NEVER WORRY ABOUT PASSWORDS AGAIN p38

PC PRO

10 TIPS FOR WINDOWS POWER USERS

Discover things even Bill doesn't know p30

£164 OF BONUS SOFTWARE See p66

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13 rival suites that put Windows Defender to shame p78

Surface Pro 6

Back in black but is it worth buying? p44

9th Gen Intel Core!

Exclusive reviews of new chip & PCs p54

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HIGHLIGHTS THIS MONTH

Full contents overleaf

REVIEWS OF THE MONTH

Microsoft Surface Pro 6

Our editor isn't overly happy with Microsoft's choice of ports – as he makes clear on p7 – but, that aside, the all-black Surface Pro has a number of things in its favour. First, there's speed, with the latest generation of Intel technology inside. Second, surely the best detachable design in the business. And third, although we're loathe to admit it, the all-black design does look rather lovely. Will this be enough to persuade you to part with the lashings of cash Microsoft demands? Find out on p44.

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WINDOWS POWER TIP OF THE MONTH

Bring all of your most valuable Windows tools to the fore by customising the "secret" Power Menu – just one of the ten in-depth tips we provide in this month's feature for Windows power users.

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PHONES OF THE MONTH

It's been a massive month for phone releases, with both Google and Huawei releasing new flagships. But which, if any, will make you open your wallet? Check out our smartphone reviews from p68.

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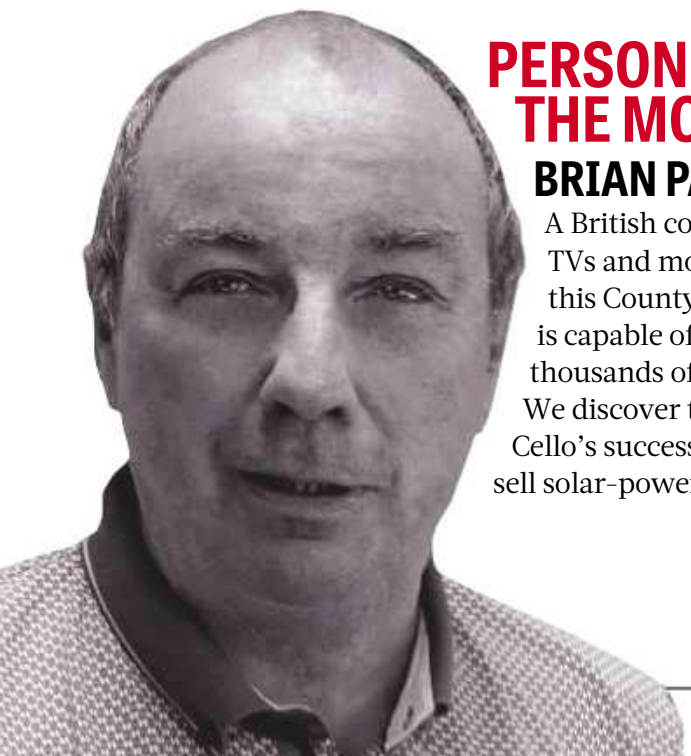
RESEARCH OF THE MONTH

Step by literal step, we're moving closer to a time when we can power our phones and smartwatches through our own movement. We speak to a University of Surrey researcher making this miracle happen.



PERSON OF THE MONTH

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BRIAN PALMER

A British company making TVs and monitors? It's true: this County Durham business is capable of producing thousands of units per month. We discover the secrets of Cello's success, and its plans to sell solar-powered TVs in Africa.

THE LABS IN ONE NUMBER

p78

22%

That's how much Windows Defender drags your system down, according to independent tests. Just one reason why you should switch to more efficient and more accurate security suites.

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30 10 tips for Windows power users

We round up ten sophisticated ways to take full advantage of the power on offer in Windows 10 – including many that were new to us until we started digging... and new to the world until the recent October Update.

COVER STORY

38 Get the most out of your password manager

Password managers are the key to your digital security, but there's a lot more to them than simply remembering your logins. Nik Rawlinson shows how to make the most of services such as Dashlane, 1Password and LastPass.

104 Five signs that it's time to outsource

Outsourcing isn't just a meaningless buzzword – it could really help your business. Steve Cassidy runs through five warning signs that could mean it's time for your company to embrace the idea.

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22 Cello

We meet the County Durham-based company that is single-handedly keeping the British TV manufacturing industry alive – and reviving a couple of familiar brands.

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10 Android 'punishment' a win-win for Google

Why plans to make search and software giant less dominant could backfire.

12 Unveiled: Hot hardware releases

We take a first look at a gaming phablet from Huawei, a revived Palm device and Facebook's first ever hardware.

13 Obituary: Paul Allen

We look back at the career and philanthropy of the Microsoft co-founder.

14 Why Windows keeps breaking

After another update fiasco, Stewart Mitchell explores why Windows updates keep arriving with major flaws.

VIEWPOINTS

p58 **Intel has announced its 9th Gen Core processors – we review the new chips and two new PCs based on them, including this Chillblast system on p58**

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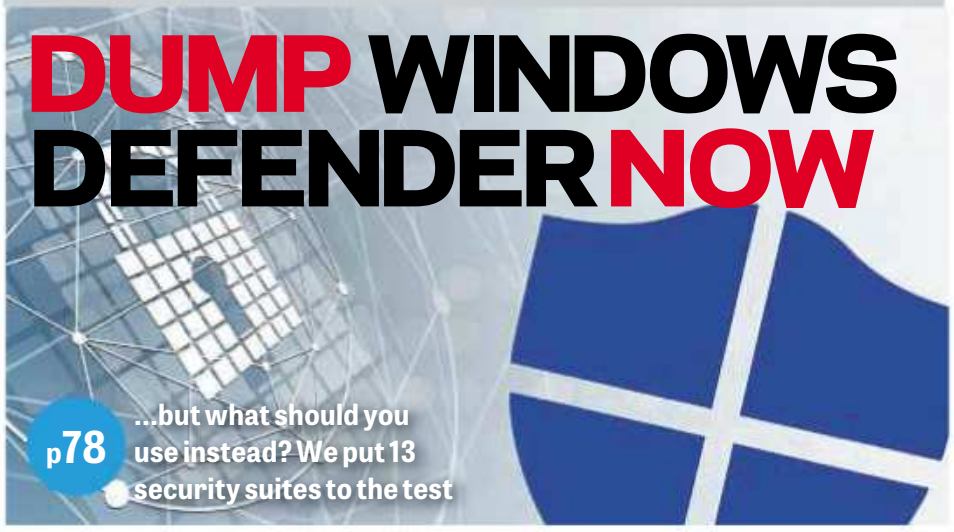

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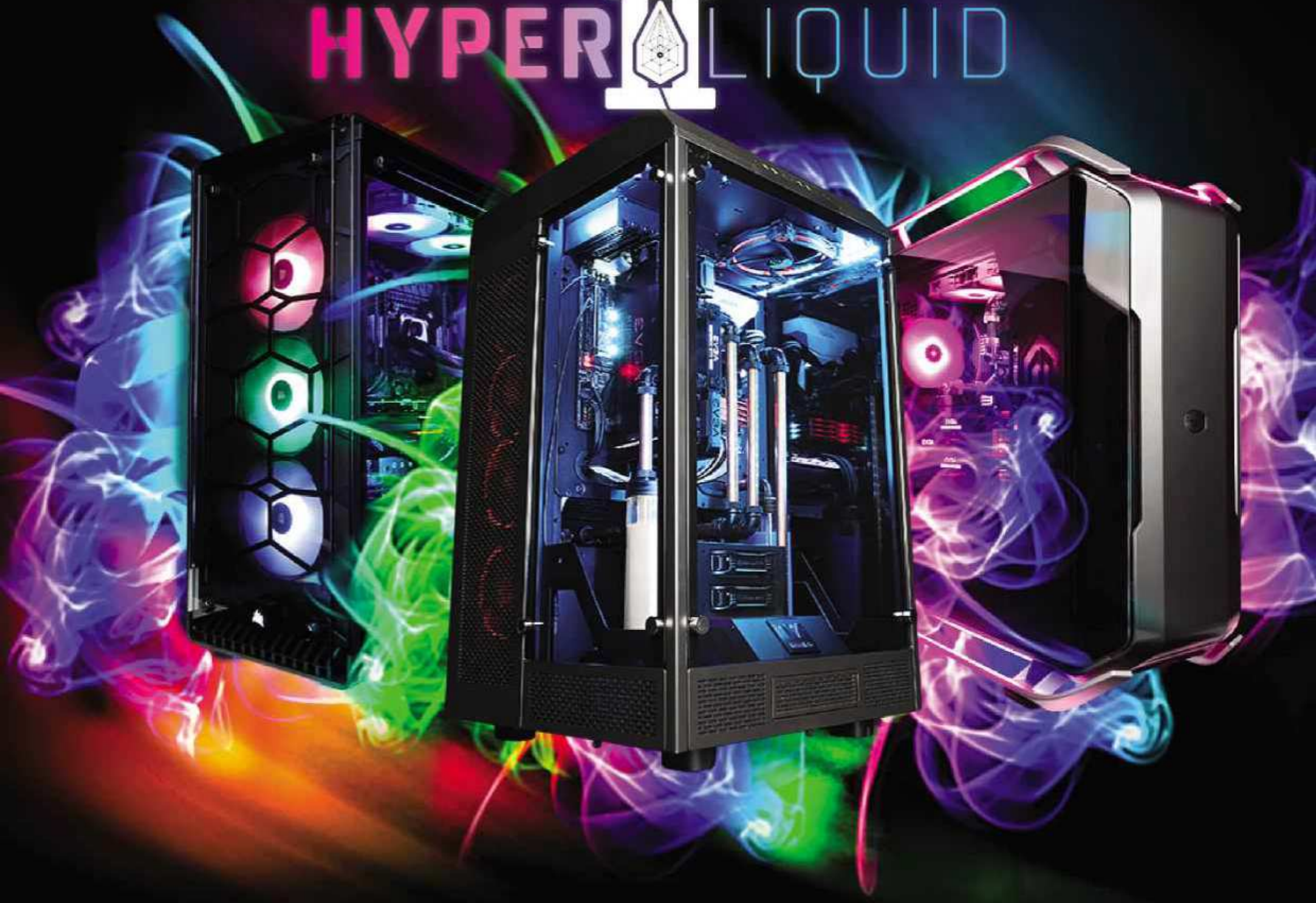

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Editor's letter

A laptop is a fashion statement, but it's also a tool of work

WHAT DOES YOUR laptop say about you? If it's battered at the edges and finished in old-school grey, you may consider every scratch a badge of honour. Perhaps you're a MacBook advocate, where industrial design and that mirrored Apple logo send a message of success. Or you might have smothered it in stickers, turning it into a no-logo John Doe.

Whether we like it or not, our laptops say something about us. I think Microsoft understands this. After all, the only visible difference between the Surface Pro 6 (*see p44*) and Surface Pro 5 is colouring: dressed in svelte black, the Pro 6 is a fine-looking beast.

It's bizarre, though, that we've got to the tail end of 2018 and the company remains incapable of looking outside its own bubbled existence. With a couple of exceptions, every Microsoft exec I've met has been clever, motivated and passionate – but so deeply instilled in the Microsoft way of doing things that they can't separate themselves from the Bill Gates Borg. It's as if the prime consideration when hiring is to make sure the potential employee shares the Microsoft world view; anything different is dangerous.

Take the lack of USB-C ports on the new Surface devices. Surely someone in the design team must have shouted out that sticking with mini-DisplayPort was stupid? Really, really, dazzlingly stupid. I suspect no-one did, so frightened were they to rock the boat. And even if junior designer Bob did find the courage to raise a hand and question the wisdom of sticking with a display connector so old-fashioned that it wears spats and knows how to foxtrot, nobody listened.

Why, Microsoft, why? In USB-C we have a modern format that supports power, video and data, whether you choose USB 3.1 or the superior Thunderbolt 3 bus. Sticking with DisplayPort is the equivalent of sticking with Gary Lineker because he did a good job in the Mexico World Cup.

But no, mini-DisplayPort it is, and so we have to explore why. Tooling costs? Definitely an argument there: this is the same chassis as before, so there are minimal R&D costs to absorb and greater profits for the Microsoft machine. And perhaps that was the deciding factor. Although I say Microsoft machine, I'm sure that the Surface division must need to robustly defend its profit and loss figures when compared to the cash-generating arms of Office and Azure.

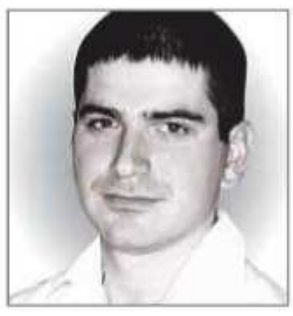
Whatever the reason, it's a misstep. Microsoft may justify the lack of USB-C by saying customers aren't asking for it yet, but Microsoft needs to be at the forefront of change, pushing it and avoiding proprietary formats.

People need a compelling reason to upgrade their laptops now more than ever. I'm a big fan of Intel's new generation of mobile processors, and note that AMD has finally entered the mid-range game with the mobile Ryzen 7 in the Lenovo Yoga 530 (*see p60*), but a bump in speed and battery life just aren't enough to make most people want to retire their two- or three-year-old machines.

We want something new. Maybe that's the ability to play *Fortnite*, but more likely it's infrastructure: show me that I can get rid of a cable and I'm a happy man. Asus believes that design is the key, with the bold design of its ZenBook S (*see p62*) setting it apart. While I'm not a fan of the glossy lid, it includes three USB-C ports, two of which support Thunderbolt. If you're reading, Bob, I suggest you apply for a job there.

Tim Danton
Editor-in-chief

CONTRIBUTORS



Barry Collins
If you've got the Windows 10 October Update to install without deleting all your important files, Barry has some devious tips to share from **p30**

Nik Rawlinson
Passwords keep cropping up this month, from bonus software (**p66**) to security suites (**p78**) – Nik kicks it off with a guide to password managers on **p38**

Lee Grant
What can you do when a laptop refuses to update? Take it to Lee and his wife, who run a computer repair shop, and they may just find a way. See **p116**

Paul Ockenden
If you want to automate your home the correct way, by which we mean the geeky way, then discover how Paul has wired up his home from **p113**

EDITORIAL
EDITOR-IN-CHIEF
Tim Danton: editor@pcpro.co.uk
EDITORIAL FELLOW
Dick Pountain
ASSOCIATE EDITOR
Darien Graham-Smith
REVIEWS EDITOR, EXPERT REVIEWS
Jonathan Bray: jon@alphr.com
FEATURES EDITOR
Barry Collins
FUTURES EDITOR
Nicole Kobie
BRIEFING EDITOR
Stewart Mitchell
LETTERS & SOFTWARE EDITOR
Nik Rawlinson

ART & PRODUCTION
ART DIRECTOR
Paul Duggan
FREELANCE DESIGN
Bill Bagnall
SUB-EDITORS
Max Figgett, Monica Horridge

CONTRIBUTING EDITORS
Steve Cassidy,
Dave Mitchell,
Jon Honeyball,
Paul Ockenden,
Davey Winder

PHOTOGRAPHY
Rebecca Steinman

CONTRIBUTORS
Tom Bruce, Lee Grant,
Alan Martin,
Nathan Spendelow

ADVERTISING
Tel: 020 7907 6662
GROUP ADVERTISING MANAGER
Ben Topp: ben_topp@dennis.co.uk

PRODUCTION
GROUP PRODUCTION DIRECTOR
Robin Ryan
NETWORK PRODUCTION MANAGER
Kerry Lambird
PRODUCTION EXECUTIVE
Sophie Griffin

CIRCULATION & SUBSCRIPTIONS
Tel: 0330 333 9493
customercare@subscribe.pcpro.co.uk
CIRCULATION MANAGER
Emma Read
NEWSTRADE DIRECTOR
David Barker
DIRECT MARKETING EXECUTIVE
Luke Tutt

LOGOS & REPRINTS
Tel: 020 7907 6132
ENDORSEMENT LICENSING MANAGER
Ryan Chambers: ryan_chambers@dennis.co.uk

SOFTWARE DOWNLOAD TECHNICAL SUPPORT
software@pcpro.co.uk

We look at Windows "power user" tips on p30 – if you could add one power feature to Windows, what would it be?

"I'd like Windows to be more bullish about backups. Not just to make it easier from a 'let's back up your Windows PC point of view', but to look at all the places its users will store data, particularly photos, and deliver a holistic solution. I wouldn't even mind if Microsoft used OneDrive as the repository."

"A compartmentalised app installation model that doesn't result in a hundred different apps squirting rubbish all over your hard disk and Registry, please. Microsoft may argue we have that now, in the form of Store apps, but that's hardly the norm."

"If Microsoft is serious about building market share for Edge then it needs to take user privacy seriously – the kind of users who do things with Edge need some proper help with security. That's why I would like Microsoft to invest in some Ghostery-style features."

"Rewrite the updater. It doesn't even reliably tell you if you're up to date or not: it just has this pretence of credibility, which is intensely annoying. I should be able to see all updates that are there, and have confidence that I can download them and update WHEN I WANT. There are too many scenarios where you can't have Windows do an update on you in the background – using a laptop as part of a recording studio, for starters."

"Oh, and another thing. The documentation on each update is appalling in terms of knowing what something is and when it came out. Sort it out, Microsoft."

"The option of a proper search that actually looks inside files rather than running queries against a messed-up index."

LETTERS letters@pcpro.co.uk
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PC Pro, 31-32 Alfred Place, London, WC1E 7DP

MANAGING DIRECTOR John Garewal
DIRECTOR OF ADVERTISING Julian Lloyd-Evans
GROUP CFO/COO Brett Reynolds
CHIEF EXECUTIVE James Tye
COMPANY FOUNDER Felix Dennis

PRODUCTION & DISTRIBUTION
Printed by William Gibbons.

Distributed by Seymour Distribution, 2 East Poultry Avenue, London EC1A 9PT. Tel: 020 7429 4000.

PC Pro is produced by Danton Media Limited and published monthly by Dennis Publishing Limited, a company registered in England, number 1138891.

SUBSCRIPTIONS
Price: UK £49.99; Europe £70; Rest of World £90. Visit dennismags.co.uk/pcpro for our best offers. To renew a subscription, change an address or report any problems, visit managemymags.co.uk

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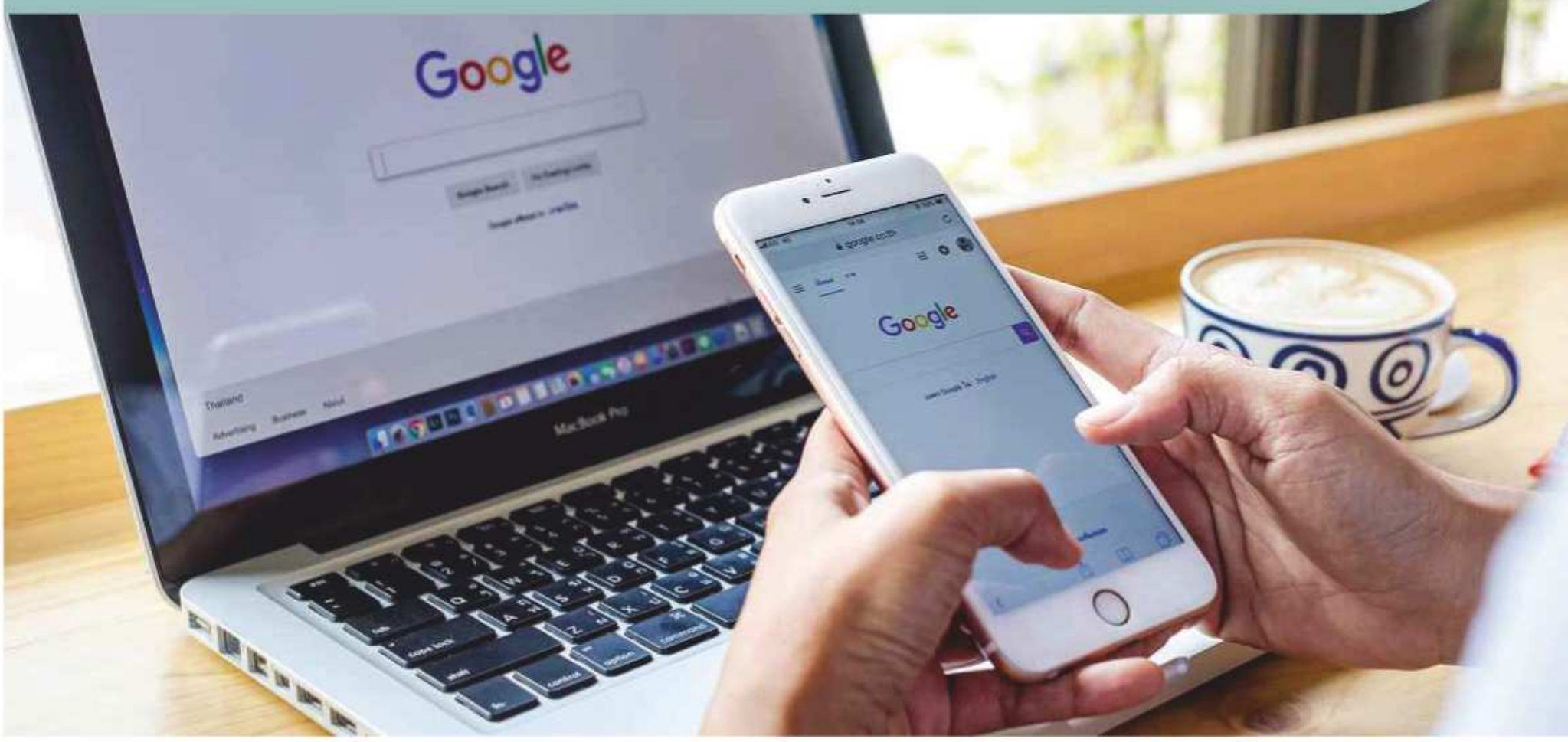
Briefing

Background and analysis on all the important news stories



Android 'punishment' a win-win for Google

Plans to make search and software giant less dominant could backfire

PROPOSED CHANGES TO the way Google licenses Android in Europe could actually end up doing the company more good than harm.

Following its £3.8 billion EU fine for insisting phone manufacturers included all of its apps, Google has proposed a remedy that would make it possible for handset manufacturers to exclude some apps and even work on forks of the Android OS.

However, faced with the potential of losing both the advertising and data revenue from its search and Chrome features, the company plans to start charging a licence fee for several products.

A source close to the Google competition case told *PC Pro* that the proposed settlement was nothing more than Google "thumbing its nose at the EU".

In the long run, our informant suggested, the remedy proposed by Google wouldn't restore competition and would instead make Google even more money.

In a company blog, Google laid out plans that would give manufacturers more freedom in exchange for having to pay for its software. "Device manufacturers will be able to license the Google mobile application suite separately from the Google Search App or the Chrome browser," the company said. "Since the preinstallation of Google Search and Chrome, together with our other apps, helped us fund the development and free distribution of Android, we will introduce a new paid licensing agreement for smartphones and tablets shipped into the EEA. Android will remain free and open source."

In effect, the insider said, Google is saying that if it's not allowed to make money from the pre-loaded apps it will need another revenue stream.

But, given the market's reliance on features such as Google Maps and Play, it looks likely that manufacturers will simply pay up – leaving Google with both the data and extra revenue.

"The bottom line is that Google's so-called remedies would mean that both Android and Google's other dominant mobile products

will remain immune from effective competition," Thomas Vinje, a lawyer at Clifford Chance, whose clients have raised competition concerns over Google's Android contracts, told the *Financial Times*.

His view was echoed by analysts, who said that the impact on Google would be minimal in the near term and could, instead of helping consumers, actually push the price of handsets up.

"The reality is those apps and services are in high demand from users, so manufacturers are still going to want to preinstall them," said Geoff Blaber, a mobile specialist with CCS Insight. "Search and Chrome have a lot of demand and the reality is there are few alternative options.

"This could have the unintended consequences that we feared and make smartphones more expensive. With all the apps that Google is going to start licensing now – it's a reasonable quantity – that could add to the final price. Handset prices will be going up."

> "It looks likely that manufacturers will simply pay up – leaving Google with the data and extra revenue"

Quality control

Not only could prices rise, but the quality of software might suffer if manufacturers take up the option to fork the OS. "It could make it more difficult to control the fragmentation on Android because they [Google] use the apps and services as a carrot and stick to maintain a high level of consistency in the Android codebase," Blaber said. "If manufacturers can implement their own versions of Android it's more difficult for Google to maintain control."

Five stories not to miss

1 Oracle issues deluge of security updates

Oracle swamped admins with a "Patch Tuesday" equivalent that saw the company issue 300 security fixes in one go – covering a range of key services such as Database, Fusion Middleware, Java SE and WebLogic. In addition, the company revealed an authentication flaw in the sign-in process for the libssh library that would allow anyone to access machines.

2 Google+ demise sparks investigation into data breach

Google+ made more noise on its closure than at any time since it was launched thanks to a security glitch that saw the data of 500,000 users exposed online. US officials are investigating why Google didn't disclose the leak sooner, which ran from 2015 to March this year, and instead kept the breach in-house before announcing it will shut down Google+.

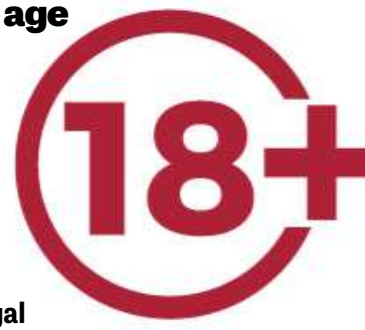
3 Amazon's recruitment AI isn't so intelligent

Amazon has dropped its AI recruitment tools after it was revealed the technology wasn't giving female candidates a fair chance of reaching interviews. The four-year-old AI was supposed to create shortlists based on skills, but because the machine learning was based on previously seen CVs in what remains a male-dominated industry, female applications were effectively devalued. Read Nicole Kobie's views on the matter on p25.

4 Hackers hide malware in boot system

Security experts have warned of a new threat vector that's been seen in the wild, where hackers have installed malware in the Unified Extensible Firmware Interface (UEFI) boot system, so that it resurfaces even after an operating system reinstall. According to researchers from Eset, the Russian hackers used malicious code dubbed Lojax to infiltrate UEFI, which allowed the malware to persist inside the computer's flash memory even after a factory refresh or hard disk replacement.

5 Government outlines £10 million costs for age verification



The government plans to underwrite the British Board of Film Classification (BBFC) in its role as the age-verification watchdog, after it couldn't find legal insurance to cover the risks of being sued. "Contingent liability" will provide unlimited indemnity to the BBFC during its tenure, with officials expecting costs of up to £10 million in the first year.

Unveiled

The key details of this month's hot hardware releases

Huawei Mate 20 X

Huawei is attacking the high-end phone market with a new phablet-cum-games console.

Huawei is pitching the handset as a rival to Nintendo's Switch, with its own gamepad and controllers. The 7.2in 1080p screen offers plenty of space for gaming, movie watching or ebook reading. There's also the same three-camera system as found in the Huawei Mate 20 Pro (*see p68*) and a sizeable 5,000mAh battery to keep all of this powered.

Huawei claims it's the first smartphone to use graphene as a cooling material, which should allow the handset to run at full-throttle for longer periods with fewer overheating or performance issues.

The only problem? Initially, the president of Huawei Europe told us in a private briefing, it will only be released in China.

KEY DIGITS AND DETAILS

Availability China only
Price To be confirmed
OS Android 9
Processor Kirin 980
Memory 6GB
Storage 128GB
Dimensions & weight 85 x 8 x 175mm (WDH), 232g

BELOW The Huawei Mate 20 X's 7.2in 1080p screen is perfect for gaming and for scrawling notes

Palm

Palm was a stalwart in these pages long before the iPhone was even conceived. Now the brand has been resuscitated by a San Francisco-based company declaring itself the "new Palm" in partnership with Chinese manufacturer TCL.

The Palm reboot has caused much head-scratching, mostly because the companies are trying to revive the concept of the PDA as a smartphone companion. Slightly larger than a credit card and with a 3.3in screen, it's intended to free consumers from their main phones, but still provide access to many of the functions of handsets they're supposed to leave at home.

Companion devices that allow users to access messages without the user going through the truly onerous task of removing their phone from their pocket aren't new, but the Palm is at least a change on the Bluetooth-link format because it also works as an independent handset.

"Companion phones have been tried in the past and have not really captured consumers' imagination," said Ben Wood, an analyst at CCS Insight. "However, this is a slightly different approach as you don't rely on Bluetooth to connect to the master phone – the Palm device is a fully featured 4G phone that allows you to have two phones with the same number."

Unfortunately, acting as a second phone means buyers will also – at launch, at least - need to purchase a second carrier contract.

Still, being water- and dust-resistant might make it an option for outdoorsy types, although the device has some notable shortcomings. As Wood said, "the lack of a 3.5mm headset jack is an obvious omission on a device that would make a fantastic portable music player".

KEY DIGITS AND DETAILS

Availability November (US only)
Price $349
Processor Octa-core Qualcomm 435
OS Android 8.1
Cameras 12MP rear, 8MP front
Memory 3GB RAM
Storage 32GB
Dimensions 51 x 7.4 x 97mm (WDH)
Weight 62.5g

LEFT The size of a credit card, the revived Palm is both water- and dust-resistant

Facebook Portal

Facebook has revealed a pair of video-calling devices for the home, the Portal and Portal+, the firm's first foray into hardware.

Facebook is pitching the 10in Portal and 15in Portal+ as an easy way of staying in touch, claiming the devices "make video chats feel less like a call and more like you're actually in the same room".

The devices' 'smart' cameras follow subjects around a room and Portal links with Facebook friends and connections on Messenger, even if they don't have a Portal. There's also hands-free voice control and the devices include Alexa, which means users can access news feeds and music as they would on Amazon's own Echo speakers.

The big question in the wake of Facebook's privacy and security furores is whether people will allow such intimate technology from the firm into their homes.

Facebook says users can disable the camera and microphone with a single tap, that it can't access the devices' encrypted comms, and that the AI is run locally rather than on its servers.

"When I heard that AI is local and the camera does not recognise you, I realised that for some companies it will be the trust consumers have in their brand, not the technology, that will limit what they can do with their products," said Carolina Milanesi, an analyst at Creative Strategies.

KEY DIGITS AND DETAILS

Availability November
Price Portal, $199; Portal+, $349
Screen 10.1in and 15.6in
Resolution 1,200 x 800 and 1,920 x 1,080
Connectivity Wi-Fi, Bluetooth

RIGHT Facebook says its Portal and Portal+ devices will make video chats easier than ever

Obituary Paul Allen (1953-2018)

After co-founding Microsoft with Bill Gates in 1975, Paul Allen dedicated himself to philanthropic projects

PAUL ALLEN MAY be forever remembered as Bill Gates' sidekick, having partnered Gates in forming Microsoft at the birth of personal computing, but he was so much more than that.

As Gates himself acknowledged in a blog post published shortly after Allen's death from cancer at the age of 65: "Microsoft would never have happened without Paul".

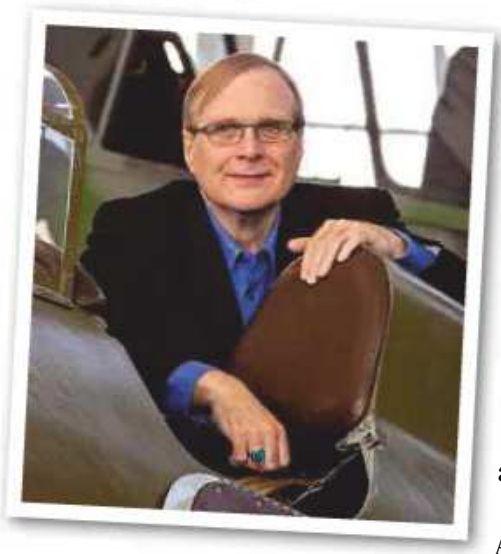
Allen was arguable the driving force in the early days of Microsoft, coming up with the company name and selling IBM on an operating system (MS-DOS) that at the time was still a glint in his eye.

It was Allen who persuaded a young Bill Gates to leave Harvard and join him in creating what would become the world's dominant software company. Indeed, the world's largest company, full stop.

Allen was first diagnosed with cancer in 1983, when he took a more distant role within Microsoft as his day-to-day activities were greatly reduced. Gates offered to buy him out, but an astute businessman as well as canny coder, Allen refused the $5-a-share offer – a decision that proved wise when the company went public at $21 a share, and saw Allen build a fortune worth $26 billion by the time of his death.

Increasingly sidelined by Microsoft, his wealth allowed him to fund multiple projects, financing major tech research, as well as sports and the arts in the Seattle area and philanthropic schemes worldwide.

For example, when the SETI search for alien life needed to fund an array of telescopes, Allen stumped up the $25 million that saved the project.



ABOVE One of Allen's pet projects was developing a commercial spacecraft

He poured $500 million into the Allen Institute for Brain Science, which is researching how the human brain works, and another $100 million into a cell research centre aimed at fighting disease.

In total, he's estimated to have spent more than $2.6 billion on charitable projects as diverse as fighting Ebola, saving elephants and monitoring sealife.

Despite his philanthropy, Allen's penchant for lavish yachts, the high life and other indulgences earned reproach in some quarters. He was also criticised for making political donations on both sides of the US spectrum, but fundamentally he will be remembered for his pioneering work at Microsoft, which later funded technology programmes he hoped would make the world a better place.

In his own words: "As long as we work together – with both urgency and determination – there are no limits to what we can achieve."

Microsoft opens its doors to Linux

MICROSOFT SURPRISED ITS long-standing critics by open-sourcing some 60,000 patents when it joined the Open Invention Network (OIN), a consortium of tech companies that allows all members to use each other's code without fear of legal ramifications.

Microsoft has been criticised for a long time within the industry for restricting innovation by maintaining a wide portfolio of patents that it only licensed to selected partners. Although the firm has increasingly embraced the open source movement, this mass outpouring of patents has still raised some eyebrows.

"We believe Microsoft will be able to do more than ever to help protect Linux and other important open source workloads from patent assertions," explained Erich Andersen, the company's deputy general counsel in a company blog.

The move means OIN developers – including Red Hat, Google and Suse – can work on improving their Linux distros without fear of prohibitive legal action.

The move marks an enormous shift in Microsoft's attitude to Linux in the days of former CEO, Steve Ballmer. In 2001, Ballmer branded Linux "a cancer that attaches itself, in an intellectual property sense, to everything it touches".

Why Windows keeps breaking

After another fiasco, Stewart Mitchell explores why Windows updates keep arriving with major flaws

It's starting to become a habit. After blue-screen bugs halted the release of the Spring Update to Windows 10 earlier this year, the Fall Update quickly became the Fail Update. Reports of widespread user file deletion forced Microsoft to yank the update and send it back for repairs.

But with "tens of millions" of Insiders testing Windows releases and one of the biggest QA departments in the software industry, why does Windows keep breaking?

Broken or unstable updates aren't confined to Windows, of course, with experts warning the latest case highlights a weakness that spans the entire industry. "Nowadays, software development teams typically follow an agile development model in which new software versions are released on a frequent basis," said Cristian Cadar, who leads the Software Reliability Group at Imperial College London.

"This model offers various advantages, but at the same time comprehensively testing many updates in a relatively short amount of time is challenging, and as a result a significant number of these updates introduce errors and/or security vulnerabilities."

Testing in public

While software companies do still have in-house testing experts, there's an increasing reliance on customers to test updates and new features – often as part of an early adoption programme.

It's a good way of widening the scope of testing as it allows software providers to get feedback from companies and developers. However, it can leave customers feeling like guinea pigs.

"I have heard customers of Microsoft complaining that it appears as though they use the market to do the testing," said Julian Bass, a senior lecturer in Software Engineering at the University of Salford. "I can't substantiate that that is a strategy, but it appears that it's willing to release things and then sort of patch gaps afterwards, at least customers seem to get that perception.

"They are relying on people spotting problems, but you'd think that the software majors wouldn't be putting problems out there for people to spot."

Worse still is when companies fail to act on warnings. In the recent Windows 10 Update fiasco, for example, testers on the company's Insider programme had actually reported data loss issues, but the company either missed the warnings or chose to ignore them. "I discovered a number of reports that had a shared theme of data loss as far back as three months ago," Rafael Rivera, a software engineer and Microsoft watcher who went back through logs to assess the issue, told *PC Pro*.

"As an outsider, unfortunately, I don't have access to associated data so I cannot discern if these Feedback Hub items were viewed, actioned upon, or missed outright," he said. "But I surmise with low vote counts and high volume of reports coming into the Feedback Hub, these reports went unnoticed."

> "The fear is that many testers fail to report bugs because they don't receive any recognition when they do"

Microsoft declined to comment on how the data deletion bug escaped its attention.

Failure to report

Since then, however, Microsoft has added a new feature to its Feedback Hub app that allows users to rate the potential impact of a bug on a one-to-five scale, in theory allowing complaints with a high risk to stand out from minor flaws.

Still, the fear is that many testers simply fail to report bugs because they don't receive any recognition when they do. "While the Feedback Hub has two-way communication features, they're rarely used, resulting in the widely shared perception that it's a feedback black hole," said Rivera.

Analysts agree that testers are treated poorly, with little or no recognition for reporting flaws. "I personally stopped providing feedback because I would take a lot of time and effort to report problems, only to hear nothing from Microsoft," said Michael Cherry, senior analyst with Directions on Microsoft.

"I would always provide as much information as possible, about the hardware, software, and what I was doing. I tried my best to make sure that someone reading the report I filed would be able to understand what had happened and be able to reproduce the issue.

"But it felt like no one appreciated the effort. Rarely did anyone ask for additional information or check

ABOVE The bugs within the October 2018 Update were very embarrassing for Microsoft

back with me to see if the issue was resolved in a subsequent build."

But are the people who volunteer for early beta programmes representative of the computing population as a whole? "In some cases, the feedback comes from people sending you information, in some cases it relies on telemetry or automated feedback," said Cherry. "In either case, the issue becomes, 'Are you getting sufficient coverage of all possibilities of running the code on all possible hardware, with all combinations of software?'

"The information may be useless, because the early adopter may be running a virtual machine, or without all their production apps and utilities. So you have a large number of 'testers' testing the code in the same or similar hypervisor environment, and not in real-world situations. So your code may look better, based on feedback, than it is."

Culture of silence

Even where the testing procedures are working as they should, there are fears that the culture within technology companies means that when developers actually spot problems, they may be unwilling to bring it up with senior management. "In almost any situation where you have a fixed stake in the ground, such as saying 'we are going to ship two feature updates a year,' then no one individual wants to be the person who raises their hand and says 'I don't think we are ready to ship'," said Cherry.

"That person is effectively the person on the assembly line who is going to pull the cord or hit the big red stop button and shut down the assembly line," he continued. "The question becomes is the organisation one that protects and empowers the lowest employee on the line to hit that button? Do you get bonuses for shipping or for shipping quality?"

Academics agree that there's a huge amount of pressure on developers to get software out of the door to fixed schedules, regardless of how many bugs might have been discovered during the testing process. "It appears as though there's a rush to get features out to the market, perhaps without investing sufficient time and resources in the quality assurance side of things," said the University of Salford's Bass.

"Certainly the software sector is seeing unprecedented levels of complexity, applications are more distributed, they're interacting with a larger number of other systems and there are increased numbers of dependencies.

"That does make quality assurance a more challenging problem, but you'd think, then, that the response to that is that you have to invest more in quality control."

The A-List

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

PREMIUM LAPTOPS

Dell XPS 13 9370

Ultraportable from £1,248

from dell.co.uk

This 2018 update to the all-dominant Dell XPS 13 keeps tweaks to the minimum: slimmer bezels, eighth-generation Intel Core processors and the promise of even longer battery life are the most important benefits. Just keep in mind that Dell has embraced USB-C ports at the expense of the old-fashioned Type-A variety.
REVIEW Issue 284, p54

ALTERNATIVES

Apple MacBook Pro 15in (2018)

A machine for true power users with amazing specifications, including that infamous Core i9 – and up to 4TB of SSD storage. **From £2,349 from apple.com/uk**
REVIEW Issue 288, p48

Dell XPS 15

We all know what to expect from Dell's XPS 15 range, yet it continues to reign supreme – this time thanks to sheer speed, courtesy of Intel's latest chips. **From £1,399 from dell.co.uk**
REVIEW Issue 289, p62

Razer Blade 15

A gaming powerhouse as you would expect. We recommend buying one of the specs with a 144Hz Full HD screen and GeForce 1070 graphics. **From £1,700 from razer.com**
REVIEW Issue 288, p63

SMARTPHONES

NEW ENTRY

Huawei Mate 20 Pro

Android 9, 128GB, £899

from carphonewarehouse.com

Brutally expensive, but this is the most flexible and powerful Android phone we've seen. The power comes from Huawei's own Kirin 980 chipset, which bests the Snapdragon 845 for both games and day-to-day use, while the flexibility stems from a brilliant triple-camera setup on the rear. With a highly effective optical zoom and great results in all lighting conditions, it really can replace a proper camera. **REVIEW Issue 291, p68**

ALTERNATIVES

NEW ENTRY

Honor Play

If you can look past its mediocre camera, the speedy Play offers great battery life and a highly respectable 6.3in screen. **£280 from store.hihonor.com/uk**
REVIEW Issue 290, p72

OnePlus 6

If you don't need the frills and thrills of the Mate 20 Pro, the OnePlus 6 is a great-value alternative. Fast, nice camera, bargain. **£469 from oneplus.net REVIEW Issue 286, p68**

Apple iPhone Xs Max

Yes, it's expensive, but this is the best Apple phone out there. Fast, gorgeous and a killer screen. **128GB, £1,099 from apple.com/uk**
REVIEW Issue 290, p56

TABLETS

Apple iPad

9.7in tablet from £319

from apple.com/uk

While we criticise Apple – and quite rightly – for its failure to deliver a new design on this thick-bezelled basic iPad, we can't quibble about its value for money. With support for the Pencil, it's now also a viable alternative to the iPad Pro. **REVIEW Issue 285, p48**

ALTERNATIVES

Apple iPad Pro 10.5

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

Amazon Fire HD 8

If you're just looking for entertainment, save money and buy the Kindle Fire HD 8. It's simply superb value. **£80 from pcpro.link/290fire8**
REVIEW Issue 290, p87

Microsoft Surface Go

We weren't expecting much from the Surface Go, but the £509 version is a highly portable work companion. **128GB, £509 from microsoft.co.uk**
REVIEW Issue 290, p80

EVERYDAY LAPTOPS

HP Envy 13 (2018)

A bargain ultraportable, £849

from hp.com/uk

If you care about the colour accuracy of your laptop screen, this isn't for you. But, for everyone else, it's a bargain. It has buckets of power thanks to a Core i5 processor, 8GB of RAM and GeForce MX150 graphics in our review model (ah0001na), as well as the fit and finish of a luxury machine.
REVIEW Issue 288, p61

ALTERNATIVES

NEW ENTRY

Asus ZenBook UX410UA

A superb value 14in laptop, with the looks of a much more expensive machine. The pricier 8GB/256GB version is best, though. **£539 from pcpro.link/280zenbook**
REVIEW Issue 280, p68

Asus ZenBook UX391UA

Exclusive to John Lewis, this burgundy 13in laptop is eye-catching – perhaps too much so – and pretty powerful, with nine-hour battery life too. **£999 from johnlewis.com**
REVIEW Issue 291, p62

HP Pavilion x360 14-cd0008na

We freely admit that this isn't the perfect laptop, but if you're on a tight budget and want a family-friendly machine then it's still a great choice. **£699 from pcpro.link/290hp**
REVIEW Issue 290, p62

ENTHUSIAST PCs

Chillblast Fusion Hero Gaming PC

9th Gen Core i5 PC, £1,850

from chillblast.com

With a Core i5-9600X processor, watercooling and Nvidia GeForce GTX 2070 graphics inside, you might expect this to be an overbearing beast – but it actually runs quietly, even when pushed. Needless to say, it packs plenty of power and is great for 1440p gaming. **REVIEW Issue 291, p58**

NEW ENTRY

Scan 3XS Gamer RTX

NEW ENTRY

A fine alternative to the Chillblast Fusion Hero Gaming PC, Scan chooses an AMD Ryzen 7 2700X to accompany the GeForce GTX 2070 graphics. It's noisier than its rival, but you're saving £250 and getting all the benefits of eight overclocked cores and 16 threads. **£1,600 from scan.co.uk**
REVIEW Issue 291, p59

Scan 3XS Vengeance RTX

If 4K gaming is your priority, this combination of an Intel i7-8086K processor and GeForce GTX 2080 graphics card is suitably potent. If you're willing to spend the extra cash, consider upgrading to the Core i7-9700K or even Intel's top-of-the-range Core i9-i9900K. **£2,400 from scan.co.uk REVIEW Issue 290, p60**

WORKSTATIONS

Scan 3XS WI6000 Viz

Core 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**

Apple iMac Pro

There are no major design changes, but the new iMac Pro's internal components are a very different matter. Apple creates a compelling workstation with an octa-core Xeon processor, AMD Radeon Pro Vega 56 graphics and 32GB of ECC memory. **From £4,899 from apple.com**
REVIEW Issue 284, p50

Scan 3XS WA6000 Viz

The A in this machine's name stands for AMD, with the 32-core Threadripper 2990WX CPU making its phenomenal debut. You can buy better all-rounders, but if your tasks including rendering using CPU-bound applications then it offers amazing value for money. **£4,800 from scan.co.uk REVIEW Issue 289, p59**

MONITORS

Eizo FlexScan EV2450

1080p display, £278

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**

ViewSonic VP3268-4K

It's true that you can buy 32in 4K monitors for around £500, but we think it's still worth spending the extra money on this ViewSonic. In return, you get superb colour accuracy and terrific all-round quality. **£882 from pcpro.link/286view**
REVIEW Issue 286, p65

Iiyama ProLite X3272UHS-B1

Looking to kit an office with 4K displays? This 32in screen is a perfect option, with image quality and value for money taking precedence over features you may never use. **£430 from box.co.uk**
REVIEW Issue 288, p72

ENTHUSIAST/SMB NAS DRIVES

Synology DS918+

Four-bay NAS, £500

from laptopsdirect.co.uk

While all of Synology's NAS drives share the same great OS, with all the attendant apps, the DS918+ stole top spot in our Labs due to its horsepower, the four available drives and the sheer number of roles it can perform. **REVIEW Issue 284, p81**

Qnap TS-453Be-4G

Qnap markets the TS-453Be at businesses rather than home users – although, in our opinion, it's equally at home in both situations. It's straightforward to use and a very solid performer, as well as being extremely versatile. **£558 from pcpro.link/284qnap**
REVIEW Issue 284, p80

WD My Cloud EX4100

If you're looking for a solid, speedy NAS – particularly for a small office – then take note of the affordable WD My Cloud EX4100. Despite that reasonable price, it includes four bays, and its mid-range specification can handle office duties well. **£291 from pcpro.link/284wd1**
REVIEW Issue 284, p83

WIRELESS NETWORKING

Zyxel Multy X

Mesh networking, £250

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

Linksys EA9500 Max-Stream

If a mesh network isn't for you, this feature-packed router is an excellent choice. It's packed with eight Gigabit Ethernet ports and can work as DLNA server. Most importantly, it delivers extremely fast speeds. **£225 from pcpro.link/288link**
REVIEW Issue 288, p82

Tenda Nova MW3

Don't want to spend over £200 on a Wi-Fi upgrade? The Nova MW3 is a bargain choice, killing off notspots and spreading Wi-Fi throughout your home. It's not as fast or wide-ranging as the Zyxel Multy X, but boy does it win on value. **£83 from pcpro.link/288tenda**
REVIEW Issue 288, p69

WORKGROUP PRINTERS

Xerox VersaLink C600DN

Colour laser, £780 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**

Brother HL-L9310CDW

If you can't quite afford the Xerox VersaLink C600DN, consider this good-value rival from Brother. This colour laser provides great output quality, low running costs (1.1p/7.8p) and speeds of up to 32ppm, as well as plenty of security features. **£440 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. **£376 from printerland.co.uk**
REVIEW Issue 279, p101

HOME OFFICE PRINTERS

HP PageWide Pro 477dw

All-in-one inkjet, £339

from ebuyer.com

While this isn't the most compact inkjet MFP, it is one of the fastest – it hit 44.8 pages per minute in our tests. With excellent print quality and low running costs, the only thing that counts against it is that you'll need good quality paper to take advantage. **REVIEW Issue 287, p81**

Canon Pixma TX6150

Squarely aimed at home users with a creative bent, the Pixma TS6150 produces excellent photos, and quickly, too: it took 70 seconds for a borderless 6 x 4in print. With respectable running costs, it's a very classy multifunction printer for the money. **£100 from pcpro.link/287can**
REVIEW Issue 287, p80

Xerox WorkCentre 6515DNI

Just like the HP, this isn't the world's smallest printer – but for a £299 colour laser, it's amazing what you get in return. Pin-sharp scanning, great all-round printing, and solid speeds of over 20ppm. Only high running costs count against it. **£299 from printerland.co.uk REVIEW Issue 287, p85**

VIDEOCONFERENCING

Polycom RealPresence Trio 8800 Collaboration Kit

Full VC kit, £1,209 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 videoconferencing 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. **£243 exc VAT from pcpro.link/275log**
REVIEW Issue 275, p97

BUSINESS WI-FI

DrayTek Vigor 2862Lac

Secure router, £354 exc VAT

from netxl.com

This 802.11ac router is loaded with potential, from bolstered security to a 3G/4G SIM card slot to expansive VPN options. There's almost nothing a business could ask for that it doesn't do, making it an easy choice for any switched-on SME. **REVIEW Issue 286, p100**

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. **£647 exc VAT from broadbandbuyer.co.uk REVIEW Issue 281, p97**

TP-Link Omada EAP225 V3

A brilliantly affordable AC1350 access point that's a great budget choice for small businesses wanting to create a secure, easy-to-manage wireless network in the office. Plus, it can scale up as your needs grow. **£53 exc VAT from scan.co.uk**
REVIEW Issue 288, p101

SCANNERS

NEW ENTRY

Brother ADS-3600W

Network scanner, £455 exc VAT

from ebuyer.com

If you need a fast desktop scanner that won't break the bank, the 50ppm ADS-3600W is hard to beat. It will slot into any office setup and its cloud support is superb.
REVIEW Issue 291, p98

NEW ENTRY

Fujitsu fi-7160

A standalone workhorse of a scanner that's made all the more powerful by Fujitsu's PaperStream IP technology. This helps streamline large scanning jobs, while the 80-page ADF and 60ppm speeds keep things moving. A fine alternative to the Brother. **£533 exc VAT from ebuyer.com**
REVIEW Issue 291, p100

Xerox DocuMate 6440

If you're looking for something a little cheaper than our other choices, but still need to handle heavy workloads, then the 6440 is well worth a look. It hit speeds of nearly 70ppm in our tests, has a large ADF and includes versatile software. **£395 exc VAT from printerbase.co.uk**
REVIEW Issue 278, p98

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SECURITY SOFTWARE NEW ENTRY

Kaspersky Internet Security 2019

Kaspersky won our security suites for four reasons: supreme protection, minimal performance impact, lots of features and a great price. A superb choice for those who demand more. **1yr, 3 devices, £25 from pcpro.link/291kis REVIEW Issue 291, p85**

Bitdefender Internet Security 2019

NEW ENTRY Not the fuss-free offering of last year, but the Autopilot mode still rarely interrupts. And its protection remains top-notch. **1yr, 3 devices, £25 from bitdefender.co.uk REVIEW Issue 291, p84**

Panda Free Antivirus

NEW ENTRY Forget Windows Defender. If you want free protection that you can rely on, and that won't kill your resources, choose Panda. **Free from pandasecurity.com REVIEW Issue 291, p87**

PRODUCTIVITY SOFTWARE

Microsoft Office 2016

We'll be honest: there's very little here for anyone upgrading from Office 2013. However, Microsoft's is still the best office suite for professionals. **Home & Student, £65 from pcpro.link/254off REVIEW Issue 254, p62**

Google G Suite

Not a fully-featured alternative to Office, but it has enough core features to cover most people's needs, with extra tools available via add-ons. And it's brilliant for collaboration. **Free from docs.google.com REVIEW Issue 284, p35**

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. **£32 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. **£34 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. **£55 from pcpro.link/278cyb REVIEW Issue 278, p73**

RACK SERVERS

Broadberry CyberServe Xeon SP1-208S

It may only have a single CPU socket, but this is a big rack server with a Xeon Silver lining. It's a good option for SMBs, with plenty of room to grow and the ability to keep costs down by choosing your own storage devices. **£1,995 exc VAT from broadberry.co.uk REVIEW Issue 284, p94**

Lenovo ThinkSystem SR550

This is an affordable entry point to the world of Xeon Scalable processing. The design allows you to start small and expand as your needs grow, while the server management features are top-class. **£1,858 exc VAT from lenovo.com REVIEW Issue 284, p98**

PEDESTAL SERVERS

HPE Proliant ML350 Gen10

A perfect expression of HPE's "buy now, upgrade later" mantra, you can upgrade every part of the ProLiant to your needs. We reviewed the model 877621-031, which features an eight-core 2.1GHz Xeon Silver 4110 CPU, 16GB of RAM and a Smart Array RAID card – a fine starting point. **£1,799 exc VAT from ebuyer.com REVIEW Issue 288, p96**

Lenovo ThinkSystem ST550

Not as expandable as the HPE ProLiant, but this is a great hardware package – the Xeon and RAM are the same as HP, but it has a Lenovo RAID 930-8i card and a management platform that costs £23 per year. **£1,809 exc VAT from ebuyer.com REVIEW Issue 288, p97**

SECURITY

Panda Adaptive Defense 360

We didn't think Adaptive Defense 360 could get any better – we were wrong. Panda packs this latest version to the gills with new features, including improved management, a great range of endpoint protection services and a data-monitoring policy to help GDPR. 25 seats, 1yr subscription, **£1,231 exc VAT from pandasecurity.com REVIEW Issue 289, p97**

WatchGuard Firebox M270

The M270 dispels the notion that high UTM performance has to come at a high price. It offers a persuasive range of security measures and is ideal for SMBs that want the same protection as enterprises. **£2,743 exc VAT from watchguard-online.co.uk REVIEW Issue 290, p101**

NAS APPLIANCES

Qnap TS-1277

Thought AMD's Ryzen processors were for consumer PCs only? Qnap clearly doesn't, as evidenced by the eight-core 3GHz Ryzen 7 1700 inside 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, £2,436 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

Veritas Backup Exec 20

If you want total control over your data protection, Backup Exec 20 is the perfect choice. It's easy to use, yet provides a superb breadth of features, and the price is within reach of even the smallest business. **£370 per TB exc VAT from span.com REVIEW Issue 286, p98**

Backup Everything Business

The name makes quite a claim, but it supports Windows, Linux, Mac, VMware, Hyper-V, Exchange and more. Add a price that undercuts Backup Exec, and it's a tempting alternative. **£10 per month for 100GB exc VAT from backupeverything.co.uk REVIEW Issue 286, p94**

VOIP SERVICES

3CX Phone System 15.5

There's no getting away from it: 3CX Phone System is a very impressive bit of software. It's a breeze to deploy, has a great range of features, and if you're looking to host your own IP PBX then you can't go wrong. You can even get 3CX to host it in the cloud for free for a year. **8 SC Standard, £266 exc VAT (first year free) from 3cx.com REVIEW Issue 285, p94**

RingCentral Office

This cloud-based VoIP service has a great set of call-handling features. SMEs that want an easier alternative to an on-site IP PBX will find RingCentral delivers an affordable and powerful service. **From £7.99 per month exc VAT from ringcentral.co.uk REVIEW Issue 285, p97**

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Profile

BACKGROUND INFO ON INNOVATIVE BRITISH COMPANIES

Cello

We meet the man who is single-handedly keeping the British TV manufacturing industry alive

KEY FACTS

Cello is the only company to manufacture its own television sets in the UK. It also makes TVs under the Goodmans and Ferguson brands.

FORMED 2001

HEADQUARTERS
Bishop Auckland, County Durham

STAFF
Around 100

WEBSITE
celloelectronics.com

The phrase "British television manufacturer" sounds like an anachronism, not heard since the days of Ceefax and Frank Bough.

Indeed, when I saw a press release trumpeting Cello as a British television manufacturer, my first instinct was to hunt for the catch. It surely just ships the TVs over from the Far East and puts a British manual in the box?

Not so. With somewhere in the region of 100 staff beavering away at the company's factory in Bishop Auckland, Cello is every bit the manufacturer, the last of its type in this country. It's not a hardy survivor from the days of cathode tubes, either, but a company set up to capitalise on the flat screen boom and now smart TVs.

It might not have the marketing muscle of Samsung or Sony, but as CEO Brian Palmer explains – from his holiday yacht in Croatia – that doesn't mean it can't compete.

Going flat out

Cello only came into being when the rush for LCD screens started, but Brian Palmer has been in the television business since the days of four channel buttons on the front of sets, Rumbelows and page 888 for subtitles.

He had fallen out of the industry by the turn of the century, when he spotted an opportunity to make a comeback. "I made a decision to get back in then because I'd had a previous life in manufacturing old CRT TVs and I realised the [flat screen] market would grow rapidly," Brian told us. "I saw the opportunity to be in it from the beginning."

Brian is candid about Cello's limited ambition in the early days. They were producing small screen, "me too products" with "no added technology on them" that were "leading price products for the supermarkets".

As the market switched to the 30in or 40in monsters most people have in their living rooms today, so did Cello, and the company began developing its own technology. It branched out from the supermarkets and began to target the independent stores and big online retailers, such as Amazon. Today, it has the ability to manufacture up to 2,000 screens per day from its facility in County Durham.

Reasons to buy British

Given that all the television components are made in Asia, and the vast majority are assembled over there too, what is the advantage of manufacturing in the UK? Wouldn't it be more cost effective for Cello to join the crowd? Brian Palmer's having none of that.

"100% of what we sell is made in the UK," Brian boasts. "I've no problem with components that are made in Asia, but when it's put together in China the quality that comes in is never as good as European-manufactured products. It's not about price – it costs more to do it in the UK than it would to make it in China, but we get better quality in the UK and that's the simple reason why [Cello manufactures over here]."

The other advantage of being based in the UK, in the market where Cello sells the vast majority of its products, is that the company can operate a UK support desk, also run from the Bishop Auckland HQ. "We get a lot of happy consumers that write to me and say how marvellous it was that they had a problem and were able to ring somebody, and someone answered the phone and was able to help them," said Palmer. "In this day and age, that's unusual."

But does any of this make any difference to the buying public? If you're scouting for a new TV set, does the fact that it's made and supported in Britain outweigh the brand recognition of Samsung, LG, Sony and the other multinational giants? Here I sense the first tinge of frustration from Palmer – that the company can't even get its foot in the door with major British high street retailers. "When you get to big multiples, buyers have their own ideas about what they want to buy," he said. "Buyers follow the major brands and then they have their own brand range, which is built in China.

"I don't understand multiple buyers," Palmer added. "Research will tell you that the UK consumer prefers to buy products made in the UK. But multiple buyers... don't look for products made in the UK, they just look to put their name on the cheapest possible product."

