling it's an invasion of privacy. Others aren't bothered by them at all. I have a friend whose house has units in almost every room – it doesn't bother him or his family.

A sensible balance is to have cameras covering the external parts of your property, and at entrance points, leaving the main living and/or working areas as a more private space.

An alternative is to use internal cameras to protects areas where you might have valuables, using timers or interfaces to your alarm system so that the internal cameras are enabled only when there shouldn't be anyone in the building.

There are two schools of thought when it comes to the visibility of security cameras. One is to make them so obvious that they act as a deterrent. The other is to hide them, so you're more likely to catch miscreants unawares.

I'm in the latter camp, which is the reason most of the cameras I've written about in this column have been small, battery-powered devices. My favourites remain the Blink system (now owned by Amazon), and Netgear's Arlo – and both ranges have seen updates recently.

Blink's new camera is the XT. I say "new", but it's been available in the US for some time; it's only recently appeared on this side of the pond. It's a similar size to the existing Blink camera, but it's black. Rather than the bright-white light sported by the original camera for night-time illumination, the XT uses infrared so it's stealthier. However, the biggest difference is that the XT is waterproof, and so can be used outdoors. It also offers 1080p video, where the original Blink supported only 720p.

It communicates using your existing Wi-Fi network. But, as with the original Blink cameras, it needs a Sync Module sitting somewhere within range to control the operation. And bear in mind the Sync Module isn't weatherproof. One good thing with the Blink XT is that it has a switch inside that disables the status LED. This again adds to the stealthiness of the unit, since there's no visible indication of the device recording.

The Blink XT runs on normal AA lithium batteries, with the manufacturer claiming a battery life of up to two years. In my tests, I've found that this is reduced if the camera is triggered frequently (which stands to reason), but also if the Wi-Fi signal strength is poor. The great thing about Blink is that there are no subscription fees for ongoing storage. The downside is that, unlike the Arlo, there's no web interface – only

LEFT **The display shows the capacity remaining, as well as the input and output details**

Android and iOS apps. And there appears to be a problem with the former, inasmuch as notifications can be missed if the phone has gone into one of Android's deeper sleep modes.

Overall, though, Blink is good. It's cost-effective compared to rivals and the new XT camera is a great addition to the lineup.

Moving on to Netgear's Arlo system, from which I've been testing two new cameras. The first is the Arlo Go, which is effectively an Arlo Pro camera with a built-in 4G modem. In fact, you can only use this cellular connection; you can't hook up an Arlo Go to an existing base-station. But that's fine; since it doesn't connect to an existing system, you have the flexibility to set up different scheduling and geofencing rules.

The camera I have here is branded as V-Camera by Vodafone, and it's part of the company's new range of connected kit. I'll cover some of the other devices in the next few months.

The V-Camera is supplied with a micro-SIM that costs just £4 per month when used in the Arlo Go, but it's available only to existing Vodafone customers (the £4 charge is added to your normal monthly bill). On the plus side, the SIM has the usual free European roaming that you expect from a phone SIM these days, so you can take the Arlo Go on holiday and use it to protect your hotel room or holiday cottage.

It's slightly bigger and heavier than an Arlo Pro, and it works with the usual screw-in camera mounts –but not the round-ball magnetic mounts to which other Arlo cameras will attach. I don't think that's a bad thing because the Go is more likely to be used in remote places, so better security is a good thing.

I love the fact that you can leave this camera hidden in the middle of the forest, miles away from any mains power connection or Wi-Fi signals, and it will record any activity it spots and upload the clips to the cloud. The battery is sufficient for around a month, but you can extend that using a solar panel, which is available as an optional extra.

I can think of myriad uses for the Arlo Go. My unit is currently keeping an eye on the house of a relative who died recently. But for a few days before that I was using the device as a wildlife camera to record birds and foxes in my garden. There are several proper wireless cameras on the market now, but the majority require a Wi-Fi connection to talk to their various cloud services. The Arlo Go is one of a few that don't even need Wi-Fi – and I love it!

The other new Arlo camera that I've been testing is the Pro 2. As you can probably tell from the imaginative product name, it's an update of the Arlo Pro. It's moving in a different direction to the Arlo Go, however – I'll come on to the reasoning in a moment.

The headline change is that the video resolution is now 1080p rather than the 720p of the previous Arlo lineup. As with the Blink XT update, this effectively doubles the pixel count and, as a result, the footage is noticeably clearer. Faces are easier to recognise – and, for externally mounted cameras, you're more likely to be able to read the number plate of a vehicle that pulls onto your property. It's worth the upgrade for this feature alone. But there are three more tricks that the Arlo Pro 2 pulls off, albeit with a great big caveat.

The first is that it pre-buffers footage, so can upload clips that begin three seconds before any motion is detected. This overcomes one of the main complaints users had about earlier Arlo wireless cameras. The second is that you can define motion-detection zones, allowing you to monitor specific areas – or mask out parts of the image where you're not interested in triggers. It isn't quite as flexible as some other systems, since these detection zones can only be rectangles. The final change is that, on payment of an additional subscription fee, you can have continuous video recording to the cloud, such as that offered by Nest. This moves Arlo into a different league entirely.

ABOVE **The Blink XT is waterproof, offers 1080p video, and can be used outdoors**

"There are a few proper wireless cameras on the market now, but the majority require a Wi-Fi connection"

BELOW **Slightly bigger than the Arlo Pro, the Arlo Go has a built-in 4G modem**

I mentioned a caveat, and also that the Pro 2 is moving away from the philosophy of the Arlo Go. The problem is that these three features all rely on the Arlo Pro 2 having a continuous power feed. Netgear also says that they only work indoors – but my tests suggest otherwise.

The reason a power supply is needed is because these features are quite hungry. My measurements show that when powered, the camera consumes around 1.62W and becomes quite warm. If you unplug the power lead, the camera continues to work like a higher-resolution version of the Arlo Pro, but it drops back to a lower-power mode and the three additional features stop working. Incidentally, when powered the motion detection uses the image sensor (hence the ability to define zones), but when running on the internal battery it reverts to PIR detection.

However... Remember that Mrcool power bank I wrote about at the start of the column, and the fact that it provides 88.8Wh of power? Well, at 1.62W the power bank will last almost 55 hours, or just over two days. I've tested this and the Arlo Pro 2 runs very happily indeed when plugged into the Mrcool – and all of the additional features work just fine.

@PaulOckenden

LESLIE COSTAR

"I considered it my national service: taking the flack when the mail server broke at least once a day"

In 2011, CIX seemed to have no future. Leslie reveals that an emotional connection as much as a business opportunity led him to buy it

I was a relatively latecomer to CIX. This was back in the 1990s – and in my defence, I was only 14.

My discovery of the internet went from CompuServe to AOL and then to the famed Compulink Information eXchange, as it was once known. Introduced to CIX by a Catholic priest at my school, I soon began discussions with anyone and everyone on its conferencing system. I had ideas above my station, as you do when you're young; not only do you think you know everything, you want to tell everyone too.

Little did I know that it was the place to be at that time. It was very much akin to a night club that, once you went to it, made the other popular ones you used to go to seem a little touristy. It had its faults, niggles and weird features, but what decent club doesn't? After I left school in 1999, I ended up working there for two years. I considered it, in a fun way, as my national service: helping people to diagnose dial-up networking issues on Windows, and taking the flack when the mail server broke at least once a day.

In 2001, I started ICUK with my business partner. We did it by lobbing together other people's services under our brand. We were a virtual host, virtual reseller, virtual ISP – and virtual everything. But we worked hard, and it worked, and people were happy. We moved from virtual to physical. The business grew and experienced all the associated problems: finding new staff, migrating customers onto your own servers, your own pipes with BT, and spending a fortune with Cisco – a sum that was equivalent to what you'd pay for a deposit on a London apartment.

But I owe a lot to CIX. It was my first proper job. It taught me what MX records were with mail servers. One of the guys there taught me scripting and VBScript, and how NT IIS Shared Hosting works. I learnt company structures, and experienced people's pain as both a customer and a member of staff. Much of that went into building ICUK and, in some ways, I felt I didn't want to repeat the mistakes I'd witnessed with CIX's own growth in the late 1990s.

Leslie is co-founder of ICUK, which breathed new life into CIX after buying it in 2011
@madetea

"I learnt company structures and experienced people's pain as both customer and a member of staff"

While ICUK was growing, I watched on as CIX went through its decline. After numerous buy-outs, repacking and relabelling, I watched as it went back to its roots as a conferencing provider – but with the legacy hosting and email stuff still chomping away at data centre power as if it were going out of fashion. So, one February in 2011, glancing across to my partner in crime, I said "shall we buy CIX?". "Okay", he replied, and the initial contact email was sent.