Part of Cello's struggle to tempt the high-street retailers might be down to marketing budgets. While the likes of

ABOVE As well as selling Cello-branded TVs, the company is reviving the historic Ferguson name

ABOVE RIGHT 100% of Cello's TVs are manufactured in Country Durham

Samsung can blanket-bomb print, broadcast and online ads, and offer marketing incentives to retailers, Cello is operating at a more modest level. But that has its advantages, too.

"The millions and millions they pour into telling the consumer they're the best – that's difficult to compete against," admitted Palmer. "It's not the price and technology that's difficult to compete against.

"It's one thing for me to make a product as good as Samsung, but it's another thing for the UK consumer to believe it's as good as Samsung. We can make a product and we can make it more competitive than the major brands, because we don't have the same margin requirement as what a major worldwide brand like Samsung and Apple and other companies have.

"My long-term aim is a desire to convince the British public we're selling TVs as good as Samsung or LG, but a lot less expensive."

> "My long-term aim is a desire to convince the British public we're selling TVs as good as Samsung or LG"

Brand recognition

While many consumers on the hunt for a new television may not be familiar with the Cello brand name, those of a certain vintage may be more familiar with names such as Goodmans and Ferguson.

Goodmans now outsources the manufacture of all of its LED televisions to Cello. Meanwhile, Palmer recently struck a deal with Technicolor in France to revive the Ferguson brand in the British market. The company will begin selling 4K, Android-based smart TVs under the Ferguson brand at the end of 2018.

Is reviving these brand names one way to battle the marketing might of the multinational giants? "It's a way to increase our overall share of the market," said Palmer. "Some people do remember the Ferguson brand. We tend to market these lines to the independents, who remember it. These people are perhaps old in the head and don't know the Cello brand, so it gives us another in for the business."

That's not to say Cello is relying solely on the shrinking independent retailers, though. The company not only "does a lot of business" through Amazon directly, but through third-party resellers either selling Cello products through Amazon themselves or through other online channels.

Beyond British shores

While Palmer is staunchly supportive of British manufacturing, there's no sense of jingoism. Although the company sells a high proportion of its product over here and plays heavily on the uniqueness of its British manufacturing, it's also exploring opportunities abroad. It manufactures low-voltage televisions for the Norwegian market, for instance, where an unstable grid and the country's extreme climate can lead to huge swings in electricity supply and prices.

Cello is also developing a product that would never work in the British market – solar-powered televisions. "We came up with the idea a few years ago and we patented aspects of it," explained Palmer. "This is a TV that can run directly from a solar panel and also at the same time charge a battery that's inside the TV. In many African countries, 80% of people have no grid power. With a standalone product like this, you can bring television to people who wouldn't be able to get it otherwise."

While he waits to crack Africa, he's enjoying the last of his holiday before he heads back to Bishop Auckland for the company's busiest time of the year. The firm's workforce fluctuates from 80 in off-peak periods to around 140 as the busy Christmas season kicks in and demand for new televisions peaks. "We have 45,000 square feet in Bishop Auckland. We have two production lines there. We can make up to 2,000 small screen TVs a day. We very much try to have everything all under one roof and that's been a good thing for us."

It might not be denting Samsung's bottom line, but there's no sign of the end credits for Britain's last remaining TV manufacturer, either. **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

Is this the best way to shop online? I'm not buying it

Google's sponsored Shopping service lets users down – we should demand better

Darien Graham-Smith is *PC Pro*'s associate editor. His motto is "a penny saved is a penny towards the next electronic gadget".
@dariengs

I spent last month's column bashing Google. Then, having dispensed my 950 words of vitriol, I naturally went straight back to using it. Google Search has its detractors, but it's the one I know – and the one that knows me. However loose my search terms, it somehow always manages to intuit what I'm looking for.

Except in one scenario, that is. You won't be amazed to learn that I do an increasing amount of shopping online – not just for groceries and such, but for clothes, computer parts, musical instruments and all the other things that used to mean a trip into the West End. I miss the bustle of the high street, but I love the ability to compare prices much more widely: Tottenham Court Road's loss is very much the gain of retailers in Leeds or Berlin.

Unfortunately, this sort of bargain-hunting is where Google falls down. To be sure, it indexes more or less every shopping site on the web, including dozens of garden-shed businesses I'd never have otherwise heard of. Search for a specific item and it'll come back with an impressively long list of suppliers, with customer ratings, item specifications and more, all helpfully presented next to your search results. Yet, somehow there's one very important bit of data it almost never seems show, and that's the price. Weird, huh? And this omission turns online shopping into much more of a chore than it needs to be.

Wait, you say. There's a Shopping link right at the top of the page that brings together all of that information, and lets you browse prices at a glance. That's true – except for the rather important point that it only lists retailers who have paid for inclusion. In switching away from the main search page, you've left behind the Google that aims to provide comprehensive, impartial information. Now you're in the hands of the online equivalent of the helpful chap in the bazaar who, out of the kindness of his heart, guides you to the one specific shop with the "very best prices".

What annoys me about this is that it's worse than what we had before. The old "Froogle" service (later rebranded as "Google Product Search") was launched more than 15 years ago, and for a decade it did a fine job of aggregating all the online deals that Google could find, without prejudice or favour.

Then in 2012 the company decided to, shall we say, reorient its priorities, and here we are. In place of the old, useful service we now have a pay-to-play, exclusionary platform that betrays the free, open image that Google likes to project. The main search engine has probably suffered, too: I suspect the company might try a bit harder to include prices in search results if it didn't have an incentive to drive people elsewhere.

> **"I have to believe that, on some level, the decision-makers at these huge tech companies do want to improve our lives"**

What sort of shopping experience might we be enjoying today if the company had chosen to go the other way and embrace the full potential of an intelligent shopping aggregator? I can see it now: I'd be able to search for "girl's duffle coat, red, 3-4 years" and find a hundred options to browse through, along with photos, prices, reviews and "buy it now" links. The most frustrating thing? You just know that Google already has all the data and resources required to make that happen – if it wanted to.

Dream on, you're probably thinking. Google knows its own business, and the fact that it's stuck with paid listings for so long tells you all you need to know. If it started providing independent shopping information for free, it would destroy that revenue stream, and undermine its search-based AdWords profits into the bargain.

You might be right. Yet I have to believe that, on some level, the decision-makers at these huge tech companies do want to improve our lives, at the same time as getting filthy rich. If they didn't, they'd have gone into banking or petrochemicals instead. You can't tell me that every move Google makes is backed up by careful financial analysis; sometimes it's blatantly obvious that a decision has been pushed through purely because a product manager thought it was cool, and to hell with the balance sheet.

Or, maybe it's not about changing the world. Maybe it's just about fair dealing. Google might have stepped back from its "don't be evil" mantra, but parent company Alphabet Inc still exhorts its employees to act honourably and "do the right thing". When we're talking about a company that's made billions of dollars out of us, couldn't that mean exercising some of those enormous resources to help us save a few quid for ourselves?

Even in cold capitalist terms, Google hobbling its own online shopping feature is surely a risky move, because it creates an opportunity for some scrappy young rival to step up and plug the gap. It turns out, Bing Shopping already exists – who knew? – and is currently based on the same sponsored model as Google Shopping. But Microsoft hasn't been shy about investing in its engine, and it has everything to gain by evolving it into the sort of open, consumer-oriented service that Google has chosen to deny us.

Google should be scared of that possibility. As I noted last month, this isn't a company that can take its continued market share for granted. Give people a reason to try Bing and plenty will stick with it, if only through inertia. I'm not talking about your random bloggers and bots either, but the most valuable type of surfer there is: the one who opens up their laptop with credit card in hand, looking to spend money online. If Google won't help us find bargains, it has no-one else to blame if we end up shopping around for a new search engine.

darien@pcpro.co.uk

Enough is enough: it's time to get us out of this jam

We don't need smart motorways to ease traffic congestion, we need smartphone satnavs

Barry Collins is a former editor of *PC Pro*. He was robbed in at least six of those driving tests.
@bazzacollins

As a guy who took ten years and seven attempts to pass his driving test, I'm arguably not the best qualified person to lecture on traffic management. But having spent the equivalent of a working day stuck in traffic over the past month alone, I know something needs to be done.

Ironically, part of the reason that I've sat nose-to-tail on motorways recently is because of the installation of a so-called "smart motorway" at the top of the M23, near where I live. The major part of the work is the conversion of the hard shoulder into a fourth lane of traffic. The rest is the installation of new overhead signs, traffic sensors and CCTV cameras that allow the control centre to monitor traffic levels, adjust speed limits to smooth traffic flow and close lanes to allow emergency services to reach all the poor sods who will now break down in four lanes of flowing traffic instead of on the hard shoulder.

It's not all that different from the hardware installed on regular motorways today – another application of the word "smart" to make something sound more sophisticated than it actually is.

My real problem with all this isn't the daft branding, however, but that it's fiddling at the edges. Another lane will become just another place to temporarily park cars if there's a smash near Gatwick or a jam on the M25. No amount of tinkering with the road signs or the speed limits is going to prevent almighty tailbacks. We need drivers to be smarter, not motorways.

Now, I'm what you might call a smart car sceptic. Do I believe that smart cars will eventually replace human drivers on the roads? Yes, it's inevitable. Will it happen within the next decade? The next 20 years? Nope. The concept of smart cars and human-driven vehicles seamlessly mingling on the roads is for the birds. For smart cars to take off, you will need dedicated smart car lanes and proper roadside infrastructure. If it will take the Highways Agency two years to implement two junctions' worth of smart motorway on the M23 then the infrastructure required for nationwide smart cars is decades away. Trust me.

So until our GPS-enabled, self-routing smart cars are able to route around traffic for us, we need to do it ourselves. And the infrastructure to do that already exists. We've got it in our pocket.

I'm a full-blown fanboy of the Google-owned Waze. Turn off its social-networking nonsense (why would I want to see where other Waze users are on the roads?) and it's a fabulous free satnav that has the best traffic avoidance I've tested. I've even taken to using it on roads and journeys that I know well, because if there's a traffic problem in the area, it knows how to dodge round it better than I do.

How come I started this column bemoaning the fact I've spent hours in traffic, then? Because I've been travelling in vehicles – coaches to football matches, friends' cars, taxis – that don't use satnavs, or at least not satnavs with live traffic updates. They simply blunder down the "fastest" route, irrespective of the traffic chaos at the time.

Now, I'm not suggesting we mandate satnavs with live traffic updates. But in much the same way that the insurance companies are now offering discounts to people prepared to put one of their black boxes in their cars (and there's a whole different column on that pernicious practice, by the way), why can't the Highways Agency ease congestion by incentivising drivers to use satnavs that will steer them around the traffic hotspots?

Say, for example, that there's a smash on the M1 tonight. Satnavs could almost immediately advise drivers to take alternative A-roads. Those drivers who take the advice and don't end up contributing further to the tailbacks could then be rewarded with 50p off their next road tax bill. That may not be much of an incentive in itself, but if you did that a few dozen times over the course of the year, the savings would add up. And, more importantly, people would get to their destinations much more quickly.

None of this is rocket science. The government already attempts to re-route people around accidents and traffic jams via electronic road signs. But why not have an API – accessible to all the satnav developers, free of charge – that delivers all of that traffic information direct to people's smartphones? It would mean no more turning up on the M25 at 10pm to find that the junction's been shut for roadworks, for instance.

All it requires is a bit of forward thinking. Jeremy Corbyn has talked about re-nationalising the railways, but that's 20th century thinking. Nationalise the satnav, if you have to – but do something that's going to make a difference in 2019, not 1979.

barry@bigtechquestion.com

> **"Until our GPS-enabled, self-routing smart cars are able to route around traffic for us, we need to do it ourselves"**

Amazon's HR proves artificial intelligence is truly dumb

We don't know how neural networks see our world, and that's hilarious and scary

Nicole Kobie is *PC Pro*'s Futures editor. She prefers natural stupidity to artificial intelligence.
@njkobie

Amazon built an AI system to sift through CVs, and it turned out not to like women – a fact that doesn't so much highlight algorithmic bias as it does reveal the stupidity of much of the AI that's already in use.

In 2014, Amazon started investigating ways to automate its hiring. "They literally wanted it to be an engine where I'm going to give you 100 resumes, it will spit out the top five, and we'll hire those," a source told Reuters, which uncovered the project. Within a year, it was clear the system was discounting women as candidates for technical jobs, such as software development roles. Unable to fix it, the company scrapped the entire programme.

This isn't a surprise. First, neural networks are only as good as the dataset used to train them. Suppose you wanted to train a network to spot signs of cancer in medical images. You would show it a huge database of images, telling it which ones featured cancer and which ones didn't, and it would unpick the difference between the two. It wouldn't know what cancer is or who the patients are – it's merely looking for anomalies. Because that's relatively simple, it works well when trained with high-quality, physician-labelled datasets. If the training data is incomplete, limited or incorrect, then the neural network will reflect those flaws.

In other words, it's garbage in, garbage out. That's what reportedly tripped up Amazon. The HR department fed the neural

network ten years of CVs of previous hires, and so naturally the system looked for staff who were like the ones already working there; all it did was replicate existing hiring practices, but more quickly.

And Amazon, like other tech companies, has a diversity problem – its workforce is actually 40% female, but that falls to fewer than a quarter in managerial positions. Because the system saw that fewer women were being hired, it avoided them.

That's an oversimplification: the system has no idea what gender is, it doesn't know what a woman is, and it doesn't understand systemic workplace discrimination. It isn't sexist, it's too stupid for that. The neural network, trained on flawed data, simply noted that the word "women" – such as in the phrase "women's college" or "head of the women's chess club" – was found on unsuccessful CVs and not on the resumes of the people that Amazon hired, so it tossed them onto the reject pile.

Such a flaw can't be easily corrected, although Amazon reportedly tried. That's because neural networks don't actually think like we do. We assume that the AI spotted words such as "women", but men and women could have used different language or phrasing, or some other signal unseen to us. Researchers have managed to fool neural networks by adding in background noise that we humans can't see. In one case, a toy turtle looked to the machine like a rifle; in another, a stop sign was seen as a speed sign. We don't know whether it's the colour, or the shape, or something else that the network is using to identify an object. We don't see the same.

Another lesson in what we don't know about how neural networks think comes via Janelle Shane, who offers hilarious examples of the strange way neural networks see the world via her "AI Weirdness" blog (**aiweirdness.com**). She trained her neural network on Sherwin-Williams paint colours, then asked it to come up with its own names. The results included "Sudden Pine", "Stanky Bean" and "Turdly". Her latest efforts include snake types ("Cancan Rattlesnake"), *My Little Pony* characters ("Creep Well") and college courses of the future ("Survivery").

And these are the machines we're going to use to organise and optimise our world? Don't believe the hype. Whenever someone sings the praises of neural networks, ask about the training data and how accuracy will be assessed – especially if it's being used for sensitive tasks such as hiring, policing and governance. And remember that if Amazon can't get it right, there's no reason to think that a startup's neural network isn't going to spit out Turdly results, too.

work@nicolekobie.com

Creating art on a computer screen is rational

Playing with numbers is a dangerous game that could lead to vertigo, nausea and pleasure

Dick is editorial fellow of *PC Pro*. He thought Gauss and Euler were a kitchenware firm until he discovered Smirnoff.

Most people encounter turning points in their lives, and one of the earliest in mine came while deciding to apply for university: I loved both chemistry and maths, and had the A-level results to study either. I could have become a mathematician, but the lure of smells and bangs was too strong.

However, I've never lost my love of maths, especially number theory, and I still do some for fun from time to time. In the 1960s, I spent months playing at topology, in particular notations for classifying knots. More recently, I wanted to hear what the prime numbers sound like, which led me into a computer music composition project.

A subject of fascination for me has always been irrational numbers. These are numbers that can't be expressed as fractions – that is as the ratio of two whole numbers such as ½ or 3,793/8,331. Examples are pi and 2, which can only be represented by infinitely long, non-repeating strings of decimal (or binary, hex, octal and so on) digits, which are impossible to complete. And the weirdest thing about irrational numbers is how many of them there are.

> **"If you showed each picture for a second, you'd be done in two years, although I wouldn't sit up waiting for the *Mona Lisa* to appear"**

Consider this. You can present all the numbers as a line that stretches off forever to the left and right, on which every point represents a different number. You can tick off the whole numbers along this line, like the marks on a ruler, and in between each mark there will be infinitely many rational numbers, fractions whose decimal representation comes to an end like 4.567757, and infinitely many irrational numbers. The scary thing is that there are "more" (whatever that means) irrationals than anything else, because if you choose a point at random on the line, there's a 100% chance it will be irrational! I know, it made me feel seasick too when I learned this, from an article in *Quanta Magazine* called "Why Mathematicians Can't Find the Hay in a Haystack" (**pcpro.link/291maths**).

Almost all the numbers we use in everyday life are rational, whole numbers such as 12 eggs or fractions such as £4.56, but these are like needles in an infinite haystack of irrationals, impossible to locate by random search. And worse still, the hay itself is impossible to describe in finite space.

Rational numbers are easier to handle, and they're all we can deal with on a computer that has both finite memory and finite word-length. But even rational numbers can boggle the mind. Another of my passions is computer graphics, and images on a computer screen are really nothing but tables of numbers, displayed as colour intensities by the graphics hardware. Suppose your computer has a 1,920 x 1,080 display and 32-bit colour; then every line on that screen could be represented by a 61,440-bit long binary number, and every possible image by a 66,355,200-bit number (61,440 x 1,080).

So, you could write a program that counts from 0 to 66,355,200, converts each number to a bitmap and displays it, and it would eventually show everything that could be possibly seen on that screen, like the proverbial monkeys on typewriters that might produce Shakespeare. It wouldn't take infinite time, either: if you showed each picture for a second, you'd be done in two years, although I wouldn't sit up waiting for the *Mona Lisa* to appear. The more I think about this, the more I want to set it up in a gallery – people might sit in front of it hoping to see something recognisable, like the librarians in Jorge Luis Borges' *The Library of Babel* searching for a legible word.

Maths is like a good rollercoaster that induces vertigo, nausea and pleasure all at the same time. For me, the ultimate boggle is Cantor's "diagonal" proof that there are infinitely more real numbers, rational and irrational, than there are whole numbers. Build a table, infinitely deep and infinitely wide, of all the real numbers. Traverse this table diagonally, taking the first digit of line one, second digit of line two and so on, add one to it and string these all together into a new infinitely long number. This new number can't be anywhere in the table because it differs from every number in the table in one place, so infinity squared isn't big enough to hold them all – they are uncountable. First encountered at school, this still hurts my head a little even now. Perhaps I made the right choice after all: in chemistry you can only poison yourself or blow yourself up.

dick@dickpountain.co.uk

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Readers' comments

Your views and feedback from email and the web

Let books be books

I know you love your technology, and no doubt many readers will agree that "clever tech makes ebooks smarter than paper", as Nicole Kobie seems to believe (*see issue 290, p38*). But I don't want them to be smart.

I much prefer to read books in print. I can focus on the text without being distracted by emails, Twitter or the urge to look things up. Granted, my Kindle is invaluable when I want to take a lot of books with me but have limited space. It's the Kindle's sheer simplicity that makes it ideal. If books start to be whizzy and interactive, I might as well read them on my iPad, and within five minutes I'll be back on Twitter. **Tim Morris**

Pitfalls of being responsible

I brought my copy of *PC Pro* into work today. Opening to Tim Danton's editorial about having a paper clear out (*see issue 290, p8*), I clocked his mention of the new *PC Pro* app and thought I'd give it a go. Of course, the first thing it wanted was my customer number – but the sheet of paper on which it was written was now in the recycling bin. Since this was at work, where we have secure recycling, I couldn't simply go and retrieve it. So, I guess I won't be trying the all-singing all-dancing *PC Pro* app until next month. The irony of the situation didn't escape me. **John Williams**

Specs appeal

It seems that, over the years, *PC Pro*'s descriptions of thin and light laptops (*see issue 289, p77*) have become too bland for your writers. Surely what we readers want to know is why, when six of the laptops have Core i7-8550U processors, do they range from 103 (Labs winner) to 71 for the Asus ZenBook. Surely adding 8GB of memory can't be the reason? If so, tell us. Why does the i5-8250U in the Acer Spin 5 achieve a score of 71 with a maximum frequency of 3.4GHz, a base of 1.6GHz and a smart cache of 6MB? Instead of describing what looks beautiful, we need you to tell us why one laptop's configuration is helping it achieve higher benchmark scores than another laptop with same processor. **Clive Innes**

***PC Pro* editor-in-chief Tim Danton replies:** Thanks for keeping us on our toes, Clive! It's always difficult to pinpoint why one machine does well or poorly in our benchmarks, but we've talked before about thermal throttling, where the system has to force the processor down to lower speeds to keep its temperature down. This, along with the multitasking benefits of extra memory, is the most likely reason for the results you see.

BELOW What makes one laptop do better than another in our benchmarks?

To VPN or not to VPN?

I use Dashlane to store my passwords and was interested in its new VPN feature. However, whenever I'm out with my laptop, I use my phone's hotspot for connectivity, as I hate being forced to give personal information to use free Wi-Fi. Is this any more secure than a public Wi-Fi or should I still use my VPN as well as my hotspot? **John Clifton**

***PC Pro* replies:** It's all a question of trust – and who you trust the most. The provider of the hotel Wi-Fi, your mobile service or your VPN provider? Somewhere along the line, someone will be able to see what you're browsing, should they choose. We would always recommend using a VPN when connecting to public Wi-Fi, but only if you're sure that your VPN provider isn't logging your online activities. Dashlane's VPN is provided by AnchorFree which, according to Dashlane's FAQ, "does not collect or retain any personal information from Dashlane's users, and therefore does not share any such data with third parties". As long as this satisfies your security requirements, we would opt for that or an alternative VPN, combined with the offer of free Wi-Fi, rather than draining your battery and bandwidth by using your phone as a hotspot.

It's a fix!

Paul Ockenden was trying to recommend a car mount for one of your readers (*see issue 289, p113*). Two names are certainly worth looking at: Brodit and Herbert Richter. Brodit has a range of fixed platforms and phone holders that provide a solid mount for virtually any phone, while Herbert Richter produces holders with movable arms that can be used with different devices.

As for in-car uses for a smartphone, I would suggest that a dashcam would be legitimate and needn't distract the driver. Satellite navigation and dashcam usage at the same time probably requires two separate devices, but which *PC Pro* reader doesn't have a spare (old?) smartphone lying around at home? **Paul Fairbairn**

Star letter

In a recent *PC Pro* podcast, Jon Honeyball stated his disappointment with Google for its recent lack of innovation with G Suite. While I agree the office suite market overall has only taken incremental steps lately, I think we're on the cusp of some real innovation. It's all thanks to machine learning and big data, which Google and Microsoft are both well placed to harness. Google is using its AI skills in Gmail to offer contextualised predictive sentence completion (Smart Compose) and in Google Sheets to let users query big data using plain English statements, rather than having to learn complex formulae or resort to expensive data analysts.

Innovations like these are just the start, and while they appear simple to the user, they're only possible because of complex, integrated systems running behind the scenes. For me, these simple changes will deliver true productivity improvements. Imagine the time saved from never having to look up addresses, never making typos or simply just having your regular emails and documents written on your behalf after a few key strokes. Similarly, how many more people will be able to query big data who can't at the moment, simply by requesting it using their natural language?

We tend to expect innovation to deliver us something totally different to what we have already, but sometimes innovating the most boring, simplistic or repetitive tasks is where the real benefit and change can happen. Michael Webster

Our star letter writer wins a copy of Serif Affinity Designer. Built from the ground up over a five-year period, every feature, tool, panel and function has been developed with the needs of creative professionals at its core.

No date on the update

I recently wrote to Asus, which manufactured my 18-month-old laptop, to ask how long it would take it to provide a BIOS update addressing the Spectre vulnerability identified in January. Its response was that this is in development, but it couldn't provide an ETA for the latest release.

It concerns me that, as a registered customer, I've not had any kind of communication from Asus other than my own chasing of them to address these issues. Should manufacturers have a duty to advise their customers of these vulnerabilities and provide them with a timeline for an expected fix? **Dale Connolly**

Brain power

Having spent a long time in aerospace, I have a soft spot for all things CFD, so I was intrigued to read Steve Cassidy's column about the exploits of the University of Eindhoven modelling a cycle peloton (*see issue 289, p120*).

One could see why they might want to test and demonstrate their capability using a subject free from commercial constraint, but it highlights one of the problems we face today – just because we can does not mean we should. For me, there are too many variables.

> "Supercomputers have their place, but it's very easy to use them as a proxy for thinking"

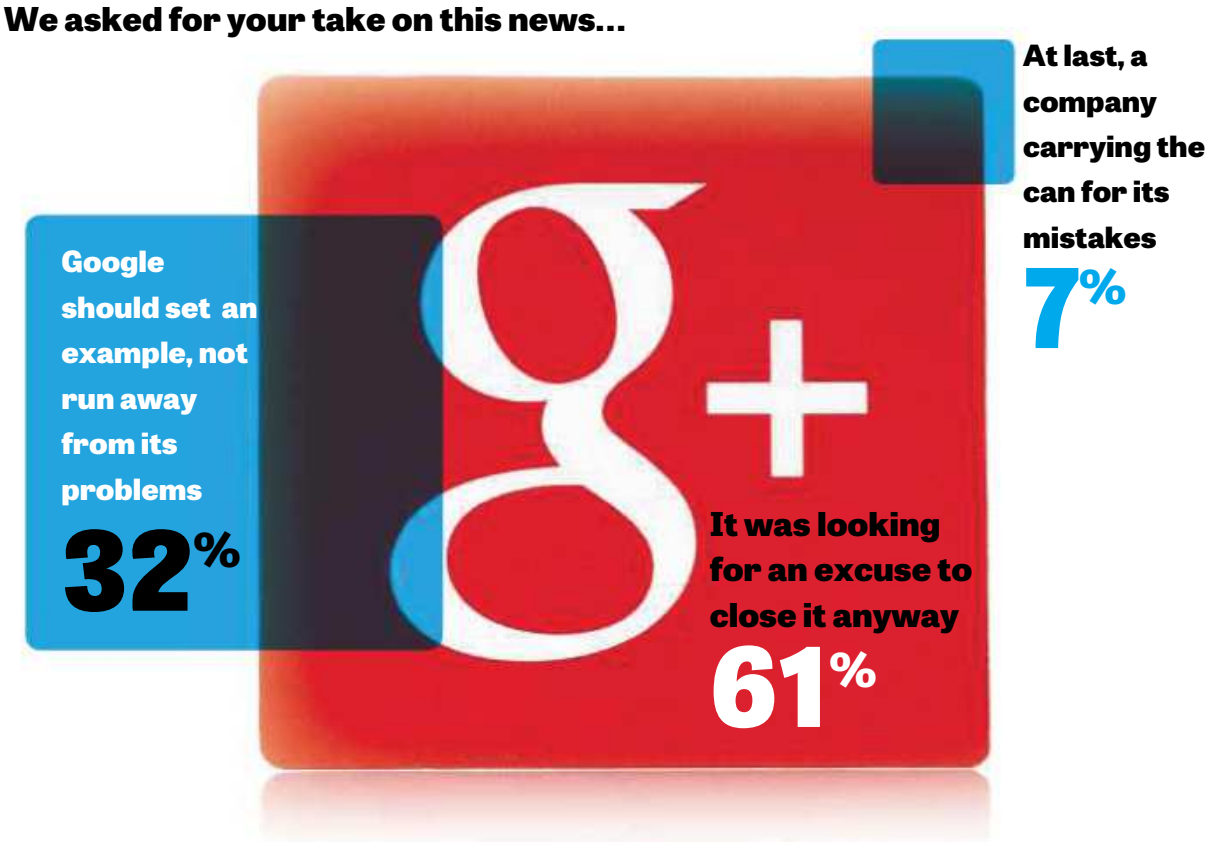
Supercomputers have their place, but it's very easy to use them as a proxy for thinking. In the olden days, the lack of computing power placed a premium on understanding both what problem was being solved and how to capture the key features of the solution in an representative way. The finest engineer I ever worked for would check calcs, which may have taken me days to do, using only a small non-scientific calculator. The limited computing we had only highlighted a gap in his knowledge once in three years.

The ubiquity of computers today reduces or discourages our ability to build a profound understanding of the key parameters that drive a problem. I fear we become better at solving the problems the codes present than the real-world problems that drive the success or failure of the project.

What's the solution? Detailed planning is key and should include a conscious decision about when to switch the computers on. **Nick Dale**

Readers' poll

Google has announced it's closing Google+ in the wake of a security breach as it struggled to create a platform that met its customers' needs. We asked for your take on this news...



It seems that many people will miss Google+, including Alastair McKenzie. "If you are old enough to remember VHS versus Betamax, G+ was Betamax. WAY better than Facebook but not first to market," he wrote. "Yes, I used it. Yes, I always preferred it to Facebook. Yes, I always hoped people would desert Facebook and come to recognise G+'s superiority. No, I don't trust Google anymore. A bad move."

However, the clear majority of respondents to our poll were, if you'll forgive the pun, nonplussed by Google+'s continued existence. "I had an account but hadn't used it in six years," explained Will S. "Everybody I want to follow already uses apps so Google+ was redundant to me."

> "Google+ is a great site and has many followers and it's not nefarious like Facebook. I don't think G+ will shut down – I've heard from a reliable source that it won't" Ken Pudsey

> "People signed up and didn't engage, so they didn't get a lot of feedback and thought it was a ghost town. Didn't occur to them that it might be down to the way they were using G+. Yes, I'm talking about you, journalists" Garry Knight

> "I was and still am a Google+ user. Its Communities and Collections made it stand out. I'll be transitioning to Steemit" Patrick Hutton

> "I had high hopes but it felt as if Google had given up immediately after its launch; it then slowly died" David Ward

Join the debate

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Get the latest news and updates by following us @pcpro

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10 TIPS for WINDOWS POWER USERS

Forget easy Windows tips. We round up ten sophisticated ways to take full advantage of the power on offer in Windows 10 – including many that were new to us until we started digging... and new to the world until the recent October Update

1. CUSTOMISE THE POWER USER MENU

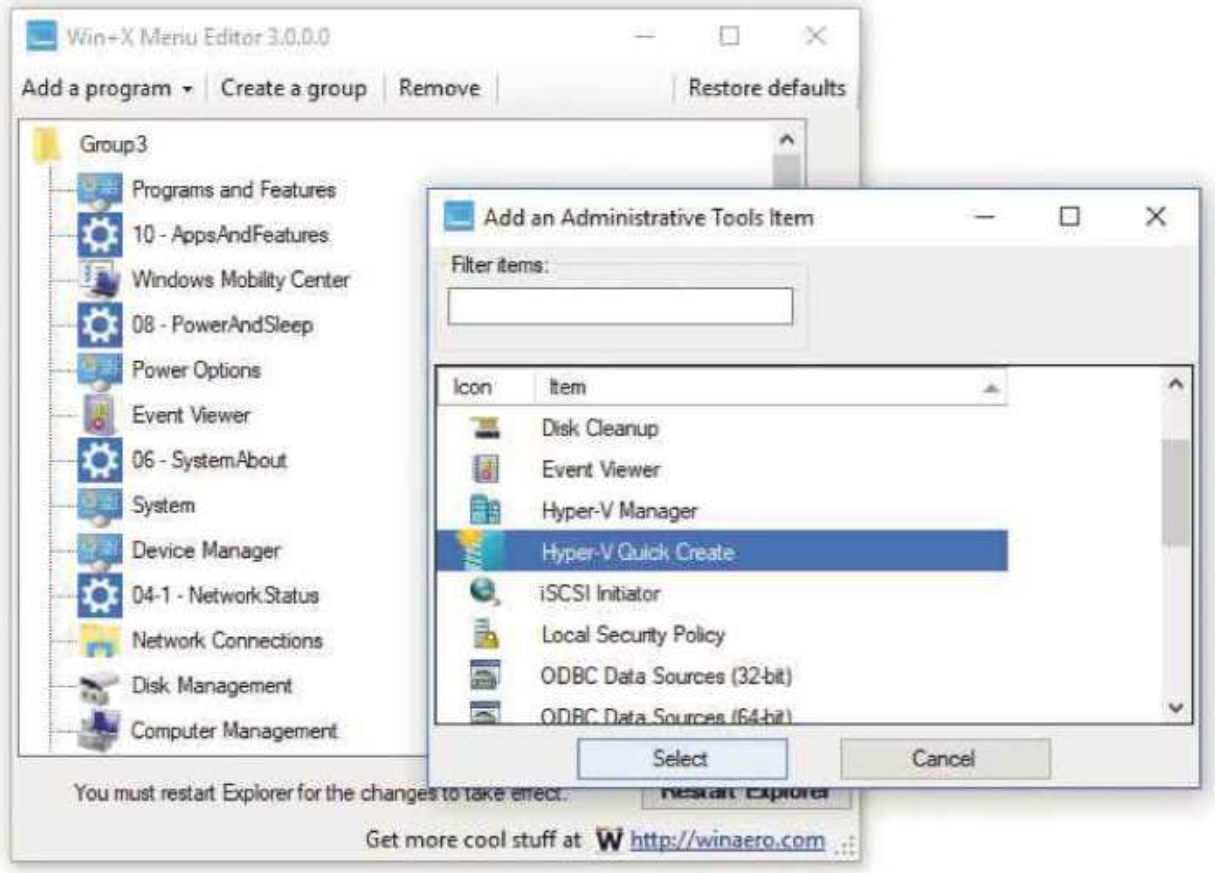
You're a power user, so you know about the Power User menu in Windows 10, right? The one that appears when you right-click on the Start button or press Windows+X. Good, just checking.

What you might not know is that you can customise this menu, removing features that you'll never bother with (I can't recall ever needing the Event Viewer, for instance) or replacing them with ones that you'll need more often (such as the Hyper-V Quick Create tool we cover later in this feature).

To customise the Power User menu you will need to download a small applet called Win+X Menu Editor from **winaero.com/download.php?view.21**.

Once installed, you can edit each of the three different groups in the Power User menu (extra points if you'd already spotted it was divided into three), or create a new group of your own. You can add functions from the Control Panel or Administrative Tools, or you can add specific applications if you wish, although that rather defeats the object of the main Start menu.

If you bodge it up, you can always restore the default menu.



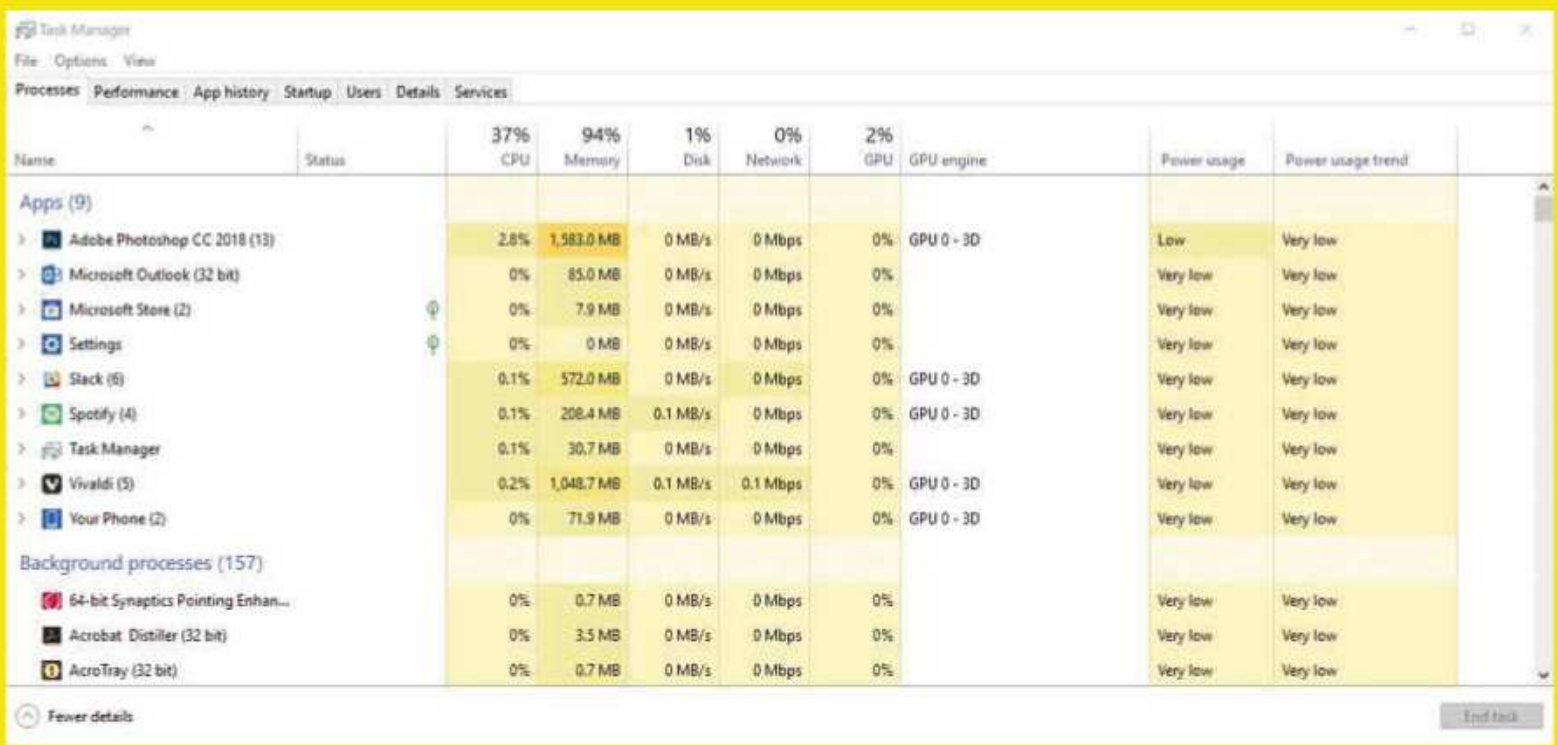
2. IDENTIFY THE BATTERY THIEVES

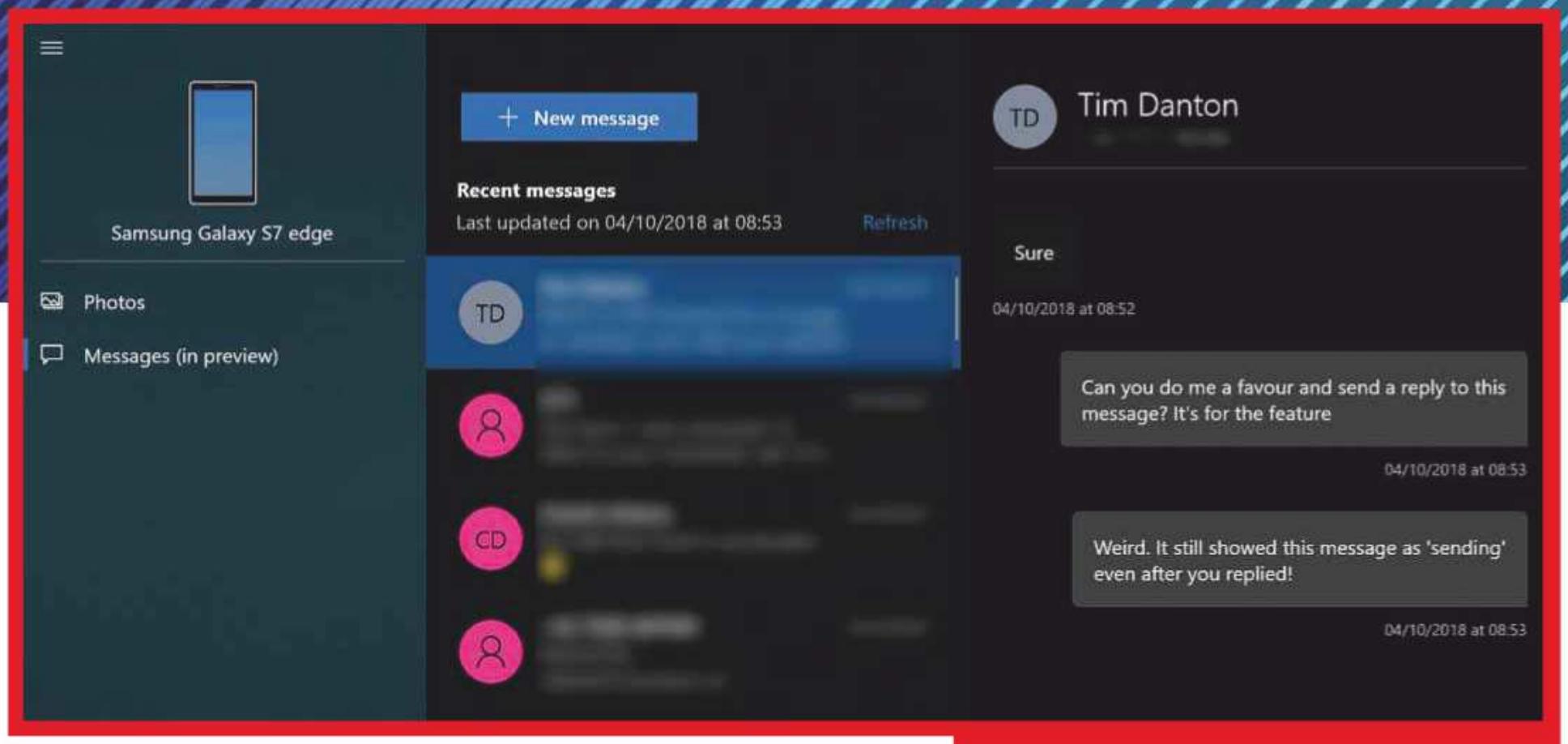
Common sense is normally a fairly good guide to which apps are burning through your laptop's battery. Adobe Premiere rendering a 4K video is going to be smashing through more battery than Word, I think we can all agree.

However, you don't have to rely on educated guesswork anymore. The latest Windows update has enhanced the information available in the Task Manager, with two new columns showing "Power usage" and "Power usage trend". The former is the amount of power the app is draining at present, while the latter reveals its impact over time.

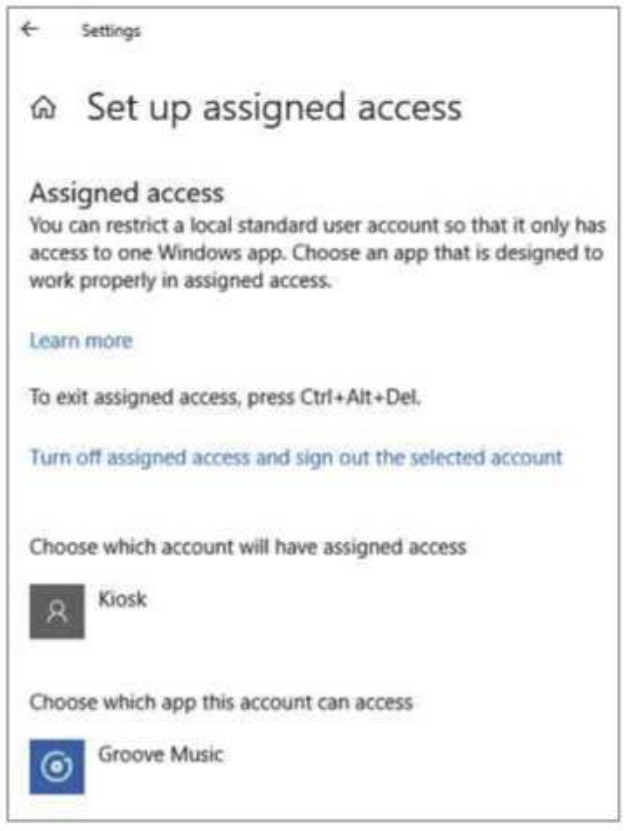
If you suddenly notice your battery indicator plummeting like Theresa May's approval ratings, fire up the Task Manager and see if there are any glowing red apps in the Power usage column.

Whilst we're poking around the revamped Task Manager, you might notice another new column in there called GPU engine. This reveals if an app is leaning on the GPU's 3D engine – and you can often find some surprising results. We wouldn't have assumed a Word doc without graphics would be troubling the 3D engine, but then we would have been wrong.





3. SET UP A WINDOWS KIOSK



Here's one for the IT admins or consultants in the house. Sometimes you need to set up a Windows device for one specific purpose. An internet kiosk for the company's reception, for example, or a laptop to power Spotify for the music in a venue.

You don't want users of that device to have access to anything other than that single app, because it's not necessary. For such use cases, you can effectively create a kiosk – a user account that has access to only one Windows Store app.

To do this, you first need to set up a secondary user account on the computer (you can't do this with the main admin account for, hopefully, obvious reasons). Ignore Microsoft's attempts to create a Microsoft account for your new user and click on the options that say "I don't have this person's sign-in information" and "Add a user without a Microsoft account" in the user setup wizard. You might not even bother with a password on this account, as it's only going to have access to a single app.

Once the new user account is set up, go back into the admin's account and type "assigned access" into the Windows 10 search bar and click on the option for "Choose an account for assigned access".

Choose the account you've just set up and then choose the app that account can access. Note that the app must already be provisioned for the account you're using. So, if you want to provision an app that's not one of the core Windows apps, download it afresh from the Windows Store on the new user's account.

As of October's Windows 10 update, you can also assign the Edge browser as a kiosk app. One example case is to provide an internet kiosk in reception, for getting guests to sign in via a page on the company's intranet.

Microsoft has a special page dedicated to deploying Edge in a kiosk scenario which is worth reading at: **pcpro.link/291kiosk**.

Note that, when you want to exit the kiosk account, you must use Ctrl+Alt+Del because the account doesn't have access to the Start menu and its various power/login options.

4. DEAL WITH SMS MESSAGES FROM YOUR DESKTOP

iPhone users have been able to read and respond to SMS messages on their Macs for years. Finally, though, Windows is taking steps in the same direction with the Your Phone app bundled in the October update.

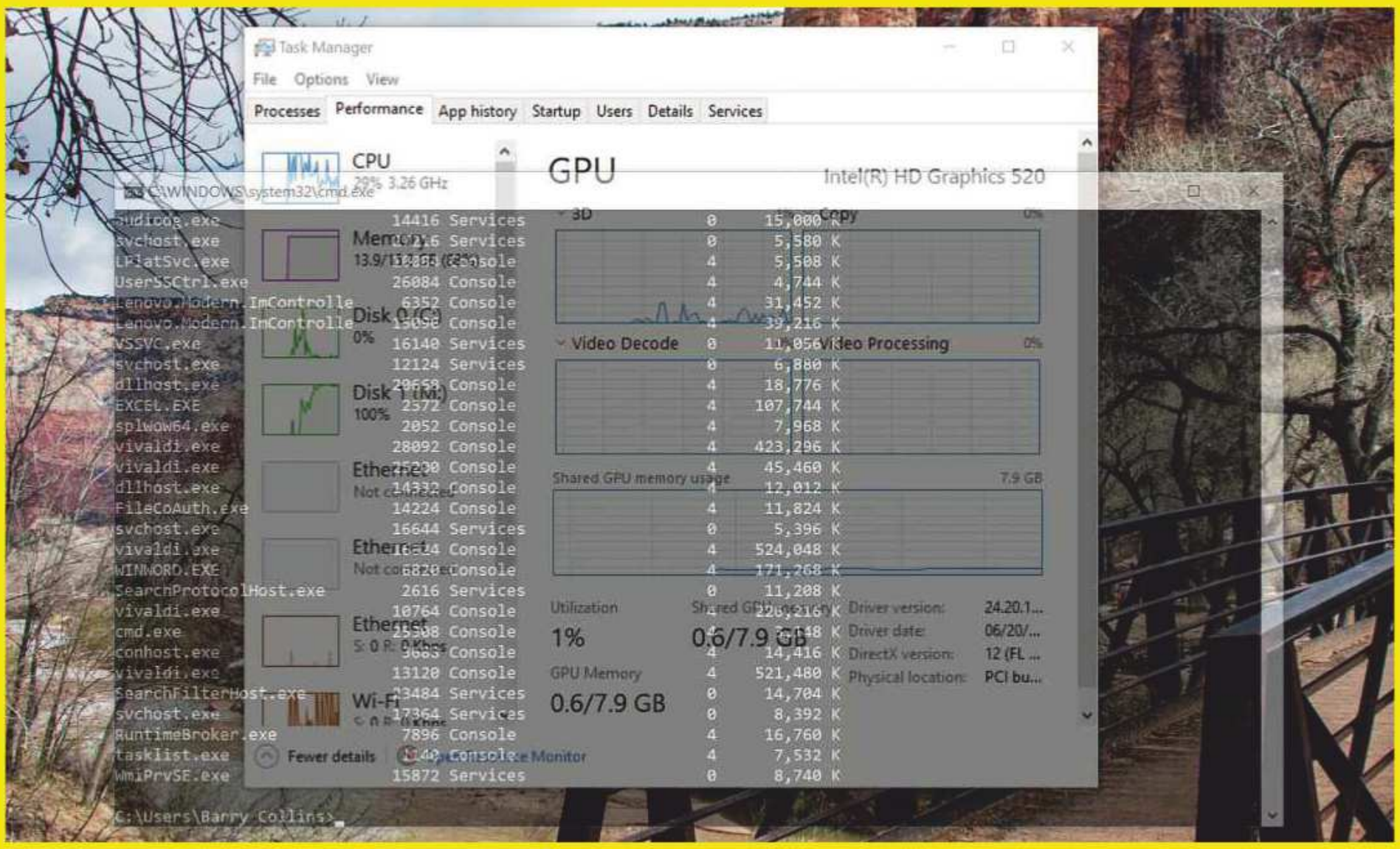
Currently, this only works with Android handsets, but iPhone support is coming if Apple is prepared to loosen the padlock on its SMS services.

With Your Phone, you're able to read and send SMS messages from the desktop app. Incoming messages also display a Windows notification, which is handy if you've got the phone on silent during a meeting, for example.

The service is most immediately useful for authentication codes. Some banks send out SMS codes to authorise payments, for example, meaning you don't have to dip into your pocket to copy the code into your web browser.

At the time of writing, the Messages facility was still "in preview" and there are certainly a couple of bugs that need to be squashed. When we sent a test message to the editor of this fine organ, the message appeared to get stuck with a spinning progress wheel – which continued to display even after he had replied! When the wheel eventually stopped, the messages were displayed out of chronological order, as you can see from the screenshot above.

Also something to watch for – next year, the Your Phone app will begin mirroring Android apps on your desktop. We've already seen apps such as BlueStacks offering Android emulation on the desktop, but this could – and we do stress could – allow you to run your favourite mobile apps on the desktop without having to create fresh installations.

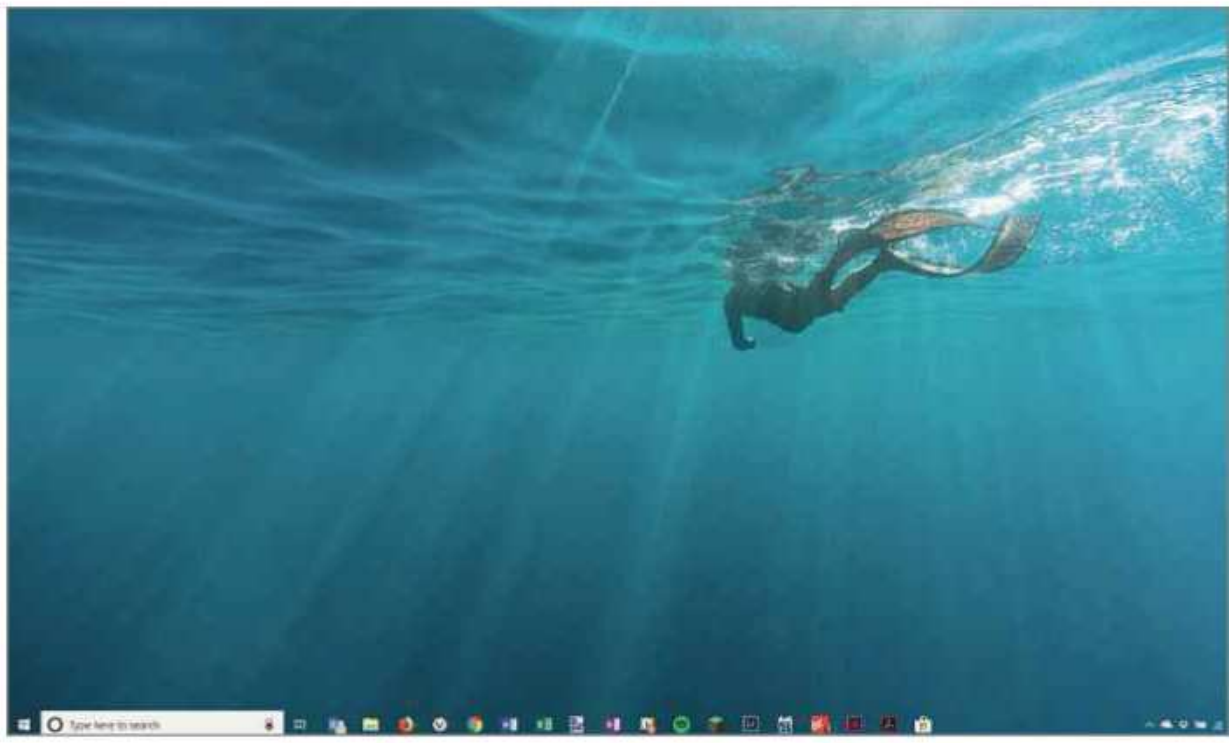


5. MAKE A COMMAND PROMPT TRANSPARENT

Are you rattling commands into a Command Prompt but want to keep an eye on what's happening beneath the Command Prompt window? You can now make the Command Prompt window transparent, letting you see what's going on in the background.

There are two ways to pull this off. With the Command Prompt window selected, you can hold down the Ctrl and Shift keys, and then use the mouse scroll wheel to adjust the level of transparency.

Alternatively, you could hold down the Ctrl and Shift keys and use the + and – keys to achieve the same effect.



6. THE TRANSLUCENT TASKBAR

While we're making things see-through, how about a translucent taskbar? It gives Windows a much cleaner look, especially if you've got a tidy desktop. The look works best with relatively plain wallpapers that haven't got too much fussy detail at the foot of the screen, such as the diver wallpaper (one of the Windows 10 defaults) in our screenshot.

This can be achieved by downloading a small app from the Windows Store called TranslucentTB (**microsoft.com/store/productId/9PF4KZ2VN4W9**). Once installed, it places an icon in your system tray that allows you to fiddle with different settings.

By default, the taskbar will be translucent if you've got no full-screen windows open, but it goes back to black when you have or when you open the Start menu. You can fiddle with the settings and many others from the system tray until you get it just right.

7. GO DARK

Our final cosmetic feature is perhaps the most important for those of us who spend a vast proportion of our days gawping at a computer screen. So everyone who reads *PC Pro*.

Windows has a new Dark Mode, something which is very much in vogue at present. With this setting enabled, Explorer windows, the Settings menus, Microsoft's bundled apps and even some third-party applications (such as Paint.Net) are given a charcoal makeover.

The dark windows can take a little getting used to, and it's more difficult to see where one window starts and another ends when you have two windows overlapping one another.

That said, the dark menus definitely reduce the degree of glare you get from the screen, especially on big desktop monitors. Whether that will have any long-term eyesight benefits is impossible to say, but it certainly can't do any harm.

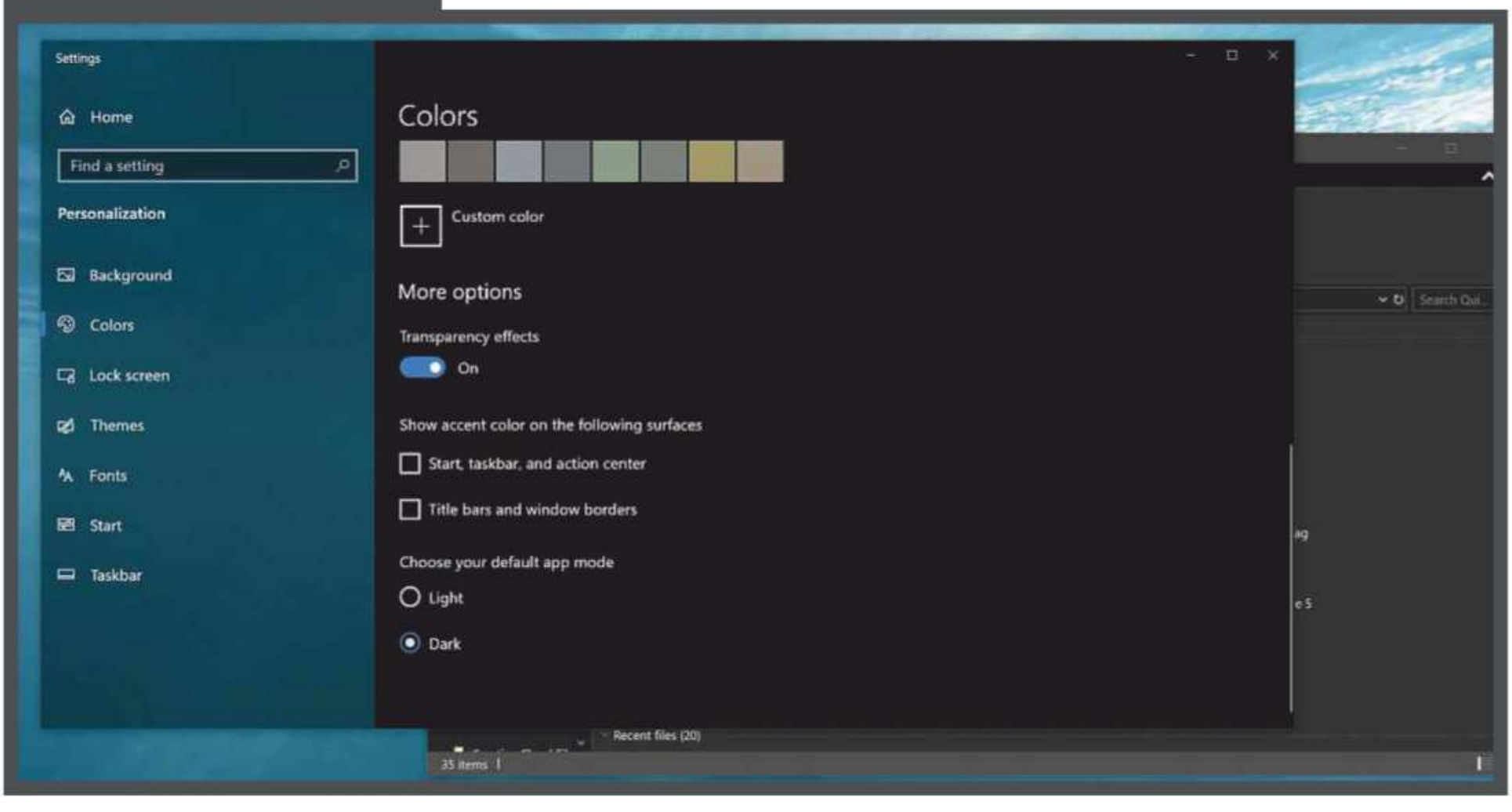
8. OPEN WEB FILES WITHOUT SAVING THEM FIRST

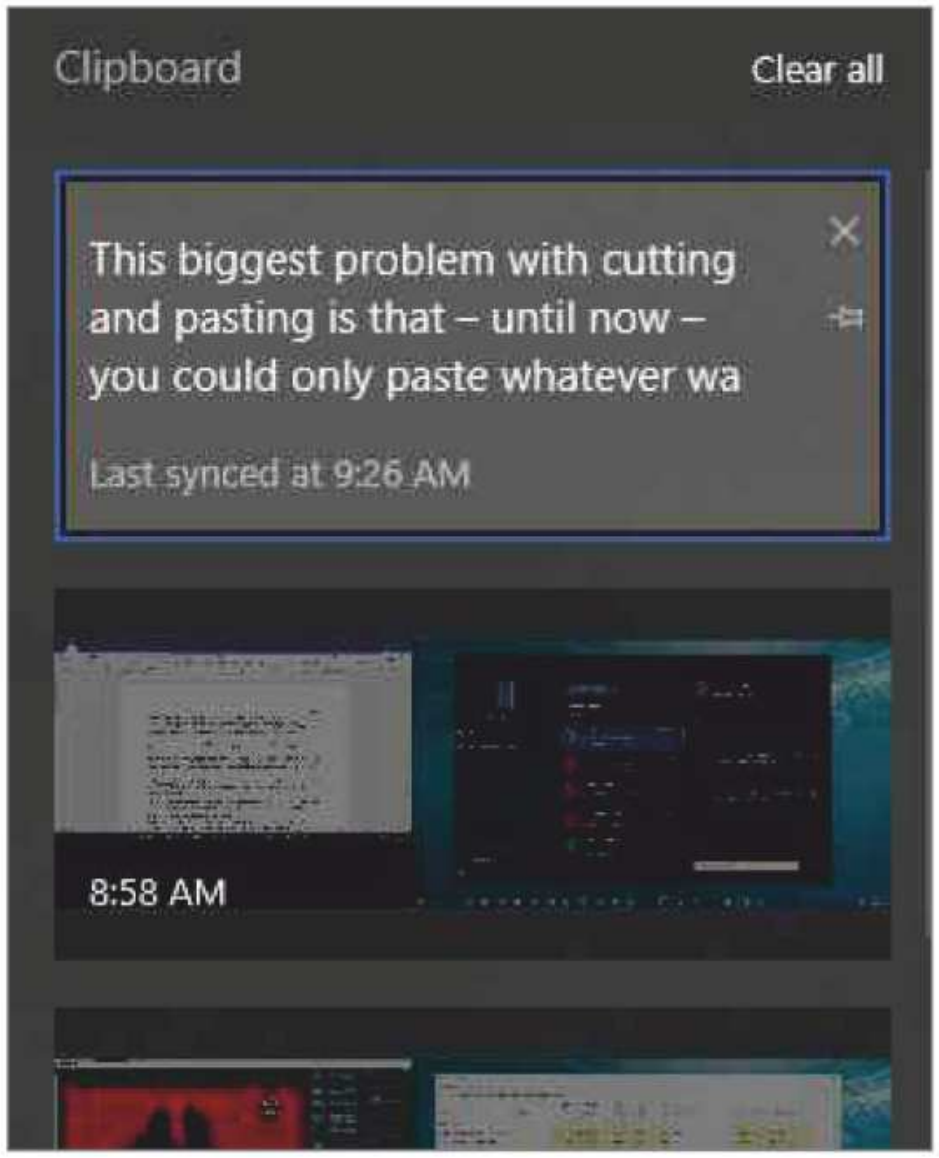
This is a wonderful little nugget from our Real World contributor, Paul Ockenden.