Buying decision

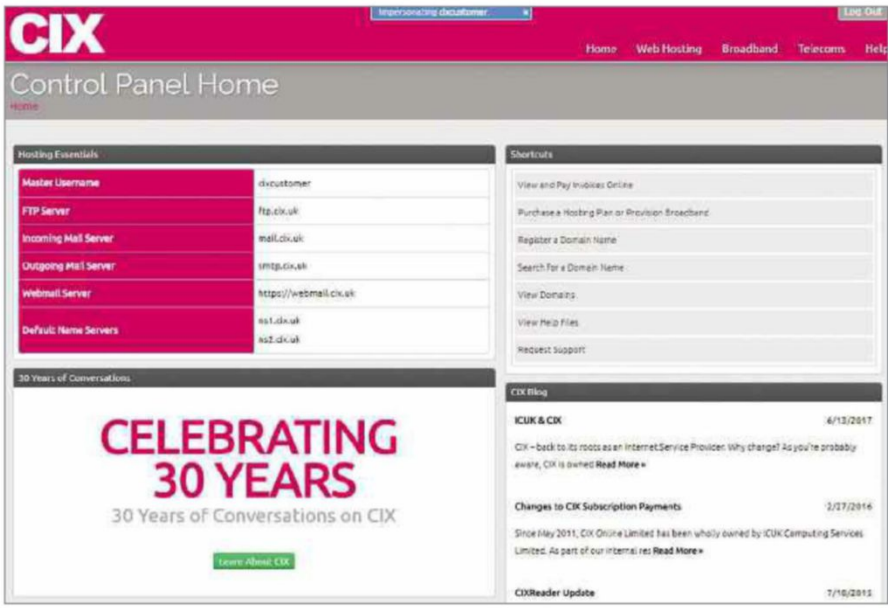
Why did we choose to buy CIX? With Facebook, Twitter, LinkedIn and the many other free web forums out there and growing in popularity, why would people still be paying for a closed service that was built on technology from the 1980s? I still can't answer that – but the emotional connection with CIX was probably the primary reason. To me, it was a piece of history that needed a new home and someone to look after it.

In May 2011, CIX was ours. All the deeds had been signed, and ICUK was now listed as its parent company. It's an interesting experience buying your first company. Solicitors ask more questions than you can imagine, and, unlike most house purchases, you're never quite sure if in 20 years' time it will be worth anything.

We got to work and updated the systems. We compiled CoSy (remember that?) onto Linux. Virtualised all the old Windows 2000 servers running virtual hosting. Updated the official reader, at the time called Ameol2. We brought in a brand-new mail platform. Converted three racks of hardware down to about half a rack. We updated the web front-end, and even released a new reader called CIXReader that doesn't connect to CoSy – all mod-cons coming into place.

Meanwhile, ICUK continued to grow, launching Ethernet leased lines, new broadband services and investing heavily in our wholesale arm. In 2017, we made the decision to make CIX its own ISP again. But unlike ICUK, which would concentrate on wholesale, CIX would retail to consumers. We saw it as a good opportunity to breathe new life into CIX, and get the brand out there once again.

Which raises another question: why would anyone want to run a



RIGHT After 30 years of traumatic life, CIX is going back to its roots as an ISP – targeting retail customers

retail-focused ISP in 2018? How on earth could we compete against the likes of BT and TalkTalk – and why would we even want to?

For us, it stems from legacy. When a business starts, you often chase after anything, or anyone, that's willing to pay you for something. It's somewhat irresistible when someone asks "can you do my broadband for me," so you just say yes, and then worry about sorting it out once you're back in the office.

So ICUK had many "legacy" retail customers, and our resellers didn't want to compete with us directly – so CIX, the retail ISP, was reborn.

Running an ISP

It's hard work to run an ISP, both for retail and resellers. You need a good team around you. A team you can trust, and with people who care about the job they're doing. Finding such folk isn't easy, but once you have them, keep them. At all costs.

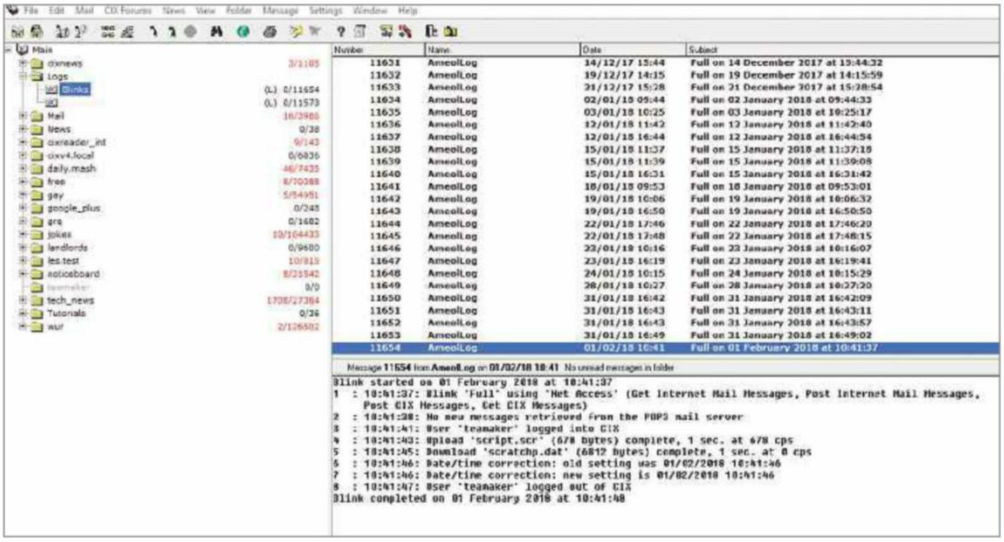
You also need to keep your eye on the ball. It's so easy to fall behind another provider, or have a sense of "we're better than them" attitude. Whether or not you're better isn't for you to decide: your customers will decide that for you. Having to pick up the flack every day for problems that sometimes aren't even in your control can go two ways. Your customers may end up thinking you're just not for them and leave, or they'll appreciate the honesty and personal touch and reward you with their loyalty.

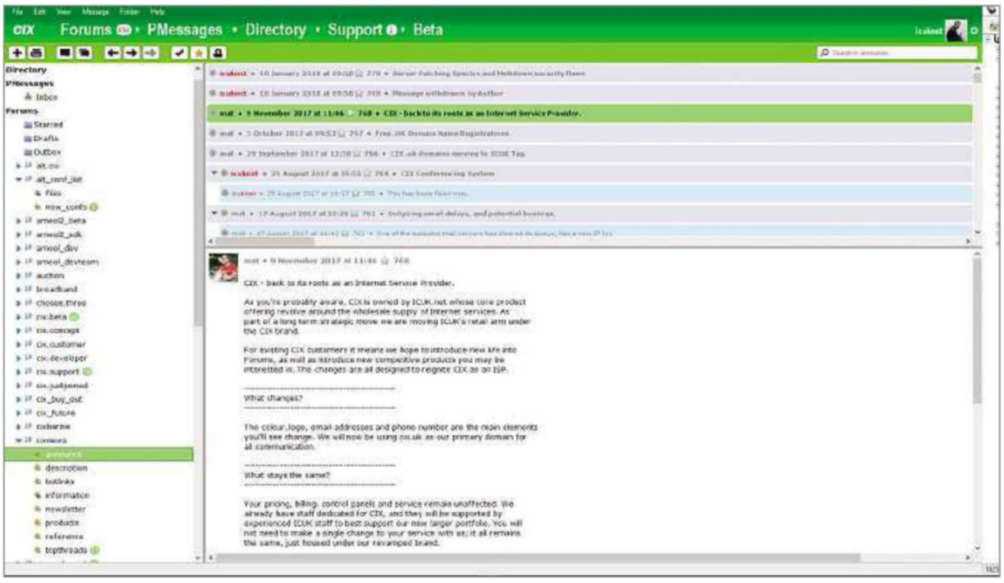
Then there's the equipment. Don't think for one moment that ISPs are loaded. Any decent ISP will be ploughing a good portion of its profits into expanding the network and putting systems in place, so that waking in the middle of the night to fix something becomes a rare occurrence over time.

This is especially difficult for a smaller-than-average ISP trying to break cover. And yes, the odd corner being cut has been done – just to get things working. The important thing is that you uncut it as quickly as you can, so it doesn't happen again.

And suppliers? That's where the fun begins. Back in the 1990s, an ISP would have had a few leased lines going into their self-made data centre in the back of their office, with some ISDN lines installed and a local number to ring it. Now, an ISP will have several points of presence (PoPs) in data centres across the UK, with numerous dark fibre links connecting them together. All plugged into the tier 1 carriers – and while you hope they won't go down, you also hope your backup connections are working well. Then there's making sure you have enough transit from your providers when Wimbledon is on, or when a breaking news story emerges; "excess bandwidth", as it's known in the trade.

The main supplier that all internet service providers deal with is Openreach. Your telephone line, your broadband connection and your local exchange are all supplied by this beast of a company. Yes, we bill you; we manage the connection, the IP address, the bandwidth and all the rest of it. However, it's Openreach's core product that we're supplying – and if you're in the middle of nowhere and can only get 1Mbit/sec on a good day, when the town down the road is bathing in 80Mbits/sec FTTC, there's little we can do for you.





ABOVE Remember Ameol2? One of ICUK's first jobs was to update the CIX reader to something suitable for the modern user

"Don't think for one moment that ISPs are loaded; they'll be ploughing profits back in to expand the network"

Love it or hate it, Openreach is here to stay. Whether in the future it remains part of the BT Group is anybody's guess, and for discussion in another article.