Falling into the Michael Caine category ("not a lot of people know that"), did you know that you can type a web address into the standard Windows file/open browser?

What use is that, you might ask? Well, let's say you've found an image from an online photo library and want to open it for editing in Photoshop. Instead of saving the file locally and then opening from Photoshop, you can right-click on the image to copy its URL, open Photoshop and then click File | Open. When the file browser appears, paste the web address into the "File name" bar and it should open automatically.

It works for pretty much any type of file. Need to download a PDF form from a website? Click to copy the PDF's file location, open Acrobat and repeat the File | Open and paste routine. Job done.





9. RETRIEVE MULTIPLE ITEMS FROM YOUR CLIPBOARD

Whisper it, but us journalists could barely survive without the old cut and paste. However, we're not the only ones who rely on Ctrl + C and Ctrl + V.

This biggest problem with cutting and pasting is that – until now – you could only paste whatever was the item copied to the clipboard. That all changes with Cloud Clipboard.

Press Windows+V and you should see a small window appear with a back history of anything you've added to the clipboard. That could be code snippets, text, images, screenshots, whatever.

If you want to select the item before last, you just click on it and it's pasted automatically into the active window.

It's called Cloud Clipboard, because it can (optionally) work across multiple devices. Copy a web URL on your laptop in the office, for instance, and you can helpfully retrieve it later on your home PC.

You can clear out the Cloud Clipboard at any time if you've copied sensitive information, such as a password. You can also pin items to the Clipboard, such as a boilerplate email reply. We've only been using the tool for a day or two and it's already become faintly indispensable.

10. SET UP A LINUX VM IN MINUTES

Dual-booting into Linux – for a spot of dev work, say – was always a considerable faff. Firstly, the installation was a trudge, requiring bootable USB drives and often a workaround for Windows Secure Boot, which often snared genuine installations in a bid to thwart malware. Then you had to shut down Windows to access the Linux environment.

Virtualisation, of course, made this considerably less faffy, but there were still obstacles to overcome. You would need to install some kind of virtualisation software, then find the correct ISO, and even when you got past the installation hurdles, performance was often sticky.

Windows 10 Pro has done away with all of this hassle in the form of Hyper-V Quick Create. With this system, it's possible to create a new Ubuntu virtual machine in as few as three clicks and have yourself a slick-performing VM within minutes.

This is all thanks to Canonical and Microsoft working together to support Enhanced Session Mode. In this mode, the VM adopts the Remote Desktop protocol, letting you resize the client window, copy and paste between virtual machine and the underlying Windows 10 OS, and with automatic sharing of folders between guest and host. In effect, Ubuntu runs like a desktop application, allowing you to hot-swap between Ubuntu and Windows at will.

This is all very easy to set up, but there are a couple of gotchas along the way, which we discovered when deploying this feature ourselves.

How to set it up

First, you must type "Windows features" into the Windows 10 search bar and select the option to "Turn Windows 10 features on and off". Hyper-V virtualisation isn't switched on by default in Windows 10 Pro, it needs to be activated.

In the Window that appears, tick Hyper-V. However, don't assume – as we did – that by ticking that box, you'll also activate everything inside its submenus. Instead, click on the plus sign next to Hyper-V and also ensure that Hyper-V Management Tools and Hyper-V Platform are ticked, and then the items in their submenus. Without these, the hypervisor will simply stall on launch.

Once you've ticked all of the correct boxes in the submenus and clicked OK, Windows will need to reboot to install the necessary components.

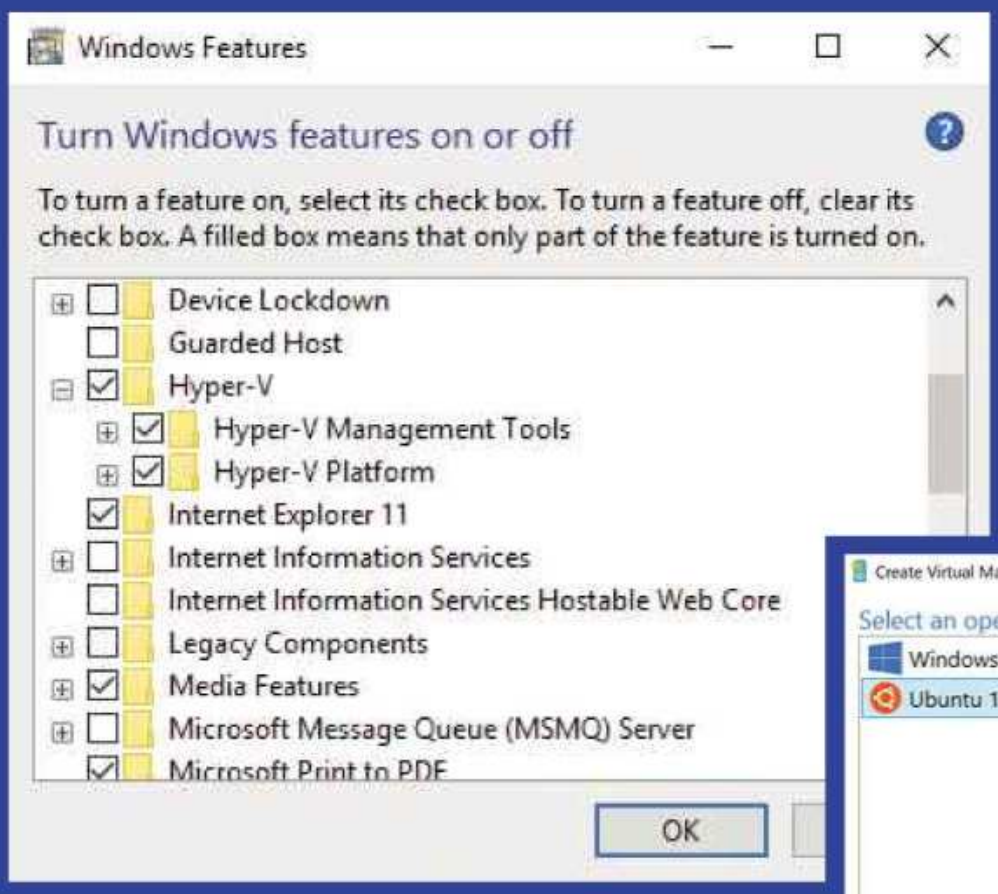
When you're back at the desktop, type "Hyper-V" in the Windows 10 search bar and you should see the option to open Hyper-V Quick Create.

Here you'll be asked to create virtual machines for one of two operating systems: the Windows 10 dev environment or Ubuntu 18.04 LTS. Don't get too excited about the Windows 10 option, by the way – this isn't a juicy way to run up free Windows 10 licences. It's an evaluation copy of Build 1709 that will "expire after a pre-determined amount of time".

Choose which operating system you wish to use and click More Options if you want to change the name of the VM from the default name of the OS. Then click Create Virtual Machine. Windows will now download the OS of your choice – Ubuntu is a 1.5GB download compared to Windows 10's hefty 12.7GB.

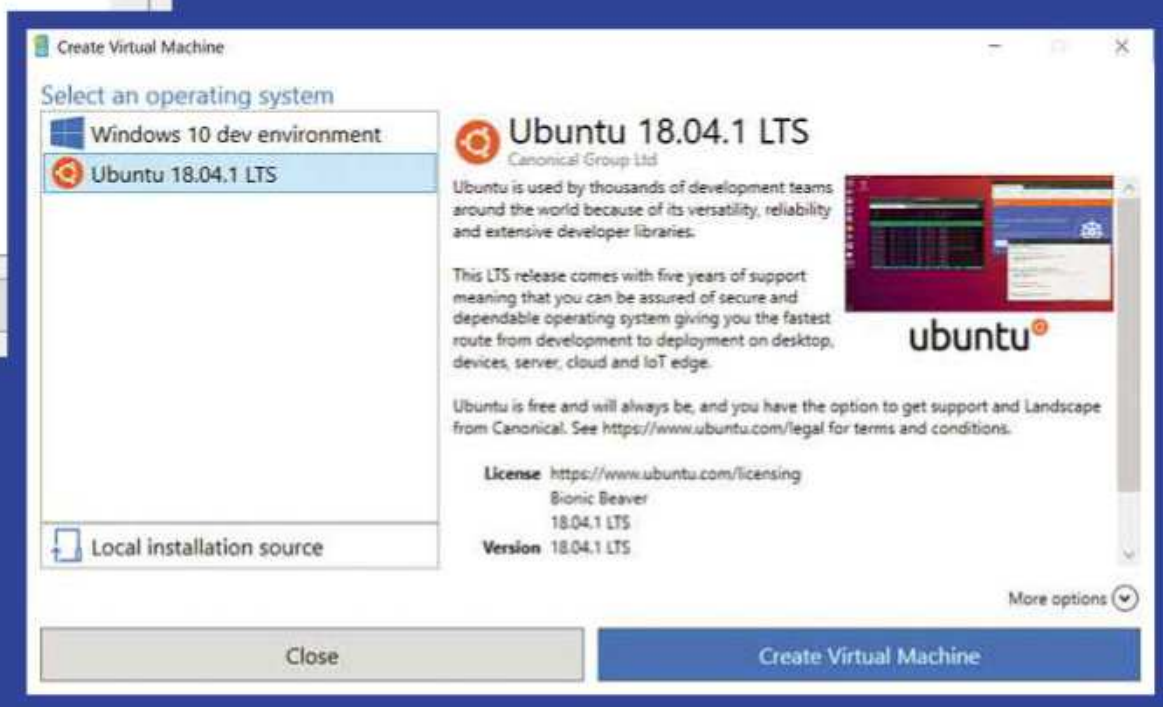
Once it's installed, you should end up at the Hyper-V Manager Window with the option to fire up your VM for the first time. If you want to fiddle with the VM's settings beforehand, now's the time to do it. Click on Ubuntu in the right-hand menu and select Settings – from here you can determine how much memory to assign to the VM, the number of virtual processor cores it's afforded and so forth.

In future, you can also take Checkpoints from this menu, allowing you to roll the virtual machine back to its current state, in a similar vein to System Restore points in Windows.

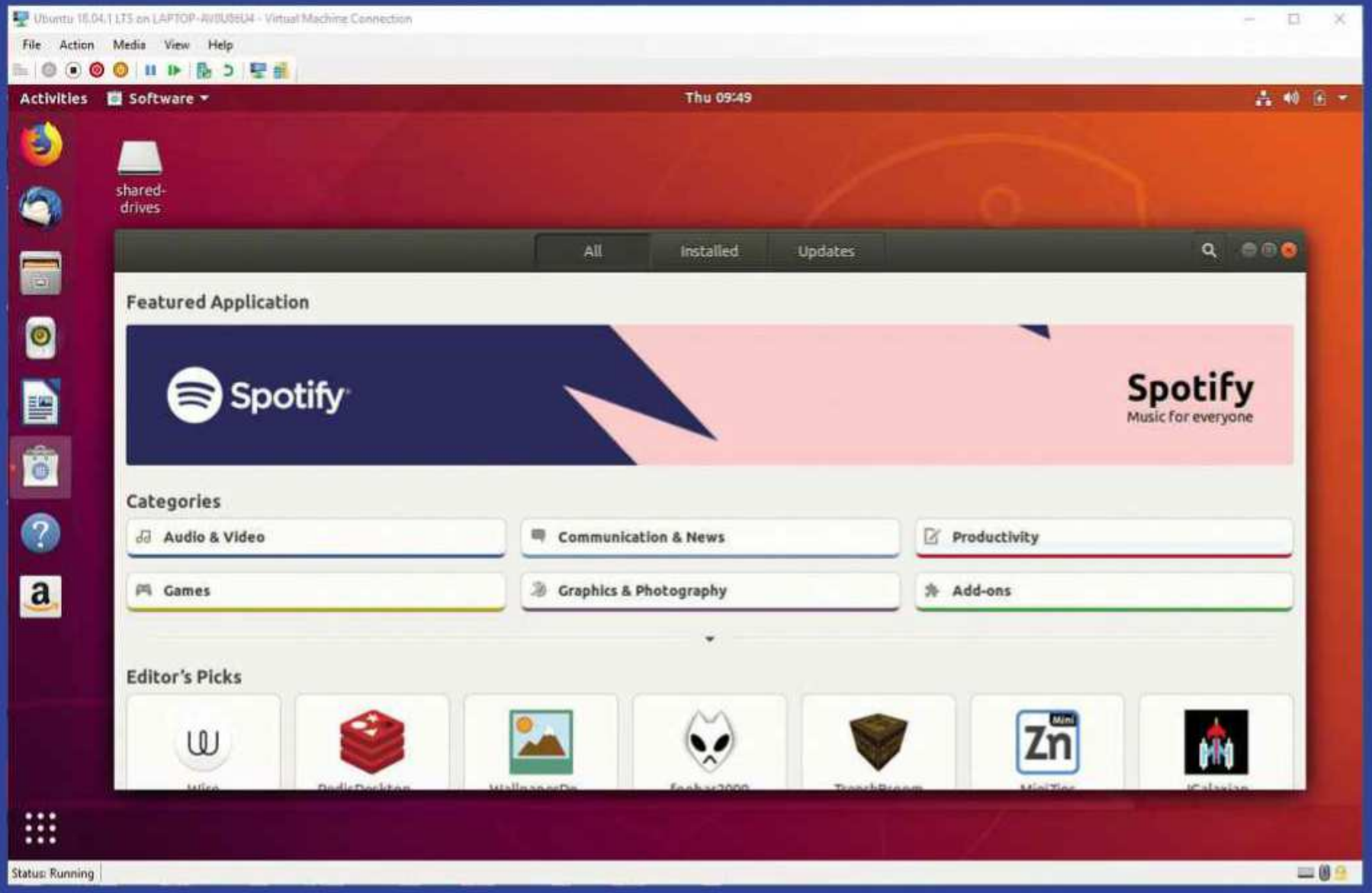


LEFT To set up a Linux VM, you'll need to first turn on Hyper-V virtualisation

BELOW Users are offered a choice between Ubuntu and the Windows dev environment



BELOW After you've entered a username and password, you're ready to roll



Once everything is to your liking, you're ready to roll. You will be asked for a username and password to log in to Ubuntu, although you still should be up and running within a couple of minutes.

If you're using a multi-screen set up, you'll be given the option to spread the VM across all your screens or restrict it to just the primary display. You can run the VM in either full-screen or windowed mode and the guest OS should adjust its resolution accordingly.

If you're a developer, or even if you just fancy playing with Ubuntu Linux for a while (Li-curious, shall we say), then this is the fastest way to get going.

We all know it's vital to create strong passwords, and to use a different one for each site and application you log into. But if you've ever tried to follow these rules, you'll know how impractical they are.

This is entwined with the limitations of the human brain. According to *Scientific American*, "neurons [in the brain] combine so that each one helps with many memories at a time, exponentially increasing the brain's memory storage capacity to something ... around 2.5 petabytes (or a million gigabytes)." Never mind a few cryptic passwords: we ought to be able to remember around 300 years' worth of HD video (**pcpro.link/291mind**).

The problem is that passwords are abstract things that don't helpfully relate to anything else in our brains. According to best practice, knowing one password shouldn't give any hint of what any of the others might be.

The solution is to use a password manager. There are several options, but these days you'll almost certainly want one that runs across multiple platforms and fits into your life as transparently as possible. Here's our guide to getting the most out of some popular options, including industry heavyweights Dashlane, 1Password and LastPass.

Note we also give away Steganos Password Manager 19 as part of this month's bonus software package (*see p66 for details*).

SET A STRONG MASTER PASSWORD

Once you've got your password manager set up, you then only need to remember one password – the master that unlocks all the others. Needless to say, it's crucial that no one learns this password, so rather than write it down try to develop a system that will help you recall it.

One good method is to use the initial letters of a memorable (but not obvious) phrase, including a number and at least one capital. For example, you might choose the sentence "Barack Obama was the forty-fourth president of the United States" (although probably best not to now that it's appeared in print!). Reduce it to initials: "BOwt44thpotUS". That's pretty difficult for anyone to guess.

You can take this principle further, effectively making your password unique to every app and site you visit, by adding elements from the URL. So, if you're logging into **barclays.com**, add the "BA" from the beginning of the domain. Swap this for "AM", if logging into Amazon, "SK" for Sky and so on. For extra unguessability, move the added elements around depending on where the domain sits in the alphabet. So, for **alphr.com**, whose initial "A" is in the first half of the alphabet, place the identifier at the beginning of the password. For Yahoo, whose initial "Y" appears in the second half of the alphabet, place it at the end of the password.

Once you've set your master password, you'll be required to enter it every time you set up your password manager on a new device, and you may need to enter it from time to time when unlocking sites and apps.

Get the most out of your PASSWORD MANAGER

Password managers are the key to your digital security – but, as Nik Rawlinson discovers, there's much more to them than simply remembering your logins

CROSS-BROWSER SUPPORT

All the mainstream web browsers these days have their own built-in password managers. If you only ever use one browser – say, Chrome on both Windows and Android, or Safari on your Mac and your iPhone – then that might suit you nicely. But the moment you need to use a different device, or a different browser, you're out of luck – here's hoping you remember all your saved passwords.

This is where third-party password managers shine; they offer plugins for the whole gamut of browsers, so you can save your passwords on any device and have them available across each of the others.

Before you get too excited, be warned that cross-platform, cross-browser syncing is often a paid-for service. Most password managers will do the basics for free, but you may find that the best features aren't included. When you install Dashlane, for example, it signs you up to an initial 30-day trial of its Premium service. When that expires, you can downgrade to the free service, which stores only 50 passwords on a single device – or start paying around $40 a year to keep the Premium service, including unlimited password syncing across an unlimited number of desktops, laptops and mobile devices. Since by now you'll have loaded the system up with passwords, it's a tempting option.

LastPass is cheaper, at $2 a month ($24 annually) for one user, offering synchronisation across unlimited devices and 1GB of encrypted storage, but it doesn't include a bundled VPN like Dashlane does.

1Password is priced between the two at $2.99 a month ($35.88 annually), again offering 1GB of storage, a handy 365-day window during which you can recover deleted passwords, and an innovative Travel Mode. This swiftly removes sensitive logins from your phone before you pass through border points – and reinstates them as soon as you're back on safe ground. This ensures that even if you're forced to turn over your device for inspection, your private login details can't be accessed.

ABOVE Dashlane lets you store up to 50 passwords on one device for free

SYNCING FOR FREE

Of course, it would be great to find a free password manager that syncs between devices – but since these services costs money to develop and operate, such options are thin on the ground. However, if you don't need mobile support, and only want to sync between Windows, Mac and Linux desktops and laptops, consider Enpass (**enpass.io**). It's free to use if you don't need smartphone or tablet support.

Rather than using its own syncing servers, Enpass stores your password vault on your local machine and uses regular cloud services, such as Dropbox, OneDrive, Google Drive, Box and iCloud, to sync between devices. It's not quite a real-time service, but it's close: the password vault is refreshed every time you unlock the keychain, bring the app into focus or make a change, plus every ten minutes while Enpass is in the foreground.

ABOVE Inspired by an XKCD online cartoon, xkpasswd.net allows you to create complex passwords that fulfil specific criteria

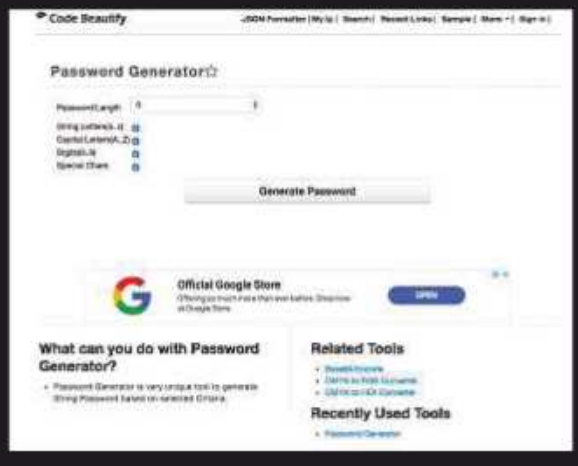
ABOVE Random.org is very easy to use: just select the number of characters and passwords you want, and hit Get Passwords

ONLINE PASSWORD GENERATORS

Phrase-based passwords are the easiest to remember, but for the last word in security there's no beating a truly random collection of letters, numbers and special characters – and there are plenty of online tools that can generate them for you.

One of our favourites is passwordsgenerator.net, which lets you select the password length and any special criteria, and provides hints for memorising the results – although we admit this can be a stretch. If you select the option to save your settings for later use, it will provide a bookmarkable link that reselects your chosen criteria when next clicked.

Other options include random.org/passwords, codebeautify.org/password-generator and xkpasswd.net, the last of these having been inspired by an XKCD cartoon.



ABOVE Code Beautify's generator doesn't have any bells or whistles: choose the length, toggle four tickboxes and you're set

ABOVE As well as creating passwords, passwordsgenerator.net generates a sentence to help you remember them

To access Enpass' cloud syncing settings, open the Tools window (called Preferences on macOS), switch to the Sync tab and select your preferred cloud provider from the dropdown list. If you later decide that you need mobile support, there's a one-off charge of $9.99 per platform.

STEP AWAY FROM THE DEFAULT SETTINGS

Password managers are designed to be secure out of the box – but there are several things you can do to further tighten them up. For starters, we recommend setting your manager to automatically log you out after a period of inactivity, to minimise the danger of someone else hopping onto your PC and accessing your sites when you've been called away.

To do this in Dashlane, open the Settings window, switch to the security tab and pick a suitable period – 15 minutes is good – from the Automatic logout dropdown. Also make sure all five criteria for requiring the master password are selected, so that nobody can see your sensitive information without entering the password if they come across your PC during the unlocked period. Untick the option to remember the master password.

You can also make Dashlane more stringent about two factor authentication. By default this is only required when you install the software on a new device, but in the Security pane you'll find the option to require 2FA every time you log in.

Another potential security upgrade is to make Dashlane less visible. By default, when Dashlane finds username and password fields on a web form it adds a little logo, so you can see at a glance that it knows how to log you in. However, this also tells anyone who's watching that your password has been stored. If you're using a secure master password it's unlikely they'll gain access to your password vault – but still, you're better off not advertising the information at all. Go to the View tab and untick the option to show Dashlane logo in login fields.

If you're using 1Password, there's a handy setting that lets you lock your password vault with a keypress (by default, Windows+Shift+L), to make certain that no one will gain access your passwords when you're away from the keyboard. For additional safety, you can also set 1Password to lock your entire computer after a short period of inactivity. Switch to the Security pane to specify this, picking an interval of between 30 seconds and 12 hours. You can also set 1Password to flush the contents of the Windows clipboard after a short time, so people can't even get a clue as to what you were working on; when you enable this feature the timeout is set to 90 seconds by default, but note that you can set it between five seconds and two minutes.

BELOW 1Password can lock down your password vault at the press of a key

Finally, a more physical way to beef up your security – especially in light of the strict requirements of GDPR – is to combine either Dashlane or LastPass with a USB-based security token, such as the YubiKey (**yubico.com**). Starting at $20 per key, and available with USB-A and USB-C connections, these provide hardware-based authentication, and can be used to log into Google, Facebook, Dropbox, Salesforce and more. They're a great way for businesses to ensure that users can securely access their accounts even if they don't have their phone or email access to hand.

Turn to p66. If there's a card with a code, you're entitled to download Steganos Password Manager 19

BEYOND PASSWORDS

A good password manager isn't just about storing passwords. Dashlane and 1Password can both also store credit card details in a digital wallet, along with IDs and secure notes.

Storing these credentials means you'll have them conveniently available should you ever need to report your cards lost or stolen, and it also allows your password manager to automatically fill in payment details on online shopping sites. Dashlane keeps a helpful record of every transaction it's been involved in, and stores these records in a dedicated receipts folder; if you prefer not to use the feature, untick the option "Ask to save a receipt during checkout" on the General tab in its options.

Another noteworthy feature of Dashlane is its built-in VPN: this protects your privacy from external threats, helping to ensure that spies can't snoop on your activity, and websites can't work out where you're connecting from. If you baulk at the idea of paying $40 a year for a password manager, this could make the price much easier to swallow. Using it means that your data will pass through third-party servers, but Dashlane assures users that "no history is kept of your browsing through Dashlane's VPN" – and that the company "provides no identifiable information about our users to AnchorFree, the providers of the technology behind our VPN".

The VPN isn't as fully featured as some rivals, mind you: notably, it doesn't let you choose the server you connect to, automatically selecting the country closest to your location. This means you can't use it to sneakily access content that's only available in (for example) the US. If you fancy trying it out, note that it isn't available during the premium trial period, or to Dashlane Business users.

LEFT Logging out after a set period is a wise precaution

LEFT Several managers support smartphone-based 2FA apps

LEFT 1Password can automatically clear the Windows clipboard after a specified period

LEFT A security key adds a physical authentication option for extra protection

DON'T RELY ON PASSWORDS ALONE

Strong passwords are excellent security measures; to make life even harder for malicious users, you can complement them with two-factor authentication. Here's how to set it up on three of the web's biggest services:

Google
google.com/landing/2step

Facebook
facebook.com/settings?tab=security

Dropbox
dropbox.com/help/security/enable-two-step-verification

If you use WordPress, we recommend installing the WordFence security extension (**wordfence.com**). As well as detecting incoming threats, this adds robust two-factor authentication to the WordPress login, which you can unlock using an OTP authenticator app. Search the iOS App Store or Google Play for "OTP authenticator" to turn up suitable options.

7 surprising things you can do with 3CX

Think you know everything there is to know about 3CX? As the software PBX keeps evolving and new features are added, even seasoned users may be surprised by what it can do

RIGHT Web meetings made easy: there's no need for people to download plugins or use dedicated clients

3CX is a powerful communications system. That much is obvious, as reflected in its groaning trophy cabinets. Here, though, we move away from the obvious and straight to the areas that can surprise customers, old and new.

1 Clientless web meetings

Clientless web meetings are an inclusion that still surprises people, even though 3CX introduced a clientless web conferencing solution way back in August 2014. You can host a full-fat web conference directly from your browser – with no need for anyone to download annoying plugins.

That could mean sharing a sales pitch via a 20-slide PowerPoint presentation sitting on the host's desktop; it could mean running a training session for new employees who are scattered around your branch offices; or it could just be a straightforward catch-up meeting with one of your clients.

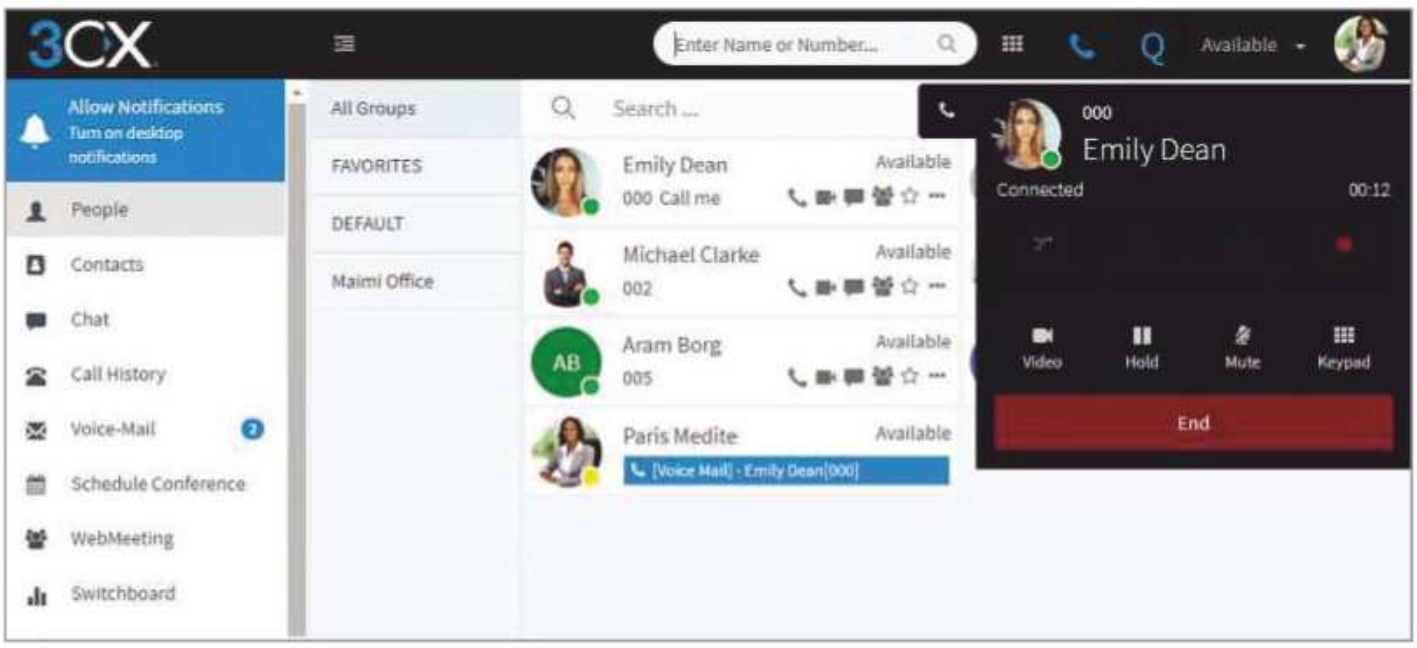
The point is that it's hassle-free – it just works – and when you're finished, no-one has annoying extra tasks clogging up their system. Close the browser window and you're done.

2 Make calls from your browser

Many people assume that, if you want to make a call direct from your computer, you need to download a client. This used to be true, but with the latest release of 3CX, it's now possible to place calls from your browser.

This service is still in beta and isn't switched on by default, so if you're interested then head to the management console. (If you want to try it right now, head to Settings | PBX | General | Enable WebRTC softphone. If you can't see this option, make sure you're on V15.5 Update 6.)

From this point on, all your users will have the option of calling from their 3CX web client whenever they click on the blue phone icon in the top-right corner. And because it uses



BELOW It's now possible to make calls direct from any mainstream web browser, with no plugins required

WebRTC, it doesn't matter whether you're running Chrome, Edge, Firefox or Opera – it will just work.

3 One console to rule them all

We've already touched on the 3CX management console, and for good reason: this is the nerve centre for all things 3CX. It shows everything you need in one easy view, grouped by System Status, PBX Status and Information.

Take System Status. At a glance, you can see disk usage, for instance, so it's obvious if you have enough space for call recordings and logs. You can also track processor usage. Naturally, there will be spikes now and then, but you'll be able to easily tell if you're pushing the processor too hard too often, and whether it's time to upgrade.

The PBX Status gives you a quick overview of key information about the 3CX installation. For instance, if you have a licence for 64 simultaneous calls then you can see how many are being used at any one time.

The console is also the place to control advanced settings such as your digital receptionist – which we covered in *PC Pro* back in issue 284, p48. Or head to **pcpro.link/291virtual**.

4 Use any platform

Many phone systems are fussy about what they run on. Some will only run in the cloud, others demand precise hardware and software combinations for on-premise installations. Not so 3CX, which has been designed to give you the choice of deployment options depending on your preferences.

Want to run it in the cloud? No problem, with a choice of vendors that includes OVH, 1&1, Amazon Web Services and Google Cloud Platform. Or perhaps you'd like to run it on an existing server in a VM? Again, not an issue, with a choice of Hyper-V or VMware.

Perhaps you want to run 3CX on a dedicated PC using Windows or Linux. Again, this isn't a challenge, with 3CX designed so it can run from an Atom-based system such as an Intel NUC box.

ABOVE **You don't need a full-blown server to run 3CX on-premises: this Intel NUC will do the job nicely**

5 Instant provisioning

It's crazily easy to set new people up on their own smartphone; if they can download an app, they can do it themselves. All they need to do is download the 3CX app on Android or iOS, where they're asked to scan a QR code – this is found in Settings | Scan QR Code. Within an instant of lifting their phone to the screen, the app will have all the settings they need.

6 Switch from audio to video mid-call

Many people prefer making audio calls to video, but there are times when you realise you need to speak face to face – perhaps to share something you can see. With 3CX, it's possible to jump from one medium to the other mid-call – in fact, it's as simple as pressing a button.

If you want to invite other people – and, in effect, create an ad hoc video conference – that's no problem, either. Just use the Add Caller button to invite them.

7 Save a heck of a lot of money

Some cost savings are obvious. If you're a larger business servicing an old PBX then switching to 3CX could save you thousands of pounds per year on annual contracts alone. However, even the tiniest of companies could save cash. There's even a permanent four-SIM Standard licence that's free of charge, which is enough for 16 extensions.

But some savings are more subtle. "3CX has cut Phillip's phone costs sharply," said Bob Bell, director of information technology at Philips Securities Group. "Voice calls go out over the IP phone system, and are routed over the PSTN at the lowest cost. The company's eight offices are bridged, and inter-office calls become free with IP telephony."

Want to try it yourself? Head to **www.3cx.com** and download it for free.

BELOW **Setting up a smartphone client is as easy as scanning a QR code**

Reviews

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

Microsoft Surface Pro 6

The Surface Pro is still the king of 2-in-1 detachables, thanks to its sparkling screen and turn of pace, but it's not as big an upgrade as it should have been

SCORE ★★★★☆

PRICE As reviewed, £958 (£1,149 inc VAT) from microsoft.com/uk

How do you approach the sixth iteration of a hugely popular product? If anyone should know, it's Microsoft: just look at how successfully it's brought incremental improvements to Office. But, if you're expecting a Ribbon-style revolution, prepare to be disappointed. This is more Office 2003 to Office 2007, with incremental improvements the order of the day.

On the surface, if you'll forgive the double meaning, the only real change is an additional colour option. Black is back, and this time it's a stylish matte finish that will turn heads. Minor internal improvements have been made, too, including an important update to the processor family – but more on that later.

Back in black

If you're familiar with the Surface Pro in the flesh from previous designs, the Surface Pro 6 won't deliver any surprises. In its naked, sans keyboard form, it looks virtually identical to every other tablet in existence. The 12.3in display is surrounded by the same chunky bezels as before, with a 5-megapixel webcam sitting top and centre. Naturally, the screen is propped up by the fold-out kickstand on the back of the screen.

It's a real lean machine, about the same size as a copy of *PC Pro*. On its own, it weighs an ultralight 770g; with the Type Cover, it's still only 1.08kg, which means it can be held easily in one hand.

Depending on how you look at it, Microsoft has taken a sensible approach to the ports or a bizarrely conservative approach. We side with the latter view. While a USB-A 3 port is always a good inclusion, as is the 3.5mm audio jack and the microSD slot (which is tucked away on the back, concealed beneath the fold-out stand), it's bizarre to stick with a mini-DisplayPort when USB-C offers so much more flexibility. Especially if you use the Thunderbolt bus.

Microsoft sticks with its Surface Connect port, with the power supply's sucker clipping on the lower right-hand side via the magical power of magnets. The Surface Connect isn't just for power, though: buy a £190 Surface Dock and you can add four USB ports, wired Ethernet and two more mini-DisplayPorts.

The rear of the laptop bears the Microsoft logo and the 8MP rear-facing camera, with auto-focus and 1080p video-recording capabilities. Quality is fine but a long way short of flagship phones such as the Google Pixel 3 (*see p70*) and Huawei Mate 20 Pro (*see p68*), but that makes sense. After all, who walks around with a £1,000 2-in-1 laptop to take videos or photos? Write in if you know the answer.

ABOVE The keyboard and stylus are both excellent, but also both overpriced

Conforming to type

The bottom edge of the Surface Pro 6 holds a magnetic connector strip that the Surface Type Cover snaps into. It's an exceptionally streamlined process, and it's equally easy to separate them. It's the highest form of compliment that almost all detachable 2-in-1 laptops now use a similar design.

Microsoft supplied the basic £125 Surface Pro Type Cover to accompany our review sample. It's compact but there's a nice amount of give when you press down on keys because the cover is raised at an angle and is so lightweight. If you're a heavy-handed typist, this takes some getting used to. Otherwise, though, its drawback is well documented: typing with the Surface Pro 6 on your lap is possible, but not something you'll want to do often.

If you want a touch more luxury, you can pay £150 for a Signature Surface Pro Type Cover. These allow you add a touch of personalisation thanks to a choice of colour – platinum grey, cobalt blue and burgundy – but their other benefit is the spill-proof Alcantara coating.

You should seriously consider buying a Surface Pen. This is a lovely, accurate stylus that's handy for drawing or note taking, but it's disappointing that it isn't bundled in – £100 is way too steep. One nice touch, though, is the clicker at the top, to which you can assign shortcuts. It would come in extremely handy during a slideshow presentation, for example.

We could live without the Surface Pen, but the keyboard accessory is essential. When folded up it also serves as a screen protector, so you can chuck the Surface Pro in a backpack or handbag without worrying about scratches.

"On the surface, if you'll forgive the double meaning, the only real change is an additional colour option: black is back"

Pixel power

The 12.3in, 2,736 x 1,824 display specifications remain identical to the 2017 Microsoft Surface Pro. Performance results are still excellent, but have dropped slightly since last year. In our calibration tests the sRGB colour gamut coverage was clocked at 88.6%, whereas last year's model had a coverage of 94.3%.

Delta E colour accuracy is also down: the previous Surface Pro had an average Delta E of 1.16, while the 2018 iteration managed 1.28. That's still an excellent score and up to professional standards, mind you, and to the naked eye there would be no difference. The maximum brightness on the Surface Pro 6 display is an exceptional 416cd/m² – that's slightly lower than in 2017, but vivid enough for work in bright conditions. The 1,308:1 contrast ratio is basically the same as last year's.

It's still a brilliant screen, but don't be lured into choosing the colour profile mode called Enhanced. This gives everything a garish, oversaturated tone that's similar to the "vibrant" modes found on many smartphones. On the Surface Pro 6, sRGB mode is the way to go.

ABOVE Oh Microsoft, why haven't you upgraded the ports as well as the insides?

Speed bump

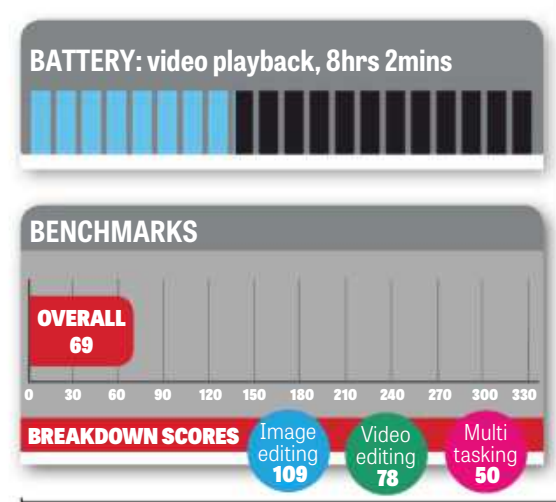
While the display quality may have suffered a small knock, performance is on the up. In our media-creation benchmarks, which measure the speed of video encoding, image editing and multitasking, the quad-core Intel Core i5-8250U CPU helped the Surface Pro to a solid overall score of 69. That's faster than the 60 achieved by the 2017 Surface Pro, which had a dual-core Intel Core i7 processor on board, and far surpasses the Dell XPS 13 2-in-1 (it scored 31), which also housed an Intel Core i7.

This isn't an irrelevant result. A score of 69 indicates the Surface Pro 6 is an all-rounder, capable of being your main machine, while the XPS 13 2-in-1 feels relatively lightweight. Fine for basic office tasks, but it will stutter under pressure.

It's a little unfair to compare the Surface Pro 6 to the Dell XPS 15 2-in-1 – one weighs close to 1kg and has a 12.3in screen, the other is a 15.6in behemoth that weighs 2kg – but the Dell's overall score of 123 shows how much power is on offer from other convertible designs.

The XPS 15 2-in-1 also has the advantage of AMD Radeon RX Vega M GL graphics, while the Surface Pro 6 must make do with Intel's integrated UHD 620 Graphics. These managed an average frame rate of 26.9fps in the GFXBench Manhattan 3 test, and 35fps in the *Dirt: Showdown* 720p benchmark at High Detail. It's well suited to a spot of *Minecraft* or *Sim City*, but don't try to play any Triple-A games.

Given the impressive 11hrs 33mins of video playback battery life on the 2017 Surface Pro, we expected the Surface Pro 6 to go the same distance. We're sorry to report that it's considerably worse, managing 8hrs 2mins of continuous video before running out of steam. Compared to other 2-in-1 laptops, that's still a commendable result but, due to the marathon battery life of the 2017 Surface Pro, we can't help but be disappointed.



The right spec for you

Of course, all those results are based on the model we were sent: a Core i5-8250U CPU, 8GB of RAM and a 256GB SSD. That costs £1,149 inc VAT, but as you can see from the pricing table above, five options are available. Note that, at time of publication, only three of the five were available in black.

PRICING TABLE

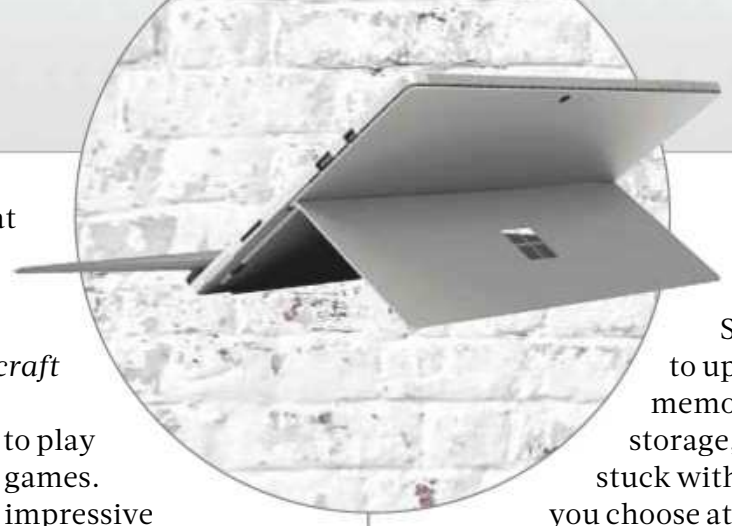
Processor	RAM	SSD	Colours	Price inc VAT
Core i5-8250U	8GB	128GB	Grey	£879
Core i5-8250U	8GB	256GB	Black, grey	£1,149
Core i7-8650U	8GB	256GB	Black	£1,429
Core i7-8650U	16GB	512GB	Black, grey	£1,799
Core i7-8650U	16GB	1TB	Grey	£2,149

With no way to hack into the Surface Pro 6 to upgrade the memory or storage, you're stuck with the spec you choose at the time of purchase. As is obvious from the table, there's a big jump from the i5/8GB/256GB model to the i7/16GB/512GB option, and unless you need the extra storage on-board we'd suggest the £1,149 model offers the best value for money.

And let's not forget that none of those prices include a keyboard or the stylus. It's worth remembering that Microsoft sells the Surface Book 2, where the screen detaches from the rigid base, and you can buy the 13.5in/Core i5/8GB/256GB model for £1,299.

Business buyers should also note that all the prices in the table are for the Surface Pro 6 with Windows 10 Home. If you want Windows 10 Pro, you'll pay an extra £100 for the Core i5 models (which use the Core i5-8350U rather than the i5-8250U) and another £50 for the Core i7 offerings. They're only available in grey, too.

BELOW The Surface Pro 6 can be used at virtually any angle thanks to that flexible kickstand



LEFT You don't have to buy the Surface Pro 6 in black, with platinum grey versions still on sale if you prefer

Lift-off for the Pro 6?

The other alternative is to buy the fifth-generation Surface Pro, with Microsoft offering up to a £200 discount on its existing stock. Prices start at £599, but that's with a genuinely slow Core m3 processor, 128GB SSD and 4GB of RAM – avoid.

However, given that last year's model had superior battery life and was only a shade slower, we're tempted by the £1,599 Core i7/16GB/512GB offering or the £999 Core i5/8GB/256GB model.

"With no way to hack into the Surface Pro to upgrade the memory or SSD, you're stuck with the spec you choose at time of purchase"

Stock levels of all the models are unpredictable, and longer term there won't be a choice: it's the Surface Pro 6 or nothing. And if you want a 2-in-1 laptop that's stylish and speedy, it's still a fine – if expensive – choice. **TOM BRUCE**

SPECIFICATIONS

Quad-core 1.6GHz Intel Core i5-8250U CPU • Intel UHD Graphics 620 • 12.3in 2,736 x 1,824 display • 8GB RAM • 256GB SSD • 8MP/5MP rear/front camera • 802.11ac Wi-Fi • Bluetooth 4.1 • USB 3 • mini-DisplayPort • microSDXC reader • Surface Connect • Windows 10 Home • 292 x 201 x 8.5mm (WDH) • 770g (tablet only) • 1yr warranty

How we test

Laptops and PCs

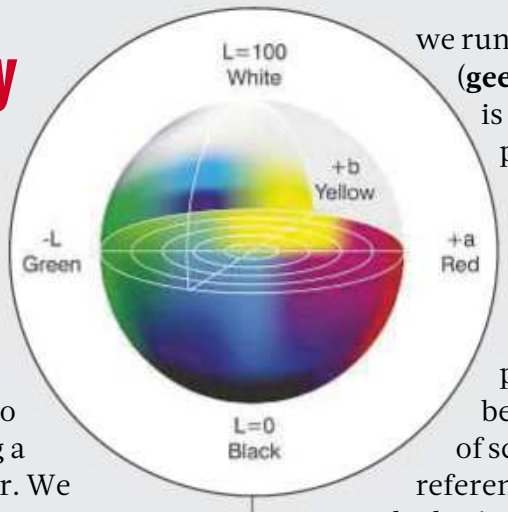
We run our own benchmarks on every Windows and macOS system we test. These are based around image editing, video editing and multitasking (where we run the video editing benchmark while simultaneously playing back a 4K video). At the bottom of each laptop and PC review you'll find the system's score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

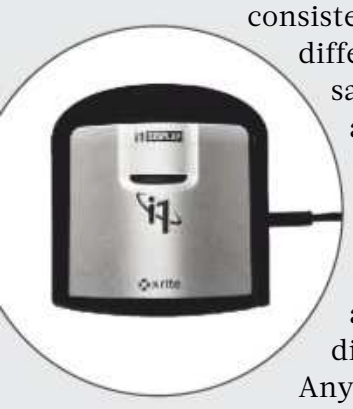
We test laptop battery life by playing back a full-screen video until the battery runs out. We set the screen brightness to 170cd/m², or as close as we can get using its settings, and switch to Flight mode.

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.



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.

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

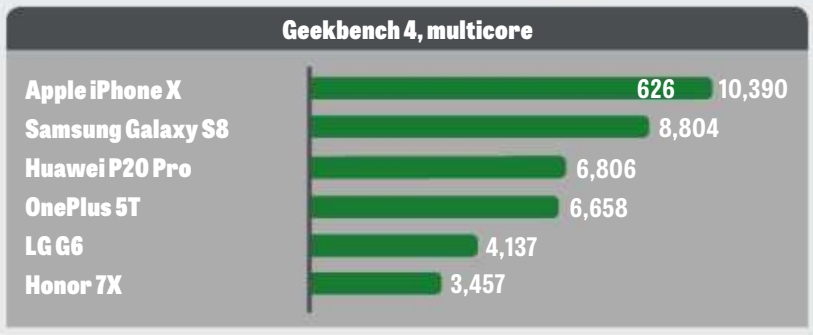
Phones and tablets

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



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.

Microsoft Surface Laptop 2

Flawed genius, but there's so much to like about the Surface Laptop 2 that its irritations can almost be forgiven

SCORE ★★★★☆

PRICE As reviewed, £1,042 (£1,249 inc VAT) from microsoft.com

Is this the perfect ultraportable laptop? It's certainly close: from its classy design to its stunning touchscreen display, the Surface Laptop 2 seems to offer everything anyone could want. And, unlike the first version, Microsoft doesn't cripple it with Windows 10 S – Windows 10 Home sits in its place.

Let's start with the design, because this beautiful, sleek, lightweight machine deserves to be admired. At 1.25kg, you can even hold it in the palm of your hand while you type with the other. Almost precisely the width of a 12in ruler, and measuring 14.5mm slim at its thickest point, compact doesn't even start to describe it. Our review sample came in the platinum finish, but black, burgundy and cobalt blue versions are also available.

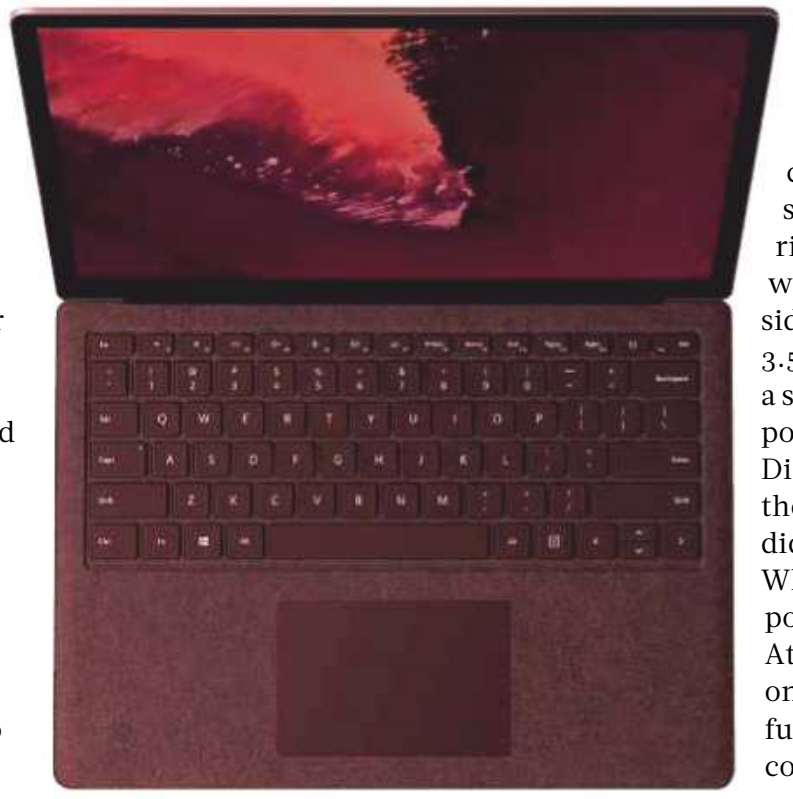
The sturdy aluminium chassis is complemented by a spill-and-stain-proof Alcantara fabric that surrounds the keyboard and touchpad. You'll find the same material on the dashboards and seats of sports cars. Not everyone loves this design touch, but it softens the metallic edges and adds a dash of luxury. I'm a fan.

But my favourite design aspect of all is the hinge. It may sound odd to say, but Microsoft has perfected the art of opening a laptop. The closed lid can be lifted and opened fully with only gentle pressure applied from a single finger, without causing any wobble or movement to the rest of the laptop. With most designs, you need to hold the base down with your other hand to prevent the laptop from sliding.

The back of the laptop is a clean, silvery slate with an elegant Microsoft logo in the middle. Every edge is curvy, smooth perfection. Likewise with the black bezels that frame the display.

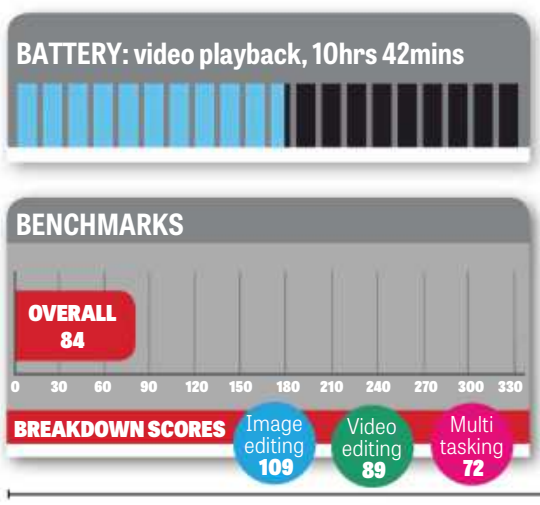
The vents are located at the rear of the laptop's base, while the speakers are hidden below the surface at the point where the keyboard meets the screen. You won't be able to crank out tunes at high volumes, but audio quality is fine if you're only listening casually or watching Netflix away from home.

BELOW It's not to everyone's taste, but the Alcantara fabric is resistant to spills and stains



Where's USB-C?

How disappointing, then, that Microsoft spoils the party with its supplied ports. Microsoft's Surface Connect charging connector sits alone on the right-hand side, while the left-hand side only offers a 3.5mm audio jack, a single USB-A 3 port and a mini-DisplayPort. It's as if the past three years didn't happen. Where's the USB-C port? Thunderbolt 3? At this price, it's only fair to demand fully up-to-date connection options.



Microsoft will point to the £190 Microsoft Surface Dock, but even this is looking old. Two mini-DisplayPorts, four USB-A 3 ports, an audio out and Gigabit Ethernet are a poor return for that outlay. Note that neither the Dock or the chassis includes an SD or microSD slot, either.

Performance upgrades

This hammers home the point that, aside from new design finishes, the Surface Laptop 2 is essentially the same piece of hardware as the original Surface Laptop. What's changed is on the inside.

The main upgrade is to the processor, with Microsoft embracing Intel's 8th Gen mobile Core processors (the 9th Gen chips we review from p54 are for desktops only). We would steer clear of the cheapest version, which is only available in grey and includes a Core i5-8250U processor, 8GB of RAM and a 128GB SSD. The only thing in its favour is a price of £979.

Microsoft has the temerity to charge an extra £280 to upgrade to 256GB, and if you want 16GB of memory, you have no choice but to pay £2,079 for the Core i7 version with a 512GB SSD or a brutal £2,529 for its 1TB sibling. Note that only the grey version is available in these 16GB of RAM configurations, too.

In Microsoft's defence, the Core i5 with 8GB of RAM and a 256GB SSD proved a potent combination in our benchmarks. When put to test in our image editing, video editing and multitasking benchmarks, the Surface Laptop 2 achieved an overall score of 84 – battering the 49 of the first Surface Laptop. It's helped by the PCIe SSD, which hit sequential read speeds of 629MB/sec in AS SSD.

There's no discrete graphics chip tucked away so you're still dependent on the limited charms of Intel's UHD Graphics 620. That stuttered to 13.8fps in *Dirt: Showdown* at 720p, and returned 70fps in the off-screen Manhattan 3 test. Both results point to the fact this machine is for lightweight gaming only.

There is one more chink in the Microsoft Surface 2's shiny armour, and that's battery life. During our video playback battery test, the power ran out after 7hrs 7mins. That's disappointing when the original Microsoft Surface Laptop made it to 10hrs 42mins. Microsoft promised a battery life of over 14hrs on the Surface Laptop 2 but, realistically, you should expect about half that.

Ergonomic highs

The good news? That's it for disappointments. Typing on the Microsoft Surface Laptop 2 is a joy, with a reassuring sturdiness to each key – plenty of travel and a hefty click make every sentence a pleasure. Nor is it annoyingly loud; you won't make any enemies if you're hammering away on public transport.

The touchpad is as responsive as any I've used, allowing me to execute Windows shortcuts with ease. The Alcantara fabric, on which your wrists rest while you type, provides an added sense of luxury. Even better, it won't be ruined if you spill a cup of coffee on it.

As with all Surface devices, the screen is gorgeous. While we don't really need numbers to back this up, there are some key ones to note: covering 96% of the sRGB gamut coverage is an excellent start, but an average Delta E score of 0.85 is nothing short of brilliant. That's the sort of colour accuracy we might see from a professional-level monitor. A top screen brightness of 335cd/m² is less exceptional, and note it's a glossy screen so you will see reflections inside, but those are the only potential complaints.

I don't have any use for a touch display on a laptop without a 360-degree hinge – I don't like how the lid wobbles each time you tap it – but the touchscreen on the Surface Laptop 2 is excellent, responding to the subtlest of gestures. Microsoft sticks to the same 2,256 x 1,504 resolution as before, with an aspect ratio of 3:2, which is great on a 13.5in laptop.

Buy now?

The Microsoft Surface Laptop 2 is agonisingly close to being a perfect ultraportable. Its design is flawless, both functionally and aesthetically, and unless you want to play heavyweight games then the performance from this Core i5 incarnation is more than good enough.

However, it's flawed. USB-A and mini-DisplayPort look dated now, so how will they appear in two years' time? That's why the Surface Laptop 2 falls short of a recommendation, especially when the identically specified Dell XPS 13 costs £50 less (albeit with a lower resolution screen).

Despite these issues, I still fell in love with the Microsoft Surface Book 2. Yes, it's expensive. Yes, the ports are collecting a pension. And yes, battery life could be better. However, the Surface Laptop 2 is a highly desirable device, and I want one. **TOM BRUCE**

ABOVE The back of the laptop, with its understated logo, is elegant and clean

"Typing on the Microsoft Surface Laptop 2 is a joy – plenty of travel and a hefty click make every sentence a pleasure"

ABOVE The screen is stunning, but it's glossy so beware of reflections inside

BELOW The lack of USB-C ports – there's only a USB-A and mini-DisplayPort – is odd to say the least

SPECIFICATIONS

Quad-core 1.6GHz Intel Core i5-8250U processor • Intel UHD Graphics 620 • 8GB LPDDR3 RAM • 13.5in PixelSense touchscreen, 2,256 x 1,504 resolution • 256GB SSD • 720p webcam • 2x2 802.11ac Wi-Fi • Bluetooth 4.1 • USB-A 3 • mini-DisplayPort • Surface Connect power • Windows 10 Home • 308 x 223 x 14.5mm (WDH) • 1.25kg • 1yr warranty

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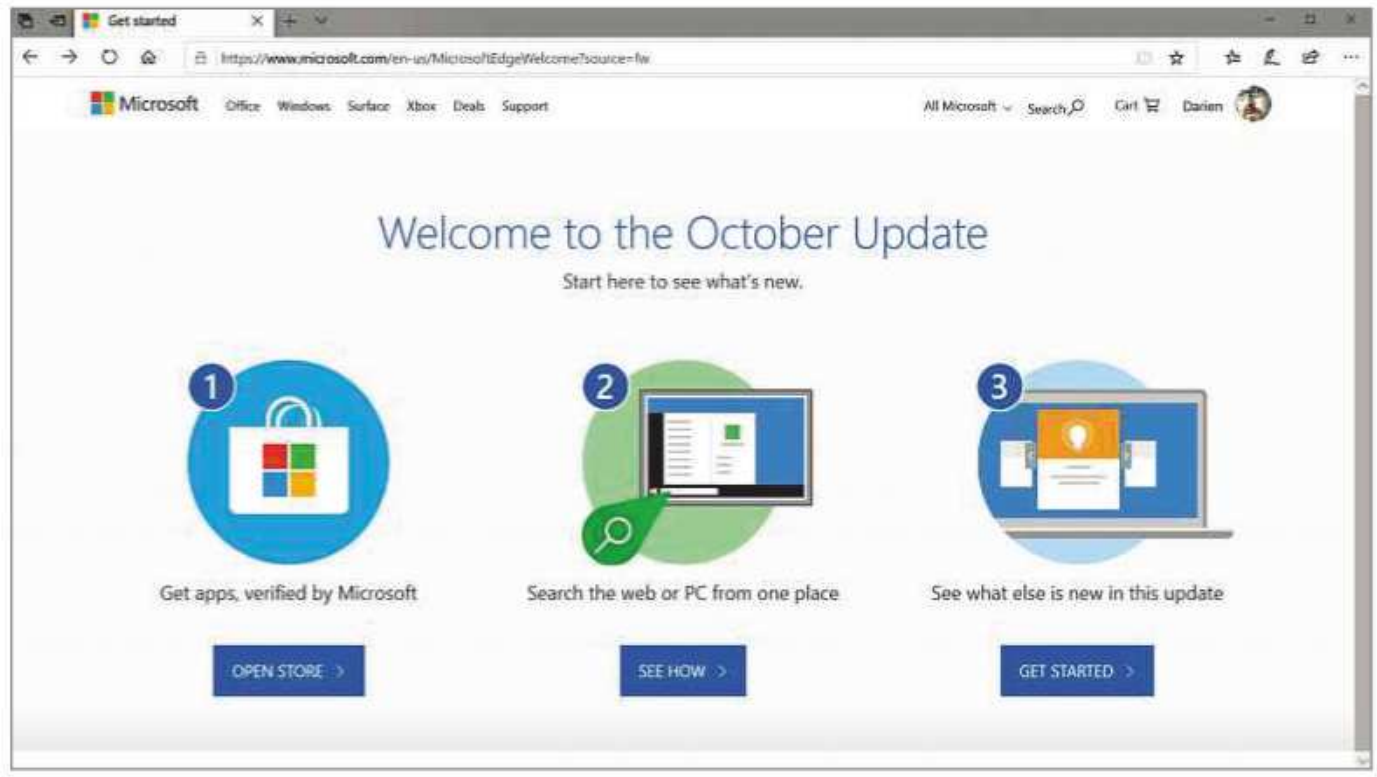
Microsoft Windows 10 October 2018 Update

No headline-grabbing new features, but this is yet another steady upgrade... if you ignore its early hiccups

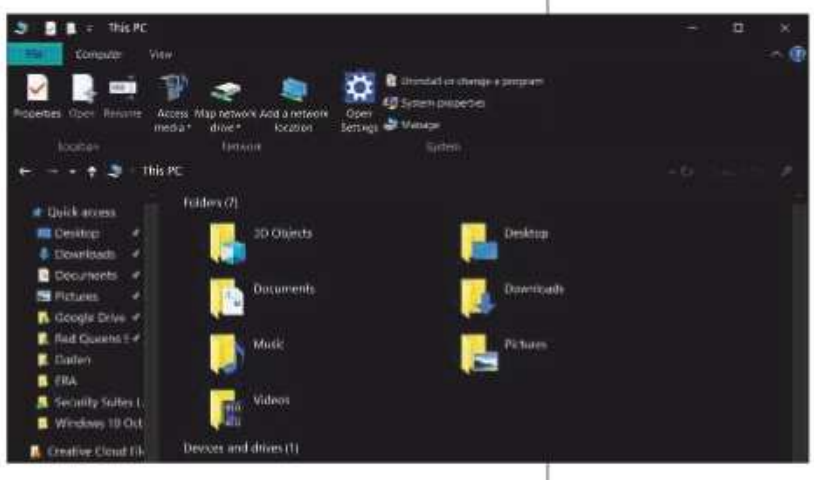
SCORE ★★★★☆

PRICE Free for existing Windows 10 users from pcpro.link/291win10



The latest major update to Windows 10 is upon us. Codenamed "Redstone 5", and internally identified as build 1809, it has the catchy official moniker of October 2018 Update. Chances are that your machine will have already been quietly upgraded through Windows Update, but you can download the upgrade assistant directly from **pcpro.link/291win10**.

Let's address the elephant in the room. When the update was first released, there were reports of files being deleted (*see p14*). But there's no need to panic. The bug only affected a tiny proportion of upgraders – namely those who had moved their personal folders to locations other than the default – and Microsoft moved quickly to remedy the situation.



Certain users have also reported that the October Update installer broke their Intel audio drivers, leaving them with no sound in the updated OS. This issue has already been remedied, with a patch now being pushed out via Windows Update.

So, while these early bugs are embarrassing for Microsoft, they shouldn't put you off downloading the October update. Especially when there are so many nifty features for power users, as we explore in our "Power Tips" article starting on p30.

Visual changes

When you first boot up after installing the October 2018 Update, you'll have to look closely to spot any graphical changes. Yet the visual style does continue to evolve, as it has in the last two updates. Explorer windows now have sober grey borders by default, rather than the coloured edges of the previous release, and there's a wider use of shadow and transparency to give more sense of depth. The effect is understated but helps the desktop feel more coherent and professional.

There are also some fresh display options to play with. A new Dark Mode gives a moody black background to the File Explorer, Settings and various other apps and components. It remains to be seen whether many users will really make use of this, especially since you have to delve into the Settings app to turn it off and on, but it's nice to have the option. There's perhaps an element of keeping up with the Joneses too, as macOS acquired a similar feature in its Mojave release.

Elsewhere, you'll find it's now possible to adjust the system font size independently from icons and other interface elements – useful for high-DPI screen users who want extra readability without scaling up the whole interface. It's good news for those with impaired vision, and indeed the option is tucked away in the Ease of Access settings. It takes a bit of fiddling to get good results, though, and it's a pain that you have to sign out and in again to actually see the effect of your changes: hopefully this will be made smarter in a future update.

ABOVE The update is free for existing Windows 10 users – you may have already been upgraded

"While these early bugs are embarrassing for Microsoft, they shouldn't put you off downloading the October Update"

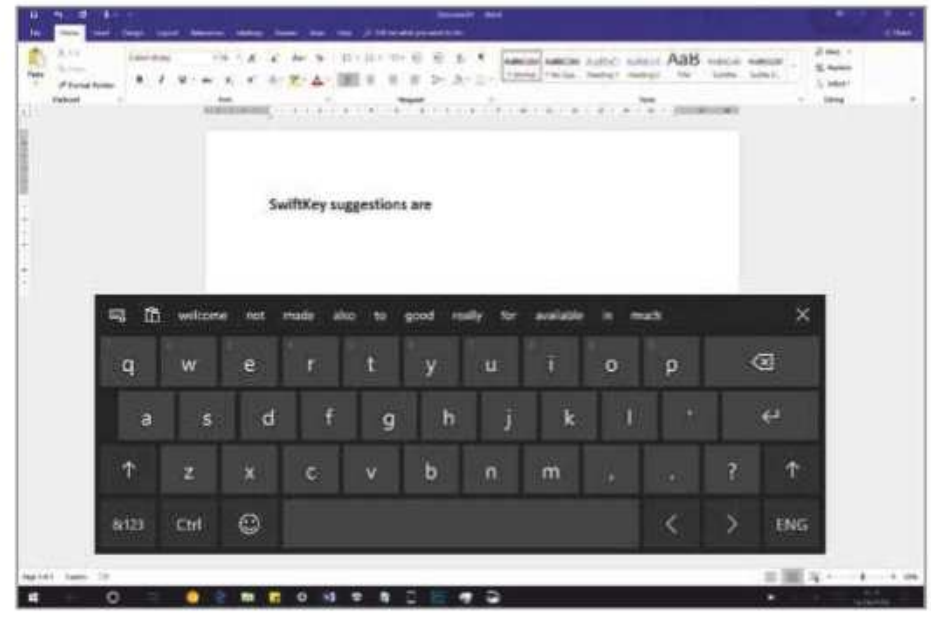
LEFT The new, moody Dark Mode aims to reduce eye strain at night and in low light

A final enhancement is the addition of HDR options to the Display Settings page. You can see at a glance whether your display devices support HDR streaming and gaming, calibrate how HDR content is rendered and disable HDR when running on battery power.

Tablet mode and smartphone enhancements

To the surprise of absolutely no-one outside of Redmond, Windows 10 hasn't caught on as a tablet platform. Its touchscreen mode has gradually been getting more usable, though, helped along by the swipe-to-type option included in the 2017 Fall Creators Update. Dragging a finger (or stylus) around the virtual keys is an easier way to enter text than tapping out each letter, especially one-handed. It's also much more pleasant than repeatedly jabbing your digits against an unyielding glass screen.

Now, the October Update integrates the full SwiftKey virtual keyboard, following Microsoft's acquisition of its publisher back in 2016. This speeds up typing by adding smart predictive suggestions, based



BELOW The SwiftKey keyboard for tablets suggests words based on your habits, which should speed up typing

on your personal usage, so you can often select *le mot juste* with a single tap. If you're using SwiftKey on your Android smartphone or iPhone, the database synchronises across devices, giving the keyboard a head start on predictions. I won't be ditching my physical keyboard any time soon, but these improvements make me a lot more open to giving Windows 10's tablet mode a whirl.

SwiftKey underpins another neat new cross-platform feature, too: the Clipboard History tool. On the desktop, you can access this by pressing Windows+V instead of Ctrl+V in any app. This pops up a window showing all the fragments of text you've recently copied (and images from compatible apps), and allows you to insert any of them with a click. This history can be synchronised across all your Windows 10 devices, and with a forthcoming SwiftKey update, it will be available on your smartphone, too. If you're squeamish about Microsoft having access to everything you copy, you can simply leave the sharing feature disabled.

The October Update also sees the Your Phone app become an integrated part of Windows. This allows Android users to read and reply to SMS messages from the desktop, and drag and drop files and photos from your mobile device onto your PC. The app is basic, but it's clean and convenient, and I like the way you don't need to take your phone out of your pocket to review and share your recent photos – you just need both devices to be on the same wireless network. It's a shame it can't pick up videos, though.

Other new features

The October Update also brings a host of small but welcome refinements, scattered liberally throughout the OS. One is an update to Windows' built-in screenshot function: the old PrtScn button works as it did before, but you can now also press Shift+Windows+S to access the Snipping tool. This lets you grab a selected marquee, a freeform area or the whole screen, and immediately edit, crop and share it in the Snip & Sketch app.

If you're more interested in capturing game footage, you'll be glad to know that the Game Bar has been souped up: now, when a game's in progress, it shows a live frame rate counter, plus at-a-glance stats showing CPU, GPU and RAM usage.

For those seeking to eke out as much battery life as possible, the Task Manager has been updated with a new column showing how much power each process is consuming. Once it's been running a while, a "trend" indicator gives you an idea of each program's long-term power profile.

On the subject of Microsoft pushing its own technologies, a subtle change is that the Start menu now automatically pops up web search results from Bing, rather than waiting for you to request them. Weirdly, the firm has also built a "Search with Bing" capability into Notepad, a feature no-one was asking for.

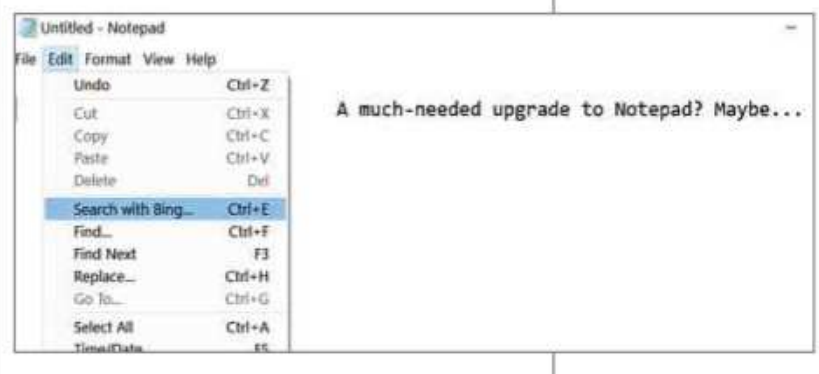
That application sees some more useful changes, too. Notepad can now correctly parse text files created on Unix and macOS systems; you can change the text zoom; the Find and Replace function can now search whole documents (rather than only going up or down from the insertion point); and you can enable a new status bar showing line and column numbers. The Registry Editor also gets a clever new feature: when you want to navigate to a particular key, there's now a autocomplete function that makes it far, far quicker to type in lengthy paths.

Windows' built-in ransomware protection feature gets a much-needed brush-up, making it easier to whitelist a trusted program: before, you had to delve into your Program Files folder and locate the executable by hand, whereas now you can browse a list of recently blocked apps and unblock each one with a click. Microsoft has also taken the chance to crowbar in an advert for OneDrive, encouraging you to keep copies of your files in the cloud, so you can simply roll back to a previous version if anything untoward should happen.

The Edge browser gets a smattering of cosmetic tweaks, but the thing I'm happiest to see is a set of new options for handling auto-playing videos. You can block all such content, allow it only on specific sites, or tell Edge to automatically mute the audio until you click to enable it.

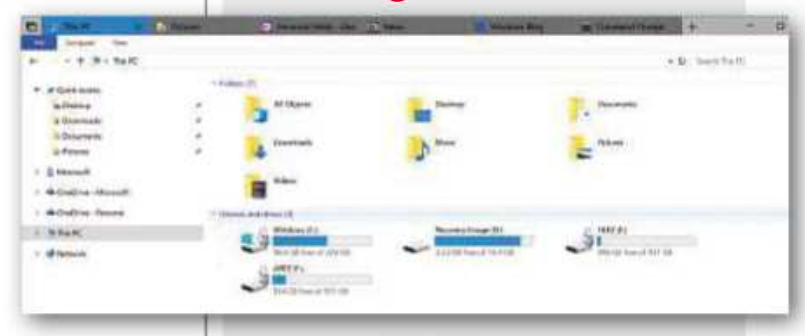
Lastly, the October Update brings Windows 10 fully up to date with the latest Emoji standard, which includes new bald and red-haired smilies, plus icons for badgers, mangoes, DNA, toilet paper and more. As before, you can access Windows' built-in Emoji panel by pressing Windows+full stop.

BELOW The Your Phone app allows you to drag and drop photos from your phone to your PC



ABOVE You can now search Bing directly from Notepad, but we're not sure anyone will actually do so...

Missing Sets



The October Update was expected to debut an ambitious new productivity feature called "Sets", which lets you collect applications together as if they were tabs in a browser. For example, you could have a single window with tabs along the top for switching between a web page, a File Explorer window and a Word document. It's a promising idea, but the company has decided it's not yet ready for prime time – so, unless you're on the Insider track, you'll have to wait until the next major update to try it out.

We also had high hopes when Microsoft announced that, starting with the October Update, Windows 10 would use machine learning to analyse your schedule and figure out the least intrusive time to install updates. For sure, it's a positive step if it means your computer is less likely to restart in the middle of a meeting. Disappointingly, though, it does nothing at all to prevent your work from being lost when that spontaneous reboot finally rolls around. Must try harder, Microsoft.

Verdict

It's only six months since the last major release, so if this update isn't a huge step forward, we shouldn't be too surprised. It would have been nice to have one big new feature to play with, though. Without Sets, it feels like a lot of side salad and no steak.

Nevertheless, lots of little plus points do add up to a worthwhile update, and you're bound to find something to like. The new mobile features might be modest, but they're an encouraging step towards an OS that works cleanly and seamlessly with non-Microsoft devices. Add in the fact that it's free and we can't grumble.

DARIEN GRAHAM-SMITH

See p30 for our power tips for using Windows 10

PC PRO RECOMMENDED

9th Gen Intel Core desktop CPUs

The latest range of processors is here – but what's really new in the Coffee Lake refresh?

SCORE ★★★★★

PRICE From £292 (£350 inc VAT) from scan.co.uk

Intel has unveiled the first of its 9th Gen Core desktop processors, but if you were expecting big things, prepare to be disappointed: they're very similar to the 8th Gen models. If you're in the market for a desktop PC, however, then take a careful read. The changes deliver a performance boost (as we see in our i9-9900X review on p56) that means this is set to be the high-end desktop PC choice for 2019.

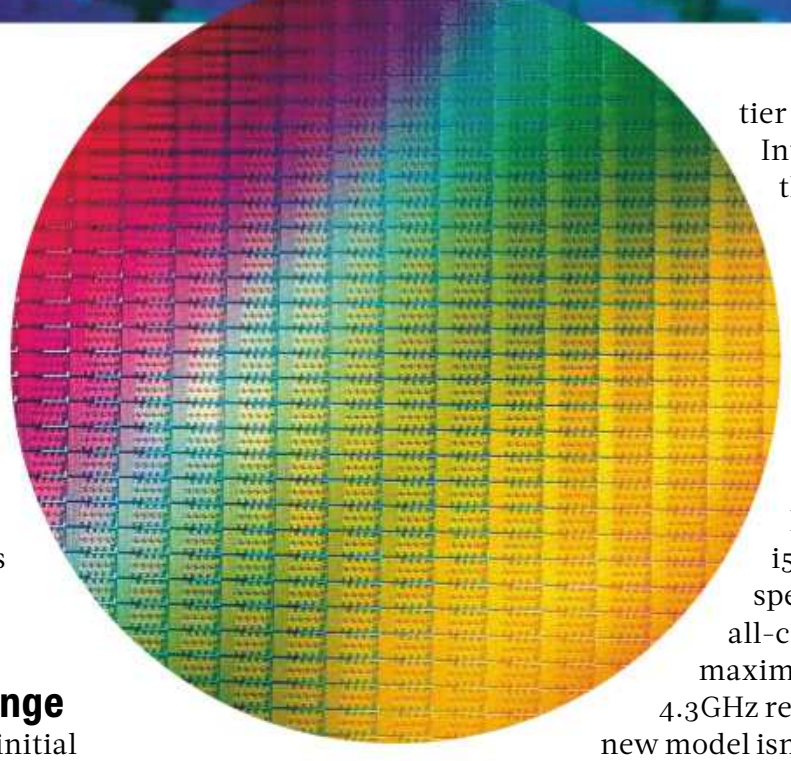
Core specs

Intel has so far announced ten 9th Gen processors. All of them are desktop models, but they divide into two ranges. Mainstream users and gamers get what's called the "Coffee Lake Refresh" – a name that if anything oversells the chips, since the CPU and GPU cores are exactly the same as found on last year's Coffee Lake models. However, clock speeds are higher, and the Core i7 has more physical cores than before. They're supported by the new Z390 chipset, which also introduces a handful of technical advances.

Meanwhile, for professional creators demanding extreme desktop performance, there's a range of new X-series chips. These too use the same internal designs as last year's X-series chips; those were based on the Skylake-X core, so this year's crop is the Skylake-X Refresh.

Mainstream range

Unexpectedly, Intel's initial tranche of mainstream 9th Gen chips doesn't include a Core i3 processor. That's presumably because the emphasis is on performance, which isn't a key consideration for lower-tier chips. Instead, Intel has extended the range upwards, offering the first Core i9 chip for regular desktop motherboards.



ABOVE Intel has used a soldered thermal interface material (STIM) for the first time in the new chips

For the Core i5-9600K, all that's new is the clock speed: last year's Core i5-8600K had a base speed of 3.6GHz, with all-core and single-core maximums of 4.1GHz and 4.3GHz respectively. The new model isn't a huge step up, but it's hard to complain as the price has barely changed at all: Intel quoted a $262 price for the i5-9600K, versus $257 for the older model's launch price. Those prices are for bulk orders,

Model	Process	Base speed	Max all-core turbo speed	Max single-core turbo speed	Cores	Hyper-Threading	GPU	L3 cache
Core i5-9600K	14nm	3.7GHz	4.3GHz	4.6GHz	6	✗	UHD Graphics 630	9MB
Core i7-9700K	14nm	3.6GHz	4.6GHz	4.9GHz	8	✗	UHD Graphics 630	12MB
Core i9-9900K	14nm	3.6GHz	4.7GHz	5GHz	8	✓	UHD Graphics 630	16MB

Model	Process	Base speed	Max all-core turbo speed	Max single-core turbo speed	Cores	Hyper-Threading	GPU	L3 cache
Core i7-9800X	14nm	3.8GHz	4.4GHz	4.5GHz	8	✔	None	16.5MB
Core i9-9820X	14nm	3.3GHz	4.1GHz	4.2GHz	10	✔	None	16.5MB
Core i9-9900X	14nm	3.5GHz	4.4GHz	4.5GHz	10	✔	None	19.25MB
Core i9-9920X	14nm	3.5GHz	4.4GHz	4.5GHz	12	✔	None	19.25MB
Core i9-9940X	14nm	3.3GHz	4.4GHz	4.5GHz	14	✔	None	19.25MB
Core i9-9960X	14nm	3.1GHz	4.4GHz	4.5GHz	16	✔	None	22MB
Core i9-9980XE Extreme Edition	14nm	3GHz	3.8GHz	4.5GHz	18	✔	None	24.75MB

note. If you want to buy the retail version of the Core i5-8600K now, it costs £350 inc VAT from **scan.co.uk**.

It's a similar story with the new Core i7. Although the base clock is slightly down on last year's flagship i7-8700K (from 3.7GHz to 3.6GHz), all-core and single-core turbo speeds are up – from 4.3GHz and 4.7GHz respectively. There's also been a significant change to the core configuration: where the i7-8700K had six cores servicing 12 threads, the new model has no Hyper-Threading but eight physical cores. The effect of this will very much depend on the workload, but with 33% more silicon in the package we'd expect to see a performance gain. It's launching at $374, slightly up from last year's $359.

With the Core i9 we're in somewhat uncharted waters, since all previous Core i9 models have been Skylake-X chips with very different (and more expensive) architectures. Look at the specs, though, and it's clear what we're dealing with: it's basically the same as the Core i7, with the addition of Hyper-Threading, more L3 cache and a tiny speed boost. In case there was any doubt about who it's aimed at, Intel is pitching it as "the best gaming processor in the world".

It's worth mentioning that, like all K-suffixed processors, these chips come with Turbo speeds unlocked. To an extent, therefore, the advertised higher clock speeds aren't all that meaningful. However, for the new chips Intel has also made a significant change in its manufacturing process, using "STIM" – soldered thermal interface material – instead of cheap thermal paste to connect the cores to the heat-spreader on top of the chip. This should enable more efficient cooling, helping 9th Gen chips to hit higher speeds than their predecessors.

The new chips also include hardware measures to address the recently discovered Spectre and Meltdown exploits. In previous Coffee Lake chips, these patches were implemented in the firmware, and could reduce overall system performance by a few percentage points. That slowdown is now effectively eliminated, giving 9th Gen Core processors another small performance advantage.

Enthusiast range

The first thing you might notice about Intel's new X-series chips is that they have seemingly skipped a generation: the model numbers have leapt from the 7000s straight to the 9000s, bringing the high-end range into line with the mainstream.

In reality, though, very little has changed. The Skylake-X core is exactly as chunky and powerful as it ever was, and the main difference between models remains the core count (along with the amount of L3 cache available to service those cores). Prices are all but identical too, starting at $589 for the lone Core i7 model, and scaling from $898 up to $1,979 for the various Core i9 options.

The key difference between this crop of processors and the last is that, as with the mainstream chips, speeds are modestly up across the board – which is probably again down to the wonders of STIM.

AMD advantage?

The 9th Gen processors revealed so far represent a broad sweep, covering price points from $262 up to nearly $2,000. The idea is evidently that every desktop user – from home hobbyists to dedicated gamers and demanding professionals – should be able to find an Intel chip to match their budget, rather than being tempted away by AMD's disruptive Ryzen platform.

Whether the new chips are a smart buy is harder to say. Intel's prices tend to work out higher on a per-core basis than AMD's, but its cores are individually more capable – so your best buy depends on the particular sort of work you have to do. The new Core i7-9700K could shake things up with its eight physical cores, however: for moderately demanding home and office users, it promises the best of both worlds.

"In case there was any doubt about who the Core i9 is aimed at, Intel is pitching it as 'the best gaming processor in the world'"

Verdict time

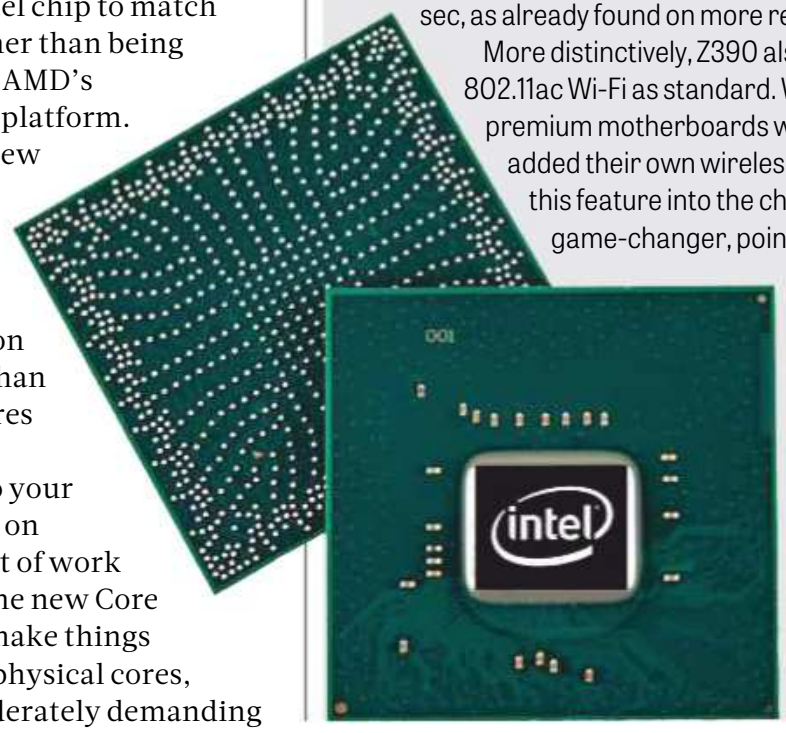
The arrival of a new generation of CPUs used to be like Christmas come early, but it's hard to get excited about yet another repackaging of Intel's 14nm core. It's a decent core, to be sure, and we understand the immense challenges the company faces in producing even faster, even smaller designs. Even so, we want more.

Nevertheless, the switch to STIM should help all these chips run faster and overclock better than ever, and it's good that the performance hit from security updates is now minimised as well. We will have to wait until next month to see just how good the mainstream models are, but you only need to look at the i9-9900X review overleaf to see its advantage. It's not a huge one, but since prices have barely changed, any improvement at all is a bonus. **DARIEN GRAHAM-SMITH**

Z390 chipset

To accompany the new desktop chips, Intel has launched the new Z390 chipset. This is largely the same as last year's Z370 – the original Coffee Lake chipset – but features two enhancements. First, it comes with built-in support for six USB 3.1 Generation 2 ports supporting transfer speeds of up to 10Gbits/sec, as already found on more recent Coffee Lake chipsets.

More distinctively, Z390 also includes integrated 802.11ac Wi-Fi as standard. We've seen plenty of premium motherboards where manufacturers have added their own wireless controllers, but moving this feature into the chipset is a potential game-changer, pointing towards a future where it becomes a standard feature on all desktop motherboards.



If you don't want to splash out on a new high-end motherboard, however, you don't have to: existing chipsets and boards designed for Coffee Lake will also work with Coffee Lake Refresh processors.

Intel Core i9-9900K

A brilliant performer with great overclocking potential, but most people should stick with a cheaper alternative

SCORE ★★★★½

PRICE £500 (£600 inc VAT)
from scan.co.uk

Intel's Core i9-9900K is ostensibly aimed at gamers – but its appeal ought to be much wider than that. It's one of only two mainstream Intel chips to include a full eight physical cores (the other one being the new Core i7-9700K), and it also delivers the highest clock speeds yet, with an insane maximum single-core turbo speed of 5GHz. This is a chip that will tear through productivity tasks just as happily as shoot-em-ups.

It's a lot easier to accommodate than Intel's enthusiast-class X-series chips, too. It will fit in the same LGA 1151 socket as last year's Coffee Lake processors, with most Z370 motherboards just needing a BIOS update to support it. And it features the same integrated HD Graphics 630 GPU, which could be a big help if you're putting together a functional desktop workstation.

So, how does it perform? With the Core i9-9900K happily installed in my own desktop system (supported by 8GB of DDR4 RAM) I began by running the standard *PC Pro* benchmark suite – and the results speak for themselves. The Core i9's excellent image-editing score of 170 showcases the benefit of those super-high clock speeds: even professional workstations with dual Xeon or Ryzen processors tend to get stuck around the 160 mark.

Nor had I any complaints about the video-editing and multitasking results. Naturally, the Core i9-9900K can't hope to compete here with the extravagant 16- and 32-core systems we've tested, but its multitasking score of 289 is up there with the best of the overclocked gaming machines we've seen, with a fantastic overall score of 266 straight out of the box.

Just to confirm what an achievement this is, I tried installing an eighth-generation Core i7-8700K in the same system – until last month, Intel's absolute top-end desktop chip – and repeated the benchmarks. This time I got a score of just 133 in the image-editing test, and 197 overall. It's good, but it's no Core i9.

If you demand even more juice, you're also free to ramp up the multipliers on the i9-9900K as far as you dare. I tried setting the all-core turbo maximum to 5GHz, and watched in wonder as the Core i9-9900K's multitasking score was lifted by nearly 30% to 359, yielding a massive overall score of 311. That's a remarkable performance, and the fact that I was able to achieve it using a Be Quiet Dark Rock 4 air cooler is a testament to the improved thermal design of Intel's ninth-generation Core chips. I wouldn't want to push this setup much higher, as temperatures were up in the area of 95°C, but we've seen reports of specialist coolers getting these chips to 7GHz and beyond.

There's no doubt that the Core i9-9900K will also handle modern games; the question here is whether it might be overkill. When I partnered the chip with an Nvidia GeForce RTX 2080 and tested *Metro: Last Light* with all visual settings turned up to maximum, performance was unsurprisingly excellent, with an average frame rate of 126fps at 1080p. That's only 3fps faster than last year's Core i7-8700K however, and tests on a comparable Ryzen 7 2700X system yielded almost identical performance.

While *Dirt: Showdown* is now getting a little long in the tooth, this title benefited more from the power of the Core i9-9900K. At Full HD resolution with Ultra visual settings, I got 148fps, versus 115fps with the older Core i7 CPU. In short, the Core i9-9900K will surely keep your games running smoothly for years to come. It's an open question as to whether it's a smart investment, though, or whether you'll be just as well off with a cheaper CPU.

ABOVE **Helpfully, the i9-9900K will fit in the same LGA 1151 socket as last year's Coffee Lake processors**

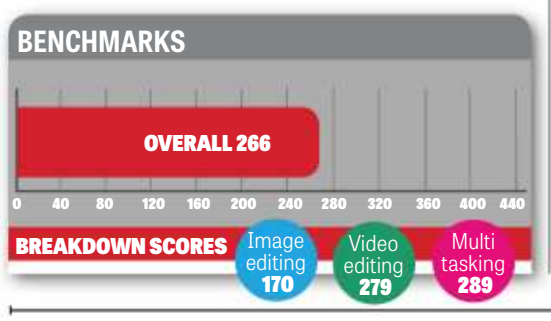
"The Intel Core i9-9900K's multitasking score of 289 is up there with the best of the overclocked gaming machines we've seen"

That indeed is the rub with the Core i9-9900K in general. It's a superbly powerful CPU, and much cheaper than Intel's Extreme range – but at £600 it's not exactly a bargain. AMD's Ryzen 7 2700X CPU doesn't quite match the Core i9's ludicrous speeds, but it provides just as many cores for half the price. Or, Intel's own Core i7-9700K hits similar clock speeds for £100 less, though it lacks Hyper-Threading.

Still, to quibble over the price is to miss the point of this chip. It's a flagship piece of silicon, and a genuine step forward in desktop performance. After hearing that Intel's ninth-generation CPUs would be using the same CPU and GPU cores as last year's models, my expectations weren't high, but the company has pulled something unexpectedly impressive out of the bag – a chip that power users and gamers alike will find extremely tempting indeed.

DARIEN GRAHAM-SMITH

BELOW **The i9-9900K will keep your games running for years, but is it overkill?**



SPECIFICATIONS

3.6GHz base frequency • 5GHz max boost frequency • Coffee Lake 14nm architecture • 8 cores (16 threads) • Hyper-Threading • 16MB SmartCache • dual-channel DDR4 memory up to 2,666MHz • Socket LGA 1151 • 95W TDP

Asus ROG Strix GL12CX

Very noisy when pushed, but if you're after raw power, the Core i9-9900X-powered Strix has it in spades

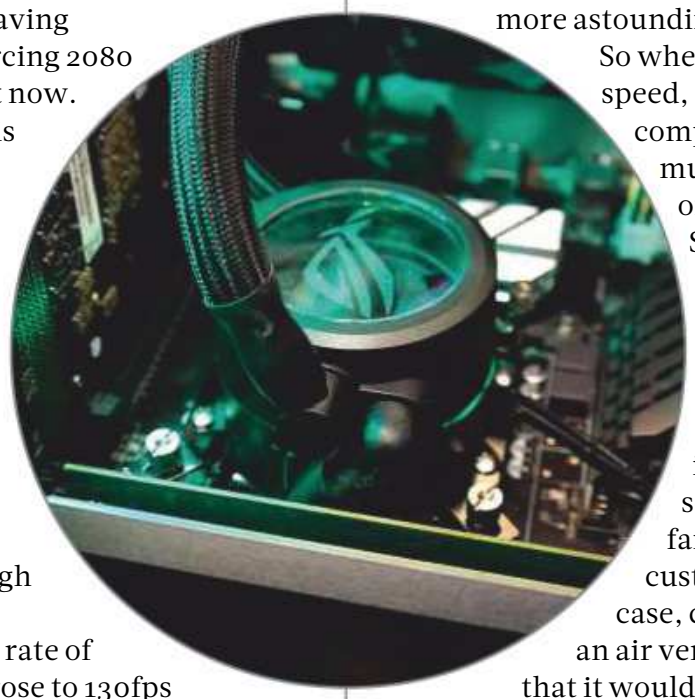
SCORE ★★★★☆

PRICE £2,500 (£3,000 inc VAT)
from rog.asus.com

How much power do you need? And what are you willing to sacrifice to get it? Those are the two key questions you need to ask when deciding whether or not to buy the astonishingly quick Asus ROG Strix GL12CX – although the £3,000 asking price may well make such matters academic.

Putting aside the cost for a moment, let's take a moment to understand what it offers. This is the first PC we've seen with a Core i9-9900X inside, and kudos to Asus for sending it in so quickly after the processor's launch – and pre-overclocking it to 4.8GHz to 0. Partnered with GeForce GTX 2080 graphics and a watercooling system, it's darn close to the enthusiast's dream machine. The only upgrade you might have hoped for is a 2080 Ti card instead of a 2080, but I suspect that even Asus is having problems sourcing 2080 Ti silicon right now.

Besides, this combination didn't exactly prove sluggish in our tests. We used to think *Metro: Last Light* was a demanding benchmark, but the Strix skipped through at 4K with an average frame rate of 63.3fps. That rose to 130fps at 1440p, but you're wasting your cash if you restrict this PC to anything less than 4K gaming. It also crossed the magic 60fps mark in *Rise of the Tomb Raider* at maximum quality settings at 4K, while it swallowed the lesser challenge of *Dirt: Showdown* whole with a 116fps average. Just for kicks, I also ran *Metro: Last Light* at 1080p. The Strix rewarded me with a 200fps average.



LEFT **Despite having watercooling inside, the ROG Strix GL12CX is obnoxiously loud when pushed**

ABOVE **The Strix feels reassuringly heavy and screams "high quality" from every viewing angle**

It should be no surprise that it blasted through our media-creation benchmarks as well. A score of 351 is frankly ridiculous, and notably its biggest gain compared to normal systems was in our multitasking test. This asks each PC to simultaneously bulk-edit photos, transcode 4K video and play a full-screen 4K film, which is normally enough to draw a silicon tear from the most stalwart of processors. The eight cores and 16 threads of the i9-9900K proved more than a match, and no doubt if Asus had supplied 32GB of RAM rather than 16GB, it would have produced an even more astounding score.

So when it comes to speed, I have no complaints. I'm much less fond of the noise the Strix makes to achieve this. You might imagine that with watercooling in place and some hefty fans in a custom-designed case, complete with an air vent at the top, that it would be able to power along without sounding like a Hoover. Sadly, that's not the case. You'll need to wear noise-cancelling headphones if playing stealth games.

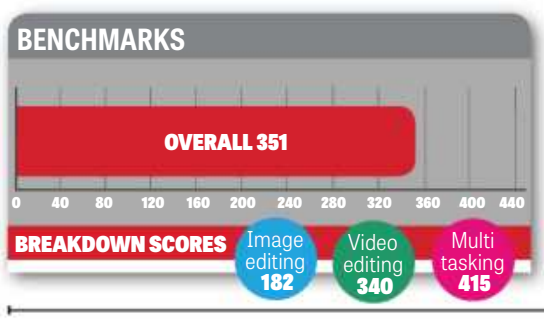
That's a shame, because everything else about the Strix's design is worthy of praise. It's compact but also reassuringly heavy: you feel like you've bought a high-quality system whenever you touch it. Oddly, it comes with both a metal side panel and a plastic viewing panel, so you can choose which you want to install. It would have made more sense to include a tempered glass panel: if you've invested this much in a machine, you surely want to gaze lovingly at its insides on occasion.

Not that Asus goes overboard with the lighting. The twin 8GB Samsung DIMMs are dull, lightless affairs, with the only light source inside the case coming from the graphics card's strip lights and LEDs on the Optane memory card: this scored devastating sequential read/write speeds of 1,497/2,673MB/sec in AS SSD. There's little room for expansion, either: no spare DIMM sockets, no empty M.2 slot, and a solitary PCIe x1 slot. And good luck squeezing your hands inside to add a card, as space is so tight even sardines would raise an eyebrow. Thankfully, Wi-Fi and Bluetooth are already provided via the motherboard.

Things get more interesting at the front. Four front-mounted USB-A ports and an SD card slot accompany a combo 3.5mm jack on a header panel at the top, and if you remove the magnetic cover you'll find a DVD writer and hot-swappable caddy for a 2.5in SSD. There's even a splash of colour, with two programmable LED strips and a backlit ROG logo.

"It should be no surprise that the Asus blasted through our media-creation benchmarks – a score of 351 is frankly ridiculous"

The big question is whether all this is worth £3,000. For the vast majority of people, the answer is no – and it misses out on an Recommended award due to its sheer noise levels when playing games. If, on the other hand, you don't care about such things, you have money to burn, and you will truly take advantage of this incredible system's power then go ahead and buy. Just remember to pick a nice pair of wireless headphones while you're at it. **TIM DANTON**



SPECIFICATIONS

3.6GHz Intel Core i9-9900K processor overclocked to 4.8GHz • ROG GL12CX Z390 motherboard • 16GB 2,666MHz Samsung DDR4 RAM • 8GB Asus ROG Nvidia GeForce GTX 2080 Turbo graphics • ROG 120mm watercooling • 512GB M.2 PCIe SSD • 2TB hard disk • Windows 10 Home • Asus ROG Strix chassis • 700W PSU • 179 x 400 x 456mm (WDH) • 1yr warranty

Chillblast Fusion Hero Gaming PC

A powerhouse of a system that provides a showcase for the Core i5-9600K and Nvidia RTX 2070 graphics

SCORE ★★★★★

PRICE £1,542 (£1,850 inc VAT)
from chillblast.com

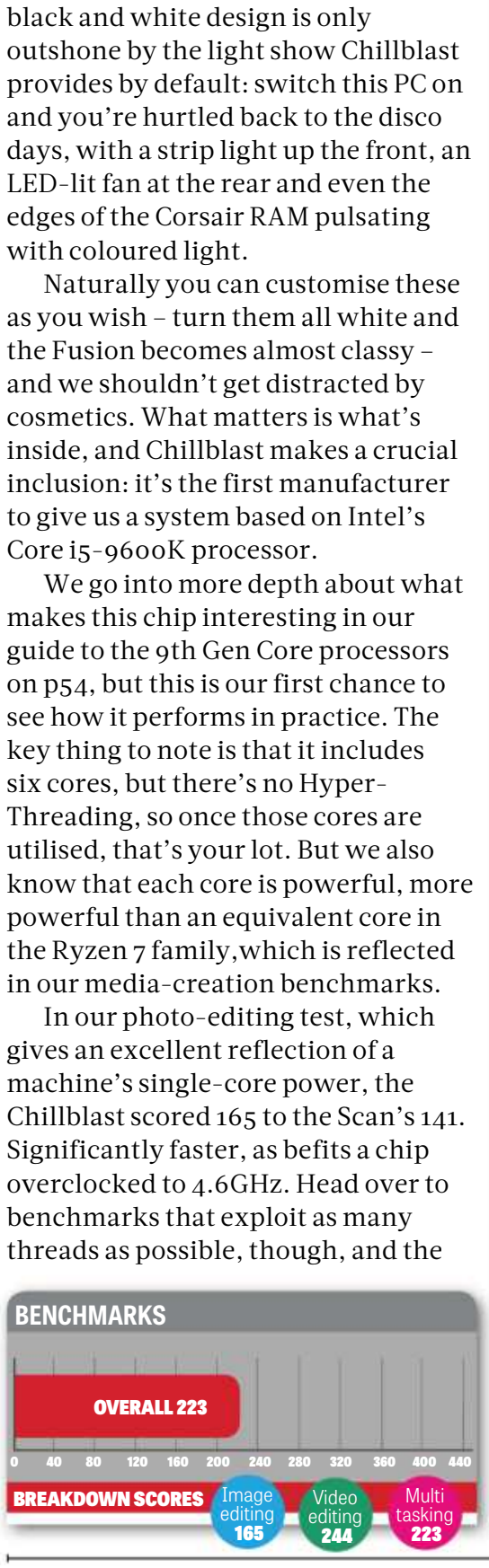
Big. Brassy. Breakneck speed. Those are the words I'd reach for if someone asked me to describe the Chillblast Fusion Hero Gaming PC (and, for some reason, restricted me to words beginning with B). And it really is big. It towers over the Scan opposite, while its angular black and white design is only outshone by the light show Chillblast provides by default: switch this PC on and you're hurtled back to the disco days, with a strip light up the front, an LED-lit fan at the rear and even the edges of the Corsair RAM pulsating with coloured light.

Naturally you can customise these as you wish – turn them all white and the Fusion becomes almost classy – and we shouldn't get distracted by cosmetics. What matters is what's inside, and Chillblast makes a crucial inclusion: it's the first manufacturer to give us a system based on Intel's Core i5-9600K processor.

We go into more depth about what makes this chip interesting in our guide to the 9th Gen Core processors on p54, but this is our first chance to see how it performs in practice. The key thing to note is that it includes six cores, but there's no Hyper-Threading, so once those cores are utilised, that's your lot. But we also know that each core is powerful, more powerful than an equivalent core in the Ryzen 7 family,which is reflected in our media-creation benchmarks.

In our photo-editing test, which gives an excellent reflection of a machine's single-core power, the Chillblast scored 165 to the Scan's 141. Significantly faster, as befits a chip overclocked to 4.6GHz. Head over to benchmarks that exploit as many threads as possible, though, and the Ryzen-powered Scan skips into the lead. This is enough to give the Scan a significant winning margin overall in our benchmarks, but note that most people, most of the time, are looking for single-task power.

You'll find full gaming results in the Scan review, and in short it's good news for Intel. The Core i5-9600K looks to be a stronger gaming chip than the Ryzen 7 2700X and, if you're looking for a 1440p gaming machine, then frankly both the Chillblast and Scan systems will fulfil the role brilliantly. Likewise for VR, with both machines scorching through VR benchmarks with outstanding scores.



LEFT **Switch on the PC and the LED-lit rear fan will start up like a machine from *Tron***

ABOVE **There are some nice design flourishes on the case, but we're not fans of the white fascia**

PC PRO ★★★★★ A-LIST

"If you're looking for a 1440p gaming machine, then both the Chillblast and Scan systems will fulfil the role brilliantly"

Chillblast opts for a motherboard based on Intel's new Z390 chipset, which has been introduced to partner the 9th Gen Intel Core processors. It's a high-spec board, too, with a ludicrous name of Asus ROG Maximus XI Hero. If you want to overclock this system then, together with the Corsair H100x watercooling unit, it provides an excellent base. The only mild disappointment is that there's no Wi-Fi module built into the board.

With a 750W PSU in place, there's potential to add another graphics card if the single GeForce GTX 2070 graphics card isn't enough for you. This will likely block two of the three empty PCIe 2 x1 slots, but one will remain free above the existing graphics card, with a PCIe 3 x16 slot sitting empty at the bottom of the board. You can also take advantage of the two empty DIMM sockets and the spare M.2 slot, with room for a second drive to keep the supplied 3TB Seagate hard disk company.

My single criticism of the Chillblast is the case, and this comes down to personal taste. There are some great touches here, including a tempered glass front panel that provides a glimpse into the internals. Naturally, bearing in mind this is quite an expensive case, there's a tempered glass side panel too. It's a shame, then, that the plastic white fascia cheapens it a little. I wouldn't want to work for long inside this chassis, either, with conditions cramped despite its size.

Personally, I'd be tempted to call Chillblast and discuss other case options, but don't throw out the DNA of the Fusion Hero Gaming PC in the process. Yes, it's £250 more expensive than the similarly powerful Scan, but it also runs much more quietly – even when pushed playing games, it never hits disturbing noise levels. If you value peace and quiet, and you don't need the heavily multithreaded performance of the Ryzen 7 2700X, then this should be your pick of the two RTX 2070 machines. **TIM DANTON**

SPECIFICATIONS

3.7GHz Intel Core i5-9600K processor overclocked to 4.6GHz • Asus Maximus XI Hero motherboard • 16GB 3,200MHz Corsair DDR4 RAM • 8GB Nvidia GeForce GTX 2070 graphics • Corsair H100x watercooling • 250GB Samsung 970 Evo M.2 PCIe SSD • 3TB hard disk • Windows 10 Home • Corsair Carbide Spec-Omega RGB chassis • Corsair RM750X 750W PSU • 233 x 495 x 516mm (WDH) • 5yr warranty (2yr C&R, 3yr labour-only RTB)

Scan 3XS Gamer RTX

The best-value choice if you're after 1440p gaming with all the advantages of Nvidia's RTX graphics cards

SCORE ★★★★½

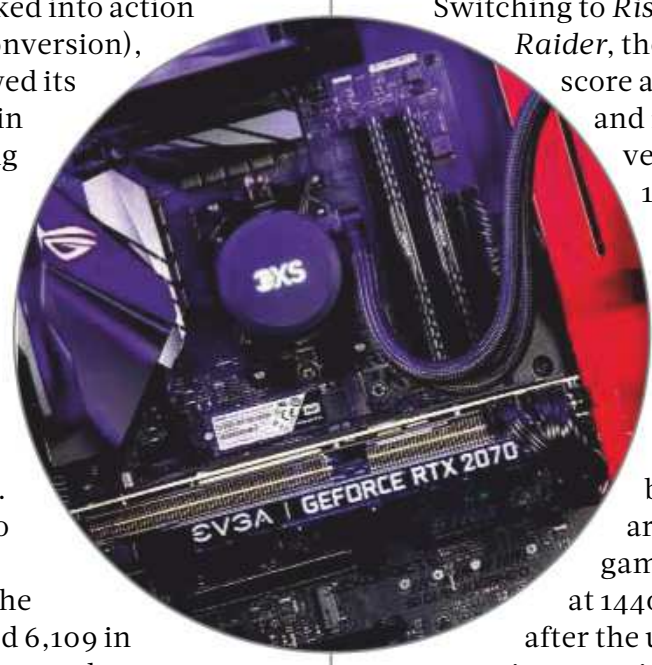
PRICE £1,333 (£1,600 inc VAT)
from scan.co.uk

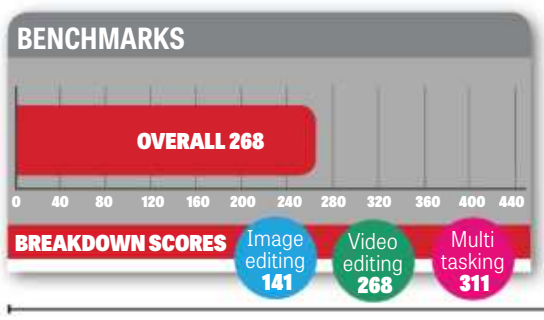
If there's one thing you can take from comparing the Scan 3XS Gamer RTX with the Chillblast Fusion Hero Gaming PC opposite, it's this: right now, AMD is killing Intel for value. Aside from the processor and motherboard, the two systems have so much in common they could be mistaken for twins (although, I admit, not in a visual sense).

They both use Nvidia's GeForce GTX 2070 graphics; they both have 16GB of fast DDR4 RAM; they both use watercooling to keep the system temperature under control and allow for overclocking; and they both use a combination of PCIe SSD and hard disk to provide the best combination of load speed and capacious storage.

When it comes to benchmarks that take advantage of multiple threads, the Ryzen 2700X – overclocked here from 3.7GHz to 4GHz – proved a clear victor over the Core i5-9600K in the Chillblast. It's slower in the single-threaded photo-editing task, but once Handbrake kicked into action (for 4K video conversion), the Ryzen showed its pace. Likewise in the multitasking section of our benchmarks, which is why the Scan's overall score of 268 is so much higher than the Chillblast's 223.

This was also reflected in Geekbench 4. The Chillblast scored 6,109 in the single-core test, a huge lead over the 4,418 scored by the Scan. However, switching to the multicore test evened things up, with the Scan just beating the Chillblast by 24,825 to 24,726.





The pendulum swung Chillblast's way in the gaming benchmarks, but not to an overwhelming extent. It was the clear winner for *Metro: Last Light*, scoring 116fps at 1440p to the Scan's 105fps. At 4K, that gap closed to 3fps (56.2 versus 53.3fps), and we saw similar results in *Dirt: Showdown*.

Switching to *Rise of the Tomb Raider*, though, saw Scan score a win at both 4K and 1440p (58.9 versus 51.5fps and 116 versus 98fps respectively).

It's easy to drown in benchmark scores, but the key thing to note is that both systems are superb gaming machines at 1440p. If you're after the ultimate 4K gaming experience, you need to find extra cash and buy a system such as the Asus ROG Strix (*see p57*).

So if the Scan is a better-value system, what are its disadvantages? The big one is noise. While the 3XS Gamer RTX is nowhere near as noisy as the Asus, it does produce an obvious constant hum. It's one of those background noises that you tend not to notice after a while, especially if you have music on in the background, but switch it off and the room suddenly seems calmer.

That's the only real complaint I could target at the 3XS Gamer RTX, though. Scan has taken its usual measured approach to system building, making sure that all the components are sensibly balanced. For instance, it doesn't waste cash on a motherboard with an X470 chipset because the 2700X can't take enough advantage of its overclocking capabilities. Instead, it sticks with the mid-range but gamer-friendly Asus ROG Strix B450-F motherboard.

This still offers plenty of room for upgrades, with two DIMM sockets sitting empty along with one empty M.2 slot, three empty PCIe 2 x1 slots (an obvious upgrade would be a Wi-Fi expansion card), plus one PCIe 3 x16 slot and one PCIe 2 x16 slot. Just note that if you ever do want to add another graphics card, you'll need to replace the 550W PSU.

There's no room in the NZXT H500 case for optical drives, but if you need to add another drive to accompany the supplied 2TB Seagate disk then it's a simple matter of removing the left-hand side panel via two thumbscrews. Naturally, such ugly things as hard disks are kept from view if you gaze through the tempered glass side panel, with a much more subdued set of lights than on the Chillblast. This reflects the overall tone of the case too, which is a wall of black. Aside from the 3XS logo at the bottom left, the only relief comes from two top-mounted USB 3 ports, a headphone and mic jack, and the power button.

Who should buy this 3XS machine? Not someone who's averse to noise – choose the Chillblast if that's you. But if you're after a top-value 1440p gaming system, and one equipped with Nvidia's excellent RTX 2070 graphics, this is a great choice. **TIM DANTON**

ABOVE If we had to sum up the all-black case in one word, it would be "subdued"

PC PRO RECOMMENDED

"Scan has taken its usual measured approach to system building, making sure that all the components are sensibly balanced"

LEFT The 3XS Gamer RTX's internals, which include a watercooling system, are bathed in a subtle LED light

SPECIFICATIONS

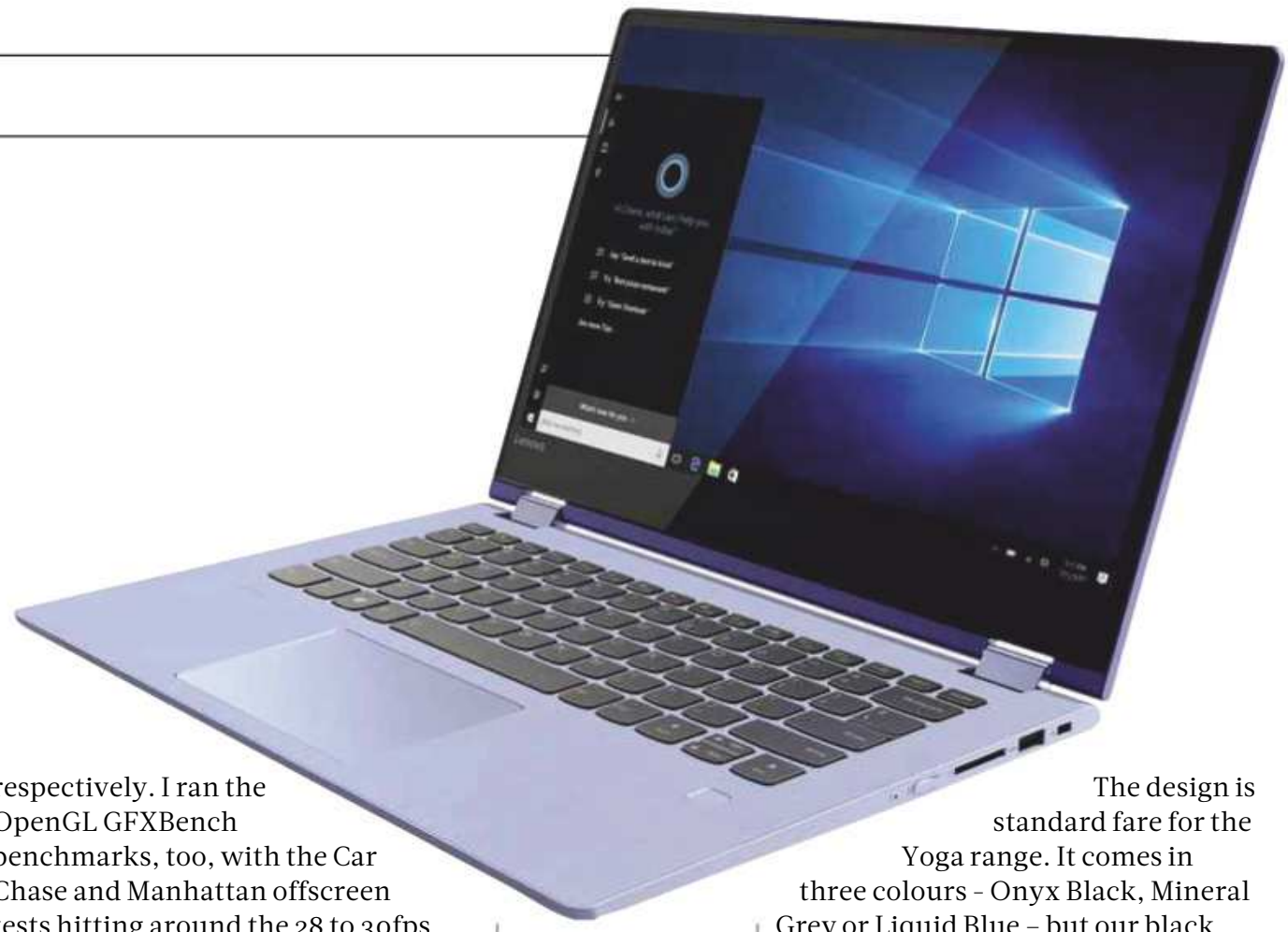
3.7GHz AMD Ryzen 7 2700X processor overclocked to 4GHz • Asus ROG Strix B450-F motherboard • 16GB 2,666MHz Corsair Vengeance DDR4 RAM • 8GB EVGA Nvidia GeForce GTX 2070 XC graphics • Cooler Master Liquid Lite 240 watercooling • 500GB WD Black M.2 PCIe SSD • 2TB hard disk • Windows 10 Home • NZXT H500 chassis • Corsair CXM 550W PSU • 210 x 428 x 460mm (WDH) • 3yr warranty (1yr on-site, 2yr RTB)

Lenovo Yoga 530-14ARR

This AMD Ryzen 7 convertible has price and half-decent gaming in its favour, but its battery life is woeful

SCORE ★★★☆☆

PRICE £625 (£750 inc VAT)
from pcworld.co.uk



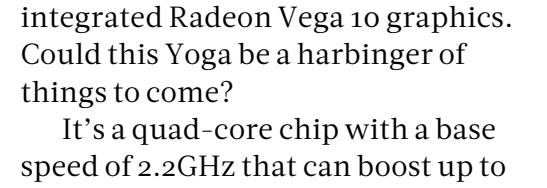
While there's nothing special in terms of the Yoga 530's design, there is something new inside: the first AMD Ryzen 7 chip we've seen in a mainstream laptop. To be precise, a Ryzen 7 2700U with integrated Radeon Vega 10 graphics. Could this Yoga be a harbinger of things to come?