That aside, I shouldn't be so gloomy. There are many rewards to be had when running your own ISP – even in 2018, with the government threatening to force us to spy on every key you press and every email you download. Yes, there's the profit side of it, but there's also the problem-solving element.

Finding the right solution for someone and getting it in and working can still be fun, as is watching the hard work pay off when a new PoP goes online and all the geekiness that comes with it. Even when you run a business with the aim of making sure the bills are paid, the technical enjoyment should never leave you – even when systems go down and you're buzzed at 3am to fix it.

It all works out in the end.

@madetea

DAVEY WINDER

"GlassWire has an evil twin option for alerting you to any device trying to connect to a rogue Wi-Fi hotspot"

Davey looks through the looking glass, and evaluates cheap background-checking services to see whether he can find any info... on himself

I'm happy being a geek, hence I've owned the **happygeek.com** domain for the past 20 years. I'm also attracted to good-looking things with high levels of intelligence, hence I've been married three times. Before I'm crucified for being a misogynist, that was an attempt at humour (which probably accounts for two divorces). Couple being a geek with a liking for good-looking, intelligent stuff and it was almost inevitable that I'd stumble across GlassWire. It's marketed as a visual firewall, which I think demands a little explanation.

The most common description I've found is that GlassWire is an interface to the Windows Firewall, but that isn't the whole story. I don't have Windows Firewall running on the laptop where GlassWire is installed – the security suite disables it – yet I still run, and still like, GlassWire. Funnily enough, I don't run Windows Firewall on my Samsung Galaxy 8+, yet the GlassWire app is installed there and I like that too. And the reason for this, in both cases, is the transparency to network activity it provides.

The Graph Apps view is good to get a broad-strokes idea of application activity and, with a mouse-click or two, to drill down into what any app has been doing online during any given period. There's a Traffic view that brings that visibility at a protocol level, but I usually watch the "all" view that combines both.

Davey is an award-winning journalist and consultant specialising in privacy and security issues
@happygeek

"I'm a fan of GlassWire, and the reason is the transparency to network activity it provides"

Things get more interesting on moving into the Usage area, if you like to know what's eating your bandwidth. Again, as is true of most areas within GlassWire, you'll be able to drill down into the data here as well – by hosts, by alerts generated and so on. The third view is an Internet of Things one, or devices connected to your network. No drilling down here, but you do get a view of IP and MAC addresses, device name if known, and first connection to the network – but that's it. I prefer the Fing app for this kind of network device discovery.

I can't comment on the Firewall view much, mainly since Windows Firewall is disabled. If it wasn't, then I could interact with it and control what it does through a more informative and intuitive interface. For example, get control over what programs can access the network using the "ask to connect" mode, rather than digging through the Windows Firewall advanced settings.

This would, of course, keep you busy on the pop-up dialog front – and that would be a huge pain; doing it in reverse with "click to block" is much easier on the finger. I do use the Firewall view, though, since it provides the quickest and clearest access to the VirusTotal function. This uses the VirusTotal database to check any app (just click and request a scan) against a bunch of AV engines to obtain a risk score. If there are any reports of it being malware, you can see quickly and then "click to block" while investigating further.

Talking of the security side of GlassWire, not only will it notify you when a new device joins the network, or an app has connected, but also if it has connected to a suspicious host. This is cool. Want warnings about changes to your HOSTS file or networking drivers and so on? It can do that as well. It even does the Fingbox 'fing of having an evil twin option for alerting you to any device trying to connect to a rogue, cloned Wi-Fi hotspot.

I like that there is a function-limited free version, but it enables the paid-for features during the first week so you can try them out. If, like me, you find them useful then you can opt for one of three subscription levels costing $39, $69 and $99. The cheapest gets you a licence for one device with three remote connections and a six-month history. The next level ups that to three devices, ten connections and a 12-month history. The Elite version brings ten devices with unlimited connections and history to the party.

I also like the Android app, which is free. It has no ads and, importantly, sends no data anywhere itself. This is a key consideration for me. A lot of apps send data over the network themselves. Look into this some more and you'll discover that, in many cases, the app developer is at liberty – through the privacy policy

BELOW **Pretty and informative, just like Davey...**

– to sell that data on to third parties. In contrast, GlassWire's developers make money through the Windows desktop application. This enables them to make the Android app free, and they tell me no app usage data leaves the device at all.

Like the desktop client, the GlassWire app is great for both an informative overview of what's connecting and to where, while a few finger-clicks can reveal all the information you're ever likely to need.

Twitter applies AI to improve UI

As someone who visits threat research labs around the globe, I'm used to being briefed on how AI – or machine learning, in reality – can help protect networks and data from attack. When I heard that Twitter was implementing AI in a new project, I immediately thought it was detecting fake news from the Russians attempting to influence political outcomes in the West.

But no, nothing quite as exciting as that. Twitter has developed a smarter way to automatically crop previews of photographs uploaded to a feed. In fairness, this is no bad thing. How many times have you uploaded a photo to find that cropping applied by Twitter ruins the preview image?

In case you're wondering why Twitter crops them at all, it's all part of "the fewer characters, the better" approach to social networking. So, images are cropped both to enable more tweets to be seen at a glance and to render a more consistent UI. This would be acceptable if Twitter did a better job of the cropping.

Using face detection to focus on the "most prominent face" is a heuristic approach that immediately fails if the image doesn't feature any faces, for example. The heuristic process used would compensate for no faces being found (even if there were, and it just missed them for whatever reason) and focus on the centre of the image instead. Twitter even had to admit that the face detector didn't recognise cats, which is unfortunate given the sheer quantity uploaded.

Badly cropped previews are, in my opinion, worse than no previews at all. Thankfully, the boffins at Twitter seem to agree, and have been working on a new, intelligent cropping algorithm. This is based upon the notion of saliency, or the bits of the image that our eyes most commonly fall upon when scanning a photo. Wider research using eye-tracking tech has been plentiful, so there's lots of data out there that's perfect for a machine-learning environment to be trained with.

The problem, as with most ML-based technologies, is one of speed. Real-time sharing of images would be too slow if every image had to go through this saliency prediction process before being cropped and previewed. The Twitter researchers tackled this issue by optimising the implementation to just worry about the most salient regions of the image being "roughly" processed, rather than delving into a pixel-by-pixel level of granularity. Things were further speeded up by using a knowledge distillation technique, where larger networks generated predictions. These are then used to train a smaller and faster network to imitate how they did it.

Twitter researchers reckon these methods, plus some complicated iterative pruning of feature maps, resulted in a ten-times speed increase of predictive processing, enabling real-time intelligent cropping. These updates are currently being rolled out across Twitter, and will also arrive for Android and iOS apps shortly.

ABOVE The GlassWire Android app is as useful as it is good-looking – and it's free, too

Encrypted Dropbox

PC Pro reader Alistair Coppin emailed in to ask a straightforward question: should I encrypt the data I store in Dropbox, and if so, how? As with all such questions, the truthful answer is "that depends". On the sensitivity of the data being stored, whether you're a business or individual, if GDPR or other data protection regulation may apply, and so on.

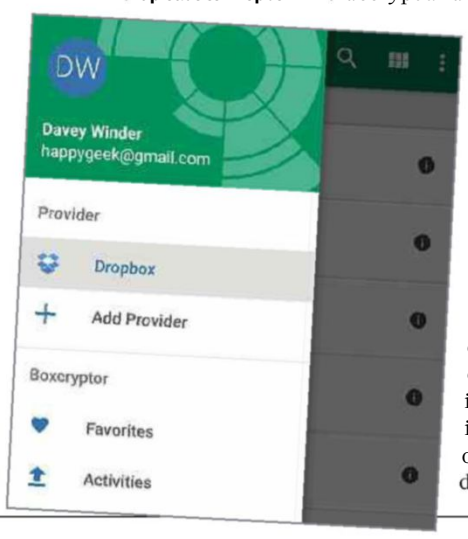
The data privacy regulatory framework doesn't apply here; Alistair is more interested in keeping his family photos private in the event his account was compromised. The next question is what does Dropbox do by default? The answer is that it provides the usual encryption of data in transit (via Secure Sockets Layer/Transport Layer Security), and encryption at rest using 256-bit AES when your data arrives.

Which is okay – but is it good enough? While 256-bit AES is decent encryption, if an attacker got access to Alistair's credentials, they could log in as him and the data would be presented unencrypted. So the first bit of advice is to use random and long passwords (get that password vault operational), together with activating two-factor authentication; your attacker would then need access to your authenticator-generated access code as well as your password.

This still doesn't get around the fact that Dropbox holds the encryption keys and could decrypt your files if law enforcement came asking. Or, indeed, if an attacker managed to compromise Dropbox itself and obtain access to those keys. Both are highly unlikely, and for the average user not too concerning.

If paranoia bites, there are options available to make encrypting your data before you send it to Dropbox both painless and secure. The latter as you hold onto the keys, not Dropbox, and the former as they really can be click-and-forget these days.

Boxcryptor is pretty good, with a Windows client that will encrypt data on the fly. Every file is encrypted separately, which means you can decrypt and view your files without engaging in a time-consuming bulk decryption process. A double-click on an encrypted file opens it in seconds. Save your changes and it's encrypted again, automatically.