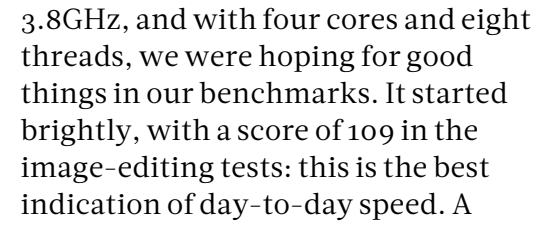
It's a quad-core chip with a base speed of 2.2GHz that can boost up to 3.8GHz, and with four cores and eight threads, we were hoping for good things in our benchmarks. It started brightly, with a score of 109 in the image-editing tests: this is the best indication of day-to-day speed. A video editing score of 75 is okay, but suggests that the processor is throttled back under sustained pressure. Where the image tests take around 90 seconds, our video edit is a 20-minute task for most CPUs.

The 8GB of supplied RAM proved a serious handbrake in our multitasking test, which is what drags the score down to 70. That means the Ryzen 7 2700U performs around the same as a Core i5-8250U processor (or a poorly cooled Core i7-8550U).

We certainly know the SSD isn't at fault. Tested with AS SSD, the 256GB PCIe drive inside the Lenovo Yoga 530 achieved continuous read and write throughput of 1,334MB/sec and 706MB/sec respectively.

You shouldn't expect a true gaming laptop for this price, but AMD's integrated Radeon Vega 10 graphics are superior to Intel's. On maximum settings at native resolution, it ran the Unigine Heaven and Unigine Valley benchmarks at 13.8fps and 14.7fps respectively. I ran the OpenGL GFXBench benchmarks, too, with the Car Chase and Manhattan offscreen tests hitting around the 28 to 30fps mark. Those are okay rather than brilliant results, but *Dirt: Showdown* scores of 42fps at 720p and 29fps at 1080p show this machine is at least capable of playing less demanding games.





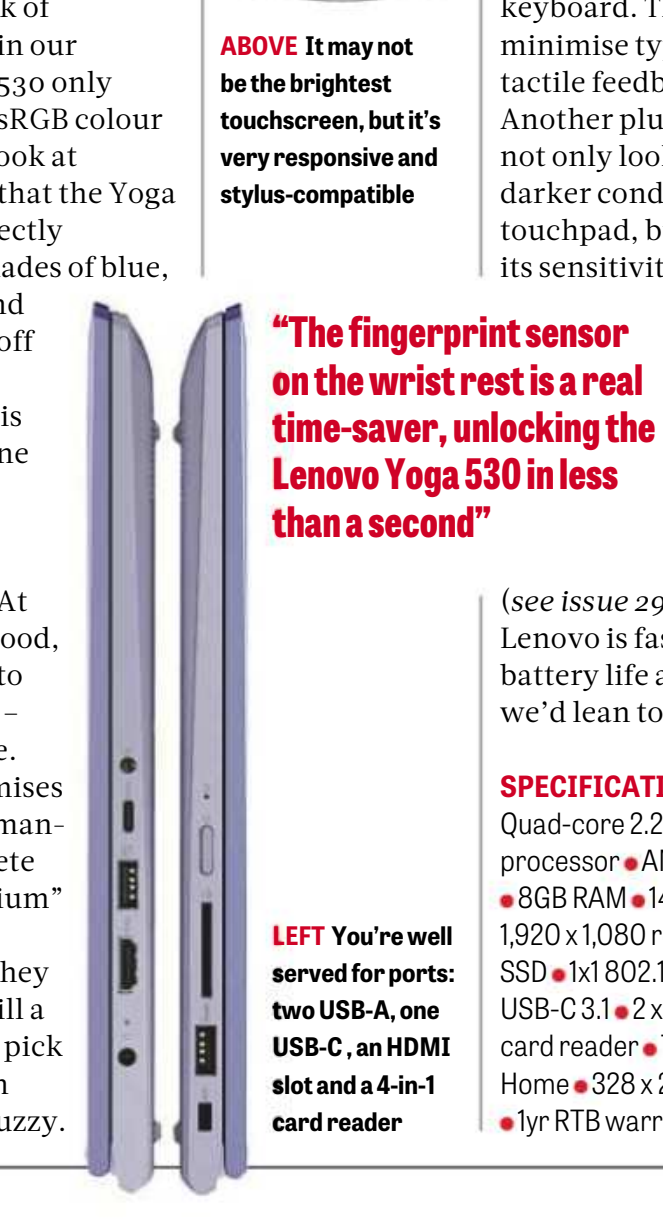
Where it falls down a cavernous hole is battery life, lasting a mere 3hrs 47mins of continuous video playback (with the screen set to 170cd/m² and flight mode engaged). That's bad news for AMD in its quest to topple Intel's laptop dominance.

Then we come to another disappointing element: its display quality. A 1,920 x 1,080 resolution is fine, but colours look flat. This lack of vibrancy was confirmed in our technical tests: the Yoga 530 only reproduced 54.6% of the sRGB colour gamut. Taking a deeper look at colour accuracy, I found that the Yoga 530 was only able to correctly reproduce a select few shades of blue, green and yellow; reds and purples were drastically off the mark.

Maximum brightness is a mediocre 250cd/m² – fine for indoor use, but you'll struggle to work with it outdoors or sat by the window on a sunny day. At least the touchscreen is good, proving very responsive to taps, swipes and pinches – and it's stylus compatible.

The Yoga's audio promises much, with a pair of Harman-branded speakers complete with "Dolby Audio Premium" processing. The speakers sound fine up close, but they aren't strong enough to fill a room. Vocals and guitars pick up well, but when a drum solo kicks in, things get fuzzy.

ABOVE The Yoga 530 is available in Onyx Black, Mineral Grey and Liquid Blue



ABOVE It may not be the brightest touchscreen, but it's very responsive and stylus-compatible

The design is standard fare for the Yoga range. It comes in three colours - Onyx Black, Mineral Grey or Liquid Blue – but our black review sample was boring; just a black shell with iron-grey hinges and a glossy interior. It weighs 1.67kg, which is on par for a 14in 2-in-1, and, with the lid closed its dimensions are 328 x 229 x 17.6mm (WDH).

There are two USB-A 3 ports, one USB-C port (3.1, not Thunderbolt), an HDMI slot and a 3.5mm audio jack. You also get a four-in-one card reader next to the power button, which is awkwardly placed on the right edge of the laptop. The fingerprint sensor on the wrist rest is a time-saver, though, unlocking the Yoga 530 in less than a second.

There's little to say about the keyboard. The keys are well spaced to minimise typos and, thanks to decent tactile feedback, it's enjoyable to use. Another plus: the cool-blue backlight not only looks good but helps in darker conditions. I also liked the touchpad, but I needed to bump up its sensitivity for it to differentiate between three-finger and four-finger commands.

"The fingerprint sensor on the wrist rest is a real time-saver, unlocking the Lenovo Yoga 530 in less than a second"

In all, this feels like a missed opportunity. At £750, it's £51 more than the HP Pavilion x360 (*see issue 290, p62*) and, while the Lenovo is faster in games, its woeful battery life and poor screen mean we'd lean towards the HP. **TOM BRUCE**

LEFT You're well served for ports: two USB-A, one USB-C , an HDMI slot and a 4-in-1 card reader

SPECIFICATIONS

Quad-core 2.2GHz AMD Ryzen 2700U processor • AMD Radeon Vega 10 graphics • 8GB RAM • 14in touchscreen IPS display, 1,920 x 1,080 resolution • 256GB M.2 PCIe SSD • 1x1 802.11ac Wi-Fi • Bluetooth 4.1 • USB-C 3.1 • 2 x USB-A 3 • HDMI • 4-in-1 card reader • 720p webcam • Windows 10 Home • 328 x 229 x 17.6mm (WDH) • 1.67kg • 1yr RTB warranty

HP EliteBook 745 G5

The AMD version of the 745 has enough power and battery life for most needs, but there's no X factor

SCORE ★★★☆☆

PRICE £1,000 (£1,200 inc VAT)
from box.co.uk

Casting my mind back through 20 years of reviewing laptops, I can't remember a single business laptop with an AMD processor inside. For HP to supply an EliteBook with a Ryzen chip is a landmark worth noting.

It's using the AMD Ryzen Pro platform, which provides all the benefits of a Ryzen 7 processor along with a security co-processor that runs AMD's GuardMI tech. This promises memory encryption, secure boot processes and support for TPM 2. AMD also guarantees image stability over 18 months and two-year availability for processors, so you can roll out a fleet over a period of many months.

The 745 G5 is straight out of HP's EliteBook playbook, but that's no bad thing. A sleek magnesium alloy chassis sets the tone, with a sturdy lid that should help it survive life on go.

The screen is built for life indoors with strip lighting overhead. It only hit a maximum of 211cd/m² in our tests, but anti-reflective coating and a solid contrast ratio of 1,322:1 meant I had no problems with readability. Don't expect pulsating colours: it covers only 59.5% of the sRGB gamut, while its average Delta E of 4.87 means colour accuracy is poor. But I don't want to go overboard here: if you're buying a laptop for general office use, you'll have few complaints.

There's a corporate feel to the ports. The right-hand side includes a slot for a micro SIM, a 3.5mm audio jack, one USB-A 3.1 port, a full-size HDMI output, an expansion dock connector and a Gigabit Ethernet port. HP also has one eye on the future, with a powered USB-C port on the right.

By comparison, the left-hand side is unloved. Aside from a Kensington Lock slot and smart card reader, all you've got is a second USB-A 3.1 port. The rest of the space is dedicated to an air vent, but don't be fooled into thinking this is a noisy laptop. Yes, the fans whine when the APU is put under pressure, but in general it's a quiet-running machine.

I say APU because the processor and graphics chip come on the same package, in this case a Ryzen 7 2700U with Radeon Vega graphics. This may sound familiar if you've already read our Lenovo Yoga 530 review opposite, and the machines performed similarly in our tests. It scored 79 overall in our media-creation benchmarks, while AS SSD read/write scores of 776MB/sec and 1,370MB/sec show that the 256GB PCIe SSD will never slow you down.

Despite the promise of Radeon Vega graphics, this isn't a gaming machine. It could only score an average of 6.5fps in *Metro: Last Light* at 1080p, and even dropping down to 720p only increased this to 21.2fps. Even the Manhattan 3 test proved a challenge, with an on-screen result of 28.3fps some way short of ideal.

Arguably its best result came in our battery rundown test, where it lasted a solid 7hrs 50mins when looping video. There's one caveat to this: HP's aggressive power management meant we could only push the screen to around 100cd/m² on battery, which is some way short of the 170cd/m² we usually choose. The corollary is that, if you're using the EliteBook on the road, you may find yourself wishing for a brighter image.

HP gets the rest of the ergonomics right. The keyboard is lovely, with a firm action and well-proportioned keys. A fingerprint reader is tucked below the keyboard on the right and there's a trackpoint for the diehards, although you'll be missing out on the excellent trackpad. Even the speakers are decent for a business laptop, with plenty of volume to compensate for lacklustre bass.

ABOVE With its sleek magnesium alloy shell and sturdy lid, the 745 G5 is a business laptop built for the road

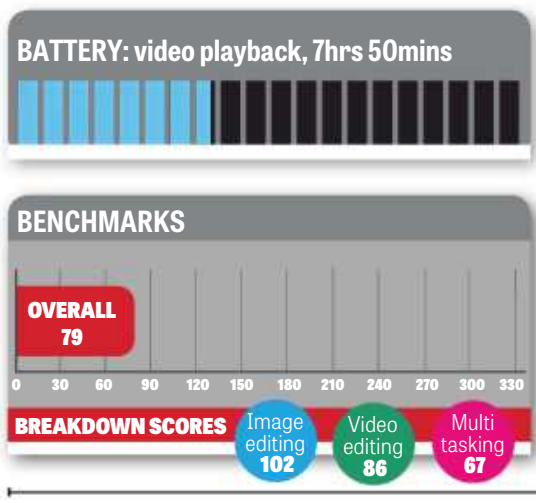
"AMD's GuardMI promises protection, while AMD also guarantees image stability over 18 months and two-year availability for CPUs"

So where does this leave the EliteBook 745? In a quandry. I'm disappointed by the screen's brightness and can't see any obvious selling point of AMD Ryzen Pro over the Intel vPro equivalent. So it will really come down to price. Off the shelf, that doesn't look fantastic: the best I could find was £1,000 exc VAT from **box.co.uk** for the official SKU I tested (3UP39EA). However, a Ryzen 5 version (3UP50EA) costs £699 exc VAT. I suspect deals can be had if you get in touch with your favoured reseller.

While those prices include Windows 10 Pro and a three-year warranty, it's still hard to call this model great value. The 745 G5 is an interesting product, due to AMD Ryzen Pro technology, but it's not begging to go on anyone's shortlist. **TIM DANTON**

ABOVE The Bang & Olufsen speakers pack quite a punch, while the keyboard's action is seriously impressive

BELOW The EliteBook is packed with ports – including Gigabit Ethernet on the right



SPECIFICATIONS

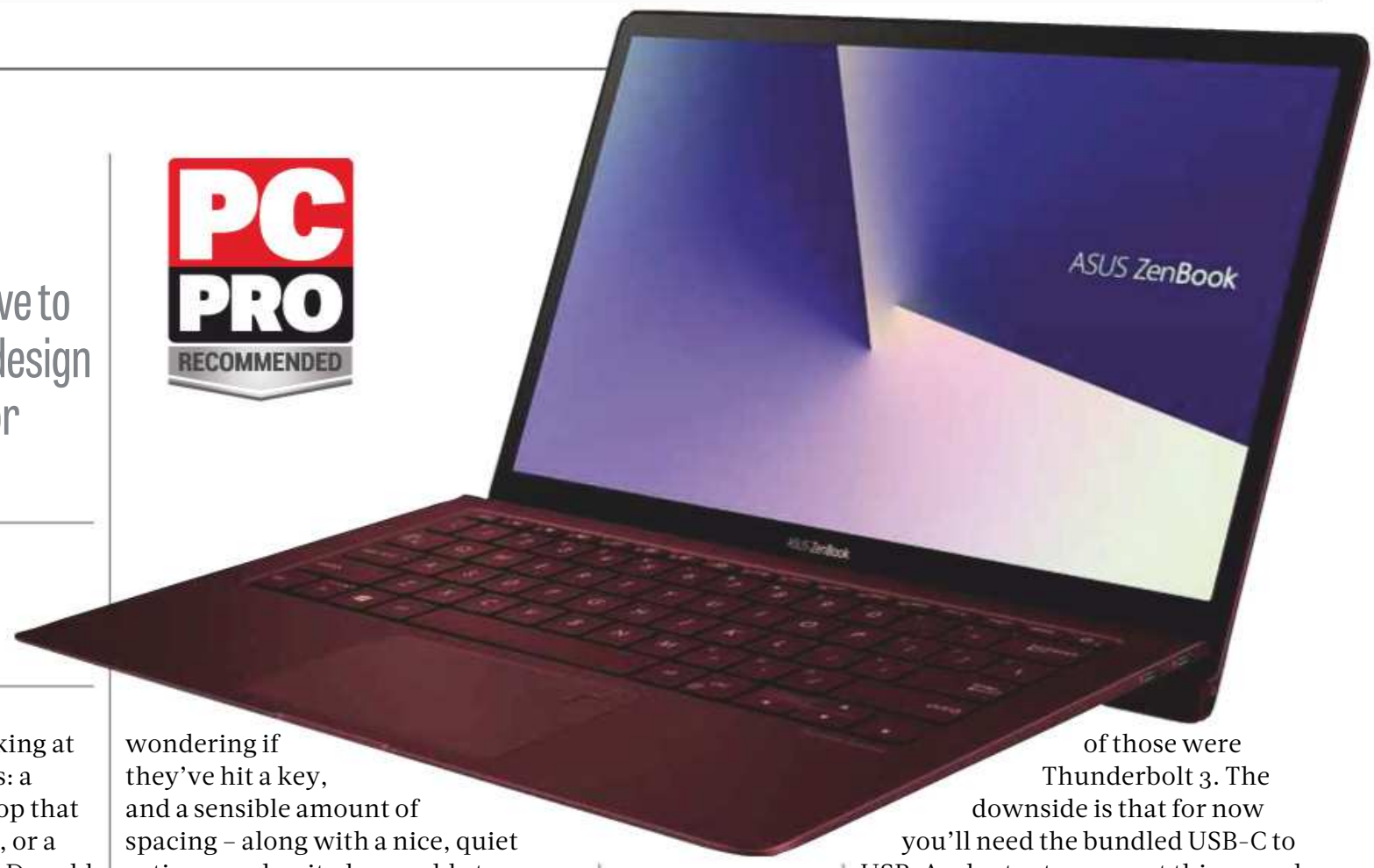
Quad-core 2.2GHz AMD Ryzen 7 2700U processor • Radeon RX Vega 10 graphics • 8GB RAM • 14in non-touch IPS display, 1,920 x 1,080 resolution • 256GB M.2 PCIe SSD • 2x2 802.11ac Wi-Fi • Bluetooth 4.2 • USB-C 3.1 • 2 x USB-A 3.1 • HDMI • micro SIM slot • Gigabit Ethernet port • 720p webcam • 50Wh battery • Windows 10 Pro • 326 x 234 x 17.9mm (WDH) • 1.48kg • 3yr RTB warranty

Asus ZenBook S UX391UA

A great-value alternative to the Dell XPS 13, but its design may be too extrovert for some people's taste

SCORE ★★★★½

PRICE £833 (£999 inc VAT)
from johnlewis.com



There are two ways of looking at the new ZenBook S series: a thoroughly modern laptop that makes a bold design statement, or a piece of bling that would make Donald Trump recoil and say "very gold, too much gold, not good".

It comes in two colours, with Asus sending me the rich burgundy finish rather than the alternative "deep blue". The inside is beautiful, with an understated matte finish that excudes class. Don't be alarmed when I say the keys are backlit in gold rather than plain white: it's actually a subtle effect that adds to the style, not to the sense of bling.

If only I could say the same about the lid. Asus abandons all sense of subtlety here, with a rich, shiny finish combined with a swirl effect. Add a bright gold logo and you can see why I mentioned Donald Trump in the opening paragraph.

Asus makes another interesting design decision with the hinge. As the photo below right illustrates, the keyboard lifts up to an angle as you bend the screen backwards. It's eye-catching, but the main purpose is to provide a more natural typing angle. I'm not convinced by this. Typing on a slope didn't feel any more comfortable than on a regular laptop keyboard, and the lid dug into my legs when the ZenBook was sitting on my lap, but if you suffer from RSI then it might be worth trying it out.

Fortunately, I like the keyboard itself. A solid action means touch typists can reach high speeds without wondering if they've hit a key, and a sensible amount of spacing – along with a nice, quiet action – makes it pleasurable to use for extended periods.

I enjoyed gazing at the 13.3in screen, too. While you can buy the ZenBook S with a 4K touchscreen, Asus sensibly supplied a 1,920 x 1,080 non-touch panel here. I don't see the point in going for 4K in an ultraportable, as you're too far away from the screen to notice all those extra pixels. In truth, Asus doesn't supply the highest quality panel around – Dell's XPS 13 is technically superior, and looks more vivid when placed side by side – but a contrast ratio of 1,138:1 and top brightness of 293cd/m² are both solid results. It can only cover 83% of the sRGB gamut, but that won't matter to most people.

I'm a little more concerned by this laptop's turn of speed under sustained pressure. It proved fine in our short image-editing test, scoring an excellent 121, and that's reflected in general use, where it flies. When asked to compress a hefty 4K video and play a video in our multitasking test, though, it took 43 minutes. The Dell XPS 13, albeit equipped with a slightly faster processor and 16GB of RAM, completed the same task in 27 minutes. While the XPS 13's superior specification accounts for some of this, I suspect the processor needs more aggressive power management in the ZenBook to keep it cool.

I can't criticise a battery life of nine hours, though, and combined with this laptop's svelte design – it's 12.9mm thick with the lid closed and weighs only 1.1kg – it's a highly portable machine. As with the XPS 13, Asus jettisons old-style USB-A ports in favour of three USB-C connectors, and I was delighted to see that two of those were Thunderbolt 3. The downside is that for now you'll need the bundled USB-C to USB-A adapter to connect things such as USB drives, but third-party port replicators abound. Plus, the fact you charge the laptop via USB-C may ultimately mean you don't even need to take the power supply with you, because such supplies are likely to become a fixture in offices and hotels.

ABOVE The inside of the laptop is beautiful, with subtle gold light illuminating the well-built keyboard

"I can't criticise a battery life of nine hours and, combined with this laptop's svelte design, it's a highly portable machine"

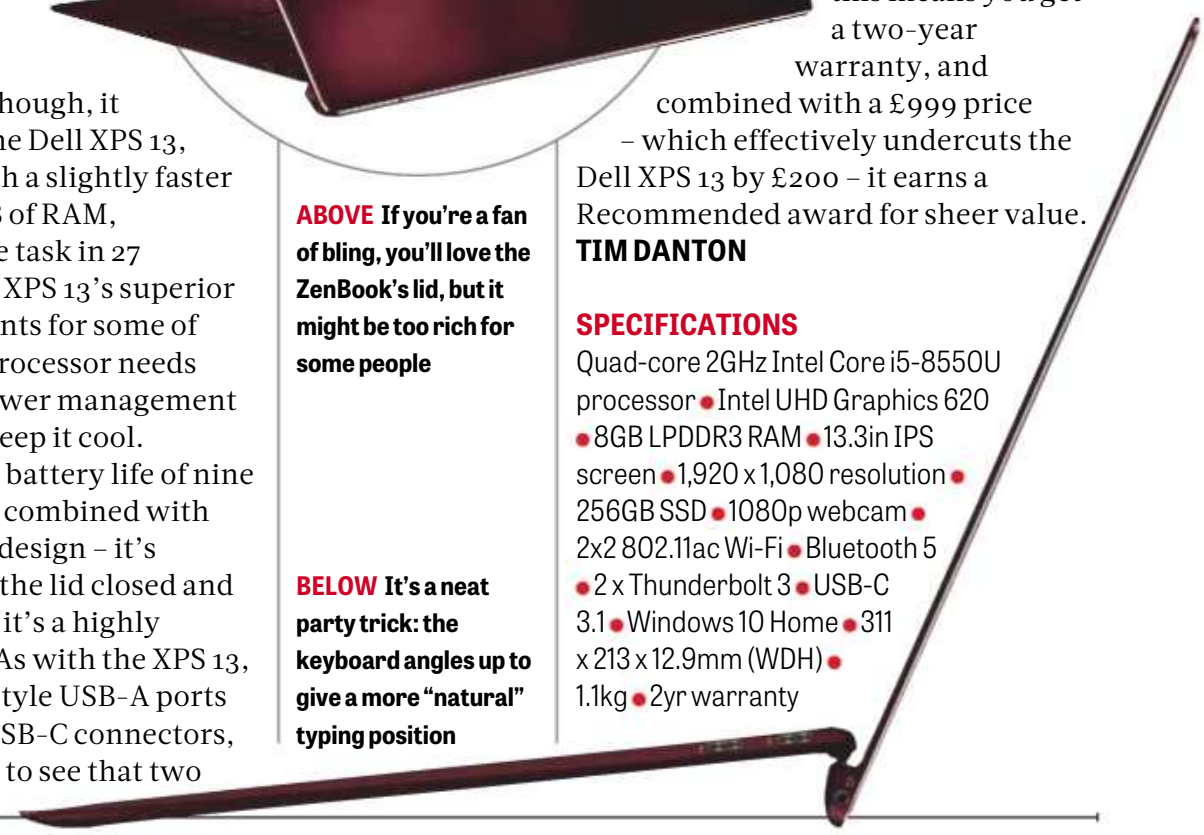
The biggest barrier to buying the ZenBook S is availability. At present, only two models are widely available: the EA028T, which is the same spec as reviewed here except with a 4K touchscreen and a rich blue finish, and the EA055T, which includes a Core i7-8550U. They cost £1,150 and £1,300 respectively, and I can't comment on the screen quality.

If you want the model I tested (ET086T), you'll need to visit John Lewis, because it's exclusively on sale there. The good news is that this means you get a two-year warranty, and combined with a £999 price – which effectively undercuts the Dell XPS 13 by £200 – it earns a Recommended award for sheer value.

TIM DANTON

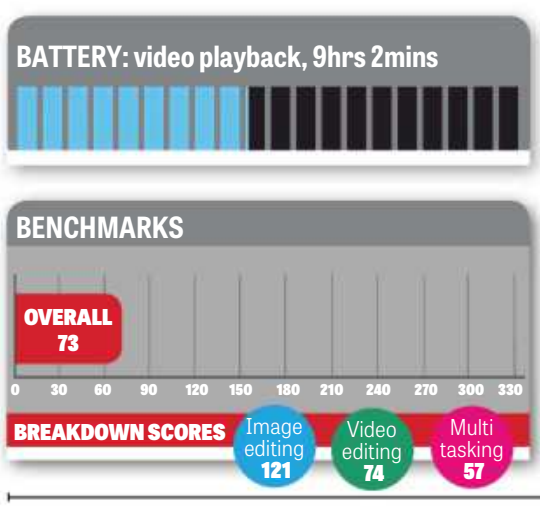
ABOVE If you're a fan of bling, you'll love the ZenBook's lid, but it might be too rich for some people

BELOW It's a neat party trick: the keyboard angles up to give a more "natural" typing position



SPECIFICATIONS

Quad-core 2GHz Intel Core i5-8550U processor • Intel UHD Graphics 620 • 8GB LPDDR3 RAM • 13.3in IPS screen • 1,920 x 1,080 resolution • 256GB SSD • 1080p webcam • 2x2 802.11ac Wi-Fi • Bluetooth 5 • 2 x Thunderbolt 3 • USB-C 3.1 • Windows 10 Home • 311 x 213 x 12.9mm (WDH) • 1.1kg • 2yr warranty



HP EliteBook 1050 G1

A powerhouse choice for businesses needing to equip execs with machines that can do anything

SCORE ★★★★½

PRICE £1,889 (£2,267 inc VAT)
from store.hp.com

There was a time when buying a business laptop meant settling for an ugly brick of a machine that had all the entertainment potential of *A Night With Des O'Connor*. The EliteBook 1050 G1 is many things, but boring isn't one of them: with GeForce GTX 1050 Max-Q graphics and Intel's Coffee Lake H-series processors, it will blast through any task.

Perhaps most tellingly, it's also gorgeous. The silver aluminium chassis offers a MacBook-like contrast to the black bezels around the 15.6in screen, and at 1.9cm thick it justifies being called slim. This is a laptop that any high-level executive would be happy to whip out in a meeting.

It's also very well connected. I'm a signed-up fan of Thunderbolt ports, and HP supplies two on the right-hand side of the chassis. Hook up HP's smart-looking Thunderbolt G2 docking station and you can live the one-cable dream. HP hasn't jettisoned all legacy ports, either: two USB-A 3 ports sit on the left-hand side, while a full-size HDMI port may come in handy when visiting offices.

There's also a full-size SD card slot hiding away next to the 3.5mm jack and, if you're a music lover, you'll probably find yourself using it. Music from the speakers lacks the depth of other laptops I've tested recently, with drums sounding weak for example.

It's fine for a Netflix binge when away from home, though, and this is one area where the 15.6in screen comes into its own. It swaps the glossy finish of consumer laptops for an effective anti-glare finish, but colours still look rich. Our colour gamut tests showed that it's also capable of displaying almost all (91%) of the sRGB gamut, albeit only 69% of the DCI-P3 gamut favoured by Netflix, but with an average Delta E of 2.93 don't expect great colour accuracy.

However, this didn't bother me in practice. What did was its sensitivity to viewing angles. Move slightly away from head-on and the contrast and brightness drops off, which is distracting when you're using a predominantly white background, such as on Word or Excel.

This irritation isn't to be confused with the brilliant Sure View mode: press F2 and, as if by magic, people to the left and right of you can't view your screen anymore. I first saw this in the EliteBook 840 G5 (*see issue 286, p63*), and am no less in love with it here.

As with all EliteBooks, HP places privacy at the heart of this laptop. There's a neat shutter you can simply slide over the webcam, just to be sure no one is hijacking it, plus the promise of a self-healing BIOS that will be restored if it's attacked. There's also a fingerprint reader and a pair of infrared cameras to support Windows Hello facial recognition. Add Windows Pro and vPro processors, and this is one highly manageable machine.

HP supplies the EliteBook 1050 G1 in various configurations, but our test machine (code 3ZH23EA) included a Core i7-8750H, 32GB of RAM and 1TB of storage. (You can also buy a Core i5 version with 16GB of RAM and a 512GB SSD for £1,751 inc VAT.) Together, they pushed the EliteBook to 185 in our benchmarks. That's equivalent to a supremely powerful desktop PC, never mind a laptop. To give an idea, our reference Core i5-4670K desktop PC encoded our sample video in 18 minutes; this laptop finished the task in 9mins 43secs.

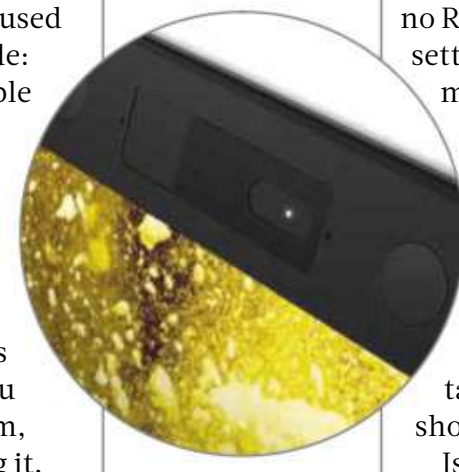
The supplied GeForce GTX 1050 graphics offer plenty of gaming capability too, as reflected by this machine's 41fps in *Metro: Last Light* at the panel's native resolution of 1,920 x 1,080 at Very High settings. Sure, it's no RTX 2080, but drop down the detail settings and you'll be able to play most games.

And then we come to this laptop's coup de grace: it lasted 9hrs 52mins in our battery-life tests. It even charges back up to 50% in less than 30 minutes. At a shade over 2kg it's hardly an ultraportable, but if you need to take it on day trips then you shouldn't need the power supply.

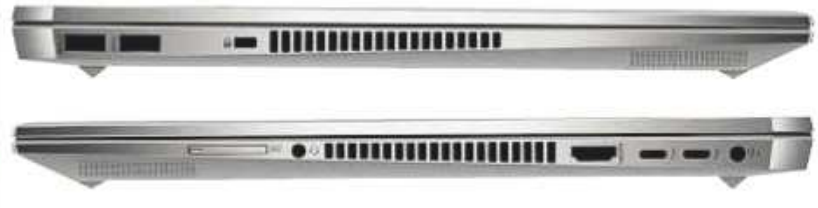
Is this a perfect laptop? No. I took a little time to adjust to the keyboard, for instance, with the single-height Enter key buried among the other buttons. I'm not a lover of the screen either, despite its many assets. But let there be no doubt: this is an excellent business laptop. It's powerful, it's sleek and that battery life can't be underestimated. **TIM DANTON**

ABOVE The EliteBook 1050 G1 stuns with its MacBook-like slim, aluminium chassis

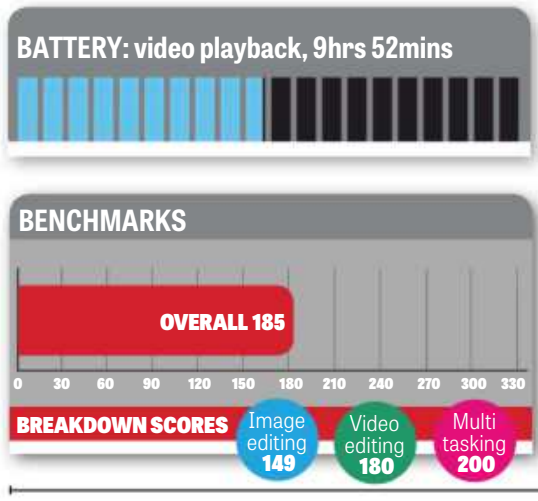
PC PRO RECOMMENDED



ABOVE As ever, privacy is a priority for HP and there's even a webcam shutter



BELOW In terms of ports, there's a full HDMI, two USB-A and two Thunderbolts on the sides



SPECIFICATIONS

Six-core 2.2GHz Intel Core i7-8750H processor • 4GB GeForce GTX 1050 Max-Q graphics • 32GB RAM • 15.6in non-touch IPS display, 1,920 x 1,080 resolution • 1TB M.2 PCIe SSD • 2x2 802.11ac Wi-Fi • Bluetooth 5 • 2 x Thunderbolt 3 • 2 xUSB-A 3 • HDMI 2 • microSD card reader • 720p webcam • 95.6Wh battery • Windows 10 Pro • 360 x 254 x 18.9mm (WDH) • 2.06kg • 3yr RTB warranty

Amazon Echo Plus (2018)

A smart speaker in both senses of the word, with great sound, a stylish design and amazing skills

SCORE ★★★★★

PRICE £117 (£140 inc VAT) from pcpro.link/291plus

Like the original Echo Plus, the 2018 remix wants to be the centre of your connected household. As before, its chief weapon is a built-in smart home hub, but this second iteration offers superior sound quality. Amazon has also eschewed the metallic cylindrical looks of last year's Plus, imitating instead the fabric-covered tin of beans chic of the second-generation Echo.

The change comes with one casualty: you can't twist the top of the speaker to adjust the volume. The big circular status LED is still there, but the physical buttons on top are the only way to alter the volume without raising your voice. Sound familiar? It should: put the Echo Plus side by side with a second-generation Echo and you may struggle to tell the difference. The 2018 Echo Plus is 11mm fatter and has rounded edges at the top instead of sharp ones, but that's it.

There's still a line-in or out connection on the back, so you can either play music directly from a source, or output the audio from the Echo Plus to another speaker. Inside, it's the same 0.8in tweeter as before, but the woofer jumps from 2.5in to 3in. In theory, this means higher frequencies will sound the same, but the bass notes should get a little boost. And that's exactly what the new Plus delivers in practice.

Compared with the launch Echo, the sound quality is night and day better, with rich, warm notes and decent bass replacing the somewhat harsh and thin output of Amazon's first attempt. It's loud, too – almost unfeasibly so for a speaker this size – but it distorts if you turn it up too high and the higher frequency notes eclipse the bass when pushed. This is a speaker for listening to at quiet-to-medium levels; it's not a party speaker.

If you want more volume, Amazon lets you combine two of these second-gen Echo Plus speakers together in stereo. Amazon even sells a bundle with two Echo Pluses and the all-new Echo Sub for £299. That brings it into Apple HomePod (£329) and Google Home Max (£399) territory, and both are better-sounding speakers; but having two speakers is always more flexible than one.

Of course, a smart speaker is about more than sound quality, and this can be broken down into two parts: intelligence and compatibility. In the great virtual assistant race, Alexa sits mid-table. It isn't as smart as Google Assistant, but is some way ahead of Siri and Cortana, while poor old Bixby is still learning to tie its laces.

What does this mean in practice? If you ask Google Assistant "how many hairs are on a cat?" it will reply, "on average, there are 60,000 hairs per square inch on the back and 120,000 hairs per square inch on the underside. 44 sq in/ft x approximately 3 square feet of surface area = 40 million hairs." Ask Alexa the same thing and it says "a cat has 60,000 hairs". So it's only out by about 39,940,000, then.

That may sound like picking on one silly example, but it's illustrative of the problems Alexa has; it just isn't great at contextualising. It's good for the simple things – telling you the weather, playing music or radio, turning lights on and off, setting alarms – but more esoteric questions often leave it stumped. Google Assistant isn't perfect, but I have much more confidence it will come up with something.

ABOVE With its fabric finish and rounded edges, the new Echo Plus is a stylish beast

ABOVE You can no longer twist the top to change the volume, but the buttons are still there

LEFT A thermometer means that the Plus can regulate the temperature of your room automatically

"It can talk to many smart home devices – from your Philips Hue bulbs to your Hive Thermostat – without needing a special hub"

In terms of compatibility, though, it's a different story. Alexa has thousands of abilities, many developed for it by third parties, and its skillset is growing every day. It can serve as a high-tech intercom, allowing you to "drop in" to other Echo speakers on your network (the Google Home only allows you to broadcast messages, not carry out a two-way conversation) or the Alexa apps on your favourite contacts' smartphones.

And as the Echo Plus includes a Zigbee smart home hub, it can also talk to many smart home devices – from your Philips Hue bulbs to your Hive Thermostat – without needing to buy any extra hardware. The Echo Plus' built-in thermometer also allows you to carry out actions based on the temperature in your room. Too hot? It automatically turns on a smart fan. Too cold? It flicks on the heater.

Amazon provides steady, solid improvements with the 2018 Echo Plus. The sound is superb for the price, it's more compact and more stylish than before, and it's even more feature packed. Alexa still needs to crib some trivia from Google Assistant, but if you want a smart speaker that gets the basics right and you will take advantage of the built-in Zigbee smart home hub, choose the 2018 Plus. **ALAN MARTIN**

SPECIFICATIONS

3in woofer • 0.8in tweeter • built-in Zigbee smart home hub • 802.11ac Wi-Fi • Bluetooth including A2DP support • 99 x 99 x 148mm (WDH) • 780g • 1yr limited warranty

Amazon Echo Show (2018)

A 10.1in screen and bigger sound, but the all-new Echo Show represents a missed opportunity

SCORE ★★★★☆

PRICE £183 (£220 inc VAT) from pcpro.link/291show

ABOVE **The thick bezel at the top of the Show may look odd, but it contains a five-megapixel camera**

The Amazon Echo Show was my all-time favourite Echo speaker, so I had high hopes for this second-generation refresh. With a slick new design, sharper 10in screen, better speakers and a fistful of extra smart features, it was surely set to steal my heart. Except it didn't.

The screen dominates, with Amazon sensibly moving the speaker from below the screen to the rear of the unit. The new Echo Show has a slightly bigger footprint than its predecessor, but it's actually a little shorter than the original. It hasn't lost its gawkiness, though. The thick bezel above the screen gives it a lopsided look, but it's there for a reason: it houses not only a five-megapixel camera but also part of the Show's far-field microphone array. This is supplemented by a further four microphones on top of the speaker, plus physical mute and volume buttons. The speaker's DC power input sits in a cut-out at the rear along with a micro-USB port, but there's no 3.5mm input or output.

Fire up the new Echo Show side by side with the original and it's streets ahead. The screen has better contrast and punch, while the touch surface feels a lot smoother. In fact, the whole 2018 unit has a higher-quality feel than the original.

It also sounds better, with fuller audio, louder volume and much more bass. If anything, the bass is too overbearing; I quickly tuned the speaker's EQ settings to push this back, because at default settings I had to pump up the volume far too loud to make voices and vocals discernible across my moderately noisy kitchen. So it's good but no match for the Apple HomePod for all-round audio quality. The improved microphone array works well (no more repeatedly shouting "Alexa", as with the old Show).

Amazon has tweaked the visual user interface, adding a number of new features. These include smart home control: drag a finger down from the top of the touchscreen, tap the Lights & More option and you'll see a scrollable list of all your smart home gear – from lights to cameras – with toggle switches alongside. This is useful because you probably can't always remember what your various smart gadgets are called, and you must say the right name to voice-control them.

You can finally browse the web via either Firefox or the Amazon Silk browser, which gives you access to YouTube among other streaming video services. Furthermore, the ability to video call to Skype users is coming soon.

Largely, though, the Show can only display the same as before. That means lyrics to songs on Amazon Music, or TV and movies from Amazon Prime Video or YouTube. It can also patch you through to the live feed from connected security cameras and show visuals for timers, weather and sports results.

There's plenty you might expect it to do that it can't, however. There's no Netflix app, for instance, and if you ask the Show to play BBC radio stations all you get is some text telling you the current show and station, a low-res icon and some Alexa tips at the bottom of the screen.

LEFT **The rear cut-out has a micro-USB port, but there's no 3.5mm input or output**

"Fire up the new Show side by side with the original and it's streets ahead – the screen has better contrast and punch"

There's not even a permanent spot for the time. You have to ask Alexa to "go to the homescreen" if you want to do something as simple as that. Why Amazon hasn't used the extra screen real estate to display a panel with the time, calendar and weather next to all third-party app data is beyond me.

Still, approach this as a feature-rich Echo speaker with video calling and playback features and you probably won't be too disappointed. After all, it works much as any other Echo has done before it, with all of the positives and negatives that come hand-in-hand with using Alexa as your digital helper, rather than Google Assistant.

Overall, the second-generation Echo Show is a big improvement on the original. The screen is bigger, brighter and better quality, the new design is nicer to use, and it sounds pretty darn good. It's still, on balance, my favourite of Amazon's Echo speakers.

However, Amazon now has Google-powered competition. If you can live without a camera, the 7in Google Home costs £139, while

ABOVE **You can now browse the web via the Echo Show – useful for finding recipes**

Lenovo offers an 8in Smart Display for £179 or a 10in version for £229. Before you part with your cash, it's worth exploring all three of those options.

JONATHAN BRAY

SPECIFICATIONS

Quad-core 1.44GHz Intel Atom x5-Z8350 processor • 10in 1,280 x 720 touchscreen • dual 2in stereo speakers • 8-microphone array • 5-megapixel camera • 802.11ac Wi-Fi • Bluetooth (A2DP and AVRCP) • 246 x 107 x 174mm (WDH) • 1.76kg • 1yr limited warranty

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Total value this month £164

Steganos Password Manager 19

Full product worth £19
steganos.com

EVERYONE NEEDS A password manager (*see p38!*), and this handy app stores passwords, bank details, credit cards and more in secure "keychains". You can have separate keychains for home logins and work, and others for family members. Each has its own master password, so having access to one doesn't mean you can see any of the others.

Your credentials can then be automatically filled in if you're using Chrome or Firefox, or you can fill forms manually by dragging and dropping fields from Password Manager onto your web page.

There are plenty of options if you need to use your passwords elsewhere, too. You can install Steganos Password Manager on another computer, run it from a USB key for easy access or use an iOS or Android device to make your logins available on the move, at which point they'll be synchronised via the cloud.

REQUIRES Windows 7 or later; 100MB hard drive space; online registration

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For more information, see pages 66 and 67 in the main magazine

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pcprodownload.co.uk

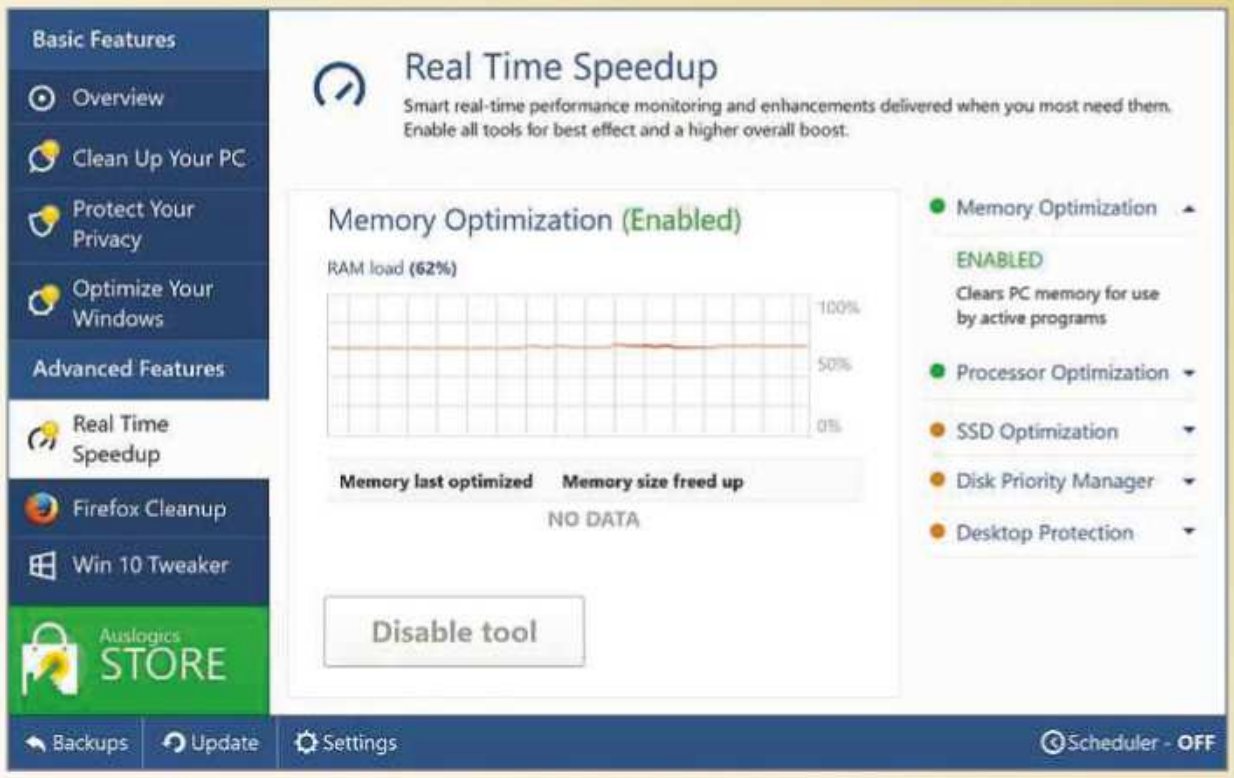
Auslogics BoostSpeed 10

One-year licence worth £45
auslogics.com

THIS EXTENSIVE SUITE of tools can improve just about every aspect of your PC's performance. It helps you disable unnecessary startup programs, and can also highlight suspected spyware, junk and left over files. It shows you which folders are consuming the most space too, and Auslogics Disk Defrag can then organise your files for optimal performance.

Useful bonus functions include modules to undelete files, fix hard drive problems, view system information, securely shred data and wipe entire drives to make sure personal data is gone forever.

Finally, the Desktop Protection tool prevents system errors and reduces crashes. This latest version of the software also includes a host of smaller improvements, to ensure it does the best job of boosting your PC's performance.



REQUIRES Windows XP or later; 75MB hard drive space; online registration

WiseCare 365 Pro

One-year licence worth £29
wisecleaner.net

REQUIRES Windows 7 or later; 30MB hard drive space

- Check your setup for problems, clean up the Registry and hard drives and boost your PC's overall performance
- Reduce the processor's workload and reclaim lost hard drive space by removing unnecessary files and Windows components
- Includes password generator, file shredder and disk shredder to keep your data safe and securely remove it when no longer required

Inmatrix Zoom Player 14 Max

One-year licence worth £23
inmatrix.com

REQUIRES Windows 7 or later; 100MB hard drive space; online registration

- Enjoy a wider range of media files with this flexible player; unlock files that your existing apps can't handle
- Takes CDs and DVDs in its stride, along with FLV, WMV, QuickTime, FLAC, XVID files and many more
- Bookmark your favourite sections with the chapter editor and return to them with a double-click

Abelssoft HappyCard 2019

Full product worth £28
abelssoft.com

REQUIRES Windows 7 or later; 70MB hard drive space; in-application registration

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Huawei Mate 20 Pro

A stunning phone with the most flexible camera you can buy. It has flaws, but is still a terrific Android option

SCORE ★★★★★

PRICE £749 (£899 inc VAT)
from carphonewarehouse.co.uk

The Huawei Mate 20 Pro comes agonisingly close to being the best Android phone, bar none. That's saying something when you look at the competition, with this month alone seeing the release of the Google Pixel 3 and Pixel 3 XL (*see p70 and p72*). So what lifts it from the pack? One, its camera, which is truly magnificent. Two, its combination of power and battery life. It's the fastest Android phone out there and almost matches the OnePlus 6 for stamina.

Built for speed

That speed comes courtesy of Huawei's own silicon. While most smartphone makers use Snapdragon 845 chips in their flagship phones, the giant Chinese company can use its own-designed chipset called the Kirin 980. Huawei made bold claims about its performance at IFA this year and, unusually for bold claims about speed, they're mostly true. If you're looking for power, whether for compute performance or 3D acceleration, reach for your credit card now.

The graphs overleaf show how the Mate 20 Pro compares to the Pixel 3 and iPhone Xs in benchmarks, and it's notable that Apple still retains its lead. But that's a totally different platform, and what matters is the difference such speed makes in everyday use.

Naturally, it's incredibly slick. With Android 9 sitting underneath Huawei's own EMUI 9 interface, moving between programs and navigating through the OS is silky smooth. It makes going back to lesser phones difficult, because you constantly notice the stutters and false starts in comparison. That said, the Snapdragon 845 powering Android 9 on the Pixel 3 proved just as smooth in day-to-day use.

In fact, there are only a few scenarios when you might notice the difference. The first is in games where Huawei has worked closely with the developer so that its "GPU Turbo" technology can boost frame rates. The obvious example is *PUBG Mobile*, where the Mate 20 Pro holds a 20% advantage over the Snapdragon 845. It also claims a similar lead in the basketball game *NBA 2K17*.

More games that support GPU Turbo will follow, but many of Huawei's speed advances come from its switch to a 7nm manufacturing process. The Snapdragon 845 uses a 10nm process, but its 7nm successor, the 855, will be available early in 2019. This is likely to match the Kirin 980 in many areas, and may even beat it for gaming.

ABOVE The in-screen fingerprint reader means that the front is almost entirely display

AI hype?

The second area where the chipset makes a difference is when it applies its AI skills. Huawei includes a dual NPU (neural processor unit) in the Kirin 980, which comes into its own when combined with the camera to recognise what it's seeing.

For an example of this, see the snapshot from a video I took using the "AI colour" function in the video app (*below left*). It's clever enough to detect that Heather was the subject of the video and applied a colour to her, and her clothing, while keeping the background black and white. And this was all done in real-time.

Some might respond "so what?" but it shows what the Kirin 980 is capable of in partnership with smart software, and what all our phones will be capable of in the future. For now, it's a bit of fun, and there's nothing wrong with that.

Face unlock

In combination with the 3D depth-sensing camera on the front, the Mate 20 Pro is also the best phone I've used when it comes to facial recognition. It's been the most successful at recognising me in the dark – most phones simply can't cope with that.

"Huawei made bold claims about its performance at IFA this year and, unusually for bold claims about speed, they're mostly true"

It doesn't work all the time, though, which is when you might need to call on yet another first for this phone: an in-screen fingerprint reader. This allows Huawei to fill almost the entire front of the phone with a screen and not stuff the fingerprint reader round the back.

Personally, I would have been happier with the fingerprint reader kept on the rear of the phone. Yes, it's clever to place your thumb on the front of the screen and unlock it, but I found it less successful than normal readers. There were times when it worked first time, and other times when it wouldn't work at all. Was my thumb a bit grubby? Or the screen? I don't know. All I do know is that I had to press my six-digit PIN into the Mate 20 Pro more frequently than I'd like.

Minor irritations

That brings me to other minor irritations I have with the Mate 20 Pro.

LEFT The AI identified that Heather was the subject of our video and applied a black and white background – in real-time

The first is storage. While it's great to have 128GB built in, the expandable storage is via Huawei's proprietary NM (nano memory) card technology. The question is: why? The world needs another storage standard in the same way it needs more celebrity chefs, and when you have a microSD standard that's so ubiquitous that prices are now affordable – a 128GB SanDisk card costs around £20, for instance – it actively hurts the consumer to create a new standard. Right now, you can't even buy NM cards.

The only comfort is that the SIM tray can hold two nano SIM cards or one nano SIM and a nano memory card. Effectively, then, you're buying a dual SIM phone with the possibility of expandable memory for an unspecified price in the future.

Then there's the notch, which eats into the 6.3in screen. In practice, I didn't find this a problem. In fact, I now barely notice it: there's still plenty of space for notifications at the top, and with such a big screen it's almost a non-issue.

A bigger annoyance is one it shares with so many flagship phones: there's no 3.5mm jack. Huawei includes a pair of competent USB-C earphones in the box, along with a USB-C to 3.5mm adapter, but this means the only way to listen to music and simultaneously charge the phone is to switch on the loudspeaker.

Reverse charge

Again, Huawei salvages credibility by making it incredibly quick to charge the Mate 20 Pro. Using the so-called SuperCharge adapter in the box, my Mate 20 Pro went from 8% to 58% in only 20 minutes. That's quite incredible. It takes a couple of hours to fully charge, but having such a quick turnaround makes a big difference compared to normal phones.

Huawei has also joined the Qi wireless charging throng, but you'll either have to pick one up as part of a bundle or pay around £60 for a charger separately. One nice feature, though, is that you can use your Mate 20 Pro to wirelessly charge other Qi-supporting phones, simply by placing them back to back. Huawei couldn't resist showing a Mate 20 Pro charging an iPhone Xs in this way during its launch presentation.

The reason it's so bullish is that it includes a 4,200mAh battery inside the 20 Pro. Compare that to the Pixel 3 and its 2,915mAh battery and you can see why the Mate 20 Pro lasted 15hrs 20mins in our battery rundown tests (using a looping video) compared to 12hrs 22mins for the Pixel 3. Notably, the iPhone Xs only lasted for 23 minutes longer than the Pixel.

ABOVE The light-catching Twilight colour is drop-dead gorgeous

In short, if you're looking for a phone that will last for well over a day away from a power supply, and that can be quickly recharged when it runs low, then the Mate 20 Pro is an excellent choice. My only caveat is that it's fussy about power sources: lower-power chargers, especially with third-party cables, may not charge your phone at all.

Body of evidence

It says something about the Mate 20 Pro that it's taken me this long to talk about its design. And this is a gorgeous phone, especially in its Twilight incarnation that catches the light to create a spectrum of colours. Even in black, as with the phone I tested, it's one of the most attractive phones I've seen, with the nice touch of a red power button for a splash of colour.

I'm just as taken by the way it feels in the hand, with the all-glass finish, rounded edges and reassuring weight making it feel like a true premium phone. This may sound trivial, but after a year this is what reminds you it was money well spent. There's Gorilla Glass to protect it from drops, and an IP68 rating that shows it's both dustproof and waterproof up to 2m – there's even a snorkeling case that allows you to take photos in waters 5m deep.

The screen, naturally, is just as lovely. Tuned to the DCI-P3 colour gamut favoured by Netflix, and with OLED technology to ensure vibrant colours and rich blacks, watching brooding films is a pleasure. A 1,440 x 3,120 resolution means a ludicrously detailed 538ppi and it flew through our technical tests, covering 100% of the sRGB gamut, 99.4% of the DCI-P3 gamut and with an average Delta E of 2.37. It's bright, too, hitting a peak of 466cd/m².

Time to buy?

This is a truly excellent phone. I can't fault the camera, the design, the performance or the battery life. And it's packed with so many features that it arguably justifies the £899 price. It's such a shame that Huawei chose to hamper it with a proprietary storage card, but at least it offers expansion.

For now, this is the best Android phone money can buy. But it isn't the best value: the OnePlus 6 and Samsung Galaxy S9 are both superior on that front. Whether it can stay at the top of the tree in the face of 2019's Android onslaught is a different matter. **TIM DANTON**

ABOVE The trio of lenses makes this a brilliantly versatile camera, and it produces some amazing shots too

LEFT The subtle red power button on the Mate 20 Pro provides a welcome punch of colour contrast

Camera talents

The Huawei P20 Pro's triple camera array was a revelation when we first tested it (*see issue 285, p68*) and in the Mate 20, Huawei has refined things even further. The phone still has three cameras on the rear. The primary camera remains an incredibly high-resolution 40-megapixel snapper with a bright aperture of f/1.8. Even the telephoto camera has the same specifications as before: 8 megapixels with an aperture of f/2.2 and an optical zoom of 3x.

What's new is that, instead of the third camera being just for black and white snaps, the Mate 20 Pro has an ultra-wide angle camera. Activated by tapping the zoom control in the camera app until you reach "0.6x", this shoots at the full-frame camera equivalent focal length of 16mm, which means you can shoot large groups of people from up close without using panorama mode.

This is fun to use, but beware: optical distortion creeps in at the edges of the frame, meaning you might not want to get too up close and personal. The lens also unlocks a new macro mode, which allows you to shoot your subjects from a mere 25mm away.

Otherwise, image quality is every bit as good as it was with the Huawei P20 Pro. It's exceptional in both good light and poor, and if you select the default 10-megapixel mode, the camera uses the extra resolution from the primary sensor to allow a seriously impressive in-camera "zoom" of up to 5x. Strictly speaking this is cropping rather than zooming, but it far outperforms the digital zoom of the iPhone Xs Max and the Pixel 3 XL at 5x. **JONATHAN BRAY**

SPECIFICATIONS

Octa-core 2.6GHz/1.92GHz/1.8GHz Huawei Kirin 980 • 6GB RAM • Mali-G76 MP10 graphics • 6.3in OLED screen, 1,440 x 3,120 resolution • 128GB storage • nano SIM plus combo nano memory/SIM slot • IP68 rating • triple 40MP/20MP/8MP rear camera • 24MP front camera • 802.11ac Wi-Fi • Bluetooth 5 • NFC • USB-C connector • 4,200mAh battery • Android 9 • 72.3 x 8.6 x 157.8mm (WDH) • 189g • 1yr warranty

Google Pixel 3

A tweaked formula delivers big dividends, with the Pixel 3 only just missing out on a place on the A-List

SCORE ★★★★★

PRICE 64GB, £616 (£739 inc VAT)
from store.google.com

Google wants you to think that the Pixel 3 is *the* Android smartphone. Faster. Prettier. And the best smartphone camera around. Although, as is becoming the norm, the Pixel 3 isn't one phone but two: the 5.5in Pixel 3 looks positively tiny next to the 6.3in Pixel 3 XL (*see p72*). There's one other difference, too: the plain Pixel 3 doesn't include a notch.

Instead, the Pixel 3's all-screen frontage looks more like the Galaxy S9, with forehead and chin bezels sitting above and below the display, surrounding the pair of front-facing speakers. Flip the phone over, and you're treated to a similar-looking mash-up of matte and glossy glass. The solitary rear camera has also shifted slightly to the left, and the top glass panel is ever-so-slightly thinner this time around, but the differences end there.

Google sticks with the circular fingerprint reader on the back – unlike Huawei with its more adventurous Mate 20 Pro (*see p68*) – while the USB-C charging port and microSD slot are both again found on the bottom edge. The Pixel 3 is IP68 dust- and water-resistant, and it supports Qi wireless charging for the very first time.

And what good is wireless charging capabilities without a charger to put it on? That's where the Pixel Stand comes in. Priced at £69, it charges your phone and, much like the Show Dock for Amazon's Fire HD 8 tablet, turns the Pixel 3 into a Echo Look-style smart speaker. It will display the time, notifications, pictures from Google Photos and even show who's at the door if you have a Nest Hello installed at the front of your house.

If you were hoping Google would reintroduce a 3.5mm headphone jack then think again, although at least Google supplies a pair of Pixel USB-C earbuds. The Active Edge feature appears again, too: squeezing the sides of the phone activates Google Assistant. It's similar to HTC's squeezy efforts, except you can't assign it to perform other actions. It does, however, benefit from "machine learning algorithms" that detect the difference between an actual squeeze and an accidental one.

Glorious display

The Pixel 3 is fitted with a 5.5in, 19:9 aspect ratio, OLED panel with a resolution of 1,080 x 2,160. It's an excellent panel, too.

On the Pixel 3's "natural" display profile – "adaptive" and "boosted" modes are a touch too oversaturated for my tastes – our X-rite calibrator recorded a sRGB gamut coverage of 94%. Colours are also practically faultless, with an average Delta E of 1.25 (anything below 1.5 is excellent, with zero being perfect).

The AMOLED display means that movies and photos benefit from plenty of pop. The screen is capable of reaching a maximum brightness of 398cd/m² with the auto-brightness setting engaged, which is decent enough for watching *Doctor Who* in the autumn sun. A circular polarising layer also helps reduce screen glare. Crucially, however, the Pixel 3 doesn't suffer from the same blue-tinted screen-flickering issues that afflicted last year's Pixel 2 XL.

Powerful performance

The Pixel 3 is powered by Qualcomm's familiar Snapdragon 845. This octa-core, 10nm chip is clocked at 2.8GHz, powers the majority of 2018's fleet of flagships and is no slouch. In tandem with 4GB of RAM, the Pixel 3 reached 2,430 and 8,007 in Geekbench 4's demanding duo of single- and multicore CPU tests. That's approximately 27% faster than the Pixel 2, but significantly slower than the Huawei Mate 20 Pro.

GFXBench GL's Manhattan 3 on-screen and offscreen GPU tests recorded faultless average frame rates of 60fps and 79fps respectively. You shouldn't encounter any problems running the latest graphically-intensive games on the Play Store.

An area where the Pixel 3 doesn't outperform its predecessor, though, is battery life. Sadly, it looks like the more demanding chipset has taken its toll on the Pixel 3's stamina, which was only able to reach 12hrs 22mins on a single charge during our in-house standardised battery-rundown test. That's not an abysmal score, but you'll be topping up your Pixel 3's battery more often than last year's flagship.

ABOVE There's no notch, just old-style "forehead and chin" bezels

PC PRO RECOMMENDED

"Using Google Assistant, the phone notifies you of an incoming call, and lets Google's AI butler pick up on your behalf"

ABOVE There's only one 12.2-megapixel camera on the back, but it's phenomenal – even in low light

Fresh Android Pie

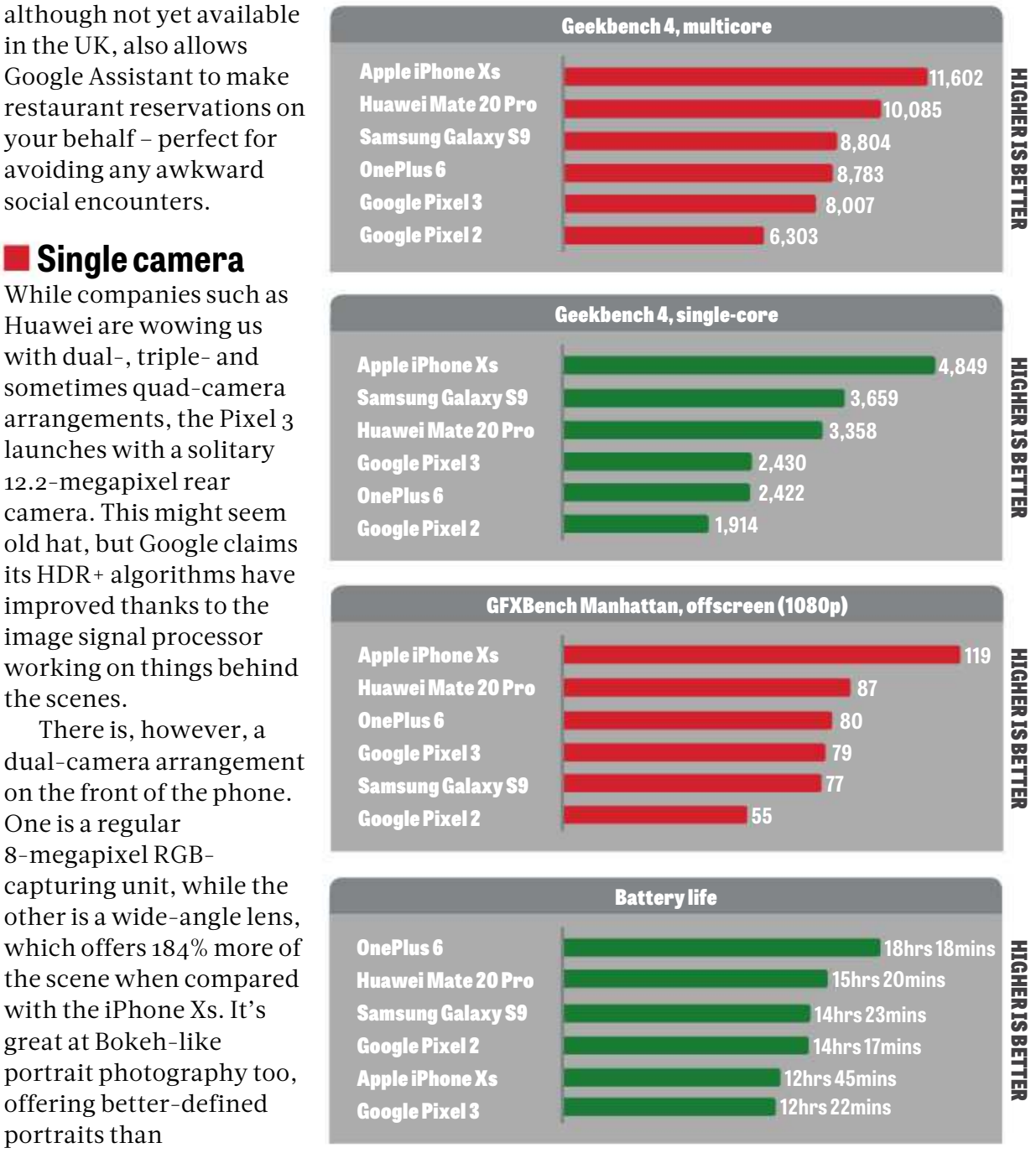
The Pixel 3 also launches with the latest version of Google's mobile operating system, Android 9 Pie, straight out of the box. No surprises there. Except, this isn't a stock Android experience as you'd expect. Instead, Google's own Pixel Launcher makes another appearance, which tweaks the UI and brings a handful of Pixel-specific features.

The way the app drawer works has changed slightly. Now, if you swipe up on the homescreen, you're presented with a scrollable list of your recently used apps, as well as a selection of five of your most-used applications. Swipe up a little further, and all of your apps are visible.

Call Screen is another handy new feature. Using Google Assistant, the phone notifies you of an incoming call, and lets Google's AI butler pick up for you. You receive a transcript while the conversation is going on, and can also choose from a list of responses – just as with the recent Gmail update on desktop.

Speaking of which, Gmail's Smart Compose feature has arrived on Android. Limited to the Pixel 3 family at the moment, simply start typing an email and Google will try to finish the sentence for you. It's creepy but effective.

Elsewhere, you can flip the phone on its front to silence any sounds and notifications. Google Duplex,



although not yet available in the UK, also allows Google Assistant to make restaurant reservations on your behalf – perfect for avoiding any awkward social encounters.

Single camera

While companies such as Huawei are wowing us with dual-, triple- and sometimes quad-camera arrangements, the Pixel 3 launches with a solitary 12.2-megapixel rear camera. This might seem old hat, but Google claims its HDR+ algorithms have improved thanks to the image signal processor working on things behind the scenes.

There is, however, a dual-camera arrangement on the front of the phone. One is a regular 8-megapixel RGB-capturing unit, while the other is a wide-angle lens, which offers 184% more of the scene when compared with the iPhone Xs. It's great at Bokeh-like portrait photography too, offering better-defined portraits than Apple's equivalent.

Back to the rear camera, and results are again phenomenal. The Pixel 3 captured images with superb dynamic range and colour saturation, which again proved better than Apple's when I placed the photos side by side. The HDR+ algorithms worked as well as ever, effectively capturing tricky areas such as cloud layers and tree foliage, while lighting up darker, shadowy areas.

Low-light performance is just as good. The relatively wide f/1.8 aperture brightened up the image nicely, capturing pictures with oodles of detail. Objects looked crisp and detailed, and colour reproduction was slightly more accurate than images captured on the iPhone Xs.

Overall, the Pixel 3's camera is a cut above everything else, but it's not as wide a gap as I was hoping. The absence of a secondary telephoto lens dampens the Pixel 3's photographic versatility, especially compared to the Huawei Mate 20 Pro, and no support for 4K video recording at 60fps is a real shame.

Pixel perfect?

Google is sticking to the same tried and tested release formula it's adopted for the previous two years: slightly tweaking the core Pixel DNA, while offering a handful of mini-improvements without radically altering the blueprint.

Sadly these improvements come with a price hike. The 64GB Pixel 3 costs £739, which is £110 more than the Pixel 2 at launch. The 128GB model costs £839. That's still less than the Huawei Mate 20 Pro, which includes a larger screen, note, but the bigger competition probably comes from the Samsung Galaxy S9 – and that's now dropped to around £500.

Despite the better-value Galaxy S9, this is the best compact Android phone you can buy. That's partly due to the promise of immediate OS updates, partly due to its simplicity, but mainly because it barely puts a foot wrong. Yes, it's expensive, but you won't regret buying this phone.

NATHAN SPENDELOW

SPECIFICATIONS

Octa-core 2.5GHz/1.6GHz Qualcomm Snapdragon 845 • 4GB RAM • Adreno 630 graphics • 5.5in OLED screen, 1,080 x 2,160 resolution • 64GB storage • nano SIM and eSIM • microSD slot • IP68 rating • 12.2MP rear camera • dual 8MP/8MP front camera • 802.11ac Wi-Fi • Bluetooth 5 • NFC • USB-C connector • 2,915mAh battery • Android 9 • 68.2 x 7.9 x 145.6mm (WDH) • 148g • 1yr warranty

Google Pixel 3 XL

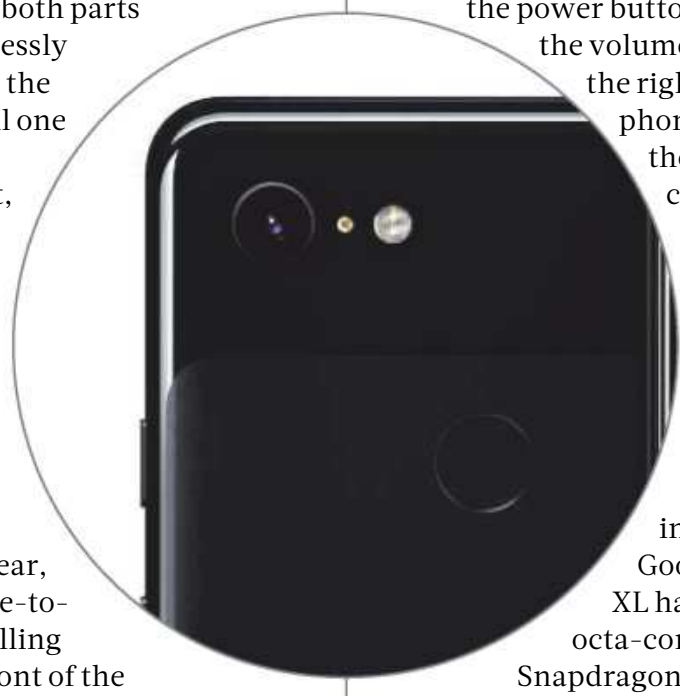
Bigger and better than the Pixel 2 XL, but without the sweeping improvements we were hoping for

SCORE ★★★★½

PRICE 64GB, £724 (£869 inc VAT)
from store.google.com

The Google Pixel 3 XL is the big brother to the Pixel 3 (*see p70*). It has a larger 6.3in display with a resolution of 1,440 x 2,960, but in most other respects it's identical: same 12.2-megapixel camera, same Qualcomm Snapdragon 845 processor and it looks almost identical, too.

The rear is still divided into matte and glass portions, with the top glossy part surrounding the single camera and flash, while the bottom matte part offers more grip that you would normally get from a glass-backed phone. Look closely, though, and you'll see that both parts are now seamlessly joined; in fact, the rear panel is all one piece of glass.



At the front, the 6.3in display has a rather unsightly notch eating away at it from the top edge. It's an OLED display, as it was last year, and it's an edge-to-edge screen, filling much of the front of the phone. The screen is topped with Gorilla Glass 5 so it's scratch- and shatter-resistant and easy to clean.

Other notable design features are more subtle. The coloured power button is a nice touch, even if I'm not sure about the choice of lime green on the white model. There's IP68 waterproofing and 10W Qi wireless charging now, as well as front-facing stereo speakers that sound pretty good for a phone.

As with the Pixel 3, the phone transforms into a mini Google Home Hub when you drop it on the £69 Pixel Stand charger – it will even patch through the video feed from your Nest Hello (if you have one) when someone rings the doorbell.

Otherwise, the 3 XL is almost identical to the 2 XL. It still has "ActiveEdge" sensors built into the frame of the phone so you can activate Google Assistant with a squeeze (does anyone use this feature?). There's still no microSD card expansion and the buttons are in roughly the same place: the power button sits above the volume rocker on the right edge of the phone, the tray for the nano SIM card is on the bottom edge next to the USB-C socket and there's no 3.5mm headphone jack.

Looking inside, the Google Pixel 3 XL has a 2.8GHz octa-core Qualcomm Snapdragon 845 with 4GB of RAM to back it up and either 64GB or 128GB of storage. There's no need for separate benchmark results on the graphs on p71: the Pixel 3 and 3 XL score identically, give or take a few points, in every key test. This isn't to diminish how responsive this phone, is, though. With Android 9 Pie on board, it's a wonderfully slick experience.

Battery life is somewhat less impressive, with the Pixel 3 XL lasting 13hrs 8mins in our video rundown test – longer than the smaller Pixel 3, but well behind the 19hrs 35mins of the Galaxy Note 9. Perhaps Google should have made space for a bigger battery than the disappointing 3,430mAh unit inside.

Then we come to the display. Peak brightness isn't the best – at 393cd/m² you might struggle to read your messages on a bright sunny summer day – but colour accuracy is fantastic. Measured with the phone's "Natural" colour profile enabled, its average Delta E score is 1.21, which is as good as smartphones get.

The screen is HDR certified, too, so you can be sure Netflix movies and TV shows look their absolute best. If you prefer a more vivid or muted look, the Pixel 3 XL has three colour profiles to choose from: Natural is, effectively, sRGB; Boosted is sRGB expanded by 10%; and Adaptive is the most vivid and closest to the DCI-P3 colour gamut.

See our review of the Pixel 3 for our verdict on the camera, because it's the same brilliant combination of hardware and software. Expect stunning results, but you miss out on the flexibility and optical zoom of the Mate 20 Pro.

The 64GB version of the Pixel 3 XL undercuts the Mate 20 Pro, costing £869 to its rival's £900, but if you want the same 128GB of storage then you'll need to pay £969. Either way it's expensive, but this is the way of such phones: the Galaxy Note 9 now costs around £830, the S9+ £799 and the iPhone Xs starts at £1,099.

ABOVE **The Pixel 3 XL's Gorilla Glass 5 screen is scratch- and shatter-resistant**

"You couldn't describe the Google Pixel 3 XL as a bargain, but it is a great phone – it's everything the Pixel 2 XL should have been"

LEFT **The cameras are stunning, but there's no optical zoom**

BELOW **The £69 Pixel Stand turns the 3 XL into a mini Home Hub**

You couldn't describe the Google Pixel 3 XL as a bargain, then, but it is a great phone. In short, it's everything the Pixel 2 XL should have been. My problem with it is that it doesn't offer more. I wanted greater battery life and for Google to stretch its lead in computational photography, not sit on its hands. Which leaves me in a tough position. I don't think any of its rivals are much better, but I'm left wanting more. Only a year to wait for the Pixel 4 XL, then. **JONATHAN BRAY**

SPECIFICATIONS

Octa-core 2.5GHz/1.6GHz Qualcomm Snapdragon 845 • 4GB RAM • Adreno 630 graphics • 6.3in OLED screen, 1,440 x 2,960 resolution • 64GB storage • nano SIM and eSIM • microSD slot • IP68 rating • 12.2MP rear camera • dual 8MP/8MP front camera • 802.11ac Wi-Fi • Bluetooth 5 • NFC • USB-C connector • 3,430mAh battery • Android 9 • 76.7 x 7.9 x 158mm (WDH) • 184g • 1yr warranty

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Apple Watch Series 4

The new Apple Watch is the sleekest, slickest and best smartwatch Apple has ever made

SCORE ★★★★★

PRICE 40mm GPS, £333 (£399 inc VAT) from apple.com/uk

When Apple launched the Watch Series 4, the company boasted it had been "fundamentally redesigned and re-engineered". Although that's true – the watch comes in two new sizes and has a 30% larger screen – when you see it in the flesh, it's less of an overhaul than you might expect. The Watch Series 4 is unmistakably an evolution of its predecessors. Still, it has a series of stand-out new features – such as fall detection and the promised ability to perform an ECG test on your wrist – that make it the best smartwatch the company has ever made.

ABOVE **The new ECG function may prove a life saver, but it's not ready yet**

Back to basics

As with all Apple smartwatches before it, the Watch Series 4 still needs to be paired with an iPhone and comes with a choice of GPS-only or GPS+Cellular (EE and Vodafone only) that can be used to make calls, send messages and stream music independently of your phone. Both models include 16GB of storage and come in either 40mm or 44mm sizes – a fraction larger than the 38mm and 42mm of yore.

That might not sound like a huge difference, but coupled with a smaller bezel, its display looks significantly larger. Rounded corners offer a more edge-to-edge experience, and Apple takes advantage of the improved display to showcase sophisticated, customisable watch faces on the homescreen. Apps benefit, too, and everyday tasks such as selecting an icon from the Grid View app launcher are made easier thanks to the extra pixels.

The pixel density hasn't changed drastically. The 44mm model has a pixel density of 341ppi thanks to its 1.7in, 368 x 448 display while the 40mm Watch 3, which has a 312 x 390 resolution 1.5in screen, is only slightly less sharp at 332ppi.

The other change is that the Series 4 is thinner than its predecessor, measuring a mere 10.7mm where the Watch 3 was 11.4mm thick. Again, that might not sound like much, but the new 44mm model we were sent feels considerably less bulky on the wrist than its 42mm predecessor. Despite this, both sizes of the Watch 4 are a little heavier than the equivalent Watch 3 models, weighing 30.1g and 36.7g without a strap respectively.

The other headline design change is that the Watch 4's Digital Crown now has haptic feedback, which makes scrolling through menus and zooming in and out in the Maps app feel much more precise than before.

As you'd expect, there's a single, subtle vibration every time you jump from one item or page to another, which makes a drastic difference from only having visual cues on screen.

Another more subtle change is that the Digital Crown now has only a red ring on its face, where it was filled with red on the Watch 3.

The side button is still situated below the Digital Crown – the only difference is it's now flush with the rest of the casing instead of protruding slightly as it does on the Watch 3. The microphone, though, has been moved to the other side of the casing so it's further away from the Watch Series 4's new, louder speaker.

Flip the watch over and you'll see more evidence of change. The back of the casing is now made entirely from black ceramic and sapphire crystal, materials that are used more sparingly on the GPS+Cellular Watch 3. Although it's more aesthetically pleasing, this is a change that Apple says has mostly been made with improved cellular reception in mind.

LEFT **Yes, that's a real strap: you can buy the Hermes version with a Double Tour strap for a bargain £1,399**

"The Digital Crown now has haptic feedback, which makes scrolling through menus and zooming in Maps feel much more precise"

ECGs and fall detection

The feature that grabbed most column inches after Apple's Watch 4 keynote was that it will be able to perform an ECG test from your wrist thanks to its new electrical heart rate sensor. During the presentation, Tim Cook said the Watch is the first consumer device ever made with these capabilities, which isn't true – search for WIWE, KardiaBand and KardiaMobile – but it's still mighty impressive to see such advanced technology being implemented in a mainstream smartwatch.

Less impressive is that the ECG functionality isn't here yet. It had only

just passed FDA accreditation when Tim Cook took the stage to reveal the watch, and when it's eventually rolled out, it will only be available in the US. It should be introduced in the UK at some point, but don't rush out and buy the Watch 4 for this function.

Fall detection has landed, as such. Enabled by the device's improved accelerometer and gyroscope, should you trip then the device assesses the severity of your fall and will call emergency services directly from your wrist. This only happens if it doesn't detect any movement from you within a minute of the fall, though, so you don't need to worry about setting it off by accident. Notably, fall detection is turned off by default for under 65s.

Apple warns that more physically active users are more likely to trigger fall detection by mistake during high-impact activities. Like a rag to a bull, I tried several times to simulate a fall – albeit with a soft mattress positioned below me – but fall detection wasn't triggered once.

watchOS 5

Other features new to the Watch 4 include the ability to notify you if your heart rate drops too low, along with atrial fibrillation detection. The latter is again US-only for now and not a Watch 4 exclusive: Watch 3 owners will get that when their watches update to the new operating system. Taking a leaf from Fitbit's book, Apple has added activity competitions, where you can challenge a friend to a week-long competition to see who can close the most activity rings.

Then there's automatic exercise detection, which detects when you start working out and opens the Workout app for you, so you can log your exercise in its entirety. This sprang into action the first time I went on a brisk walk across town. And, when I forgot to stop the workout, it automatically prompted me to do so after I'd been seated for a few minutes. Unfortunately, it wasn't so proactive when I jumped on a bike for half an hour, never asking me if I wanted to log the ride as a workout.

There are more advanced workout features now, too. Yoga and hiking have been added to the existing workout modes and, during a run, you can set pace targets and also track your cadence (steps per minute) for the very first time.

Another first? Podcasts are now available on the Apple Watch and sync with your phone automatically so the latest episodes of your subscriptions will be on hand, even if you've left your phone at home. Then there's the all-new Walkie Talkie app, which shows any of your regular contacts who own an Apple Watch and allows you to start a voice call with them instantly with a single tap.

ABOVE **The new watch faces on the Series 4 put the data and tools you need front and centre**

All these features are shared with the Watch 3. One feature exclusive to Watch 4 owners in watchOS 5, though, is its customisable watch faces. The Infograph watch face, for example, lets you add up to eight "complications" (widgets to the rest of us), where the most you could have on any face on the Watch 3 was five. That sounds trivial, but the problem with most smartwatches is that anything hidden further away than the homescreen is quickly forgotten about.

The opposite is true with the Watch 4. Its new watch faces put all manner of information to the fore, including world clocks, weather, calendar, activity and heart rate, along with shortcuts to apps such as Music and Walkie Talkie. With the option to customise all the complications, you can make the Watch 4 the timepiece you want it to be.

Twice as fast?

The Watch 4 employs an all-new 64-bit, dual-core S4 processor that Apple claims is up to twice as fast as the S3 chip in the Watch 3. History has made us treat such claims with a big bag of salt, but everything about the UI feels fast and smooth.

Elsewhere, performance improvements are much more marginal. The Watch 4's speaker has had a 50% boost to its maximum volume and the device also now supports the newer Bluetooth 5 standard, which has a longer range and better power efficiency than Bluetooth 4.2.

ABOVE **There are a couple of stylish design tweaks on the side, such as a red ring on the Digital Crown**

There's no drastic change as far as battery life is concerned, though, with Apple claiming the Watch 4 lasts the same 18 hours between charges as the Watch 3. In real-world use, I've found it usually exceeds that, lasting at least 36 hours and sometimes as long as 48 hours. Of course, this depends heavily on how you use the Watch.

Decision time

Prices start at £399 for the 40mm, GPS-only model and £499 for the 40mm GPS + Cellular model. For both, you'll need to spend an additional £30 if you want the larger 44mm watch.

Should you opt for the GPS + Cellular model, you can also choose a steel case variant, but you'll need to spend £699.

So should you buy one? First off, it's disappointing that the Apple Watch 4's groundbreaking new features won't make an appearance in the UK anytime soon. Despite this, the Watch 4 is better than its predecessor in every way. The Watch 3 has dropped by £50, meaning the 38mm, GPS-only model is available from £279, but the improvements are worth it.

It's twice as fast and thinner, meaning the only reason to put off buying the Apple Watch 4 is the price and the lack of compatibility with Android phones. **JONATHAN BRAY**

SPECIFICATIONS

40mm model: 1.5in, 312 x 390 touchscreen • 40 x 34 x 10.7mm (HWD) • 30.1g
44mm model: 1.7in, 368 x 448 touchscreen • 44 x 38 x 10.7mm (HWD) • 36.7g
Shared: dual-core Apple S4 processor • 16GB storage • 802.11n Wi-Fi • Bluetooth 5 • GPS • watchOS 5 • 1yr RTB warranty

Adobe Photoshop Elements 2019

Still powerful, but this once peerless beginner's photo-editing package is now past its prime

SCORE ★★★☆☆

PRICE £72 (£87 inc VAT)
from pcpro.link/291adobe

Just as you can rely on the Christmas decorations arriving in the supermarkets every October, so too can you can count on a new release of Photoshop Elements. Adobe adds a scattering of features every autumn to justify a fresh version, but in an era when tablet and phone apps are becoming more sophisticated, and enthusiast-grade editors are getting cheaper, it becomes harder to justify Photoshop Elements' existence.

That said, it's easy to forget how much editing power lies beneath the software's consumer-friendly surface. Plunge the software into Expert mode and you'll find many of the power features that are in full-fat Photoshop.

So what's new? Most of the fresh features come in the form of Guided Edits, where Elements takes you step by step through procedures that add effects such as motion blur, removing scratches and blemishes, or popping a colour in a black and white image.

The majority fall into the novelty category, or what Elements cringingly describes as "fun edits". Arguably, the most impressive of these is the "multi-photo text" process. Here you select a background image, add some large text over the top of it, and then fill each of the letters with a different photo. Elements makes this process practically foolproof, but it only gets you halfway there. For example, there are no instructions on how to move the photos within the frame of the letters, leading to awkward crops such as the chopped-off face in the first "O" of our test image above.

Then there's a "partial sketch" tool, where you can select part of a picture to look like it's been drawn in pencil (coloured or greyscale). This can tip over into the "easy way to ruin a nice photo" category, as the pencil sketch effect isn't very convincing. It's also one of the few times I've seen a Guided Edit fail. The final step is meant to allow you to flip the parts of the image that are sketched and which aren't, but in my test it simply turned the whole photo into a sketch.

Further Guided Edits let you overlay a frame and text on a photo, while another lets you create "fun memes" (we're applying for an injunction to prevent Adobe ever using the word "fun" again). These are the type of memes that were popular in 2012, with the photo in the centre and text above and below. It works well but you wonder where Adobe's developers have been for the past few years. What are they planning for next year: Myspace support?

In Adobe's defence, it makes sharing the memes and other Guided Edits simple. My 25MB image was automatically resized below Twitter's 2MB limit without any intervention. But the social networks you can share with are restricted to only Flickr and Twitter. Not supporting Instagram, at the very least, is baffling.

Aside from Guided Edits, other new features are thin on the ground. There's a revamped collage system:

ABOVE "Multi-photo text" looks good, but you're not told how to move photos within the letters

"Guided Edits are good at steering you and Elements has lost none of its power, but its rivals have got better and cheaper"

BELOW New features include a revamped collage tool and the hit-and-miss "partial sketch" Guided Edit

you select the images you want to use from Elements' rather tired-looking Organizer, hit the Create button, choose Photo Collage and have a selection of layouts to choose from. This time it's easy to move the photos inside the frames and Instagram-style layouts are included – but there's still no way to upload directly to that network.

There's also a revamped homescreen and a feature that uses "AI" to automatically create slideshows of events such as birthdays. There wasn't a great deal of the "I" being used in the slideshows it created for me – pictures seemed to be plucked at random and were often repetitive. Finally, there's support for the High Efficiency Image Format if you're running Elements on a Mac, which is useful if you're editing iPhone snaps.

Elements finds itself trapped in an awkward middle ground. If you want to make collages, flashy graphics or to smash your photos with filters, there are all manner of free apps available: Google's Snapseed, Over, Enlight, even Adobe's own Photoshop Express.

If you want the high-end features, such as layer-based editing, the ability to wipe errant objects out of photos or to add gradients to boring skies, then Affinity Photo is perfectly capable and much cheaper on desktop and tablet.

Which leaves me wondering what the point of Photoshop Elements is in 2019. The Guided Edits are good at steering you through tricky processes and it's lost none of its power, but its rivals have got better and cheaper. At £87, Elements starts to butt up against Adobe's own Photography Plan, which includes both Lightroom and full Photoshop. These tempting alternatives leave Elements feeling like it's run out of steam. **BARRY COLLINS**

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NetSupport DNA

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DUMP WINDOWS DEFENDER NOW

Unluckily for Windows Defender, we pitch it against 13 superior security products. Find the best free and paid-for alternatives and switch today

Are you still relying on Windows 10's built-in antivirus tool? Sure, it's better than nothing, but if you think it's just as good as any other security suite, we've news for you. This month, we pit Windows Defender against alternative solutions from big names such as AVG, Kaspersky and Norton. We weigh up how effective each one is at blocking viruses, and compare ease of use and performance. As the results make clear, there's a big difference between the best and worst packages out there – and we hope it's not giving too much away to reveal that (not for the first time) Windows Defender comes dead last.

So, if you're serious about your security, it's time to invest in a third-party suite. It doesn't have to be expensive: on the following pages, you'll find award-winning software costing just a few pounds per year for each device, and some respectable free tools as well. Making the switch needn't mean slowing down your PC, either; as we discover, many of these security suites actually make your system feel nippier than it did when running Windows Defender.

The only question is which one's right for you – so read on for our full reviews and rankings.

CONTRIBUTOR: Darien Graham-Smith

Contents

Security suites:

Six questions to ask before you buy

Whether you're looking to invest or hoping to get away without paying a penny, we ask the questions that demand answers

1 Do I still need security software?

Viruses haven't been much in the news lately, and the platforms we rely on are a lot more security-conscious than they used to be. The days when you could get infected simply by visiting the wrong website, or when you could pick up a malicious worm by merely connecting to the internet, are thankfully long gone.

That doesn't mean the threat has gone away. It may be harder for attackers to sneak under the radar, but they can still compromise your security through social engineering – that is, tricking you into voluntarily installing dodgy apps and giving away information that you really shouldn't. A good security suite can save you from yourself when you're about to make a dangerous mistake.

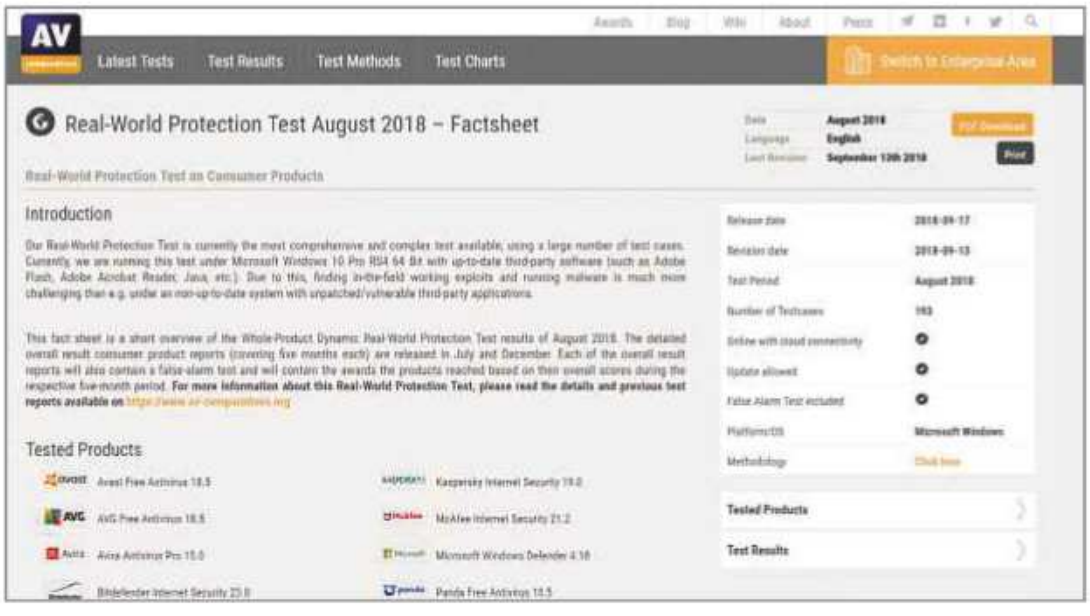
As ever, there's no telling where the next outbreak will come from, or what form it will take. Last year saw the sudden explosion of ransomware, and while security suites were quickly updated to block the threats, a heavy price was paid (often literally) by individuals and businesses who assumed that the malware threat was a thing of the past. You know what they say about an ounce of prevention.

2 Shouldn't I just go for the package with the highest protection rating?

It seems obvious. If one security suite achieves a perfect 100% protection rating and another only achieves 98%, choosing the second means you run the risk of something slipping through the net. Decision made!

ABOVE To rank the suites, we turned to recent scores from AV-Test...

BELOW ...and the Innsbruck-based testing organisation AV-Comparatives



There's more to it than that, though, because while several packages can claim to block every threat – in fact, fully half of this month's suites racked up a perfect score – very few of them manage to do so without wrongly flagging up a few false positives. At best, that's an inconvenience, as it means that you are being blocked from accessing perfectly legitimate software and files.

Worse still, if your security suite makes more than the occasional error, it undermines trust. If you're regularly being warned away from programs that you know full well are safe, it creates doubt when the software blocks something you're less certain about – and that uncertainty creates a foothold for social engineering attacks. Since almost every security suite can clean up the vast majority of malware (none of this month's contenders scored less than 99%), the false-positive rate is a crucial point of distinction between security products.

3 Won't security software slow down my PC?

Yes, it will. Sorry about that. But it won't be as bad as you fear: the lesson of the early 2000s has been learnt, and it helps a lot that modern PCs aren't starved of RAM and running on clunking mechanical hard disks.

Security packages also use clever techniques to minimise the impact. For example, applications are typically scanned when you first download and install them – which doesn't feel like much of an imposition, because you're not expecting an instant response anyway. When you run the application, the security software then only needs to briefly check whether the file has changed; if it hasn't, it doesn't need to be scanned again and can be launched at very nearly full speed.

And if you're currently using Windows without any third-party security software, you can actually expect things to feel faster after you install a new suite. That's because the built-in Windows Defender antivirus component slows down your system to a greater degree than a commercial alternative. As we discuss opposite, that's based on testing by AV-Comparatives and AV-Test across a wide range of real-world tasks, including web browsing, installing and running apps and copying files.

4 What features do I need?

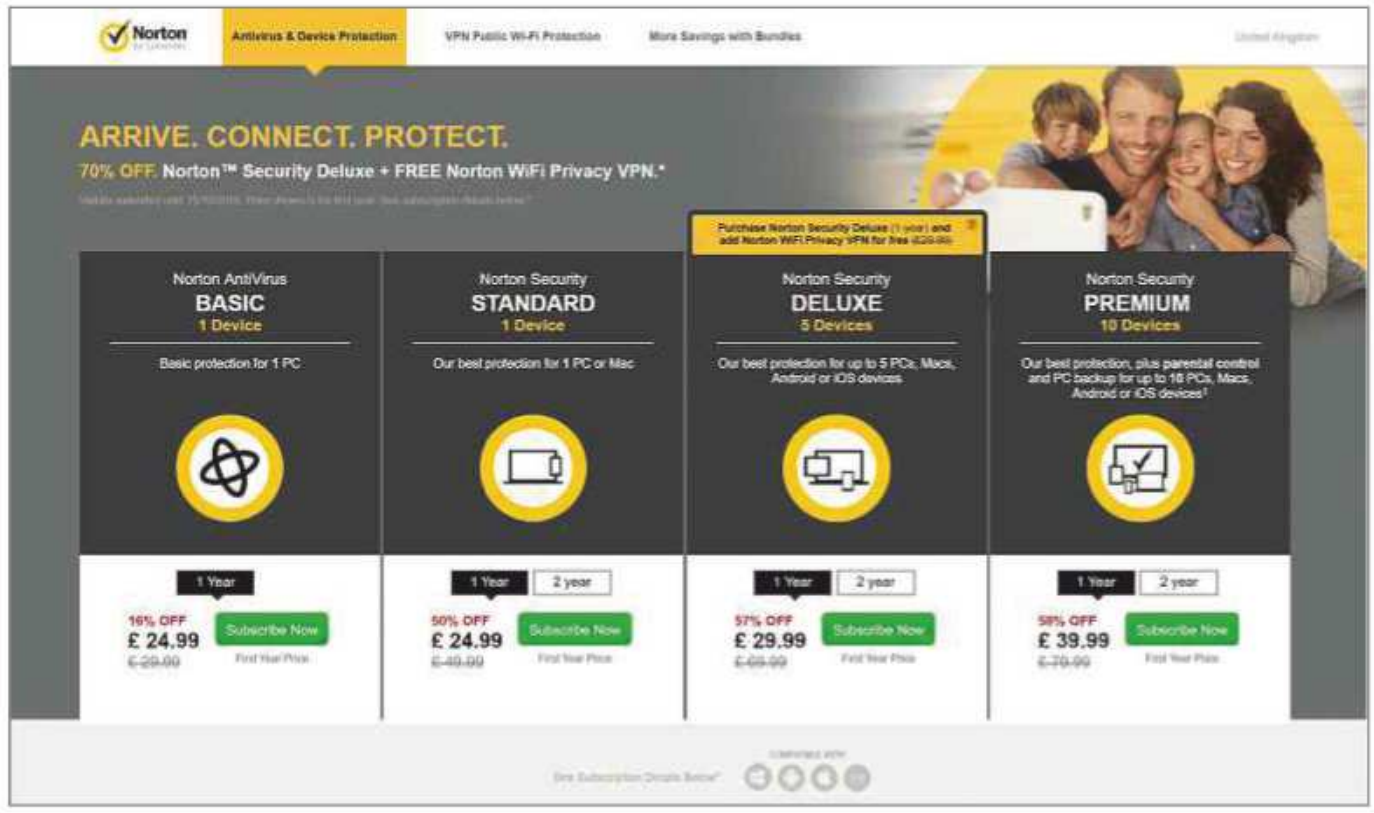
This is largely a question of personal preference. Even the most

basic antivirus tool should intercept malware as soon as it lands on your hard disk, or at worst when it's launched, and that will protect you from the great majority of threats. We'd suggest that you also look for some sort of web protection: an attempted "drive-by download" ought to be picked up by your malware scanner, but you're safer still if your security software keeps you away from the infected site in the first place. Moreover, certain suites can flag up phishing sites, which try to deceive you into entering passwords and other credentials.

What about firewall features? It's possible to overstate the need for these: if your computer is connected to the internet via a domestic router then it's very difficult for a hacker or worm to break in. However, some packages include a custom firewall that makes it easier to monitor outgoing connections from the programs running on your computer, and block the ones you don't trust. Others offer simple tools that help you configure Windows' built-in firewall to the same end.

Specialised anti-ransomware measures have recently become popular, too. These tools bar any unrecognised application from accessing your personal files – ensuring you're safe even from brand-new, unrecognised threats that manage to sneak past your regular defences. Webcam protection is another popular tool, ensuring that no app can surreptitiously fire up your laptop camera and start spying on you.

Many suites include secondary tools such as password managers, secure file erasers and performance optimisers. We don't think it's worth paying for these, as you can normally get the same benefits from free software. If you don't have kids then parental controls won't be worth much to you, either; and if this is something you want then be sure to check the feature list, because the tools on hand don't always do much more than Microsoft's free Family Safety service.



ABOVE Before you buy, take a look at the official site for deals but also look around on third-party sites

"Even the most basic tool should intercept malware as soon as it lands on your hard disk, or at worst when it's launched"

5 How much should I pay?

The old adage says that you get what you pay for – but in the world of security suites, that doesn't apply at all. Some publishers sell their products only at full price through their own websites; others are happy to let independent retailers offer deep discounts. Neither approach tells you anything about the quality of the software. There are, of course, a good number of free security tools out there too, with varying feature sets and performance records.

The best advice is simply to spend a few minutes shopping around before you buy. Like the big furniture stores of yore, certain security vendors seem to have a semi-permanent sale on, so downloading direct from the website might not be a bad idea. However, browse a few independent online retailers and you'll often find boxed editions on sale even more cheaply – as long as you don't mind waiting a few days for your software to arrive.

The same applies when your subscription is about to expire. You'll almost certainly get a friendly pop-up inviting you to extend your licence for the full RRP; you can save a lot of money by allowing it to run out and simply buying a new copy.

6 Is it safe to buy an older suite?

We all know how important it is to keep your security software up to date, so you might be wary of buying a 2017 or 2018-branded edition of your chosen suite. In reality, though, those dates are just used for marketing – what you're really buying is a year-long licence to use the software, starting whenever you first install it. The product key that comes with an older edition will happily activate the latest release, which you can normally download from the publisher's website. Or, you can just install the older software and wait for it to automatically update itself.

It's probably for this reason that some publishers have stopped using years in their product titles, while others use the dates in publicity, but not within the software itself. It's a useful thing to know, though, because if you scout about online you can often find "old" security software being sold off at knock-down prices.

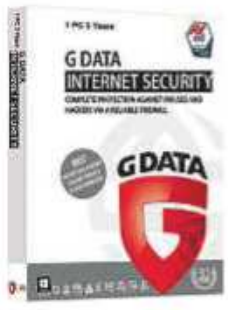
How we test

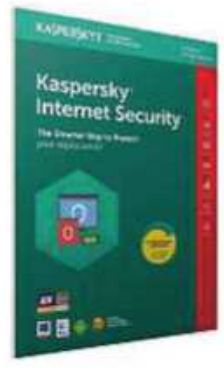
Each of the 14 security products on test this month gets a star rating out of five. This partly reflects how practical and user-friendly its feature set is, and value for money is taken into account, too.

Clearly, though, the most important question is how effective each package is at protecting you from viruses – plus, how susceptible it is to false positives, and how it impacts the responsiveness of your PC. Here we've turned to not one but two of the most respected antivirus testing organisations in the business: AV-Comparatives.org in Innsbruck, and Magdeburg-based AV-Test.org. Both labs carry out extensive independent testing of a wide range of security products, and publish protection scores, false-positive rates and performance rankings for a variety of real-world tasks. The figures we cite on the following pages represent combined averages of both organisation's most recent scores, and you'll find selected results in our graphs on p92. The full report AV-Comparatives report can be downloaded from **pcpro.link/291avc**, and you can download the AV-Test results from **pcpro.link/291avtest**.

	Avast Free Antivirus	AVG Internet Security Unlimited	Avira Antivirus Pro	RECOMMENDED Bitdefender Internet Security 2019	BullGuard Internet Security 2019	Eset Internet Security
Overall rating	★★★★☆	★★★☆☆	★★★☆☆	★★★★★	★★★☆☆	★★☆☆☆
Price (inc VAT) [1]	Free	£19 (£23)	£33 (£39)	£21 (£25)	£8 (£10)	£42 (£50)
Coverage included in price above	N/A	1yr, unlimited	1yr, 3 devices	1yr, 3 devices	1yr, 3 devices	1yr, 3 devices
Supplier [2]	avast.com	pcpro.link/291avg	avira.com	bitdefender.co.uk	pcpro.link/291bull	eset.com
Publisher's website	avast.com	avg.com	avira.com	bitdefender.co.uk	bullguard.com	eset.com
Other editions offered	Pro Antivirus, Internet Security, Premier	Antivirus Free, Ultimate	Free Antivirus, Internet Security, Prime	Antivirus Plus, Total Security	Antivirus, Premium Protection	NOD32 Antivirus, Smart Security Premium
Free trial	N/A	30 days	30 days	30 days	60 days	30 days
Features						
Malicious website detection	✓	✓	✓	✓	✓	✓
Safe browser	✓	✓	✗	✓	✗	✓
Browser extension	✓	✓	✗	✓	✗	✗
Firewall	✗	✓	✗	✓	✓	✓
Password manager	✗	✗	Separate download	✓	✗	✗
Anti-ransomware folder protection	✗	✓	✓	✓	✗	✓
Auto software updater	✓	✗	Separate download	Notify only	✗	✗
Parental controls	✗	✗	✗	✓	✓	✓
Secure file delete	✗	✓	✗	✓	✗	✗
Performance tuning	✗	✗	Separate download	✗	✓	✗
Mobile protection included	✗	✓	✓	✗	✗	✗
Webcam protection	✗	✓	✗	✓	✗	✓
Silent running/ game mode	✓	✓	✗	✓	✓	✓
File encryption	✗	✗	✗	✓	✗	✗
Other notable features	Create recovery media, email protection	Boot-time scan, multi-device management	Email protection, multi-device management	Downloadable recovery media, phishing protection, VPN	Backup module	Downloadable recovery media

1. Price quoted is for one year and three devices where offered. Exact combination of duration and devices is listed in the row below. Note that prices may vary as offers lapse. **2.** *PC Pro* links direct you to the exact deal we found at time of publication.





		LABS WINNER	RECOMMENDED			RECOMMENDED	
F-Secure Safe	**G Data Internet Security**	**Kaspersky Internet Security**	**McAfee Internet Security**	**Microsoft Windows Defender**	**Symantec Norton Security Deluxe**	**Panda Free Antivirus**	**Trend Micro Internet Security**
★★★☆☆	★★☆☆☆	★★★★★	★★★★☆	★☆☆☆☆	★★★☆☆	★★★★☆	★★☆☆☆
£13 (£15)	£38 (£45)	£21 (£25)	£8 (£10)	Free	£17 (£20)	Free	£25 (£30)
1yr, 5 devices	1yr, 3 devices	1yr, 3 devices	1yr, 3 devices	N/A	1yr, 5 devices	N/A	1y, 3 PCs
pcpro.link/291fsc	pcpro.link/291gda	pcpro.link/291kis	pcpro.link/291mca	N/A	pcpro.link/291nor	pandasecurity.com	pcpro.link/291tre
f-secure.com	gdatasoftware.co.uk	kaspersky.co.uk	mcafee.com	microsoft.co.uk	uk.norton.com	pandasecurity.com	trendmicro.co.uk
Anti-Virus, Internet Security, Total	Anti-Virus, Total Security	Free, Anti-Virus, Security Cloud, Total Security	LiveSafe, Total Protection	N/A	Standard, Premium	Dome Essential, Dome Advanced, Dome Complete, Dome Premium	Antivirus+, Maximum Security
30 days	30 days	30 days	30 days	N/A	30 days	N/A	30 days
✓	✓	✓	✓	✗	✓	✗	✓
✗	✗	✓	✗	✗	✗	✗	✗
✓	Separate download	✓	✓	✗	✓	✓	✓
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✗	✗	✓	✗	✗	✗	✗	✗
✓	✓	✓	✓	✗	✓	✓	✓
✗	✗	✗	✗	✗	✗	✗	✗
None	Autostart manager, backup, create recovery media, email protection	Downloadable recovery media, software cleaner, trusted apps mode, VPN, web management portal	Disk cleanup	None	Disk defrag, startup manager	Create recovery media, VPN	Social media privacy checker

Bitdefender Internet Security 2019

We miss the old Autopilot mode, but otherwise this update sticks to the core strengths of Bitdefender

SCORE ★★★★★

PRICE 1yr 3 devices, £21 (£25 inc VAT) from bitdefender.co.uk

Protection rating 100%

False positives 0%

Performance 93%

The 2019 release of Bitdefender Internet Security ditches the old grey-on-black interface in favour of a smarter, brighter look – and the layout has been rejigged, too. Previously, many of the suite's options and settings were hidden away behind layers of tabs and links. Now everything is flatter, with many more buttons at the front of the interface. This puts the full potential of the program at your fingertips, but less technical users might find it a bit overwhelming.

Still, there's little need to regularly engage with the interface, because Bitdefender retains its beginner-friendly "Autopilot" feature. Yet this isn't quite what it used to be: in older versions, this setting instructed the suite to detect and block threats without any user intervention. Now, instead of acting on your behalf, it prompts you with recommendations. I can see the logic of this – when files are blocked or deleted without the user's knowledge, it can lead to issues – but it means that Bitdefender is no longer the perfectly unobtrusive security suite it once was.

Another disappointment is the VPN that's now bundled into the suite. This might sound like a positive addition, but in use it feels like trialware rather than a bona fide feature: you don't get to choose your exit node, and you're limited to a pretty mean 200MB of data transfer per day, which you'll likely burn through in minutes. To unlock the full, unlimited product costs an extra £30 a year – which, to be fair, is competitive with buying a subscription to a standalone VPN.

Beyond that, Bitdefender's core functions are largely the same as last year – and we can hardly complain about that, because the software was already loaded with great features. We particularly like the "Safe files" feature, which blocks unknown applications from altering files without your explicit authorisation – a simple measure that should completely defeat ransomware. The software can even roll back files that appear to have been maliciously encrypted, automatically restoring the previous version.

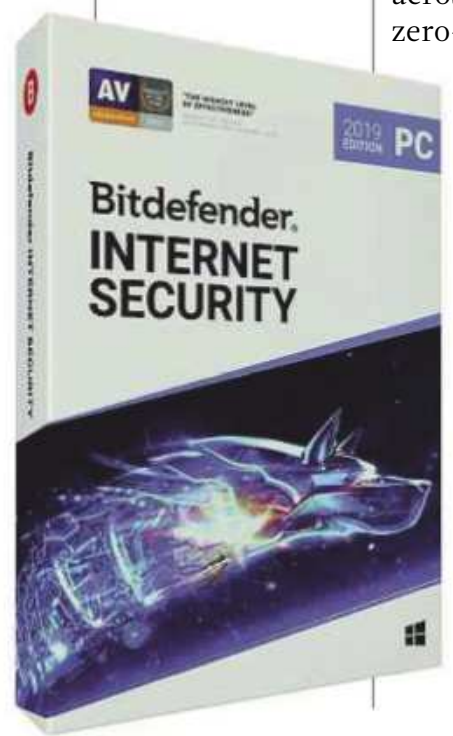
Then there's Bitdefender's flexible profile system. Many security products feature a "game mode", which suspends interruptions and CPU-heavy processes when you're playing a game; Bitdefender goes four better, with a set of profiles tailored to working, movie-watching, gaming, working over a public Wi-Fi network and running on battery power. Performance and security settings can be configured for each, and you can let Bitdefender guess when to switch profiles, or configure it to apply a particular one .

You also get webcam protection, which lets you block apps that try to access your camera, plus browser extensions that put green ticks (or red crosses) next to search results from Google, Bing and Yahoo, so you don't even need to put the software's web-based threat detection to the test. Throw in a vulnerability scanner, anti-spam and anti-phishing modules, a file encryption tool, a secure browser for banking and online shopping and a simple parental control system (which also works on Android) and you've got one of the richest feature sets around.

In truth, there's so much here that it makes the pricier Bitdefender Total Security package redundant. The premium suite adds system optimisation, anti-theft, startup booster and disk clean-up tools, but all of these jobs can be done satisfactorily with free tools. On a related note, we're also not delighted about the way the program shows you in-app adverts for other Bitdefender products, but you can turn this off from the Settings pane.

ABOVE **The sombre grey-on-black look has been replaced by a brighter interface**

PC PRO RECOMMENDED



Despite its broad set of features, Bitdefender Internet Security is nimble. AV-Comparatives rated it "very fast" in all but one of its tests (for website browsing, it was merely "fast"). AV-Test agreed that browsing was its weakest suit, recording a slowdown of 25% on a standard PC, but across all of that lab's tests the suite averaged a very creditable performance score of 90.2% – less than 2% behind first-place Avira.

And effective? Forget about it. Bitdefender romped through all of AV-Comparatives and AV-Test's malware tests with scores of 100% across the board, against both zero-day and known threats. Better still, it did so while maintaining this month's best false-positive rate, equivalent to one mistaken alert in 40,000.

It's reassuring too that these scores are very similar to last year's. Indeed, Bitdefender 2019 has changed little from the release that took the crown in our last Labs test, and we're happy to recommend it again. But, be warned: with its new interface the package feels quite different, and the loss of a "true" Autopilot mode will make it less appealing to users who prefer their security software to operate under the radar.

Kaspersky Internet Security 2019

Old reliable does it again, with supreme effectiveness, extensive features and minimal performance impact

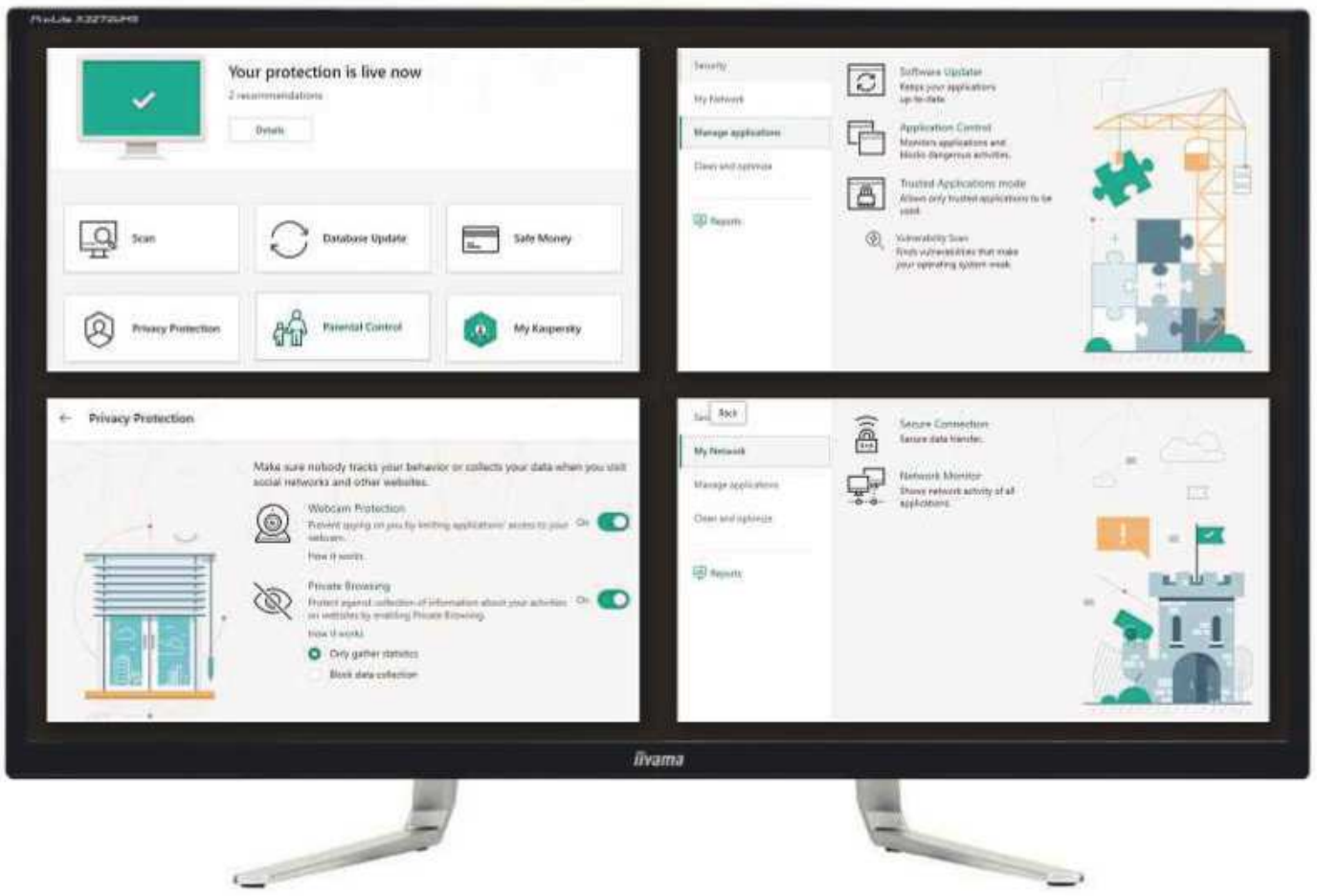
SCORE ★★★★★

PRICE 1yr 3 devices, £21 (£25 inc VAT)
from pcpro.link/291kis

Protection rating 100%

False positives 0%

Performance 93%



I've been reviewing security software for over a decade, and in all that time Kaspersky has never been far from the winners' podium. There are four reasons for that.

The first is that it's a supremely effective antivirus tool. The latest figures from both AV-Comparatives and AV-Test saw Kaspersky achieve a flawless clean sheet against all types of malware. What's more, it did so with a phenomenal false positive rate of just 0.01%; Bitdefender did very slightly better, but really this is as near to perfection as makes no odds.

Second, despite its thorough malware-detection technologies, Kaspersky is surprisingly light on resources: AV-Comparatives rated it as "very fast" in every test except archiving and unarchiving files, which isn't something you're likely to spend a lot of time doing. Indeed, with an average overall system performance score of 93%, it's one of the fastest security suites on test, drawing with Bitdefender and losing out only to Eset Internet Security. Note that percentage is compared to using no protection at all – if you're using Windows Defender with its lowly 78% performance score, installing Kaspersky will actually give you a significant speed boost.

The third thing Kaspersky has going for it is one of the most extensive feature sets in the business. Indeed, we several years ago reached the point where there were no major functions left to add, and compared to last year's release, the 2019 version is much more of a tinkering-with than an upgrade.

The one thing that's really new is the front-end: it exposes all the same functions, but has a cleaner, cooler look, with the medical green highlights of the 2018 edition replaced with a much more sombre shade.

There's been a bit of a reorganisation too, although Kaspersky has gone in the opposite direction to Bitdefender. Where the interface was previously characterised by dense lists of links and toggles, it's now more structured, with more subdivisions, more white space and jaunty illustrations to add visual interest to the various panes. The detailed stats and grungy technical settings are still there, but you now have to dig a little more deeply to find them.

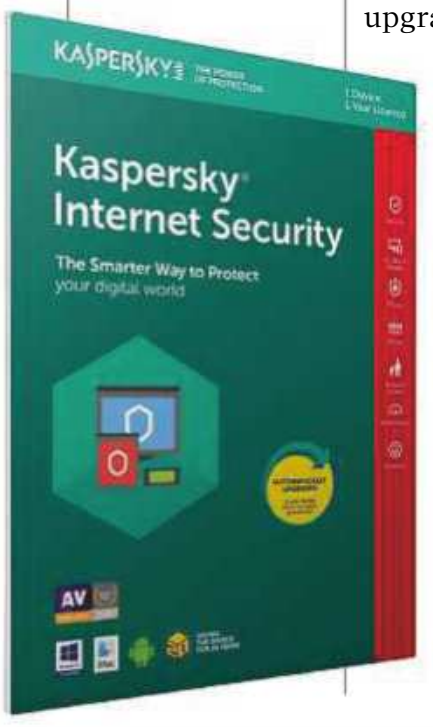
Another change is that Kaspersky now blocks adware, web trackers and "potentially unwanted applications" by default, where previously you had to opt into those behaviours. We think this is the right call, although all it means in practice is that some of the boxes that come up at installation are now pre-ticked. Along with the revamped interface, it makes the package feel a little more consumer-friendly, and less of a techie product; whether that's a good or bad thing, we'll let you decide.

So, let's talk about the functions themselves. One of our favourite features remains Kaspersky's Trusted Applications mode, which automatically blocks all software that isn't on the company's own whitelist. This makes Kaspersky ideal as a fuss-free security suite for less technical friends and family; indeed, it's a good starting point for most users, as if a program you trust is blocked, you can always individually approve it.