BELOW The Boxcryptor app automatically encrypts photo uploads to Dropbox

Boxcryptor is free for personal use, but with a few restrictions – only connecting to a single cloud provider (Dropbox is supported), for instance, and data can only be synced across two devices. The new version

Continued from previous page

comes with support for 2FA, though. For unlimited cloud services and devices, plus filename encryption, upgrade to the £34.50-a-year version. There's a free Android app, but you can't encrypt existing files with it; you'll need to use the desktop version for that. For the photo use that Alistair mentions, however, it has a camera-upload feature that will automatically encrypt and upload photos as they're taken.

Davey Winder: no data found

There are numerous reputable organisations that specialise in providing online background checks, at a cost. Which is why, especially at the smaller end of the business spectrum, I generally recommend a combination of Googling, social network exploration and common sense – unless there are regulatory requirements to be met.

What I wouldn't recommend is using one of the many services that offer such checks for a very low fee; which often turns into a recurring monthly subscription. I tried such a service recently, with a search on myself, to see how accurate you can be for £2.50. The answer? Not very.

I've led a very visible life online, since the time when the internet was only accessible to a privileged few. Searching for background on myself would, you might think, throw up a heap of information. Inputting my email address prompted a successful return in finding my full name, email IP, street address and background check data. Once I'd paid the fee, it further promised a full report that would include age, date of birth, address history, criminal records, marriage and divorce information, and property ownership details.

Having paid and entered my email address again, the result came back as: nothing found. I tried searching for my full name and, yet again, it returned zero records. If you need serious background-checking services, then, employ the proper HR firms that know their stuff. If you don't, then either do that Googling and Twitter searching yourself, or use your judgement as to whether or not someone is good for the job.

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STEVE CASSIDY

"This is a hoster that's abusing its privileged position within a market of small businesses"

Thin or fat – when is a cloud not really a cloud? Steve Cassidy discovers two companies with very different views of the future

This has been a month of battles with modern business platforms that turn out to have ancient and surprising underpinnings. It's long been a tradition in IT that no matter the roots of your system, it will always be described in the most modern marketing idioms, even when circumstances prevent most of those idioms from actually applying.

Yes, I typed that with gritted teeth. I have a couple of very new networks, commissioned in the final months of 2017, and both clients are terrible practitioners of what I call "top-down diagnosis". They believe that the more important the job is to the health of the business, the faster and more accurately the IT infrastructure will perform while running those jobs. They frequently exclaim, "oh don't run slow now, I have a meeting!", or like to delay any possible fix by explaining in excruciating detail how important their job is.

Trying to tell them which part of the system is misbehaving is almost impossible, because it's only their viewpoint that really matters. And, of course, no IT worker has ever been in this situation before, or understands things such as deadlines or profit motives. They're also quite sure that new kit is inherently unreliable and will have "bugs ironed out of it" only by the courageous and unstinting testing by real users... can you tell I find this irritating, yet?

Top-down diagnosis requires that the most complicated and innovative parts of a system are tested when there is a delivery issue, before the simpler components are looked at. So when a cloud-resident accounting product slows to a crawl and finally logs the user out, this type of user will reboot the local server,

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the PCs, the VPN router, and the fibre modem – re-logging in every time – before they call the cloud supplier and ask if perhaps something was wrong with their session.

It's important to encourage people to think about the right experiment, too. Normally, I don't bother those people whose understanding of the world is filled with malevolent spirits, cartoon physics, animism and worship. However, when they start exporting all that in a request to a techie to make it all better, to my mind they become fair game. A case of "the customer is always right, until they try to think like the supplier".

So with this incident, I sat at the next-door PC and roundly rejected all appeals to reboot the server farm, unplug the router, turn vegetarian, change electricity supplier, or any other absurd responses to a basic error. My defence consisted of continually flipping around YouTube videos at high speed, copying files across the LAN, and generally refuting all the incoming hypotheses.

This is mostly because the "cloud service" this guy was using was a Citrix session. So far as he was concerned, because it wasn't in the building, it must be "In The Cloud Somewhere" – and that made it inherently good. Yet, quite plainly, Citrix Receiver was failing to

BELOW Is Citrix Receiver encouraging suppliers and customers to "lift and shift"?

reconnect to the service: he had no idea if his accounting session was open, closed, incomplete or crashed.

Don't get me wrong. I like Citrix, and it behoves us to remember that it's the daddy of remote desktop platforms. The acquisition of Xen produced one of the sharpest 90-degree turns in the history of computing. To this day, Citrix is unapologetic about its specific, niche-orientated approach to cloud software provision. And it hasn't deserted its traditional multi-user remote access marketplace, either. Full marks to Citrix for all of this stuff.

However! What Citrix is presenting is mostly about Windows servers, and remote complete VMs of individual PCs. This tempts suppliers and customers to do a "lift and shift" – pick up the complete software manifest of a business and shift it all onto a cloud-resident hypervisor platform, offering secure access by way of Receiver. To the naïve user, they click on a cloud shortcut, they get a window, they do their work. See, cloud! Zero server! Wooo!

Um – actually, no. It's certainly possible to run a cloud service on Citrix – but a Windows server isn't capable of doing the things for which cloud sessions are famous, especially not when it's configured to provide access to a software package that has no understanding of cloud itself. So my client had bought into this idea of cloud computing, skimming lightly over the bit labelled "legacy support", and focusing entirely on all the sexy stuff about scalability, reliability, and variable-cost-based – instead of capital-cost-based – computing.

Not one of those features of cloud is relevant to what this guy is doing. He wants to keep his accounts app open all day, typing stuff in and getting reports back. The software opens many windows, uses multiple databases to represent multiple separate companies, and doesn't like it if you leave transactions open.

To achieve magical cloud scaling with this kind of legacy product requires some serious infrastructure skills, with multiple servers in a farm, centralised user management, tiered storage with virtualised connection – and the evidence suggested this "cloud platform" had none of those. The main giveaway was that the provider was asking its clients to hang back from a pending update, because some of them weren't ready for the changes to their accounting practices that taking on this product would create.

So what we were looking at wasn't cloudy at all. In fact, it wasn't all that Citrix-smart, either. It was a Windows server remote-working environment, with secure connections from something like 50 separate small-business users. It had to be that way because of the stick-in-the-mud attitude of the developer: if you wanted the full-fat feature set then you better stick with the Windows version, is its position. This made a hosted version inherently unscalable, and not that good at segregating the impact of one user session on another – hence the crashout.

This is a hoster abusing its privileged position within a market of small businesses. Rather then spend its money on a properly configured Citrix deployment, it threw it together with about 5% of the feature set being used. For its customers, this meant several retrograde steps in overall reliability. A small florist might only clean up his accounts at the end of every month; a garage with 50 staff might be doing the same job every day. The kind of database woes or misuse that take down multi-user Citrix servers are more likely to arise from abuse than over-use. But top-down diagnosis rules meant I had to sit there for some time while it crawled and crashed, before my client decided to ring the service provider.

Once the distant hosted server had a classic Windows reboot and repair process, normal service was resumed, followed by a rather committed conversation on why there was a need for a cloud solution – and why they shouldn't allow their local installations of the accounts package to fall out of subscription just because the other option was "in the cloud".

This is one of those very difficult jobs, where it's all too easy to get drawn into the fine diagnostics of what's really going on at the far end. And if you get that diagnosis right, you'll have successfully avoided being paid by 50 people, all of whom are impacted by the poor implementation of the hoster. Nobody should be supporting a deployment such as this, which manages to make the worst use of an excellent product in the dumbest possible configuration, because to keep it running with ever-smarter collective fixes simply pushes back the day when the right solution arrives.

ABOVE **The higher level your diagnostic, the bigger the system you have to reboot**

"Database woes that take down multi-user Citrix servers are more likely to arise from abuse than over-use"

Playing in the big boys' game

Right at the other end of the scale, I found myself in Madrid in January (pretty much as cold as London, I must report) with Software AG. It was mostly making noises about a much deeper investment in the IoT marketplace by way of a not-really-takeover of Silicon Valley startup, Cumulocity. I like Software AG events: it's easy to get to the hardcore techies; there isn't a lot of software business rhetoric to wade through; and there's always a short route to a practical justification for what's going on.

Not so much this time. Try as we might to make sense of the takeover, it just kept eluding us. Cumulocity will be gifted with a whole lot of sales and support staff, beefing up its ability to sell in markets where it hasn't before had a strong presence. Most of these come from existing Software AG offices and functions. Yet Cumulocity's own pages make it read a lot more like a cash injection. What on earth could be going on here?

The hints were pretty sparse, but I believe I understand the logic now. The whole purpose of taking Software AG's IoT business and putting it inside the Cumulocity business unit is, it said, about being able to pitch for larger IoT projects, in a market projected to show 70% growth in 2018. Yes – 70% growth. Whatever the size was in 2017, measured in dollars or in number of devices brought online, there will be a little over half as many again during this year. That's a lot of

ABOVE **Software AG has bought Cumulocity. Or has it?**

growing. And it seems plain this will come from businesses that aren't exactly a mom-and-pop shop doing e-bike hire (thanks to IGEL for that particular worked example).

Working on projects for large multinational companies is a bit of a deal with the devil. They're not here to make you especially rich; they're here to cut the deal as close to the bone as they can, without actually crippling themselves. Crippling you is okay, because they'll be able to hand most of your materials over to the bidder that lost out to you in the first place.

There's probably a management treatise somewhere that relates the average size of IT contract to the likelihood that one party or the other will resort to legal action at some point in the relationship. While I can't find an easily digestible infographic for this, I'm quite happy to assert that if you think you're going into a business sector with explosive growth in it, and likely risks of a lawsuit even in the course of a successful project, then it makes sense to take the risks associated with working in those fields and move them off somewhere that won't put your main brand or main bank account in peril.

This isn't a snide remark, incidentally. It's a rather unexpected outcome of the fact that IoT has become something of a fifth wave in the big-time world of global business. It's another try for IT businesses to get inside the hearts, minds and wallets of their largest customers. It won't be a smooth ride, and not for the usual reasons that surround software houses. This is more a matter of who's the best diplomat than it is about who's the best coder. Unfamiliar territory – but definitely exciting stuff. Where else have you heard of an IT sector with this amount of growth in it?

The key to thin client computing

A bit of a snowy ride around Europe to start 2018, hopping from plane to plane to catch up with various bits of the tech sector. I was especially intrigued to hear from IGEL, which is hardly a household name when it comes to thin-client computing. This hasn't made any difference to its outlook: while most of us have been unconcerned by the thinness of our clients, IGEL has been beavering away, strengthening the range of its activities in this odd little backwater.

Not without good reason, too. It's odd to put the thin-client world alongside others that have been burgeoning in adjacent sectors. Most people wouldn't like the idea of coughing up more for a thin client than for a business-grade PC, yet think nothing of spending rather more than either on iPads for staff. Similarly, there's a lot of lip service paid to the idea that IoT deployments need to be based on new, often enormous management and monitoring software. Yet, typically, the work required from an estate of thin clients comes out looking pretty similar to that generated by even thinner IoT endpoint devices.

Understandably, this presents IGEL with diversionary temptation. Could it make it big in general-purpose IoT device management, which is, if anything, a subset of what it's been into with its own devices in the thin-client continuum? Or is that diluting its proposition in a market that's been threatening to burst through for several decades now? (Yes, it's decades. I got several drinks out of several exhibitors by mentioning that I reviewed Citrix Metaframe in *PC Pro* around 1998…)

"Multinationals will cut a deal as close to the bone as they can without crippling themselves"

ABOVE **Actual size: the IGEL key measures 22.4mm x 12.2mm, and could be the future of thin-client computing**

The oddness of the market is driven entirely by the demand for managing what can often seem like the unmanageable. Thin-client computing was all about reducing the chances that people would keep their holiday pictures on their PCs, or be so lazy with their clicks on embedded links that they catch something nasty. But the PC business – including Apple – just kept moving the goalposts.

It's almost insane to try to use a Windows UI on a remote desktop server on a tablet device of any kind, and Retina screens make the problem 100 times worse. On a Retina screen, my thumb covers both the OK and the Cancel button on a RDP session to a remote host.

Nonetheless, the momentum of the tablet in business is such that there's considerable pressure to not use thin clients coming "bottom up"– users who just want to be allowed in. The main successes in thin client are "top down" – not in terms of diagnostics, but rather in terms of who decides what happens to a business's technology investment.

And top-down planning is a lot more productive than top-down diagnostics! The best story IGEL had was told in secret, slightly; not up on the stage in the keynotes. One senior chap from IGEL mentioned that the company has a product that's just a USB stick. It will boot pretty much any nasty old lump of iron into being a fully manageable thin-client workstation. Including, rather amusingly, competitors' thin clients. Somewhere in the USA, there are a whole lot of Wyse terminals – long-standing, capable devices, to be sure – equipped with the IGEL USB key. From the point of view of the network operations centre, they look and feel just the same in the software control suite as the newer deployments of IGEL boxes.

Of course, this isn't quite as heavenly as it might sound, because the whole idea of a thin client is that it shouldn't require lots of attention in a regular working week. The action in thin clients is mostly up in the server farm, with a side-order of endless fiddling about with printers. Nonetheless, the idea of being able to make every machine – fat or thin – in your entire network look and feel identical is immensely appealing.

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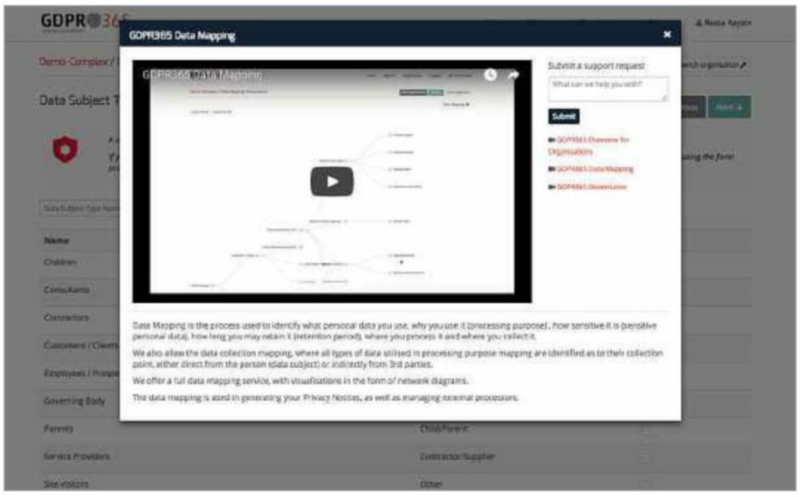
RIGHT See at a glance how compliant you are in the key areas



RIGHT The site includes helpful video guides to explain unfamiliar terms and how to set things up

Find out more by visiting pcpro.link/282gdpr

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Futures

We explore the trends and technologies that are set to shape the future

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VR continually fails to be the next big thing, argue the experts p125

Blockchain
Blockchain has amazing potential, but we need to stop the hype p126

Artificial intelligence
The power of AI is "overstated" according to one professor p127

The pessimist's guide to the FUTURE

Tired of hearing about VR? Not sold on Bitcoin or the blockchain? Don't buy the driverless car hype? Nicole Kobie reveals the arguments against such technologies from leading sceptics across the industry and academia

Hype fuels the technology industry. A few years from now, we will be shuttled about in driverless cars, lose our jobs to AI and robots, and forget our troubles in virtual worlds. Hyperloop will zip us across countries, chatbots will organise our lives, and drones will deliver our shopping paid for with digital currencies. Don't buy it? You're not alone.

While we will uncover plenty of arguments against overhyped future tech, it's worth noting that gleefully imagining a sci-fi future isn't foolish. Driverless cars could cut deaths from car crashes, robotics in factories could end industrial injuries, and digital currencies could give us financial freedom from the big banks. Such ideas are worth working towards, but while dreaming of a better future, we must beware the snake oil salesmen shilling technologies that don't exist and may never happen.

Why are such technologies overhyped? We in the media love a good headline as much as people love reading them. Startups and Silicon Valley giants alike need attention to win investment. The analyst firms are often paid by the tech industry itself, and positive predictions mean repeat customers.

That all combines to make scepticism rare, but doubt should be more common – because successful products aren't, noted Duncan Stewart, director of research for technology, media and telecoms at Deloitte Canada. "Not only is tech not very good at inventing the next big thing, it isn't even good at inventing the next little thing."

The global market for consumer hardware was $930 billion last year, he explained, and $830 billion of that was from three product categories: smartphones, computers and TVs. "There isn't really anything else that threatens them," he said. "Everybody else wants to come up with the next big thing, but since the tablet in 2010, there has not been another consumer technology that has cracked the $10 billion a year barrier. Not only has there not been another $100 billion product, there hasn't been one a tenth that big."

So forget the spoon-fed hype about the next big thing and read on to find out why it's time to be dubious about virtual reality, Bitcoin and the blockchain, artificial intelligence and even driverless cars.

VIRTUAL REALITY

Virtual reality headsets have long been the next big thing, but that's not based on anything approaching reality. At the start of 2017, analyst firm CSS Insight predicted sales of 14 million VR headsets that year. They were wrong.

Figures from Canalys at the end of 2017 showed quarterly sales of VR headsets finally breaching the one million mark, half of which were Sony's £350 PlayStation VR. Unless holiday sales leapt by an order of magnitude, VR headsets remain a niche product category that's not meeting analyst predictions. And, in case half a million in sales in a single quarter doesn't sound low to you, for context Apple sold 46.7 million iPhones during the same period.

VR headsets have improved and prices have fallen. So why aren't they selling? Stewart points to one main reason: headsets are uncomfortable. They also cause motion sickness in some, and are socially isolating, as vision in both eyes is blocked. Oh, and they're heavy: the PlayStation VR headset weighs 600g. "Wearing half a pound of electronics on our heads is not something the average consumer is keen on doing," he said.

Those who do shell out for a heavy headset find they don't use them as much as expected, Stewart added. "In my experience, I have never found a hardware technology that is more loathed by its users than VR headsets," he said. "People actively hate wearing them. That's seldom a driver of significant user adoption."