We also like the way that Kaspersky smoothly transfers you into the suite's hardened Safe Money browser when you visit a banking site, or any other site on your own customised list. It takes a lot of the friction out of the process – although for obvious reasons it won't store your passwords.

ABOVE The front-end has been tidied up – and there are even quirky illustrations

PC PRO LABS WINNER



Other welcome abilities include a software cleaner, for apps that you can't get shot of via the normal avenues; a webcam protection module that warns you if anyone's trying to snoop through your camera; an automatic software updater and vulnerability scanner; and a parental control module that allows you to restrict not only internet and application usage but social media access as well.

The one feature we have never been quite so sold on is the VPN component, because – just like Bitdefender's – it's a limited trial that allows you only 200MB of traffic a day. Still, Kaspersky hardly shoves it in your face; we're pleased to see that it's now discreetly tucked away in the Tools menu. And if you do want to upgrade to the unlimited service, it costs a very reasonable £20 a year for up to five PCs.

That brings us to the fourth and final reason we keep coming back to Kaspersky: sure, you can pay £45 for the software on Kaspersky's own website, but hop over to third-party sites and you can buy a three-device licence for just £25, making this not only one of the best, but also one of the cheapest internet security suites out there. Considering that the subscription includes Android support as well, it adds up – not for the first time – to a package that simply can't be beaten.

McAfee Internet Security 2019

If you want a fuss-free security suite that just does the job for a low price, McAfee is worth a look

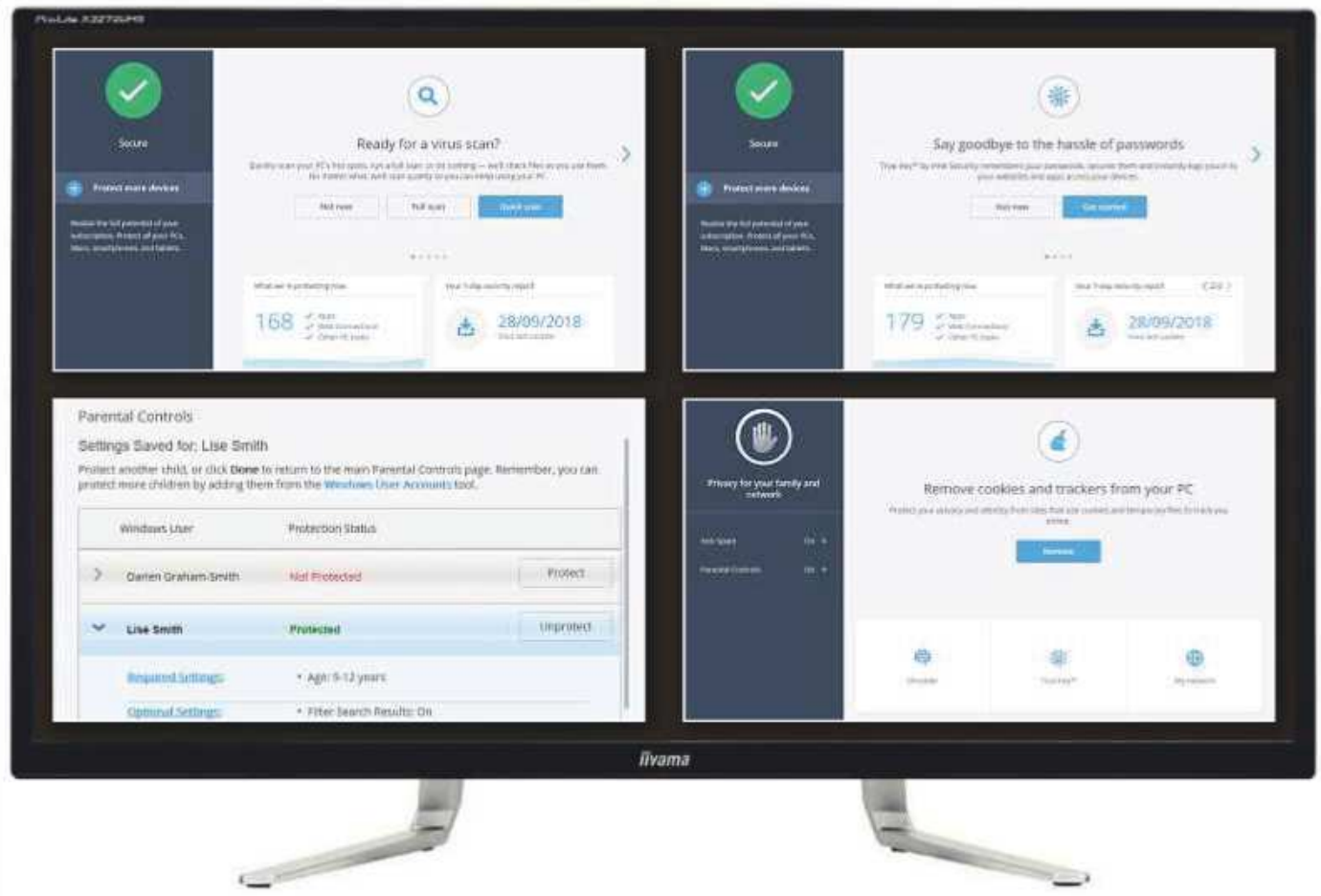
SCORE ★★★★½

PRICE 1yr 3 devices, £8 (£10 inc VAT)
from pcpro.link/291mca

Protection rating **99.8%**

False positives **0.4%**

Performance **92%**



Founded way back in 1987, McAfee is one of the best-known names in computer security. Its reputation hasn't always been enviable, though, with a string of recent last-place performances in our annual security suite reviews.

This time around, though, things are different. Around 18 months ago, McAfee was officially spun off into an independent company by former owner Intel – and the change appears to have had a salutary effect on the company. Believe it or not, in just a year, it's rocketed from the bottom of the malware-detection table to the top.

So remarkable is McAfee's rise that we'd be tempted to put it down to a statistical blip, but the results were confirmed across several months by two independent testing labs, with both AV-Comparatives and AV-Test reporting 100% protection rates against threats both old and new. This isn't a case of an excessively strict engine catching all types of malware through sheer trigger-happiness, either: with an overall false-positive rate of 0.4%, McAfee confidently outshone the likes of F-Secure, Norton and Trend Micro.

The good news doesn't stop there, as performance has been enhanced, too. Last year, AV-Comparatives ranked McAfee Internet Security as "mediocre" for launching apps, and merely "fast" for web browsing; in the latest test, those ratings have been upgraded to "fast" and "very fast" respectively. AV-Test confirmed that, of all the suites in its most recent report, McAfee had one of the lowest impacts on web browsing speed, and across all tests, it ended up with a fast performance score of 92%.

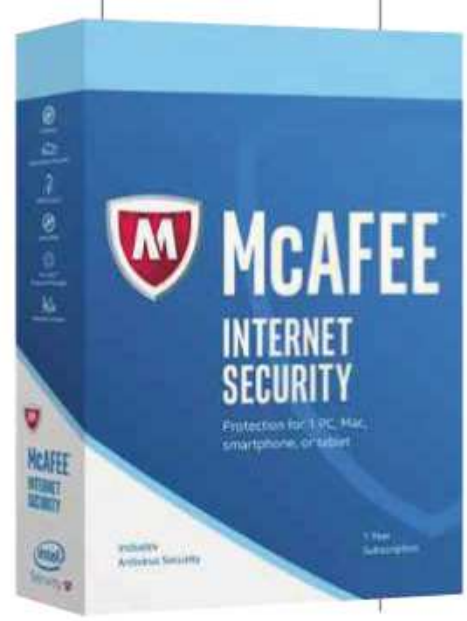
It's a drastic turnaround – yet once you start interacting with the suite, what's surprising is how familiar it all feels, and I don't necessarily mean that as a compliment. For one thing, McAfee was never a product that aspired to match every feature of its rivals, and it clearly still doesn't. You'll look in vain for things such as a secure browser, a recovery environment or configurable webcam protection. There's also no built-in ransomware protection, although to be fair McAfee does offer a free standalone anti-ransomware tool.

Still, the basics are covered. Naturally, you get real-time and on-demand malware scanning, plus web protection with McAfee's WebAdvisor browser plugin, and a custom firewall. The suite can also regularly check whether Windows and your installed applications need updating, and if you're playing a game in full-screen mode then the software will automatically detect that and keep out of the way. There's a straightforward parental controls module too, which can enforce online time limits and safe surfing based on WebAdvisor site categories.

McAfee also wins points for cross-platform support, as your licence allows you to use the software on Windows, macOS, Android or iOS. Predictably, those last three platforms don't get the full feature set – on iOS you just get some mostly redundant anti-theft and data backup tools – but if you're operating a mixed home network, as many of us are, it's nice to have everything under one roof. There's also a cross-platform password manager plugin that works with most major desktop and mobile browsers, but if you want it to store more than 15 passwords you'll need to cough up £20 a year. That sticks in the throat, especially since there are plenty of unlimited free systems out there.

ABOVE McAfee handles the basics with aplomb, but it's missing key features

PC PRO RECOMMENDED



It's disappointing that the interface hasn't had the same type of performance boost as the malware engine. I've grumbled in the past about how unnecessarily slow the McAfee front end is, and while the main dashboard looks much cleaner and more attractive than previous releases, it feels just as sluggish: every time you click a link or button there's a little delay before anything happens.

It's fiddly, too. If you want to browse through the settings, you'll have to click your way through opening 14 separate windows, with the settings further concealed within a series of collapsed panes on each one. It really discourages you from fully exploring what the software has to offer, and somewhat cheapens the excellent work that's clearly gone into the back end.

Even so, if you don't require clever features, and don't want to tinker with custom settings, there's no denying that McAfee has become a surprisingly attractive offering. The cherry on top is the price: as with Kaspersky, you can pay £35 for a three-user package at the company's own store, but follow the link above and you'll find the exact same licence available for just £10 (assuming the offer doesn't run out). In the past we've recommended you steer clear of McAfee, but on present form and at such a low price, it definitely deserves another look.

Panda Free Antivirus

Panda stays as our top choice for free antivirus protection, with a fresh look and less pushy reminders

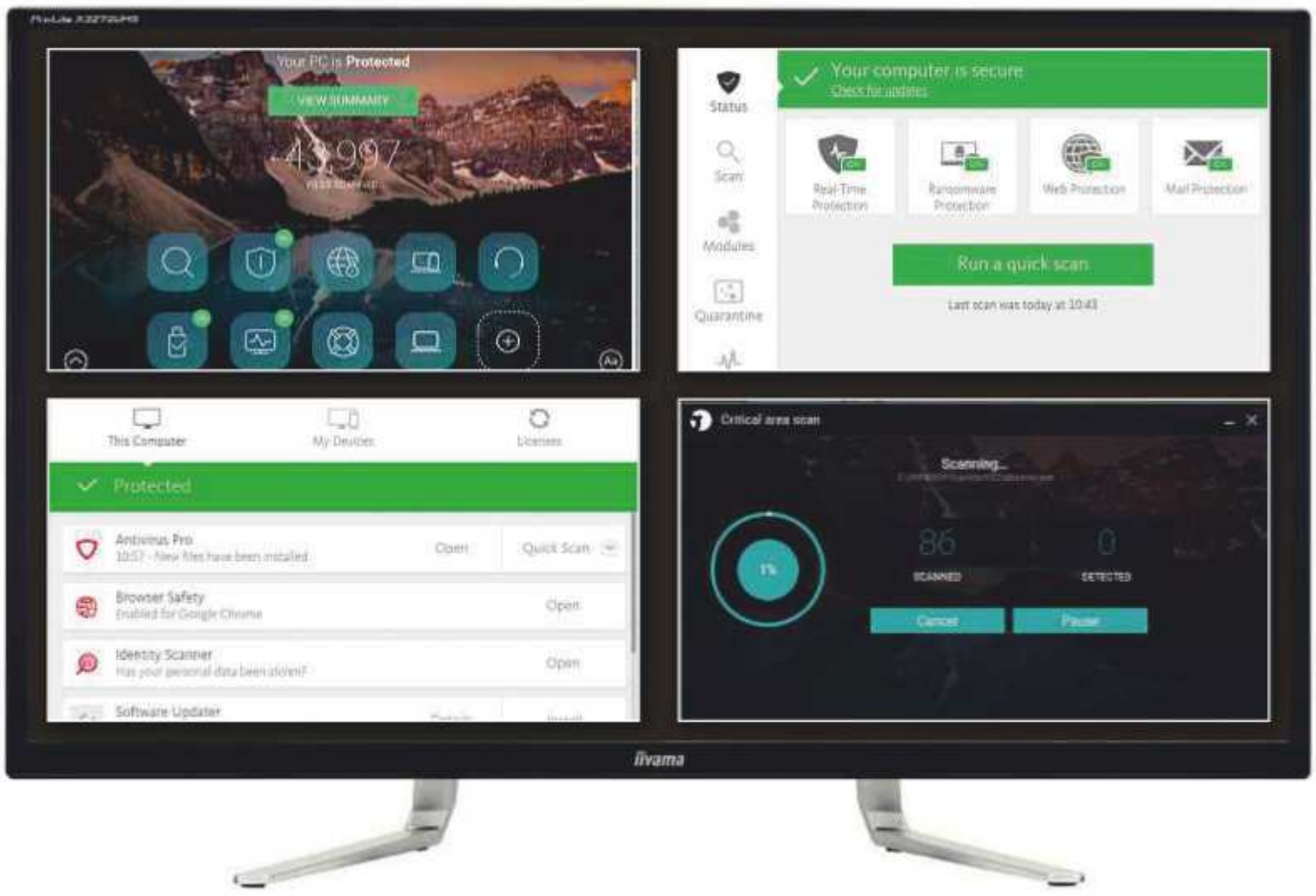
SCORE ★★★★½

PRICE Free from pandasecurity.com

Protection rating 100%

False positives 1.6%

Performance 92%



Last year we named Panda Free Antivirus our favourite free security suite, but lamented the impenetrable interface, with its controls and links dotted all over the place. So we're pleased to see that Panda has now refreshed the front end with a much more easily graspable arrangement of buttons.

As is usual with free antivirus tools, the feature set isn't huge, but the core functions are all here, starting with on-demand scans. Be aware, a speedy scanner this is not: select a full scan and you're warned that it will take several hours to complete. Even a "quick" scan churns through the entire Windows directory, which in my case took just under five minutes.

Happily, that's not something you'll need to do often, since the package also keeps an eye out for threats in real-time. Click on the appropriate icon and you can peruse a report of recent activity, and review and restore items that have been quarantined. The little settings cog exposes a decent set of options too: among other things, you can tell the program to automatically switch into game mode when an app is running full-screen, choose to be notified before a virus is blocked, decide whether or not to scan for potentially unwanted programs and configure cloud querying for unknown files.

Keep exploring and you will also find the USB Protection function, which "vaccinates" USB devices to prevent the spread of flash drive-borne worms; optionally you can set Panda to automatically do this to every drive that's inserted, though wisely this is disabled by default. You can create a USB recovery drive, as a safeguard against future problems, or click to launch Panda's free Cloud Cleaner scanner, which scans your system without needing to fully install itself on your PC, making it harder for malware to detect and defeat.

For those who prefer to make their own investigations, Panda's process monitor tool lets you see at a glance which active processes are accessing the internet, and which sites they're talking to – potentially a very useful feature for advanced users. And if you spot a process doing something it shouldn't, you can send it to quarantine with a single click.

The software also includes simple device and licence management functions, though these are so basic as to be barely useful: you can view your active software licences and track mobile devices that are running Panda Anti-Theft software, but you can't do anything clever like remotely change settings on individual machines.

A final feature worth mentioning is the VPN. It's operated by Hotspot Shield, but here the terms are slightly different: you can select the location of your exit node, from a choice of 23 countries, but the data limit is even more tight, giving you just 150MB per day. Upgrading to an unlimited licence is expensive too at £57, though this does cover five devices.

Leaving aside the "Security news" screen, which merely feeds you press releases from the Panda website, that's all the major functions – and it's really a bit cheeky that such a modest feature set is spun out across no fewer than ten buttons on the homescreen (the bottom five are revealed when you click the down arrow). Honestly, though, I can't help but admire the chutzpah.

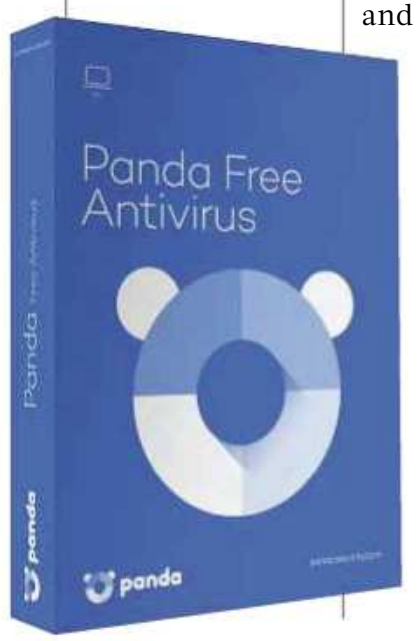
And while Panda Free Antivirus may have a narrow feature set, it's far from limited when it comes to malware detection. AV-Test didn't put this particular package through its paces, but AV-Comparatives recorded a faultless 100% score across its zero-day and known malware tests. Performance was strong, too: the lab rated Panda as "fast" for archiving files and installing applications, and for all other activities – including web browsing and running apps – it proved "very fast".

ABOVE **Panda has now simplified its once-impenetrable front-end**

PC PRO RECOMMENDED

At this point you're probably wondering what the catch is. The answer is that in its default configuration, Panda Free Antivirus pops up occasional adverts from the publisher – but these can be easily disabled from the general settings page. It also tries to install a slightly slimy "smart shopping" browser extension, but you can avoid this by simply unticking the relevant box during setup – or removing it from your browser post-installation.

In fact our biggest caveat regarding Panda Free Antivirus is its false positive rate of 1.6%. That's one of this month's worst scores, ranking ahead only of Microsoft Windows Defender, and it makes us slightly hesitant to recommend Panda Free Antivirus for non-technical users, who rely on their security software to make the right decisions. But, for the more confident, it's easy enough to restore a wrongly flagged file, and add it to the exception list so it won't get blocked again.



Overall, the performance and effectiveness of Panda Free make it a clear contender for our favourite free internet security suite – and the ease with which you can avoid pop-ups and pushy adverts seals the deal.

Avast Free Antivirus

A feature-packed offering compared to Panda, but you will be peppered with prompts to upgrade

SCORE ★★★★☆

PRICE **Free** **from avast.com**

Protection rating **99.8%** | False positives **0.4%** | Performance **90%**

For a free antivirus tool, Avast is well decked out with features. Alongside the expected on-demand and real-time virus scan capabilities, it features web and email protection, plus a browser plugin that warns you away from potentially risky links. Dig into the settings and you'll find an optional "hardened mode" too, which only allows programs on a known whitelist to run.

The package also includes a standalone secure browser, but this doesn't open automatically when you visit a banking site. It does include a handy video downloader, however, which lets you grab copies of videos from YouTube and similar streaming sites (albeit not iPlayer or Netflix).

This latest release doesn't add anything major into the mix, but it does bring a new Do Not Disturb feature, which lets you specify which full-screen apps should silence notifications, and which should be treated just like any other application.

The catch with Avast has always been the relentless upsell. Happily, the annoying adverts that used to pop up every time the software updated are now gone. Indeed, the whole interface is more straightforward than it used to be about what's actually included in the free suite, with premium features shown with a little orange padlock next to their icons. The fact that this applies to fully half of the icons in the interface feels a little pointed, though.

We were also irritated to find that when you launch a scan, the software now doesn't just hunt for malware, but also reports back on dubious "performance issues" – and invites you to shell out £20 a year for Avast's commercial clean-up software in order to remedy them. You can disable this behaviour from the settings page, but making it default in the first place is pretty obnoxious.

ABOVE **Avast is packed with tools and has even toned down the galling upsell**

Still, when it comes to performance Avast has rarely disappointed, and the latest tests confirm that its malware detection abilities are still up to snuff. Its overall false positive rate is hard to beat, with only Bitdefender, Eset and Kaspersky faring better. And it's light on its feet, too: AV-Comparatives found the package was "fast" when installing new applications and running them for the first time, and "very fast" for everything after that.

If you're looking for a trustworthy free antivirus product, Avast is worth a look. Indeed, if you want a decent set of features to play with it's probably your best bet. Those who value a quiet life, however, may well be happier with Panda Free Antivirus.

AVG Internet Security Unlimited

A perfectly good security suite, but it's beaten for value by rivals, including its free sibling

SCORE ★★★☆☆

PRICE **1yr unlimited devices, £19 (£23 inc VAT)** **from pcpro.link/291avg**

Protection rating **99.8%** | False positives **0.4%** | Performance **90%**

Avast acquired AVG in 2016 and the two suites have been gradually growing together. The latest release of AVG Internet Security looks and feels eerily similar to Avast, and it comes with several of the same features, including the same secure browser – complete with integrated video downloader – and the same Do Not Disturb feature.

But it's not quite a carbon copy. For instance, Avast's "hardened" whitelist mode isn't an option here. Also, in place of Avast's safe browsing plugin, AVG comes with something called SafePrice, which pops up adverts and special offers when you visit shopping sites. It's not exactly sneaky – the alerts are in your face – but it doesn't belong in a piece of security software.

Since this is a full security suite, rather than a cut-down antivirus tool, there are a few extra features on offer too. We're pleased to see that webcam protection has been added to the suite since last year, and there's also a new customisable anti-ransomware module. You can choose which folders to protect, and either leave it to AVG to decide what to block or set your own whitelist of applications that are allowed to access your personal files. AVG can also block access to folders for other Windows users – helpful if you need to keep things private from family members or colleagues.

Unusually, AVG Internet Security also features a custom firewall. The interface makes it easy to decide which processes should be able to access the local network or the internet – and you can also monitor ongoing connections, to see at a glance which applications are talking to whom. This could be useful when it comes to diagnosing problems – it's just a shame the interface is clunky.

ABOVE **Share a PC? AVG can block users from having access to your folders**

Given the relationship between Avast and AVG, you won't be surprised to learn that the two performed identically in the most recent malware and performance tests. Like its free counterpart, AVG intercepted a reasonable 99.8% of malware, with an acceptable false-positive rate of 0.4% and a middling score for system responsiveness.

The upshot is that AVG Internet Security is a decent, if not exceptional, antivirus solution, and while the feature list isn't as exhaustive as Bitdefender or Kaspersky's, it's likely to hit most of your buttons. There are cheaper suites out there that will give you protection that's at least as good – including AVG's own free sibling.

Do I need a password manager?

Still jotting down your passwords on Post-it notes? It's time to use a password manager to keep your precious logins safe and secure

Several of this month's security suites include password manager components that automatically log you in to the online services you visit. That makes sense, because nowadays a lot of our personal data is stored in those services – so securing access to them is all part and parcel of keeping you safe from online threats.

Using a password manager has several benefits (*see p38*). Most simply, it removes the burden of keeping track of your login details across dozens of sites. We're always advised not to use the same password across multiple services, but who can remember hundreds of username and password combinations? A password manager can.

What's more, because you're freed from having to remember passwords yourself, you can use much more complex ones, which the software will generate for you. Bye bye "letmein123", hello "Rx+okp"<3`g/w_aH" – which no human or brute-force algorithm is likely to guess. Certain managers can even periodically change your passwords on sites, with no need for you to lift a finger.

Limitations

By now you might well be sold on the idea, but we've some caveats. The password managers that accompany this month's security suites are a mixed bunch. Some – such as Norton Identity Safe – are completely free and unrestricted, but others come with annoying limitations. McAfee's True Key, for example, only lets you store a maximum of 15 passwords unless you cough up an annual £20 fee.

Other suites only give you full access to the password manager for as long as your subscription is current – which could mean frustration if you want to switch packages in the future. It's normally possible to move your data across, but it's a hassle.

Another potential sticking point is platform support. If you're relying on a password manager to log you into all your online services, it has to work on every device you use. Normally there's a browser extension that will work with most major platforms, but if you're using something slightly less mainstream – such as Safari – your options will be more limited.

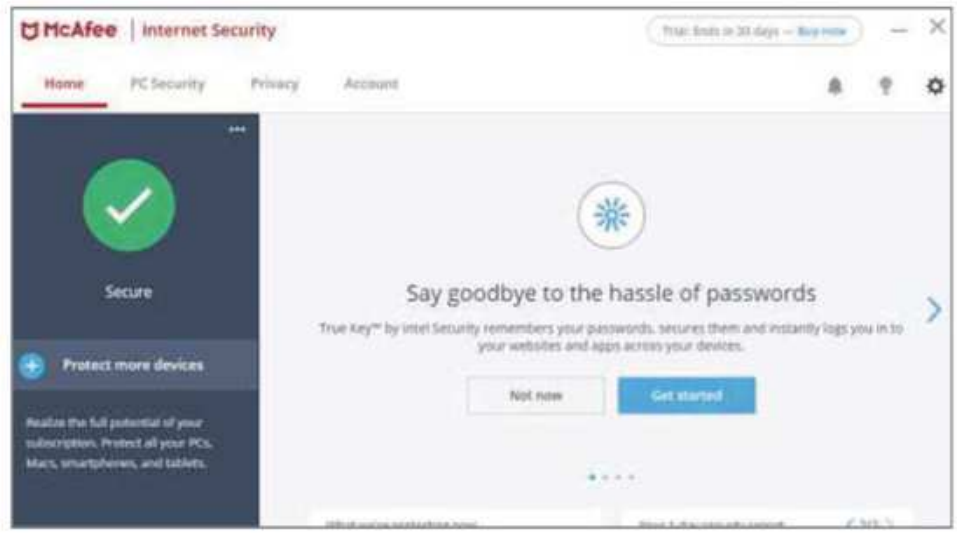
Happily, if your chosen security suite doesn't include a password manager that's suitable for your needs, you're perfectly free to use a different one. You might find that you're happy with the features that are already built into your browser: when you save passwords in Chrome, they're also available in Android, and recent versions of the software can automatically enter your credentials into apps as well as websites. Apple's Safari offers the same benefit across the desktop and iOS platforms.

ABOVE LastPass is a popular option, but it charges for use on mobile devices

Third-party options

For stricter security, and more features, a standalone third-party password manager is the way to go.

"If you're relying on a password manager to log you into all your online services, it has to work on every device you use"



BELOW You'll have to fork out £20 per year to make the most of McAfee's True Key

There are plenty of options out there, three of the most popular being 1Password (**1password.com**), Dashlane (**dashlane.com**) and LastPass (**lastpass.com**). All of these can be used for free, although they come with certain restrictions: Dashlane limits free users to 50 passwords, while LastPass charges for use on mobile devices. Not only do these systems work across all major desktop and mobile platforms, they also all support two-factor authentication – which makes it nigh on impossible for intruders to get into your accounts without your knowing.

Consequently, in the long run, the number of passwords that we need to keep track of should start to fall, as single sign-on systems – such as those that let you authenticate using Google or Facebook – become more and more commonplace. However, that also means we are putting more and more eggs in fewer baskets – making password security more important than ever.

Avira Antivirus Pro

We struggle to see why anyone would choose Avira Antivirus Pro when it doesn't win for value or protection

SCORE ★★★☆☆

PRICE 1yr 3 devices, £33 (£39 inc VAT) from avira.com

Avira Antivirus Pro is one of this month's more streamlined security products: its key functions don't extend much beyond scanning your system, websites and email for viruses. However, it's good to see that a dedicated anti-ransomware module has been added since we last reviewed the software. This isn't as configurable as Bitdefender's approach – you can't specify custom folders to protect – but it's reassuring to know it's watching for ransomware-type activity.

If you're looking for more features to play with, the Avira front-end offers a selection of add-on tools to download, including a password manager, a VPN, a software updater and a performance tune-up tool. Don't feel too special, though: these are just freebies that anyone can download from the Avira website, and in most cases you'll have to pay to unlock their full capabilities. If you want them, it works out cheaper to buy Avira's Internet Security Suite or Prime packages, which come with the full versions bundled in.

The interface also gives you various firewall options, but dig into the settings and it becomes apparent that Avira doesn't actually have a firewall of its own: it's simply acting as a front-end to the standard Windows firewall. This is a good firewall, but it feels like an attempt to make the package seem more substantial than it really is.

Moreover, the settings interface is far from pleasant to get around. It looks like it hasn't had a redesign since the days of Windows XP, and its fiddly, fussy layout is at odds with the tasteful design of the main console.

Although Avira has its foibles, it put in a creditable performance in our independent lab tests. It delivered perfect 100% protection rates in AV-Comparatives' most recent tests,

ABOVE **Avira's main console looks great, but the settings interface feels dated**

and averaged a very strong 99.9% score across AV-Test's latest reports. Its false positive rate wasn't bad, either: Avira couldn't keep up with Bitdefender or Kaspersky, but a 0.4% rate is low enough not to quibble with. A 90% performance rating puts Avira in the bottom half of the pack, but that's only three percentage points off the bronze medal.

What lets Avira down is the price. It isn't a package that you can buy cheap from an online retailer: if you want it, you'll have to pay full price from the developer's website. That makes it much more expensive than Kaspersky or McAfee, for a package that doesn't match their protection scores and offers fewer features.

BullGuard Internet Security 2019

The price makes this seem like a bargain, but we would still stick with one of its more expensive rivals

SCORE ★★★☆☆

PRICE 1yr 3 devices, £8 (£10 inc VAT) from pcpro.co.uk/291bull

BullGuard's latest Internet Security package looks a lot like the 2018 release. The only difference is that the interface has been stretched to include new buttons for identity protection options and the home network scanner – but you'll have to pay an extra £20 for these as they're only included in BullGuard's Premium Protection suite.

As it stands, BullGuard Internet Security comes with a reasonable set of features. As well as real-time virus detection, the suite includes its own firewall, plus a safe browsing component to steer you away from dodgy links on Google, Bing, Yahoo and Facebook. The parental control module is sophisticated, letting you block websites by category for specific accounts, set time limits on internet and computer usage, blacklist apps and block the transmission of certain bits of information.

Refreshingly, BullGuard's PC tune-up module isn't an optional extra, but a fully functional component – although you can achieve similar results using Windows' built-in tools.

Finally we come to the most distinctive feature – an integrated backup client. This connects to Dropbox, Google Drive and OneDrive, so you can take advantage of any spare cloud storage you may have knocking around. And a profile system makes it easy to combine this with larger backup jobs to external devices and locations on your local network.

There are a few notable absences: there's no webcam protection, and while ransomware isn't as epidemic as it once was, it would have been nice to see an anti-ransomware feature. There's no secure browser either.

A 99.9% protection score sounds great, but half of this month's

ABOVE **Design-wise, BullGuard hasn't changed much, but there are some useful new features**

contenders scored a perfect 100%. Similarly, BullGuard's false-positive rate of 2.1% doesn't sound too bad, but check the graphs and you'll see that only Windows Defender and Trend Micro Internet Security did worse.

You might be inclined to overlook that when you clock the price: BullGuard Internet Security costs a stiff £50 if you download it directly from the publisher, but boxed copies of last year's suite – which will update to the latest version on installation – can be found on Amazon for a fifth of the price. Even so, when your irreplaceable data is at stake, we would suggest that you opt for a package with more encouraging anti-malware credentials.

Eset Internet Security

A hugely configurable security suite with a light footprint, but Eset is asking too much for the privilege

SCORE ★★☆☆☆

PRICE 1yr 3 devices, £42 (£50 inc VAT)
from eset.com

Protection rating 99.1%

False positives 0.3%

Performance 96%

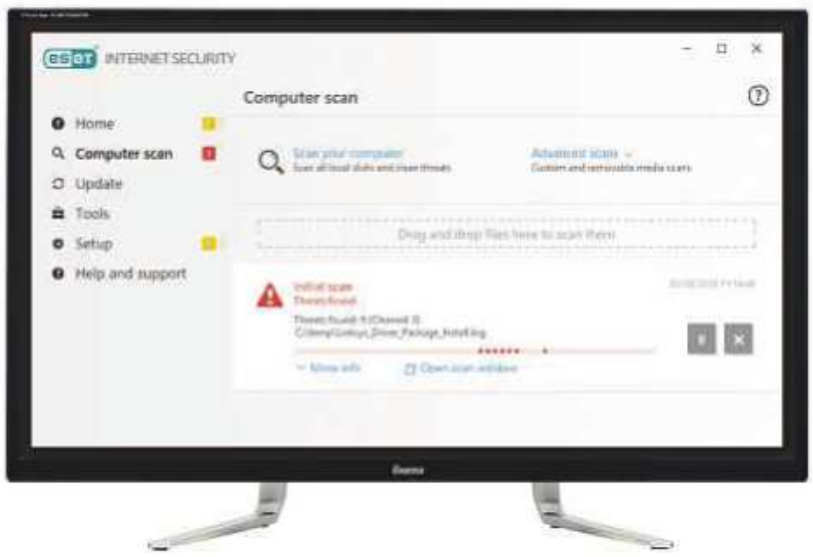
Fifty quid per annum is, in the grand scheme of things, not a lot of money to pay for online security. But when you can get highly effective alternatives for no money at all, it's a bit of an ask – and unlike many other security packages, Eset Internet Security isn't offered more cheaply through online retailers. So the question has to be what this suite does to justify the cost.

Unfortunately, Eset hasn't blown us away with its effectiveness in recent years. In our last Labs, Eset ranked joint fifth in the malware detection stakes, and this time it's slipped to the bottom of the table, with last-place protection rates of 98.4% and 99.8% in AV-Comparatives' most recent zero-day and established malware tests. Those aren't dreadful scores, but they're certainly not worth paying a premium for.

That's a shame, because in other respects Eset is impressive. Its 0.3% false-positive rate is among this month's lowest – only Bitdefender and Kaspersky did better – and when it comes to system responsiveness, Eset is a star: AV-Comparatives rated it "very fast" at every type of operation – apart from installing and uninstalling applications.

The feature set is strong, too. Eset includes a versatile custom firewall that provides all the techie features and information you could ask for. We particularly like the live network activity monitor, although it doesn't let you instantly block suspicious processes. Another neat touch is the simple system cleaner tool, which can restore your Windows settings to their defaults with a click if something's futzed with them.

There's also a safe browser; webcam and ransomware protection; and parental controls that don't just block unsavoury websites and enforce time limits, but can also track the locations of kids' mobile devices.



ABOVE **Eset looks good and can be easily tweaked, but the price is too high**

On a similar theme, you also get the option of enabling Eset's built-in anti-theft features, which let you locate your own laptop on a map if it gets lost or stolen, monitor the screen, and even turn on the webcam to see who's using it. Of course, all of this could be done using free tools such as Prey (**preyproject.com**), but with Eset you get simpler setup and technical support if you need it.

In all, Eset Internet Security looks and feels like a well put-together security product, and it's hugely configurable, too. Unfortunately, its poor test scores and high price mean we can't recommend it this year.

F-Secure Safe

Middle-of-the-road protection for a middle-of-the-road price leaves F-Secure stuck in the middle

SCORE ★★★☆☆

PRICE 1yr 5 devices, £13 (£15 inc VAT)
from pcpro.link/291fsc

Protection rating 100%

False positives 0.9%

Performance 82%

F-Secure Safe starts strong, with one of this month's highest protection rates. It's a gnat's hair behind the front runners, with an unrounded score of 99.98%, but that's good enough for us to put our trust in.

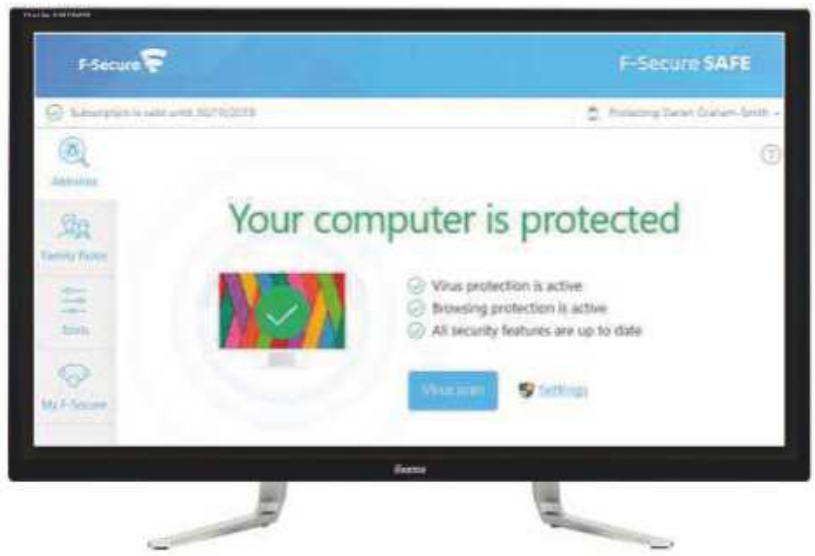
And while its false-positive rate might seem unremarkable, it's a huge step forward from last year, when F-Secure Safe wrongly flagged up over four times as many innocuous items as any rival suite. It's still not the best in the business, but we're very happy about the direction of travel.

On the features front, Safe is quite modestly equipped. It relies on the Windows firewall, rather than its own, and lacks supplementary tools such as software updaters and performance enhancers.

There's also no standalone safe browser, but what you get is arguably better: F-Secure detects when you're accessing a banking site and, rather than bouncing you into a different app, automatically locks down your system, temporarily suspending internet access for extensions and other apps so they can't spy on your activities. You have to manually end the safe browsing session when you're done, but it's probably the most fuss-free approach we've seen. It's just annoying that you can't add your own sites to the list: it only works with banking services known to F-Secure.

The other major function is parental controls, which enforce time limits and web content filtering for child accounts. The restrictions work on Android phones too, but there's no clever location-tracking feature, as there is with ESET's parental controls. You can get Android and iOS devices running the F-Secure client to report back their location, but it involves sending and receiving an SMS.

Clearly, there are things to like about F-Secure, but it's not as nimble as some suites. AV-Comparatives and AV-Test found that Safe substantially hindered app installation, with AV-Test recording a whopping 50% slowdown on a standard PC. AV-Comparatives found it "fast" when running apps for the first time and downloading files from the internet. On the upside, there's minimal impact on regular app usage and web browsing, so you won't feel bogged down in day-to-day use.



ABOVE **If you need to keep a household's worth of devices safe, F-Secure is a decent choice for the money**

You can buy a three-device licence from the publisher's website, but shop around online and you'll find a boxed five-device edition for just £15. If you've a family's worth of devices to protect, that's a solid deal, but it's not the most feature-packed suite.

G Data Internet Security

G Data is charging far too much for a mediocre feature set and below-par performance

SCORE ★★☆☆☆

PRICE 1yr 3 devices, £38 (£45 inc VAT) from pcpro.link/291gda

G Data's security software uses two scanning engines – one developed in-house, the other licensed from Bitdefender. That may sound reassuring, but since Bitdefender regularly achieves perfect 100% malware protection scores on its own, it strikes us as unnecessary.

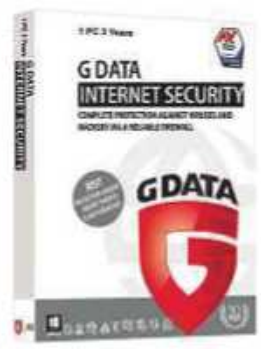
That's especially so when you look at the impact it has on system responsiveness. AV-Comparatives hasn't tested G Data lately, but AV-Test found that the current version slowed down web browsing by 29% on a standard PC, and delayed application launch by 13%. You can tweak the settings so that only one engine is used for real-time scanning – but there's no transparency into which one will be left running.

The suite does have a few distinctive features. One is a backup agent; like BullGuard, this lets you directly select Dropbox and Google Drive as destinations, although OneDrive isn't supported. It's fussy to set up though, thanks to a fiddly interface that keeps popping up exasperating error messages if you don't step through the process in precisely the required way.

There's an Autostart Manager too, but this is also frustrating. I like the idea of a simple, single console that exposes everything that starts up with Windows, but G Data doesn't show you everything that's hiding in the Registry, nor does it make any attempt to tell you about the usefulness or trustworthiness of the programs that are listed. You're better off using the startup controls that are built into the Windows 10 Task Manager.

While there's no safe browser, the suite does offer to download G Data's free browser extension. This blocks malicious sites, but doesn't make itself visible in any other way. G Data's BankGuard tech also silently monitors your browser to ensure it hasn't been tampered with; we're all for security software that keeps out of the way, but it would be nice to have outward confirmation that all is well.

ABOVE G Data's front-end is fiddly and often generates frustrating error messages



The feature set is rounded out by simple parental controls and a custom firewall; this comes set up to decide for itself what should be allowed through and what shouldn't, but if you're paranoid you can switch it into manual mode.

We can't complain about G Data's effectiveness, but we didn't enjoy using it at all. There's no shortage of competing packages that will keep you just as safe while delivering a smoother, more pleasant experience. And the £45 price tag is far too high.

Microsoft Windows Defender

Windows' built-in protection is both the least accurate on test and the most performance sucking

SCORE ★☆☆☆☆

PRICE Free

If you're running the latest version of Windows 10, you may have noticed that Microsoft's built-in antivirus agent is no longer an app in its own right. Virus protection is now just one part of the Windows Defender Security Center, along with device and network security, parental controls and system health reports. This makes sense in the larger context of system maintenance, but it's a bit odd if you're used to thinking of security suites as standalone applications.

That's not all that's changed: the Defender component has gained a new anti-ransomware capability. A toggle enables "controlled folder access", which blocks unrecognised apps from writing to specified folders. It's a positive step, but it's switched off by default, and I think I know why: whitelisting apps is a real rigmarole, requiring you to delve into the Defender settings and then, somehow, locate the original executable on your hard disk.

Then again, such ease-of-use issues are rather academic – because sadly we can't recommend that anyone should rely on Windows Defender to protect their data. The reason isn't to do with Defender's protection rating per se; an overall score of 99.9% places it toward the bottom of the list, but it's nothing to be ashamed of.

Part of the problem is that it comes with a worrying false-positive rate. In AV-Comparatives' most recent real-world protection test, Defender wrongly blocked an alarming 10.9% of non-malicious objects. And, even though AV-Test saw more positive results, Defender still winds up with this month's worst accuracy record.

Defender also had this month's most lamentable impact on system performance, receiving "mediocre" speed ratings from AV-Comparatives for file copying and app installation. And where most suites managed a "very fast" score for downloading files, Windows Defender was only rated as "fast".

ABOVE There's no dedicated antivirus app – it's part of the Windows Defender Security Center

Let's not forget the monoculture problem, either. There are no official figures on how many people are using Windows Defender, but it must be in the hundreds of millions. So when malware developers go looking for security loopholes, it's Defender they'll be targeting.

So, Windows Defender is better than nothing, but you're better off with any of this month's alternatives. Your computer will run faster, you're less likely to get compromised and you'll have fewer false positives.

Norton Security Deluxe

The one-time king has been deposed, although if you'll use it on five devices then it's good value

SCORE ★★★☆☆

PRICE 1yr 5 devices, £16 (£19 inc VAT) from pcpro.link/291nor

Protection rating 100%

False positives 1.2%

Performance 89%

Norton Security remains almost exactly as it was last year. This means that the Standard and Deluxe editions are still weirdly identical: the only difference is that the Standard package is for a single device, while a Deluxe subscription covers up to five. There's also a Premium edition for up to ten devices, which adds parental controls and a cloud backup service with 25GB of included storage.

That leaves the regular versions with real-time and on-demand scanning, plus a firewall and browser-based protection. On that note, one thing that's changed in the past 12 months is that the old Norton toolbar has finally been ditched, and replaced by native browser extensions for Norton's Safe Web and Identity Safe (that is, password manager) tools. These are fine as far as they go, but they're freebies: you don't need to buy Norton Security to get them.

Other than that, the feature set is pretty slim. The disk defragmenter and clean-up tools are so obviously superfluous it's faintly insulting, but we do like the startup manager. At first glance this looks barely any more useful than G Data's, but you can click on any item to immediately see all sorts of information about where it came from, when it arrived on your system and how many other Norton users are running it.

Indeed, it's when digging into technical detail that Norton is at its best. The front-end may look sparse and dumbed-down, but click the little Settings link in the corner and you'll find pages and pages of highly granular options to play with.

When put through its paces by AV-Comparatives and AV-Test, Norton gave a mixed performance. It achieved impeccable scores for malware detection, but it wobbled a little in the false-positive tests: both labs experienced bogus warnings when installing and then first using legitimate apps.

ABOVE Norton's slick front-end hides pages full of granular options

Norton isn't a winner in the speed stakes either, achieving an overall score of 89% – although it performed well in the web browsing and application launch tests, which are the activities where you're most likely to notice a slowdown.

At the end of the day, equivocal test scores and a mishmash of features make Norton Security hard to really fall in love with. At £19 for five devices it's very affordable though; if you're looking for a simple yet highly configurable security suite, it deserves a look.

Trend Micro Internet Security

A modern security suite with some neat features, but its performance in tests lets it down

SCORE ★★☆☆☆

PRICE 1yr 3 PCs, £25 (£30 inc VAT) from pcpro.link/291tre

Protection rating 100%

False positives 2.2%

Performance 81%

The first thing you see on installing Trend Micro Internet Security is a prompt asking you which folders you want to be monitored and protected from ransomware. It's a strong, proactive introduction that provides reassurance from the start.

Its main interface is divided into four sections. The first is "Device": here you can configure your scanning and web-filtering options and set up Trend Micro's silent-running "Mute mode". This works in an unusual way: you have to activate it manually, but you can then optionally suspend Windows Update, and even nominate specific processes that should be automatically terminated.

Next is the Privacy section, which includes some interesting features: the suite can check your settings on various social networks, and warn if you're oversharing without realising it, and it will also flag up dangerous links on Facebook, Twitter, LinkedIn and other platforms. The Data Theft Prevention feature attempts to block the transmission of sensitive data, but I found this of limited use, as it doesn't seem to be able to look inside HTTPS connections, which many websites now use by default.

Third up, the Data section lets you configure Trend Micro's ransomware component, and use the built-in secure erase utility. And finally there are the parental controls, which include category-based web filtering, time limits and usage schedules for specific apps.

Unfortunately, despite a faultless 100% protection score, Trend Micro Internet Security fell down in the false-positive test. AV-Test found that the suite didn't just throw up erroneous warnings, but wrongly

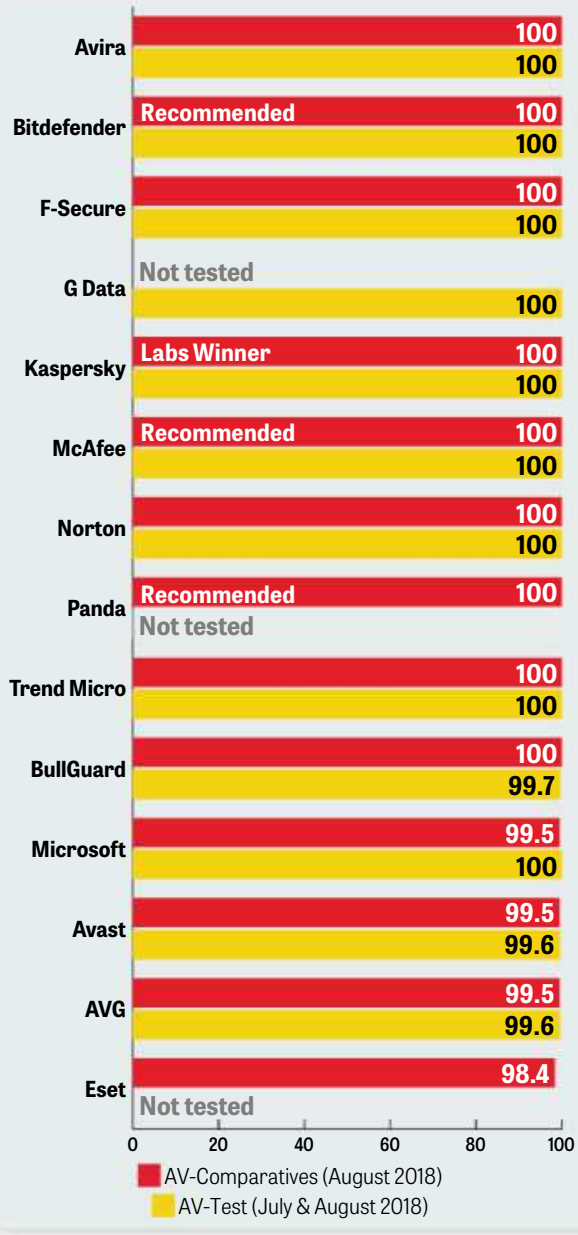
ABOVE Trend Micro includes interesting features, but its false positive results are disappointing

blocked multiple safe applications. It was one of the worst offenders in AV-Comparatives' latest real-world test too, with only BullGuard and Windows Defender ranking lower.

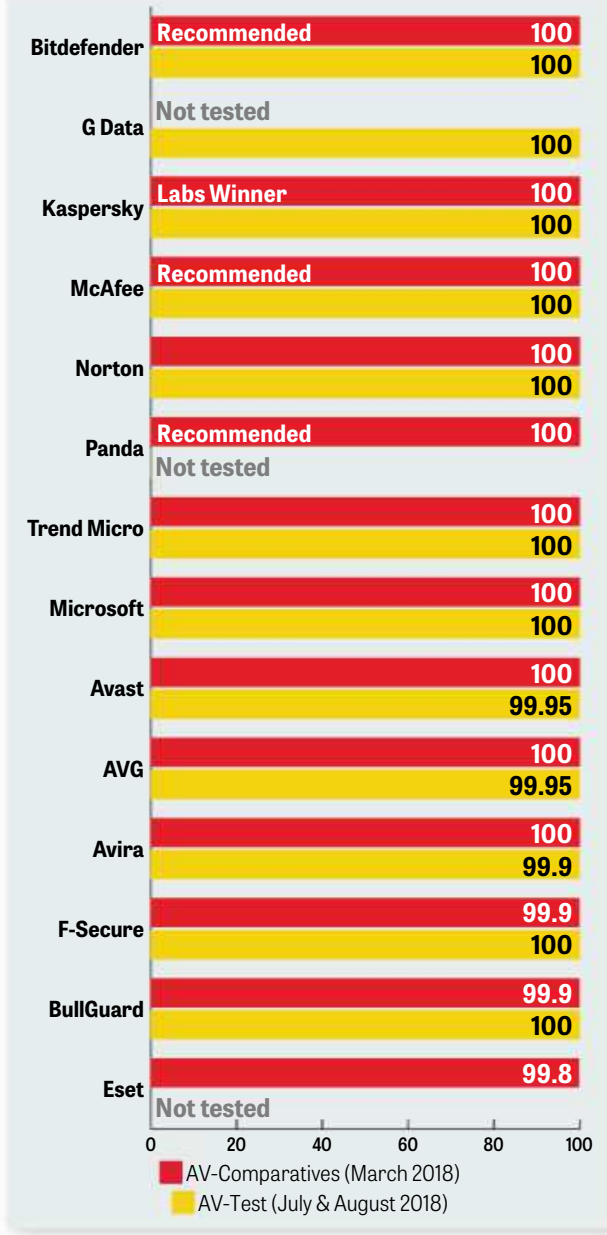
The software didn't redeem itself in the performance test, either. Both labs agreed that it was the slowest of this month's group for launching apps, and AV-Comparatives also found it had one of the worst impacts on file download speeds. With an overall performance score of 81%, it was rescued from last place only by Windows Defender.

In the end, we suggest you look elsewhere. Trend Micro's thoughtful design deserves praise, but its test results and price sadly rule it out.

Protection against current/zero-day malware (%)

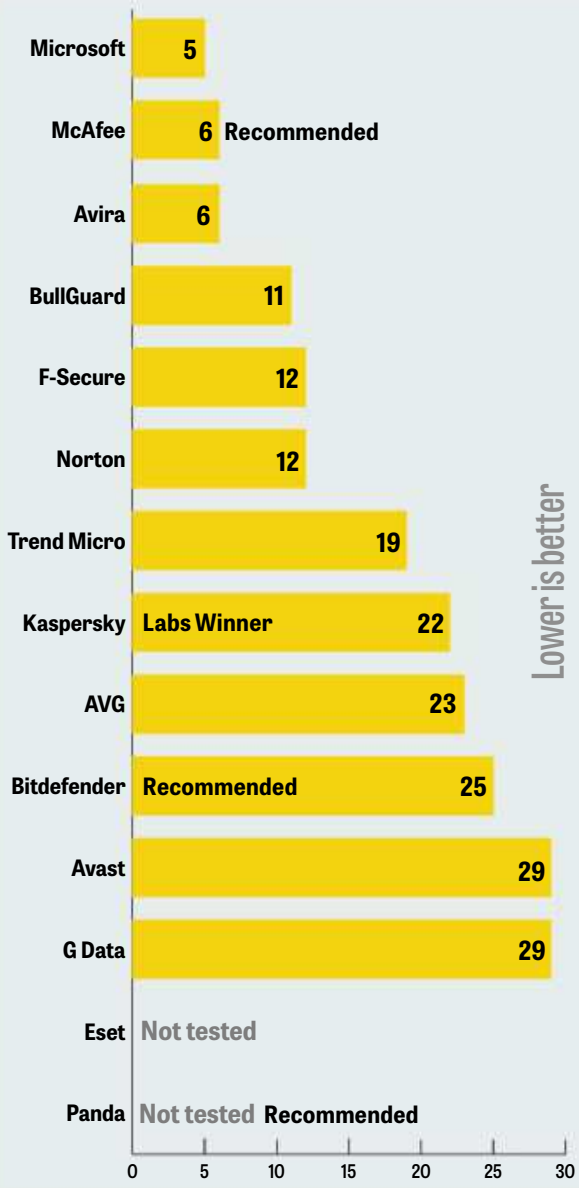


Protection against known threats (%)

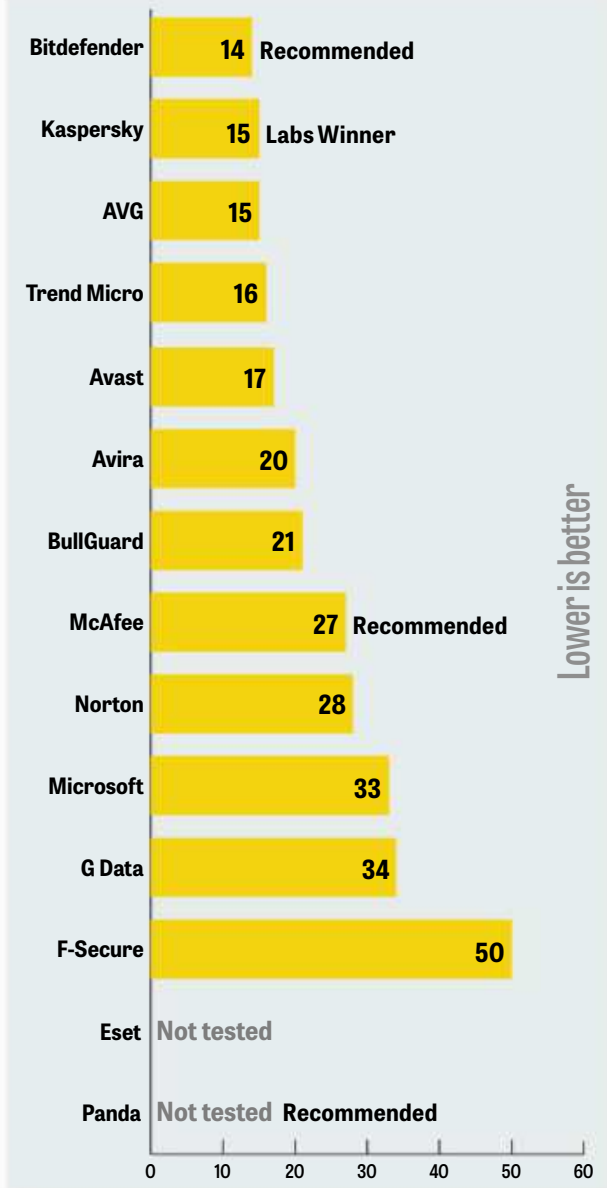


False-positive rate (%)

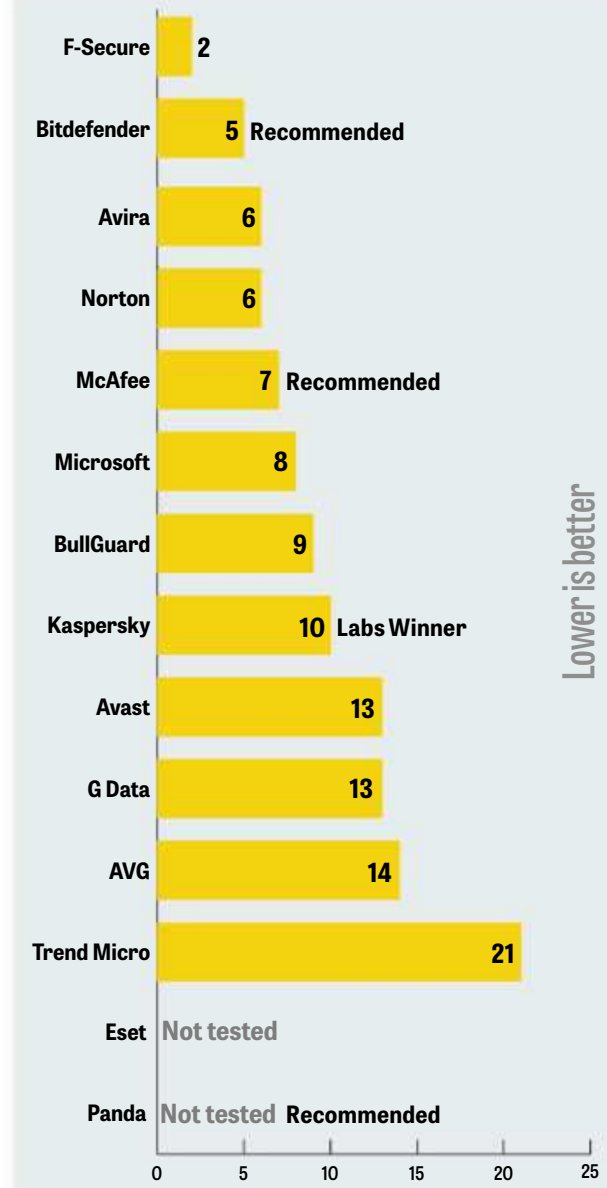
Performance impact: Web browsing (%)



Performance impact: App installation (%)



Performance impact: App launch (%)



AV-Test (Standard PC, July & August 2018)

View from the Labs

It's now almost impossible to buy rubbish security software, but look out for threats from unusual places

It's taken about 30 years, but the security software market is starting to feel pretty grown-up. Gone are the days when choosing the wrong suite meant you'd be left with a PC that was achingly slow, infested with incessant pop-ups and riddled with undetected viruses. Today, no matter which software you land on, you can be confident that it won't slow your system down too much – and even the worst performer can be expected to protect you against 99% of infections.

Does this mean that computer security is a solved problem? I doubt it. Yes, it's encouraging to see such excellent detection rates across the board: it suggests that the bad guys are struggling to find new vulnerabilities to exploit. But whenever antivirus researchers seem to be gaining the upper hand, that's invariably when some ingenious black hat on the other side of the world finds a new way to cause mayhem, and suddenly we're all once again scrambling to respond. No one knows when it will happen next, but it surely will.