The same challenges have followed augmented reality (AR) hardware such as Google Glass and Snapchat Spectacles. Both products failed in the consumer market – the Snapchat developer reportedly had hundreds of thousands of the photo-snapping glasses left over in a warehouse – although Stewart predicts AR will continue to be popular on phones for games, selfies and "looking at furniture" for interior design.

VR and AR technology still aren't a total bust, as they're already useful in the business world, particularly in manufacturing, medicine and architecture. However, their lack of success in the consumer market still presents problems for corporate use because scale matters. Look at smartphones: they cost hundreds of pounds now, but if they weren't manufactured in such large volumes, they would cost ten times as much. "If VR is not a consumer success and only an enterprise tool, there will be discomfort [learning to use the] device, the developer base will be small, the pace of innovation will be slow, and it will be expensive, because it's a million-unit market and not a billion," said Stewart. Virtual reality bites, doesn't it?

FAR LEFT Many users are put off using VR headsets by motion sickness, the feeling of isolation – and the heaviness of the hardware itself

BITCOIN

Bitcoin has made some people very rich indeed – and made some of us wish we had bought into the digital currency back when we were first reporting on it (darn!). But you don't need to be bitter about missing your chance to be a Bitcoin billionaire to see there are flaws in the system.

Whether Bitcoin and other cryptocurrencies become little more than an odd historical footnote or a financial force to be reckoned with remains to be seen, but it's not looking good. Costs are rising and exchanges can't keep up with transfers. Scammers are also creating new coins for virtual Ponzi schemes, leading Facebook to ban adverts for new currencies and to credit card companies blocking purchases of them. Hackers keep targeting the exchange left standing.

ABOVE Bitcoin isn't useful for shopping as unstable exchanges mean that fees are high and transactions can be achingly slow

And all of this is before we consider the significant sustainability issues, as mining bitcoins chews through an immeasurable amount of energy. "None of it works right, it attracts scammers like flies, the exchanges are incompetent, and now with the bubble there's irresponsible press coverage making people think they could get rich quick," said David Gerard, the author of *Attack of the 50 Foot Blockchain*. "And of course a lot of people are going to get badly burnt when this pops."

Irresponsible press coverage is making people think that they could get rich quick with Bitcoin

What's the point of such digital currencies, other than making millionaires out of speculators? It's not for anonymous transactions anymore, if that was ever the intent. Early Bitcoin stories marvelled at the ability to anonymously purchase anything from drugs to pizza online, but those looking to use bitcoins for shopping now may be disappointed.

The drastically fluctuating value and unstable exchanges mean it's not all that useful for shopping, as fees are high and transactions are slow. "It can't possibly work as a useful currency – it's really bad at the job of being a currency," Gerard said.

Indeed, payments firm Stripe stopped supporting the currency, with founder Tom Karlo noting in a blog post that fees of tens of dollars are common, making paying with bitcoins as expensive as a bank wire. "By the time the transaction is confirmed, fluctuations in Bitcoin price mean that it's for the 'wrong' amount," he added.

Karlo said Stripe is still "optimistic" about cryptocurrencies, pointing to Bitcoin Cash – which forked from standard Bitcoin last year – and other rivals as potentially learning from the original digital currency's mistakes. But some of those have been no more than scams, with authorities shutting down BitConnect, My Big Coin and Proof of Weak Hands Coin, while others have collapsed. "I have never owned any bitcoins," Gerard said. "I did have six Dogecoins, but I lost them when I reformatted the laptop they were on. If I'd held onto them they could be worth six cents now."

If Bitcoin isn't for buying, what else could it be useful for? It could become an asset like gold, said Professor Ferdinando Maria Ametrano, who teaches classes on Bitcoin and blockchain at Politecnico di Milano and the University of Milano-Bicocca . He's a fan of cryptocurrencies, calling it "incredible" that we've built a digital asset that can be transferred but not duplicated. But he said that, if Bitcoin is money, it's useless – if it's an asset like gold, we could be onto something. "If it is digital gold, it's still undervalued... If it's not digital gold, its price will go to zero." However, Jack Bogle, founder of The Vanguard Group, has suggested that the idea of Bitcoin as an asset is based on nothing more than "the hope that you will sell it to someone for more than you paid for it". Hence the hype.

Bitcoin is a nuclear explosion, and there's a radioactive fallout that's applied cryptography

BLOCKCHAIN

Even if you don't care about Bitcoin, defenders can rightly point out that it delivered blockchain into the world. That refers to the distributed ledger at the core of Bitcoin, tracking all the transactions without letting anyone meddle with the figures. Plenty believe that blockchain technology is the true innovation, with startups using blockchain to offer smart contracts, organise electronic voting, and even track consent in sexual relationships.

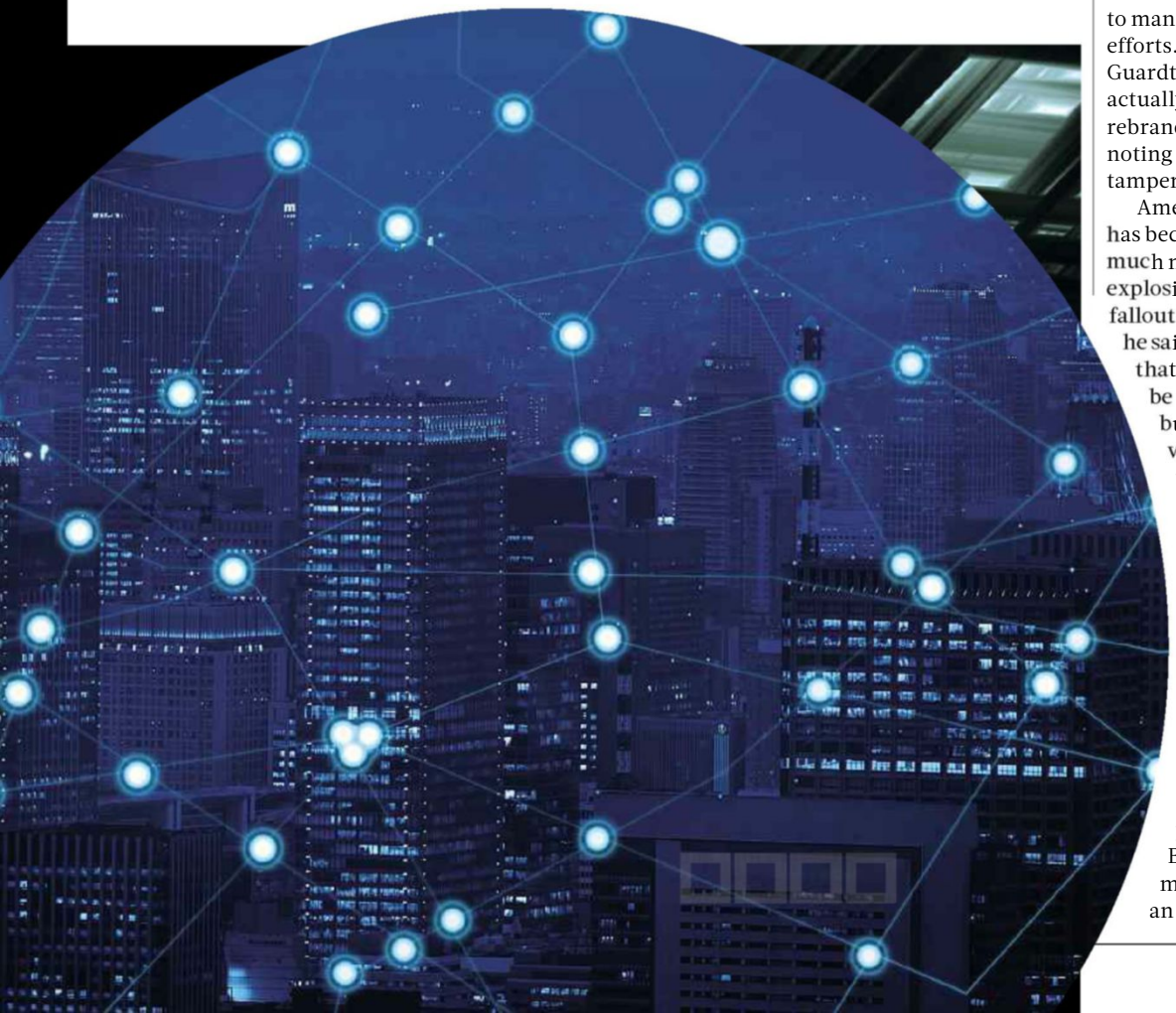
Gerard isn't convinced that such projects use real blockchains. "The main problem with 'blockchain' is that it's become a hype word," he said. "It used to mean a full Bitcoin-style blockchain, with a currency and competing coin miners and so on, but that's completely useless for anything business does. So you have 'blockchain' getting redefined to mean bits of stuff that works sort of like a Bitcoin-style blockchain – but the trouble there is that the good bits aren't original, and the original bits turn out not to be much good."

He added: "Transaction ledgers that you can only add to, with cryptographic tamper-proofing, are the sort of idea that's obviously useful. And, of course, we had them for years before bitcoin. But they seem to be getting more attention with the buzzword 'blockchain' attached."

As an example, he pointed to Estonia, which is pushing blockchain to manage its digital citizenship efforts. "But their 'blockchain', Guardtime KSI Blockchain, isn't actually a blockchain, and was only rebranded a few years ago," he said, noting the technology is essentially a tamper-evident ledger.

Ametrano agrees that blockchain has become a catch-all term without much meaning. "Bitcoin is a nuclear explosion, and there's a radioactive fallout that is applied cryptography," he said. "Many people are realising that applied cryptography can be used to harness existing business processes. They may want to call this blockchain technology, but it's not – it's just cryptography. That's the confusion nowadays."

Ametrano notes that most so-called blockchain projects are merely proof-of-concepts that haven't been properly tested in the real world. "The fact they can work in a restricted lab doesn't mean it could work in an adversarial environment," he said. At the core of the problem is people use the Bitcoin blockchain because it makes them money. "Without an active digital asset or token



BELOW **There is a lot of industry hype about the exciting potential of blockchain, but most projects have yet to be tested in the real world**

providing economic incentive, distributed consensus cannot be reached." Why would anyone do the work if they weren't getting paid?

Blockchain could have uses, particularly for digital notarisation, but Ametrano argues the rest isn't likely to work in the real world. "Frankly speaking, after two or three years of blockchain hype… they haven't delivered a single application in production," he said. In other words, if it's so useful, why aren't we using it?

ARTIFICIAL INTELLIGENCE

Artificial intelligence (AI) is coming for our jobs, according to a myriad of reports from the economists at PwC to academics at the University of Oxford. These suggest that a third of existing employment roles will disappear into a black hole of smart computing in the next decade or so. But anyone who has used a chatbot knows it's not time to panic – the AI-based online helpers can be irritatingly useless – and there are plenty of examples of neural networks incorrectly labelling images or tripping up to hilarious effect.

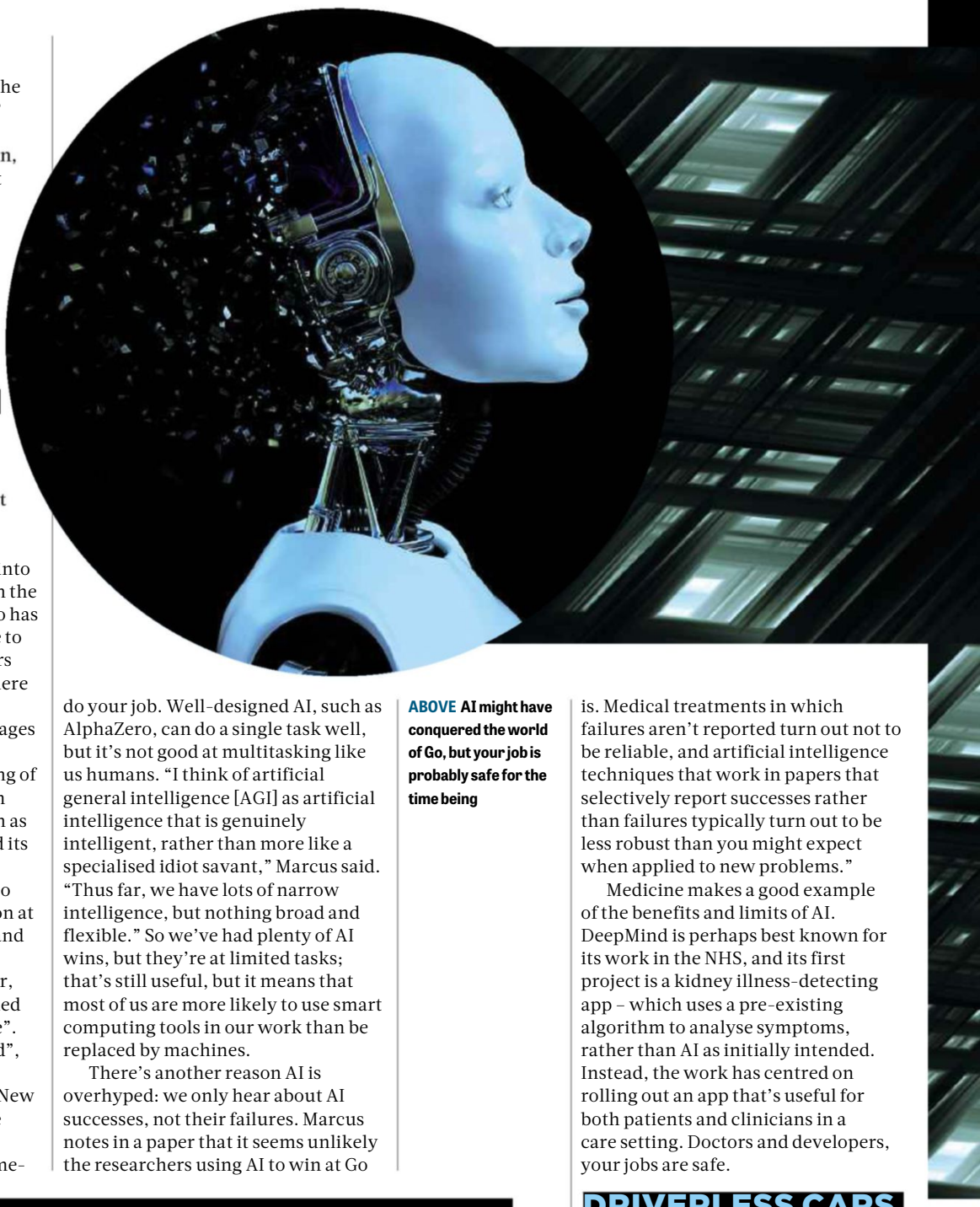
That said, there has been a string of AI successes of late, particularly in deep learning work on games such as Go from researchers at Google and its DeepMind division. This year, the deep-learning company's AlphaGo Zero project beat a world champion at the game after learning the rules and tactics through trial and error; it effectively acted as its own teacher, meaning it "is no longer constrained by the limits of human knowledge".

But such "claims are overstated", said Gary Marcus, professor of psychology and neural science at New York University, and formerly the director of Uber's AI labs. That's because AlphaZero came with game-playing techniques built-in rather than starting with a blank slate. It didn't need to learn to play games, it only needed to learn to play Go.

Those exaggerated claims aside, Marcus argues that a wider problem is "mistaking solutions on narrow, closed problems like Go for broader challenges in the open-ended world, like common sense reasoning and natural language understanding".

Indeed, AI may be able to play Go, but that same system can't learn to do your job. Well-designed AI, such as AlphaZero, can do a single task well, but it's not good at multitasking like us humans. "I think of artificial general intelligence [AGI] as artificial intelligence that is genuinely intelligent, rather than more like a specialised idiot savant," Marcus said. "Thus far, we have lots of narrow intelligence, but nothing broad and flexible." So we've had plenty of AI wins, but they're at limited tasks; that's still useful, but it means that most of us are more likely to use smart computing tools in our work than be replaced by machines.

There's another reason AI is overhyped: we only hear about AI successes, not their failures. Marcus notes in a paper that it seems unlikely the researchers using AI to win at Go haven't tried their system on other games, but we haven't heard about it because it failed. That he refers to as the "file drawer problem", when academics leave results to rot in their desks. "People never want to report their failures; successes are much more exciting," he said. "But the net effect (which we have recently seen come home to roost in other fields such as medicine and psychology) is that you wind up with a misleading picture about how robust something is. Medical treatments in which failures aren't reported turn out not to be reliable, and artificial intelligence techniques that work in papers that selectively report successes rather than failures typically turn out to be less robust than you might expect when applied to new problems."



ABOVE AI might have conquered the world of Go, but your job is probably safe for the time being

Most of us are more likely to use smart computing tools in our work than be replaced by machines

Medicine makes a good example of the benefits and limits of AI. DeepMind is perhaps best known for its work in the NHS, and its first project is a kidney illness-detecting app – which uses a pre-existing algorithm to analyse symptoms, rather than AI as initially intended. Instead, the work has centred on rolling out an app that's useful for both patients and clinicians in a care setting. Doctors and developers, your jobs are safe.

DRIVERLESS CARS

Think self-driving cars will ferry you about in the next five years? You can hit the road. That includes Chancellor Philip Hammond, who said we'll have driverless cars on British roads by 2020, Google with its Waymo driverless car due in 2020, and Elon Musk, who promises a fully autonomous model by the end of 2018.

Transport pundit and author of *Driverless Cars: On a Road to Nowhere*, Christian Wolmar hasn't always been sceptical about driverless cars. A few years back, he even wrote a letter to a local newspaper joyfully expounding the many benefits they could offer. "I was sold on the hype", he explained, "but then I started reading up on it and found there was so much exaggeration."

ABOVE **There's a lot of hype and hope around autonomous cars, but prototypes have yet to convince cynics**

Wolmar offers an example of driverless cars being used to deliver pizza, a marketing stunt from Domino's Pizza last year. "You read about it and find out there are two people in the car with the pizzas, one's an engineer and one's the overseeing driver," he said. "There are no pizzas being delivered with driverless cars. Why would you have pizza delivery with a driverless car – you want a guy to take the pizza to your door! It's patently nonsensical."

It's no surprise that a much-hyped, exciting idea such as driverless cars is being used by pizza companies, but what of the technology itself? Tech firms and universities alike are racing to be the first to develop a viable autonomous vehicle, but demos of the prototypes aren't always impressive. Some, like the GATEway pods on show in Greenwich, follow preordained routes, like trams without tracks. Others take to real roads, but Wolmar offered the example of a Nissan trial in London where the car overtook a cyclist too closely, with the company reportedly later admitting that cyclists are a challenge because they are unpredictable. "Maybe we don't want your driverless cars if they can't handle cyclists," Wolmar said.

There are plenty of other challenges. Wolmar noted that most driverless cars don't take to the road at night, as their vision isn't as good in the dark. To be truly autonomous, they'll also need to manage unmapped dirt roads, navigate when snow covers road markings, and understand car parks, petrol stations and everywhere else we go.

While those may sound like problems that can be solved one by one, driverless cars aren't developed gradually. There are six levels of automation in cars, from Level 0 with no machine help at all to Level 5 with no driver required, but development isn't progressive. Adding a few skills doesn't automatically bump a car from Level 3 to 4; instead, the differences in development are exponential. For Level 5, cars will need artificial intelligence well beyond current capabilities.

That's why many self-driving systems are actually Level 3, with tasks such as steering and braking done by the car until it meets a challenge it can't handle. It will then pass off the driving to a human. That doesn't work very well because we humans tend to get distracted and stop paying attention when we're not actively driving. It's the model behind the fatal crash in a Tesla – the driver was watching a film and neither he nor the car spotted a lorry in the road – and Google has all but given up on the idea of Level 3 cars, instead leaping straight up to Level 5, Wolmar claimed.

We humans tend to get distracted and stop paying attention when we're not actively driving

But Dr Jack Stilgoe, senior lecturer in science and technology studies at University College London, believes that Level 5 will never be possible. "The only prediction I'm willing to make is that the so-called Level 5 automated car – able to drive on any road in the world in any weather – will never exist," he said. "There are reasons why cars are being tested in predictable, well-behaved cities such as Phoenix rather than in Rome or rural Wales. The promise of self-driving cars is that everyone will benefit, that road deaths will be cut and people without access to transport... will be able to get around. The reality will be that access to the technology will be very uneven."

Some of those benefits aren't clear anyway. Driverless cars may promise safer roads, but if they're forced to stop for all people, we will have to tighten up against jaywalking and ban pedestrians from roads entirely, or autonomous cars will be continually halted in their tracks. Driverless proponents suggest we will no longer need to own cars, as autonomous vehicles can be hailed as needed, but Wolmar noted that's no different from car sharing and Uber today. Others suggest it will mean the end of large-scale parking lots, as the cars won't sit idle all day, but Wolmar argued the vehicles will still need a place to park when they're not in use. "They are presenting these changes as technical changes when in fact they are social changes," Wolmar said.

And, argues Stilgoe, if the companies selling this tech don't admit its uncertainties, then there is a real danger of a public backlash. "It is only by chance that the one person so far to die from self-driving technology was the driver of a Tesla Model S and a cheerleader for the technology," he said. "When a bystander gets killed and companies start getting sued, the backlash could set back self-driving technology by years." A little less hype, or autonomous cars may have to hit the brakes.

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Please note: Labs and features are subject to change

It's about time we rethink cyber-home security, argues Lord of the Invoice Jon Honeyball

Surely I can't be the only person who has come to the conclusion that just about every aspect of computer-related home security is utter pants. The collective "head in sand" would be hilarious if it weren't so sad. And the industry preys on our willingness to simply hand over important pieces of information to anyone who asks, while turning a blind eye to those who do.

Let's take web browsers. A more horrible piece of nonsense would be hard to find. Why is it that in 2018 we tolerate trackers, spybots, JavaScript code, and a whole world of pain? The amount of stuff going on in the background of a typical modern website is terrifying, yet the person on the street still doesn't care. Is this because they simply don't know what's going on – or is it sheer ambivalence?

As an industry, the rallying cry is that "it's handed over willingly, we have a clear privacy policy". Just try reading some of those privacy policies you sign up to when you install an app or visit a service. Here's one: "The Controller [the internet company] reserves the right to change, update, add or remove parts of this privacy policy at its discretion and at any time. The interested party [the user] has the responsibility to check periodically for any changes." So it can just change the terms on a whim and it's my fault if I don't "periodically" check whether such a change occurs.

Is this really the sort of behaviour you would expect from a household name? You should do – it's as commonplace as a Wetherspoons on the high street.

The reality is that obfuscation and then, frankly, outright theft is the name of the game. Theft of my stuff, pertaining to me! Take an Android app as an example: it demands access to my "Device & App History, Location, Phone, Photos/Media/Files, Camera, Microphone, Wi-Fi Connection Information, Bluetooth Connection Information, Device ID And Call Information". And if I told you what it did, you would laugh out loud. Then furrow your brow as the full enormity of the unnecessary data slurp starts to become clear.

Why are we putting up with this? I wish I could believe the, "well, the user said it was okay" argument, but I can't. If you've bought this piece of domestic hardware and want to use its app, you have little choice but to sign up to this agreement – which is precisely what most users will do. They're now so tired of permissions boxes that they just hit "yes" even when they actually understand the question.

This isn't a position with a happy long-term outcome. The rise of the Internet of Things just makes matters worse, because the number of yeses required increases proportionately.

That's why we need an entirely new breed of intelligent home firewall that can spot this stuff, and block it from leaving the home network. It needs to know about endpoints that are somewhat dodgy. It needs to have the concept of a timeline: to notice new, changing and unusual behaviour. It needs to block first and ask later, allowing for a reasonable set of whitelisted sites. It needs a user interface that works on a smart TV and is simple enough that a parent can understand what is being asked and why.

> **"Firms such as Google and Facebook have no qualms about making you the product, their source of revenue"**

Yet the unfortunate fact is that almost everyone who could provide such a service has a vested interest in it not working. More or less the entire tech world has its collective snout in the advertising revenue trough. Firms such as Google, Facebook and Microsoft have no qualms about making you the product, their source of revenue. Consequently, we need some sort of security portal that's driven by the likes of Ghostery and AdBlock Plus, complete with a solid smattering of outbound port filtering and real-time monitoring.

I'm certain that it would sell in huge numbers to those of us who accept that the industry is unwilling and unable to make things safe, or to design things in a realistic way. What's more, it should help to encourage companies to put customers first.

Maybe this is something I should set up in the vast tracts of free time I don't have? I would just need a few tens of millions in venture capital funding, especially if the companies were happy to write off everything as a huge tax loss. Then I could ensure that my own snout was deep in the home security trough as I leapt aboard the quango gravy train. I could end up as the new "digital tsar", and maybe even get a lordship. Lord Jon of Invoice has a certain ring to it.

Sadly, I fear my project would go nowhere because people are too lazy, too trusting and too unconcerned for it to gain any success.

Jon Honeyball is a contributing editor to *PC Pro*. He's willing to accept a knighthood if the lordship isn't forthcoming. Email jon@jonhoneyball.com

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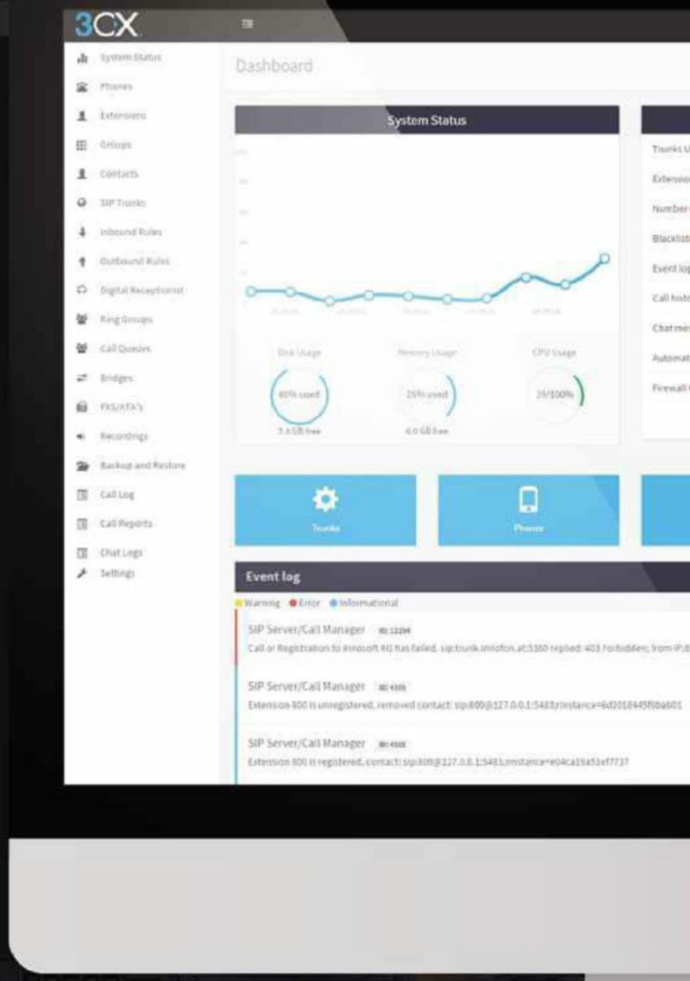

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