Darien Graham-Smith is associate editor of *PC Pro*. Email darien@pcpro.co.uk

"Today, no matter which software you land on, you can be confident that it won't slow your system down too much"

Indeed, in the future such attacks from left-field may come along more often. Hitherto, only the cleverest and most creative hackers have been likely to discover new vulnerabilities in the systems we use every day. But we're living in the age of the algorithm, and analysts predict that the bad guys are going to increasingly turn to machine learning to help them find ways through our defences.

That's a worrying thought, and all too plausible. After all, AI systems have humbled chess grandmasters; surely they can brute-force their way around our smartest security measures, too. And, as they're not wedded to human ways of thinking, the exploits they discover might be harder to understand and counter than anything we're accustomed to.

That's not the only concern on the horizon, either. Windows is now 33 years old, and it's a fairly secure and well understood system. The same can't be said of the increasing ranks of IoT gadgets that are finding their way into our homes – nor the wearable devices occupying our wrists and ears. These gadgets often run obscure software that can't easily be accessed or checked up on, yet they operate inside our home networks, with direct access to our computers and smartphones. We don't even have to imagine the risks: we've already seen real-world viruses that spread through smart lightbulbs.

Here, the answer has to be a change in perspective. In years gone by, security was all about protecting our home network from external threats; from now on we're going to have to be a lot less trusting of the systems and devices inside the perimeter.

If this all sounds a bit gloomy, be reassured by the knowledge that the security industry has matured into a vibrant and competitive community. When next-generation attacks do materialise, experts and professionals will be working round the clock to defend us. That's when you'll be glad you picked a responsive, reputable security suite – and the sooner you invest, the safer you'll be.

Active countermeasures

A reminder of some other simple but oft-forgotten steps everyone should be taking to keep their data safe online

1 Back up, back up

Backing up your files is the best way to insure yourself against potential disaster. Even if malware wrecks your Windows installation, or encrypts all your documents, you can get up and running again with ease – as log as you have a recent, safe copy of your data squirrelled away.

2 Enable guest Wi-Fi

Most routers let you set up a secondary wireless network that's insulated from your laptops and other personal devices. When friends and family want to use your Wi-Fi, put them on this network, rather than your main one, to make sure they don't infect you by accident. Ditto any smart devices.

3 Use a VPN when out and about

VPNs can cover your tracks online, and some of them can unblock US Netflix. But perhaps the best reason for using one is that if you connect to an unsecured Wi-Fi network, anyone nearby can eavesdrop on your traffic – which could include passwords and other sensitive information. If you ever log on from cafés or stations, a VPN is a must.

4 Keep updates up to date

Some of the largest malware outbreaks in history have exploited vulnerabilities in Windows that had already been patched. Don't defer updates any longer than you have to, or the consequences may be more grievous than a slow reboot.

5 Be wary of dodgy emails

When an email arrives out of the blue from a familiar source, and with your name in the "To:" field, it's only natural to open the attachment. But wait: bogus emails are a major avenue for malware infection. If you're not 100% certain of the content, skip it – or preview it on your phone.

6 Change default passwords

In the past few years we've seen more than one worm exploiting default passwords for routers, NAS appliances and other devices. Change those passwords and you'll slash that risk.

The Network

Practical buying and strategic advice for IT managers and decision makers

BUSINESS FOCUS

Picking the perfect scanner

Dave Mitchell reveals the most important features to look for in a scanner, and puts four professional models to the test

This may be the digital age, but many offices are still bursting at the seams with paper records. From invoices and statements to sales reports, contracts and who knows what else, there's no end to the documents you need to hang onto. But office space isn't free and, if half your floor is filled up with filing cabinets, that's costing you hard cash.

Digitising is the way forward. Once documents have been scanned in, the originals can go into archival storage; there are plenty of companies who will provide secure facilities at very reasonable prices. This lets you reclaim all that wasted floor space, and also means that your essential documents, in digital form, can be more easily accessed and searched.

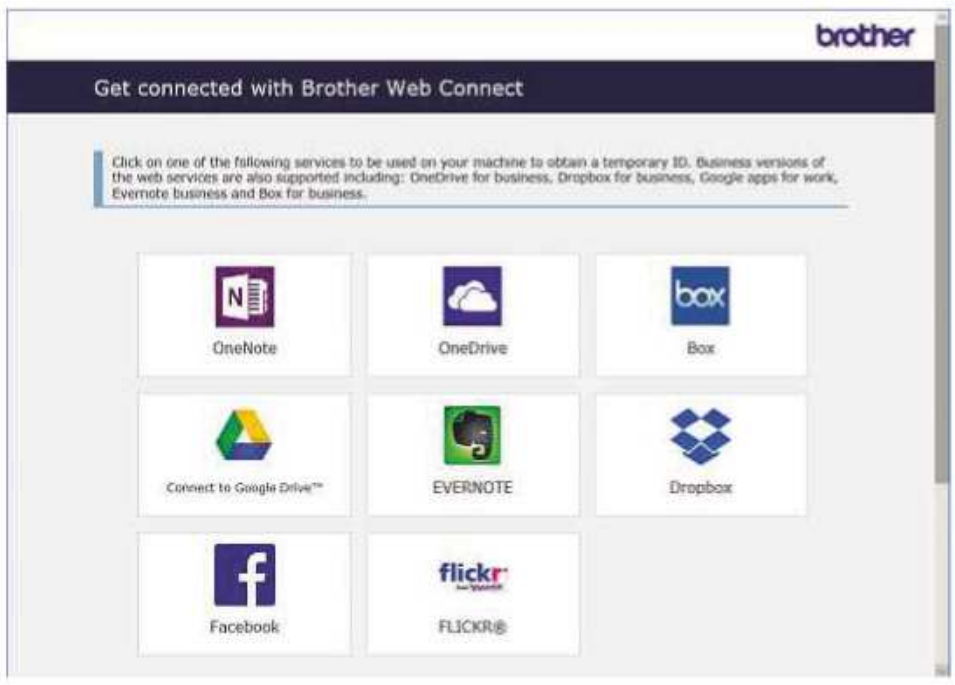
All you need to get started is a scanner, and there's a huge range to choose from, at prices to suit even the smallest of businesses. In this month's buyer's guide, we test affordable desktop solutions from four big names – Brother, Epson, Fujitsu and Xerox – to help you make the right buying decision.

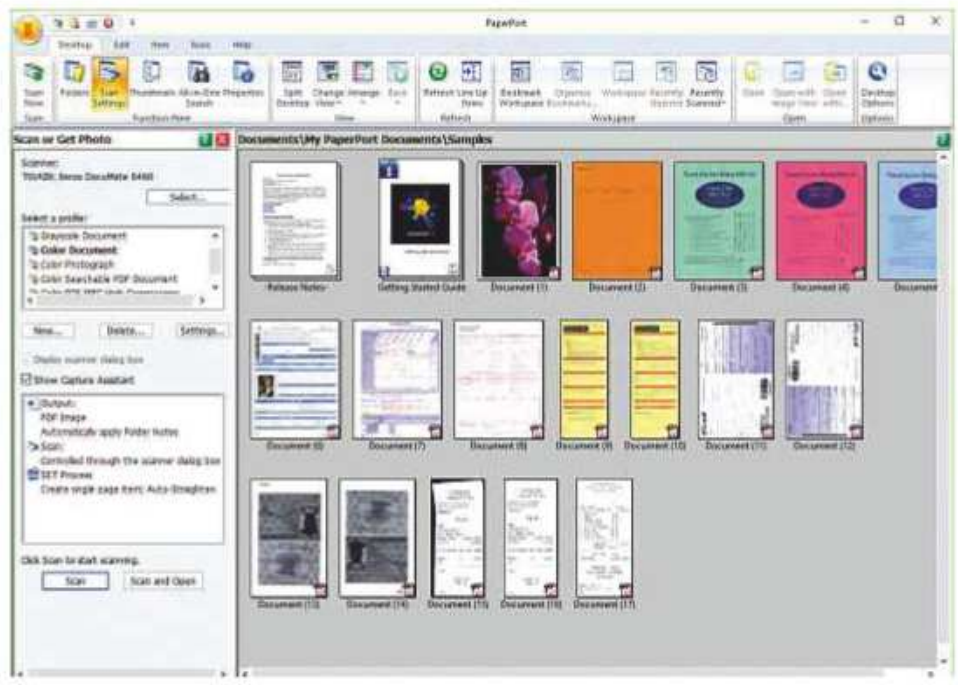
"Office space isn't free, and if half your floor is filled up with filing cabinets, that's costing you hard cash"

LEFT Some scanners give you a choice of USB, wired and wireless connections

Both sides now

Double-sided documents are commonplace these days. Most business printers support duplex printing, and enabling it by default helps reduce costs, storage requirements and environmental impact. So we'd strongly recommend you invest in a duplex scanner with imaging sensors on both sides of the paper path (sometimes called a "single-pass" model), allowing it to scan both sides at once. A single-sided model may be cheaper, but you'll end up wasting a lot of time and energy flipping pages over as you scan them. Be aware that some double-sided scanners only have a single sensor. These work by automatically turning the page over and scanning each side in turn. The technology works, but it's a lot slower than a single-pass design.





If you have a big paperwork backlog to clear, it's also a good idea to look for a scanner with an automatic document feeder (ADF), so it can scan through a big stack of documents without human intervention. Look for a scanner with a duty cycle and ADF capacity to match your expected needs: certain professional models are rated for up to 10,000 pages per day, and many ADFs have input capacities of 50 pages and upwards.

Also think about what sort of document you want to feed through your scanner scan. Modern scanners feature sophisticated and effective jam-detection sensors that will normally stop the rollers before any damage occurs, meaning you don't need to worry much about that. But if you need to scan in documents that are too precious or bulky to entrust to an ADF, it's helpful if your scanner also has a traditional flatbed option.

USB or network?

The cheapest scanners use a USB connection, but this is often a false economy as it means you will end up dedicating an entire PC to the scanning and document management functions. After all, you can't expect an employee to use it for their own work while others are queueing up to scan documents.

Network scanners are more costly, but they don't require a dedicated host PC. You can locate the scanner itself anywhere in the office, and allow users to access it from their own desktop simply by installing the software and drivers.

One modern convenience that's worth looking out for is "tap and scan". Scanners that support this feature an NFC chip that you can tap a smartphone against to create an instant connection, and scan documents directly to your mobile. If that's of interest, check platform support: some vendors only offer scan apps for Android, while others support iOS as well.

Long distance information

When using a network scanner, you need to specify whereabouts on the network you want your scanned file to be saved. It's important to standardise on this, as your digital documents will be impossible to manage if they're scattered across multiple systems. All good scanners will support both local and network locations, and some nowadays also let you scan directly to a cloud destination. This is generally a sensible idea: it provides secure storage, lets you restrict access to specific users and allows scanned documents to be searched and referred to from anywhere.

Be warned, though, not all vendors are alike in this area. Brother's network scanners are real standard-setters when it comes to cloud services, while some rivals have no sort of cloud support at all. You can work around that by scanning straight to a Dropbox, OneDrive or Google Drive location, for automatic uplift to the cloud, but those services aren't really designed for this sort of role, and lack suitable management tools. It's much better if the scanner software itself handles interactions with your cloud storage service.

ABOVE LEFT **If you want to scan to the cloud, check the spec before you buy**

ABOVE **Nuance's PaperPort software keeps your digital documents organised**

"With the GDPR now in force, all SMBs need to ensure that personal data is properly stored and secured"

BELOW **With Xerox's software, you can set up scan workflows using drag-and-drop**

We need a resolution

Nobody wants blurry scans, but don't get carried away with extravagant resolutions. Today's business scanners can all produce greyscale digital copies at 200dpi that are perfectly clean and readable. If you want to create searchable PDF (sPDF) files, you might choose to step up to 300dpi, to help ensure that the OCR process interprets everything correctly. Anything higher than that, however, is unlikely to offer any real benefit – it'll just make your scans slower and your output files unnecessarily large. Note that sPDF documents will also be slightly larger than standard ones, but the convenience of being able to effortlessly search and index your documents is normally worth it.

Scanning and GDPR

Scanning isn't just about streamlining your everyday business. With the GDPR (General Data Protection Regulation) now in force, all SMBs need to ensure that personal data is properly stored and secured. That's a lot easier to do with a digital file than a piece of paper. Not only can you store the files in a restricted network location, you can also encrypt and password-protect individual files.

Additionally, GDPR gives individuals the right to access their own data, and the right to be forgotten. Responding to a Subject Access Request (SAR) is a lot easier if your documents are all digital: you can find all documents relating to a particular client in a matter of seconds, rather than having to rummage through physical folders and filing cabinets.

Brother ADS-3600W

This affordable network desktop scanner is flexible, fast and functional, making it an easy choice for SMBs

SCORE ★★★★★

PRICE £455 exc VAT **from ebuyer.com**

It may look like a converted fax machine, but the Brother ADS-3600W is a thoroughly modern scanner. With a fast 50ppm scan speed in both colour and mono and a 50-page ADF, it will help you clear out your filing cabinets in double-quick time – and, at £455, it's reasonably priced, too.

You can take your pick of connection options: there's USB 3 for standalone use, but both Gigabit Ethernet and 802.11n Wi-Fi are also supported, along with NFC tap-to-scan operations for iOS and Android. Its 9.3cm colour touchscreen makes it a breeze to explore its features, and it takes just a few taps to fire off a fast scan directly to a network or cloud location.

When we say fast, we mean it. The ADS-3600W isn't as nippy as its competitors from Fujitsu and Xerox (*see overleaf*), but 50ppm is still a hell of a rate – and it kept up that speed with perfect consistency, at both 200dpi and 300dpi, in colour and greyscale, and with both single- and double-sided documents. Switching to 600dpi cut scan speeds to 17ppm in greyscale and 7.5ppm in colour – but there's little reason ever to use that mode, as scan quality at 200dpi is fine for creating searchable PDFs.

As well as high speeds, the ADS-3600W is built for high demand, with a 5,000-sheet daily duty cycle. We can confirm that its paper trays are suitably solid, and the input guides held firm as we scanned large bundles of bank statements.

Indeed, paper handling is near perfect. The scanner happily ate up our mix of statements, till receipts and waybills, and when a rare paper jam did occur, the ADS-3600W's lightning-fast response ensured that nothing was damaged.

To support all of this, a solid software bundle includes Brother's ControlCenter4 (CC4) scan utility and the iPrint&Scan app for Windows, which can pull in scans over the network and lets you set up fast one-click scans to the desktop. You also get Nuance's popular PaperPort 14.5 SE, plus the ABBYY FineReader Pro 11 and PDF Transformer+ OCR tools. On installing the suite on one of our Windows 10 desktops, we were delighted to see that the scanner was automatically detected and made available for immediate use. The only fly in the ointment is that the Nuance and ABBYY products are downloaded on demand by the installer, which can really slow things down. In our case, because of this, the whole setup process took nearly 40 minutes.

To complement Brother's desktop software, the scanner also has a native web-based management console, which can be used to create up to 25 profiles for scans to email servers, FTP sites and network shares with each new destination appearing in the LCD panel. Once we'd provided details of our SMTP server, we could use the scanner's local address book to create email entries for up to 300 users.

Cloud support is a particular strength. The scanner can upload scans directly to Dropbox, Google Drive, OneDrive, OneNote, Evernote, Box, Facebook and even Flickr – and it's all a cinch to set up via Brother's Web Connect portal. It took us less than a minute to register our Dropbox account, enter the unique 11-digit code at the scanner's touchscreen, and enable PIN-protected local access.

On that note, security features are good, with access and usage both controlled with Brother's Secure Function Lock. We found it easy to limit public access, create lists of local users and assign privileges to block or allow scanning to destinations such as PCs, FTP servers and the web.

If you're seeking a fast desktop scanner that won't break the bank, the ADS-3600W is hard to beat. Its versatile connection options mean it will fit into any office setup, and its cloud support is as good as you'll find at any price.

ABOVE **A 9.3cm colour touchscreen makes the ADS-3600W a breeze to use**

PC PRO A-LIST

LEFT **The extending ADF lets you scan up to 50 pages at a time**

"The scanner can upload scans directly to Dropbox, Google Drive, OneDrive, OneNote, Evernote, Box, Facebook and even Flickr"

LEFT **The provided iPrint&Scan app streamlines scanning tasks with workflows**

SPECIFICATIONS

600dpi A4 colour ADF scanner • 50ppm at 300dpi, colour/mono (simplex/duplex) • 50-page ADF • 9.3cm colour touchscreen • USB 3 • USB 2 host • Gigabit Ethernet • 802.11n wireless • NFC • Wi-Fi Direct • daily duty cycle: 5,000 pages • external PSU • ControlCenter4, Nuance PaperPort 14.5 SE, ABBYY FineReader Pro 11 and PDF Transformer+ software • TWAIN/ISIS/WIA drivers • 306 x 258 x 250mm (WDH, closed) • 4.5kg • 1yr RTB warranty

Epson WorkForce DS-1660W

A low-cost scanner with both ADF and flatbed options – just be aware that double-sided scanning is slow

SCORE ★★★★☆

PRICE £192 exc VAT from ebuyer.com

ABOVE The low-profile design reflects the DS-1660W's relatively modest ambitions

You can pay a lot for a high-end desktop scanner – but if your needs are more modest then Epson's WorkForce DS-1660W could be the perfect fit. It features a 25ppm ADF, an A4 flatbed, and it connects via both USB and Wi-Fi. And it costs very little indeed.

LEFT The A4 flatbed opens up the option of scanning a wide range of media types

The thing itself is likeably petite. It won't take up much desk space, and the lid simply lifts up for scanning books and magazines. It also contains an NFC chip, allowing Android users to get a quick scan with a simple tap.

The software bundle is lightweight, extending only to the basic Scan 2 utility and Document Capture Pro app. We found the scanner easy to install, though: the hardware was recognised as soon as we hooked it up via USB 3 to a Windows 10 desktop, and Epson's software installed the latest firmware and had us ready to scan in around ten minutes. If you want to use Wi-Fi, you can use the scanner's control buttons to connect to a WPS host, or configure the connection from the desktop installation utility. This automatically configures the software for a network connection and activates the scanner's web management console. You're invited to install the apps on other networked desktops as well, and to install the iOS app to send scans directly to an iPhone or iPad.

Epson's Scan 2 desktop software is simple and tidy. You can choose whether to scan from the ADF or the flatbed, pick a resolution, specify colour or mono scanning and switch between single- and double-sided scanning. Both local and network folders can be set as destinations, and output formats include JPEG, PDF and searchable PDF.

There are some potentially useful advanced options, too. As well as de-skew and blank page skipping, you can automatically remove punched holes, enhance text and manually tweak the brightness and contrast of your scans. Once you've dialed in a combination of settings, you can easily save them as a profile for quick access in the future.

For more advanced jobs, the Document Capture Pro app has you covered. From here, you can set up custom jobs and store them for one-touch access from the scanner's own interface. You also get a wider range of destination choices, including email, direct printing, SharePoint, FTP servers, WebDAV locations and SugarSync, Evernote and Google Drive cloud accounts. We had no problems creating a job to scan documents to our Google Drive account: we simply selected the service from the destination menu, logged in to our account, pasted the authorisation code into the dialog box and then selected a cloud folder.

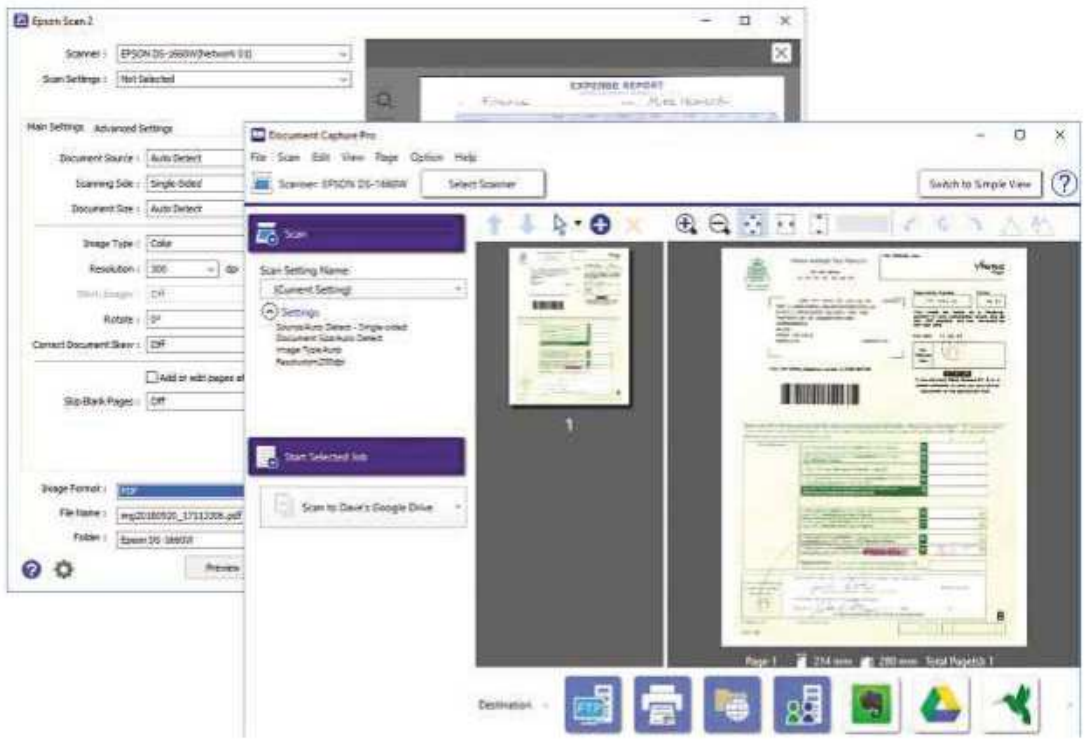
If there's a catch with this scanner, it's speed. Epson advertises that the DS-1660W will scan single-sided documents at 300dpi at 26ppm, and our experience bore that out, in both colour and greyscale modes, over both USB 3 and wireless.

However, there's no space – in the design or the budget – for a double-sided scanning mechanism, so in duplex mode, the ADF has to scan the front and back of each page in turn. This results in much slower speeds: our double-sided bank statement scanned at 300dpi came out at just 6ppm, and at 600dpi that was slashed again to just 3.6ppm.

"Photos looked sharp with excellent colour balance, while documents scanned at 200dpi were perfectly clear and legible"

Still, the flatbed isn't bad at all: an A4 colour photograph was scanned at 600dpi in 36 seconds, and only took seven seconds at 300dpi. And scan quality was very good: photos looked sharp with excellent colour balance, while documents scanned at 200dpi were perfectly clear and legible.

It's an iffy choice if you regularly need to scan double-sided documents, but Epson's WorkForce DS-1660W will suit small offices seeking a low-budget scanner with both a flatbed and an ADF. Output quality is good, the software does everything you need and the choice of USB and Wi-Fi connection is handy.



LEFT The supplied software provides a good range of scan-management features

SPECIFICATIONS

600dpi A4 colour ADF/flatbed scanner • 25ppm at 300dpi colour/mono (simplex) • 50-page ADF • USB 3 • 802.11n wireless • Wi-Fi Direct • NFC • daily duty cycle: 1,500 pages • external PSU • Epson Scan 2, Document Capture Pro software • 451 x 315 x 120mm (WDH) • 3.9kg • 1yr on-site service warranty

Fujitsu fi-7160

A standalone workhorse of a scanner, made all the more powerful by innovative PaperStream IP technology

SCORE ★★★★½

PRICE £533 exc VAT from ebuyer.com

The Fujitsu fi-7160 is a standalone USB scanner with no network capabilities, but it's still very much a business-class bit of kit. The company's PaperStream IP software is designed to streamline large scanning jobs, and the scanner itself boasts an 80-page ADF and a generous 4,000-page daily duty cycle. It won't keep you waiting around either, thanks to a claimed top speed of 60ppm for 300dpi colour scans (it's actually higher). For peace of mind when important documents are whizzing through the scanner, Fujitsu's intelligent Sonic Paper Protection (iSOP) hardware promises to make damaging jams a thing of the past.

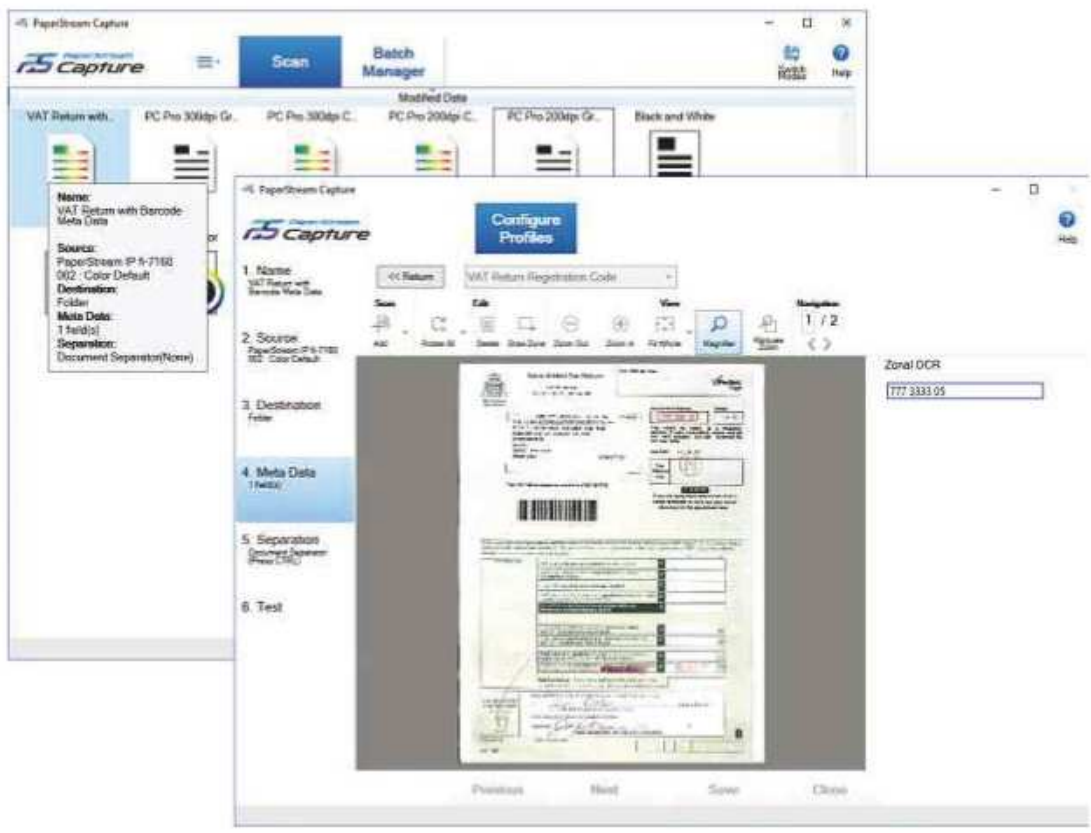
The fi-7160 doesn't have much in the way of physical controls, but there's a small LCD panel and control pad on the front panel, which can be used to scroll through a menu of scan functions. A backlight would have been nice: stick the scanner in a dingy corner of the office and the screen can be difficult to read.

Since this isn't a network scanner, you'll need to connect it to a dedicated PC via USB. Installing the bundled software package on a Windows 10 desktop took around 20 minutes; as well as the PaperStream components, this gave us the ABBYY FineReader for ScanSnap OCR software and Fujitsu's simpler ScanSnap Manager app for basic scanning tasks. There's also a local agent that allows the scanner to be remotely managed via Fujitsu's free Scanner Central Admin server.

Open up the PaperStream Capture app and you'll find a well designed profile system that lets you set up multiple scan settings for different jobs. Creating a new profile is easily done via a wizard; you're walked through the business of specifying scan settings such as colour, greyscale or mono output, resolutions, paper sizes and duplex or simplex scanning. You can set up your scan destination here too, which might be a local folder, a network location, FTP or a SharePoint server. Cloud locations aren't currently supported, though: this used to be handled by Fujitsu's clunky Capture Connect app, but now that's been discontinued.

The clever part is that profiles also include features such as hole filling, blank page removal and page rotation. Document separation for large batch scans can be implemented using blank pages, page counts, predefined OCR zones, barcodes or Fujitsu's patch codes. You can even extract data from documents as they're being scanned: to try this out, we previewed a sample scan and drew a box round the area we wanted OCR to be applied to. Once the scan had finished we were then able to export the raw text in TXT, CSV or XML format alongside the main document file. All of this is easy to get to grips with, partly because you can view a scan as soon as it's captured, and tweak settings as needed before saving it to its final destination.

ABOVE **The fi-7160 is short on controls, but the desktop software makes up for that**



LEFT **PaperStream Capture handles large batch scans with ease**

PC PRO RECOMMENDED

"You can view a scan as soon as it's captured, and tweak settings as needed before saving it to its final destination"

Once you've created a profile, you can assign it to one of the scanner's nine custom scan functions, for quick access in the future. The LCD panel can show profile names of up to 48 characters, so it's easy to detail precisely what each one does.

With all this set up, we were ready to test performance. Impressively, the fi-7160 slightly exceeded its advertised speed, with duplex scans of 50 bank statements completed at 62ppm, in both colour and greyscale and at 200dpi and 300dpi. Even at 600dpi speed, speeds weren't awful, each page taking five seconds to pass through the feeder.

We also appreciated how quiet the scanner is during operation, and output quality at 200dpi is easily good enough for document archival systems. We got the opportunity to test the iSOP anti-jam feature as well when our till receipts and waybills got slumped together in the ADF: the scanner stopped instantly with no harm done.

If you need to service a whole department, a network scanner might be a better choice, but if a standalone approach suits you then Fujitsu's fi-7160 delivers great scan speed and quality at a tempting price.

SPECIFICATIONS

600dpi A4 colour ADF scanner • 60ppm at 300dpi colour (simplex/duplex) • 80-page ADF • USB 3 • external PSU • daily duty cycle: 4,000 pages • ScanSnap Manager, PaperStream IP TWAIN/ISIS drivers • PaperStream Capture, ABBYY FineReader for ScanSnap software • 300 x 170 x 163mm WDH (closed) • 4.2kg • 1yr advanced exchange warranty

Xerox DocuMate 6460

Poor technical support, but the DocuMate 6460 delivers high scan speeds and great quality at an affordable price

SCORE ★★★★½

PRICE £775 exc VAT from uk.insight.com

If you feel the need for scanning speed, the DocuMate 6460 from Xerox could be the answer, as this deceptively compact desktop scanner claims a fast performance of 70ppm. It can do this for colour and mono scans at 200dpi with speed only dropping slightly to 65ppm at 300dpi.

The 6460 can also take some punishment, with Xerox quoting a massive duty cycle of 10,000 pages per day. It's also great for big scan jobs because its ADF can handle up to 120 pages of 80gsm paper.

The scanner's raked paper input tray offers a flatter path than most other upright desktop scanners, making it a better choice for scanning thicker media such as A4 photos. Moreover, the input tray has latches for setting the paper guides for A4 or letter sizes and lowering them allows dot-matrix paper and documents up to 3m to be scanned.

The scanner only offers a USB 3 connection, meaning you'll need a Windows PC to host it. Installation on a Windows 10 desktop took ten minutes, with the routine loading all of Xerox's generous software bundle.

This includes the Visioneer OneTouch scan management utility, along with Nuance's PaperPort Professional 14 for document management, OmniPage Ultimate and its OCR tools, plus Power PDF for creating PDFs from other file formats.

OneTouch sits in the background and links the scanner's function button to nine different actions. The panel's backlit mono LCD display shows the name of the action selected so you don't need to place a list next to the scanner.

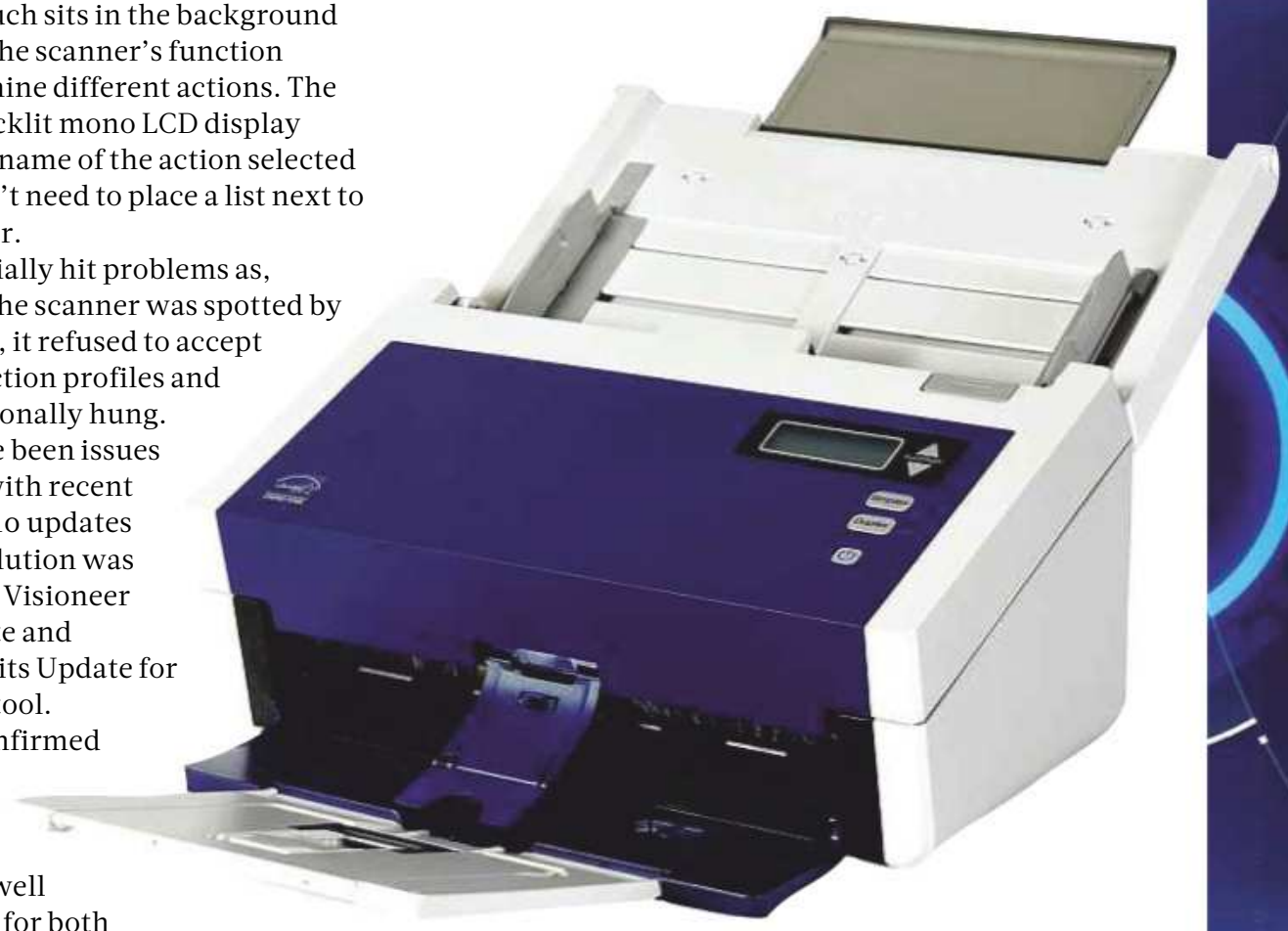
We initially hit problems as, although the scanner was spotted by OneTouch, it refused to accept our new action profiles and also occasionally hung. There have been issues reported with recent Windows 10 updates and our solution was to visit the Visioneer support site and download its Update for Windows tool.

This confirmed there was a new scanner driver, as well as updates for both OneTouch and PaperPort, and proceeded to download and apply them. It all worked fine, but this procedure isn't actually documented on the Xerox support site, which really isn't acceptable.

OneTouch actions include scanning to an application, local and network folders, printer, email, fax, FTP server or SharePoint server. To create an action, you choose a function number from OneTouch, pick a destination, add either a BMP, JPEG, TIFF, PDF or searchable PDF (sPDF) output format and assign a scan configuration.

The OneTouch Acuity feature provides anti-skew, auto-crop, page rotation, plus blank page skipping and an option to redact selected areas of an image with coloured blocks during the scan.

Adding cloud support to OneTouch requires the scanner to be registered, after which you visit the Visioneer Connect website and download plugins for Box, Evernote, Dropbox, FilesAnywhere and Google Docs. This worked smoothly in practice.



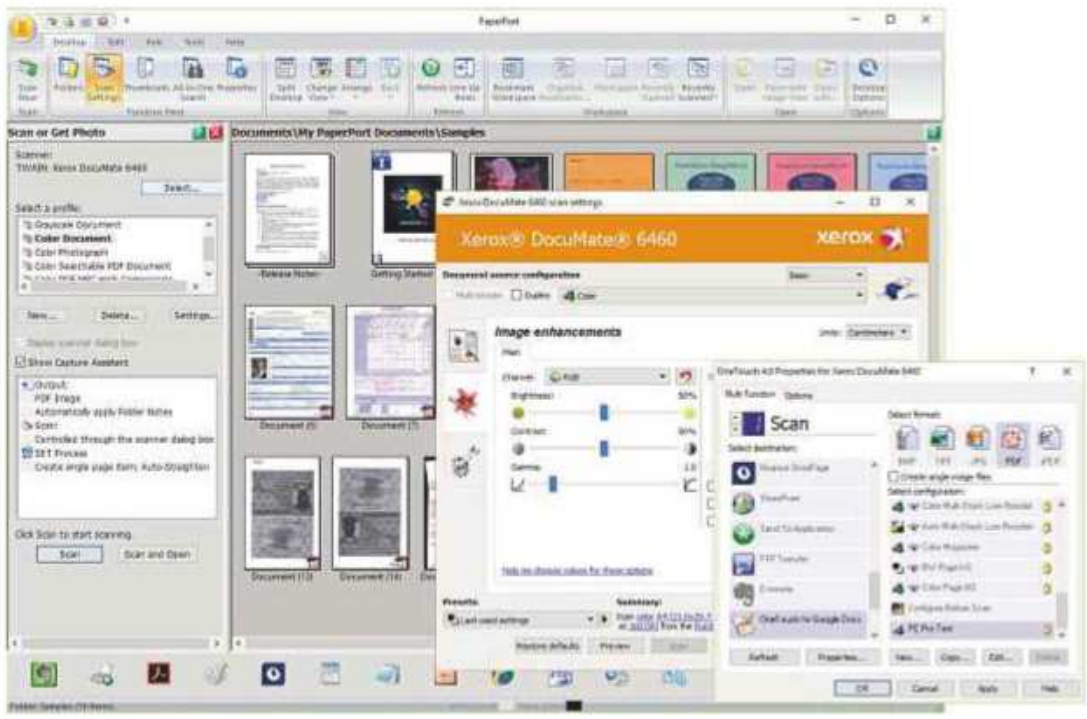
ABOVE The input tray can be adjusted for different sizes of paper, including documents up to 3m

The 6460 excels in the performance stakes, with our 50-page sheaf of bank statements returning the quoted 70ppm at 200pdi for both greyscale and colour. At 300pdi, the scanner proved to be faster than the claims by Xerox as it returned the same speed for greyscale and colour. At 600pdi, speed fell substantially but colour tests mustered 22ppm, whereas greyscale scans paused frequently and returned a lower 18ppm.

Output quality is excellent and the 200dpi greyscale and colour scans are easily good enough for document archiving. Paper handling is beyond reproach as we didn't experience any paper jams during testing and found the 6460 to be very quiet as well.

"The OneTouch Acuity feature provides anti-skew, auto-crop, page rotation... and an option to redact areas of an image"

The poor online support left us distinctly unimpressed, but there's no denying the Xerox DocuMate 6460 delivers a mighty scan speed and great quality for the price. If you want a high-volume desktop scanner but don't require network support, then this Xerox scanner should certainly be on your shortlist. ●



LEFT The scanner comes with the versatile OneTouch scan management app

SPECIFICATIONS 600dpi A4 colour ADF scanner ● 70ppm at 200dpi colour/mono ● simplex/duplex ● 120-page ADF ● USB 3 ● Daily duty cycle: 10,000 pages ● external PSU ● Visioneer OneTouch and Acuity, Nuance PaperPort Pro 14, OmniPage Ultimate 19.1, Power PDF software ● TWAIN/ISIS/WIA drivers ● 316 x 168 x 191mm (WDH, closed) ● 4.7kg ● 1yr standard advanced exchange warranty

Synology RackStation RS1219+

A space-saving rack NAS appliance with features galore and a surprising degree of upgrade potential

SCORE ★★★★½

PRICE Diskless, £863 exc VAT from broadbandbuyer.com

Measuring just 12in from front to rear, the RackStation RS1219+ is the first short-depth eight-bay NAS appliance on the market. It's great for SMBs seeking a lot of storage in a small space, as it will slot neatly into a small wall or two-post rack cabinet – yet its eight LFF hot-swap bays can deliver a huge 112TB of capacity using certified 14TB drives. If that's somehow not enough, you can even add a four-bay RX418 shelf, which is again only 12.8in deep.

Round the back you'll find four Gigabit Ethernet ports, and an internal PCI-Express slot supports either a standard 10GbE adapter or Synology's M2D17 dual M.2 SSD cache card. Dual USB 3 sockets allow local connections too.

Internally, it's a bit of a shame that Synology has opted for an elderly 2.4GHz Atom C2538 CPU. Most of Synology's latest appliances have moved to faster C3538 processors, to ensure everything keeps running smoothly. On the upside, the base 2GB of DDR3 memory can be expanded to 16GB using the two free SODIMM slots, allowing plenty of headroom for advanced services.

So, how fast is it? To test maximum performance, we installed four 12TB Seagate IronWolf NAS drives and an Emulex dual-port 10GBaseT adapter card. The drives were configured as an SHR (Synology Hybrid RAID) storage pool and a share was mapped to a Xeon Scalable host running Windows Server 2016. With this all in place, Iometer reported 7.9Gbits/sec for sequential reads, with a lower 3.2Gbits/sec for writes. With a second share mapped to a separate Xeon Scalable Windows server, we saw cumulative read and write rates of 11Gbits/sec and 3.9Gbits/sec.

For comparison, Synology's Atom C3538-equipped DS1618+ gave us read and write speeds of 9.2Gbits/sec and 4.3Gbits/sec. In our dual server test, it also returned higher cumulative rates of 11.9Gbits/sec and 5.1Gbits/sec. The RS1219+ is thus a clear step behind Synology's more advanced NAS appliances, but performance is more than acceptable for a small business.

This was confirmed in our real-world tests; here, our 25GB test file was read from the share at 4.7Gbits/sec but again written back more slowly at 3.1Gbits/sec. General backup performance was quite impressive though, with our 22.4GB folder and its 10,500 small files secured at an average of 2Gbits/sec – just 0.3Gbits/sec slower than the DS1618+.

Indeed, the RS1219+ is a great choice for backup duties, as Synology's DSM 6.2 software comes with a wealth of data-protection features. Workstation backup is handled by the slick Cloud Station Server app, which works with a Windows client to provide real-time, one-way file syncing – or you can use the Drive agent for two-way synchronisation.

ABOVE You get four Gigabit Ethernet ports, and 10GbE can be easily added

PC PRO RECOMMENDED

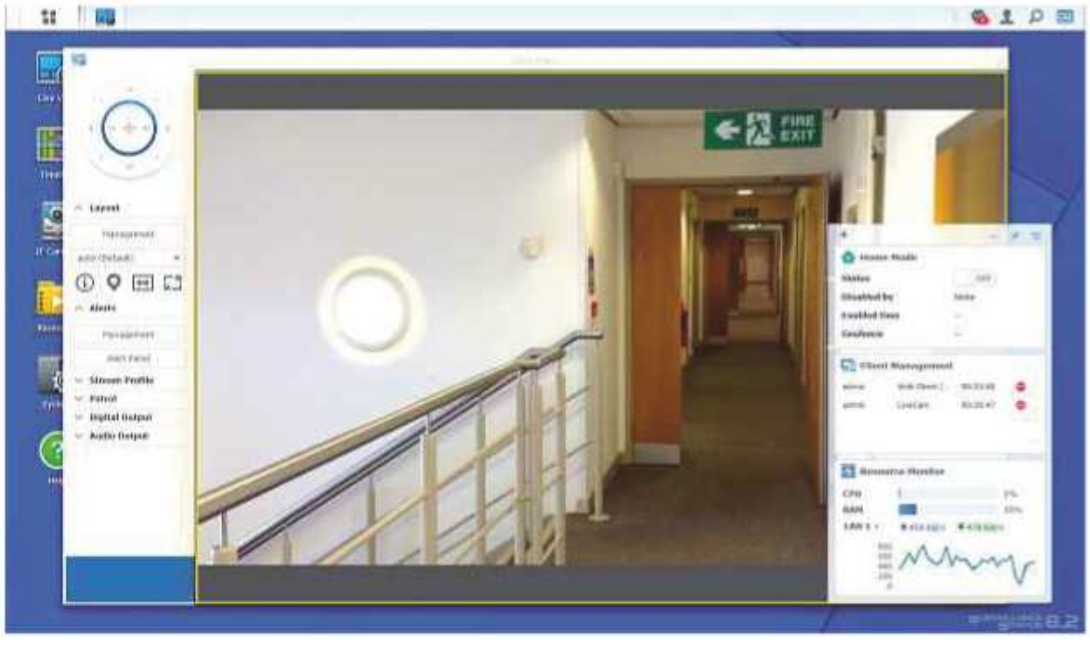
And once your client data is copied to the appliance, you have plenty of options for further protecting it. The Snapshot Replication app provides on-demand and scheduled snapshots of Btrfs volumes, plus replication to remote Synology appliances, while the Hyper Backup app handles local, remote and Rysnc backups. The Cloud Sync app can also copy appliance data to a wealth of cloud providers.

Equally, the RS1219+ makes a great surveillance recording vault, thanks to Synology's Surveillance Station 8.2 app. Along with support for 6,000 IP camera models, it now secures recordings with dual authentication. Plus, a new smart timelapse feature helpfully condenses lengthy recordings for faster review.

"The RS1219+ is great for backup, as Synology's DSM 6.2 software comes with a wealth of data-protection features"

The LiveCam app is a plus too: installing this on our iPad allowed us to pair its camera with the appliance and send video streams direct to the Surveillance Station console and record them. We only needed to provide the IP address or QuickConnect ID of the NAS, add our credentials, ensure our iPad was in the desired orientation and tap the app's play button – simple.

There are faster NAS appliances out there, but the RS1219+ is sure to satisfy most SMBs. It packs an awful lot into a compact chassis, making it ideal for space-poor offices seeking a discreet backup server or surveillance recording vault. **DAVE MITCHELL**



LEFT The LiveCam app let us use the RS1219+ to record live video from our iPad

SPECIFICATIONS

2U rack chassis • 2.4GHz quad-core Atom C2538 • 2GB DDR3 (max 16GB) • 8 x LFF/SFF hot-swap SATA drive bays • supports RAID0, 1, 10, 5, 6, SHR-1/2, hot-spare, JBOD • 4 x Gigabit Ethernet • 2 x USB 3 • eSATA • PCI-Express slot • 3yr hardware warranty

Zyxel NWA1123-AC HD

An affordable Wave 2 wireless AP with great business-class features and free cloud management

SCORE ★★★★½

PRICE £134 exc VAT from amazon.co.uk

A wireless network should grow with your needs, and Zyxel's NWA1123-AC HD makes a great starting point. This 802.11ac wireless AP can operate in standalone mode, link up with a Windows app for local management, or move into the cloud for free via Zyxel's Nebula platform.

The hardware offers all the capabilities an evolving business demands. There's support for concurrent 2.4GHz and 5GHz operations, with built-in immunity to 3G/4G interference, and MU-MIMO technology to increase the number of lanes on your wireless highway, helping the AP to support a large userbase.

Inside, there are two 2.4GHz and three 5GHz internal aerials; at the rear, you'll find a standard Gigabit Ethernet port, plus a PoE+-enabled connector. We recommend you connect this to an 802.3at PoE+ source, as using an older 802.3af PoE source will limit the radios to one transmission stream each.

Deploying a single AP in standalone mode is simple. The web-based wizard detected our region, prompted us to set a secure admin password, enabled both radios and provisioned two encrypted networks. Once you're up and running, a customisable dashboard displays useful details such as AP resource utilisation and WLAN interface status.

Although two SSIDs are set up by default, you can create up to eight per radio, with security profiles determining things like SSID masking and WPA2, RADIUS or 802.1x authentication.

Profiles can also be used to enforce MAC address filtering, QoS traffic prioritisation and L2 isolation (to stop wireless guest clients from seeing each other). There's a rogue AP detection feature too: on older Zyxel hardware this required you to switch one radio into a dedicated monitor mode, but that's no longer required.

If you've multiple APs to handle, you can use the free ZAC Windows app. This quickly discovered the AP on our LAN, displayed its SSID and allowed us to remotely edit security profiles – which can then be pushed out to multiple APs on the same LAN.

For the maximum versatility, you'll want to sign up for a free Nebula account, which enables the Zyxel's cloud-management capabilities. From the Nebula portal you can set up sites for multiple locations, and assign APs to them using their MAC addresses and serial numbers.

ABOVE The AP is so discreet it'll blend in with a white wall

PC PRO RECOMMENDED

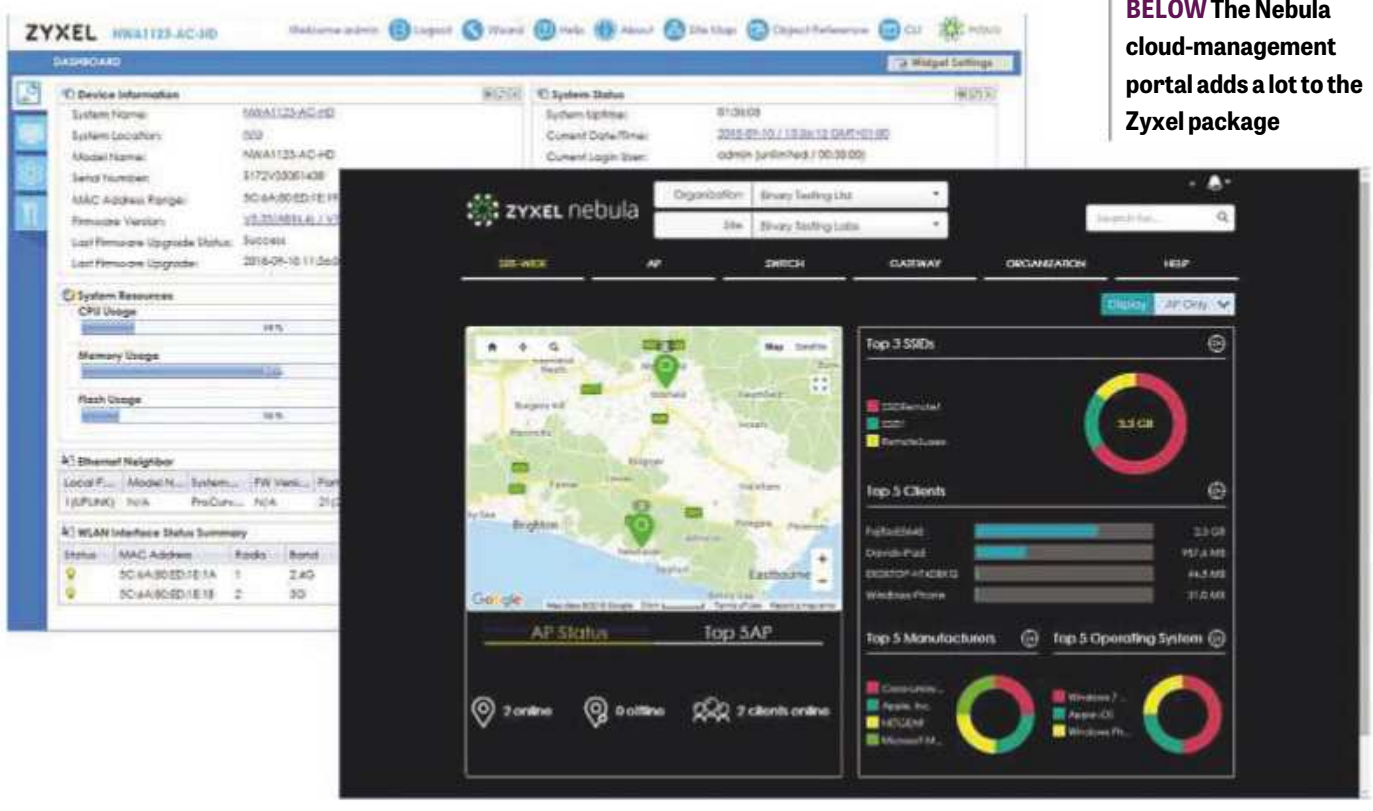
"The free Windows app quickly discovered the AP on our LAN, displayed its SSID and allowed us to remotely edit security profiles"

At first the portal might seem ovewhelming, as it's designed to manage not just APs but switches and gateways too – but you can easily switch the view to wireless networks only. The dashboard map shows each AP's location and status, with helpful charts revealing the busiest SSIDs and wireless clients, along with details of OS platform and wireless hardware.

The Nebula portal also makes it easy to manage multiple SSIDs: you can set all cloud-managed APs to broadcast all SSIDs, or associate specific networks with individual units. Schedules determine when SSIDs are active, while general site settings include on-demand and automatic AP firmware upgrades. Just note that the portal only supports up to eight SSIDs, and reporting is limited to the past seven days of event logs; if you want more than this you'll need to buy a Nebula Professional Pack licence (which also unlocks features such as email alerting and scheduled report generation).

When it comes to performance, we're more than satisfied with the NWA1123-AC HD. On a Windows 10 Pro desktop equipped with a Netgear AC1200 wireless adapter, we got an excellent average upload speed of 55MB/sec when copying a file to a server on the LAN. At 10m, we saw a slight drop in speed, but only to 49MB/sec. In fact, we had to carry an iPad 43m down the main building corridor before losing the signal.

The NWA1123-AC HD is a great choice for SMEs building a secure, extensible Wi-Fi infrastructure. Performance and coverage are good, and the free Nebula platform makes it easy to centrally manage and monitor a growing network. **DAVE MITCHELL**



BELOW The Nebula cloud-management portal adds a lot to the Zyxel package

SPECIFICATIONS

Wave 2 dual-band 2.4GHz/5GHz 802.11ac • MU-MIMO on 5GHz • 2 x 2.4GHz/3 x 5GHz internal aerials • 2 x Gigabit Ethernet (LAN and PoE/PoE+) • external PSU included • ceiling/wall mounting plate • 211 x 223 x 39mm (WDH) • 750g • limited lifetime warranty

FIVE SIGNS IT'S TIME TO Outsource

Outsourcing is far from a buzzword – it could really help your business. Steve Cassidy offers five signs that it could be time to embrace the idea

Outsourcing has become so ubiquitous in IT that it can feel suspiciously like a fad. But it's a mistake to dismiss an idea solely because it's popular. And this one is no flash in the pan: in the past decade, half a dozen techie trends have been and gone, while outsourcing has continued to grow. When issues such as edge versus fog are long forgotten, it's a safe bet that smart businesses will still be availing themselves of the advantages of outsourcing.

That's not to suggest that outsourcing isn't the right solution to every problem. But it's common to see businesses sticking with what they know for longer than they should. Here are five potential red flags that could mean it's time for you to join the ranks of successful outsourcers.

1 THE BUSINESS IS BUILT AROUND THE BOSS

I've worked with numerous enterprises where the CEO was also the primary technician, developer and head of procurement. I don't just mean little startups, but bona fide enterprises, with big names and turnovers in the tens of millions.

These were smart people, but this is putting an uncomfortable number of eggs in a single basket. Any movement of responsibility and knowledge out of that individual's head and onto a professional team is a win for the business, for reasons I'm sure I don't have to detail.

The only problem is that the boss is very unlikely to reach this conclusion by themselves. Such types are rarely eager to give up their high level of control, so moving to an outsourced model becomes not so much an organisational challenge as a psychological one – even if, in practice, all the boss is really giving up is the work of implementing applications and websites.

What if you are that boss? I've personally known quite a few of those people who write the code, design the web pages, build the PCs, set up the router and take pictures for the product catalogue – and many of them are *PC Pro* readers.

In that case, you just need to understand this: if you can say "this place would collapse without me", that's not an indicator of success – it's an indicator of risk. Perhaps you will find it reassuring to know that you don't necessarily have to hand everything over to a third party: outsourcing always involves balance

and compromise. Even so, the more diverse your IT arrangements, the better they'll be able to survive unexpected disasters.

Indeed, the requirement to document and detail what you're handing over can itself provide a very valuable kick in the pants, exposing bodge-up solutions before they become a serious problem. I've lost count of the times I've heard bosses laugh about how they've cleverly evaded their licensing obligations, or copied and pasted entire systems from online libraries without fully understanding how they work. No professional support or services provider will put up with that, and good thing, too.

2 YOUR HOME-GROWN PRACTICES ARE ATTRACTING QUESTIONS

Every business is unique, and many of them are proud of the fact. When I bring up industry standards in client meetings, the proprietor will often take that as a cue to wax lyrical about the company's distinctive history and practices, often with a few digs thrown in at rivals and professional associations that have the gall to do things differently.

But more than ever, business technology is attracting the attention of insurance underwriters, and if the whole nature of your IT estate hasn't already come under scrutiny, you can bet it will. Insurers are becoming canny and well connected enough to ask pointed questions about why Company B isn't doing the same things that Company A does. If you are finding yourself on the receiving end of such an inquisition, you could dedicate time and energy to responding – or you could outsource, and sidestep those questions in the first place.

As with most projects, the art of the deal lies in working out how to preserve the good bits of your uniqueness, while merrily jettisoning the bad bits to someone else. Another possible concern these days is that the industry experts and associations may well be a step or two behind the leading edge – and the same may apply to your outsourcing partner. You could end up finding that, for example, you can't satisfy GDPR declarations because you're not the actual owner-of-record of the whole platform.

Lines of accountability can get murky, too. In one noteworthy case I've recently seen, a certain business created a visitor access system that runs on an iPad positioned at reception. Guests tap their details into the app, including their name and details of who they're visiting. Unfortunately, once you type in "Steve", the iPad helpfully pops up details of all the people of that name who have ever logged in. It's an egregious data-protection hole – but who's responsible? The particular office with the specific iPad? The app developer? The industry association that accredited them?

In short, the caveat is that, while outsourcing can rid you of a lot of procedural headaches, it also creates a new obligation to keep on top of who's responsible for what – and who can be trusted with what.

"The art lies in working out how to preserve the good bits of your uniqueness, while jettisoning the bad bits to someone else"

3 COMPLIANCE IS BECOMING AN UPHILL STRUGGLE

Keeping insurers onside isn't the only challenge you face when you do things in-house. If you roll your own applications then you'll know that getting them through the approvals process for claiming professional capability is not simple. Certain *PC Pro* contributors have (privately) expressed the view that they would rather tangle with any number of code bugs and technical meltdowns than have to spend an evening on the sofa laboriously going through the regulations.

Unfortunately, it's not something you can simply ignore. Compliance used to be a rarefied priesthood thing, limited largely to code reviews, but these days it has crept further out into definitive statements about how certain types of data are stored, how traffic is delivered and so forth.

This makes it a painful business in the short term: all of your little tricks and bodges have to be disclosed and acknowledged. You also have to make a commitment to stay up to date. That's an open-ended promise that could involve some acute and

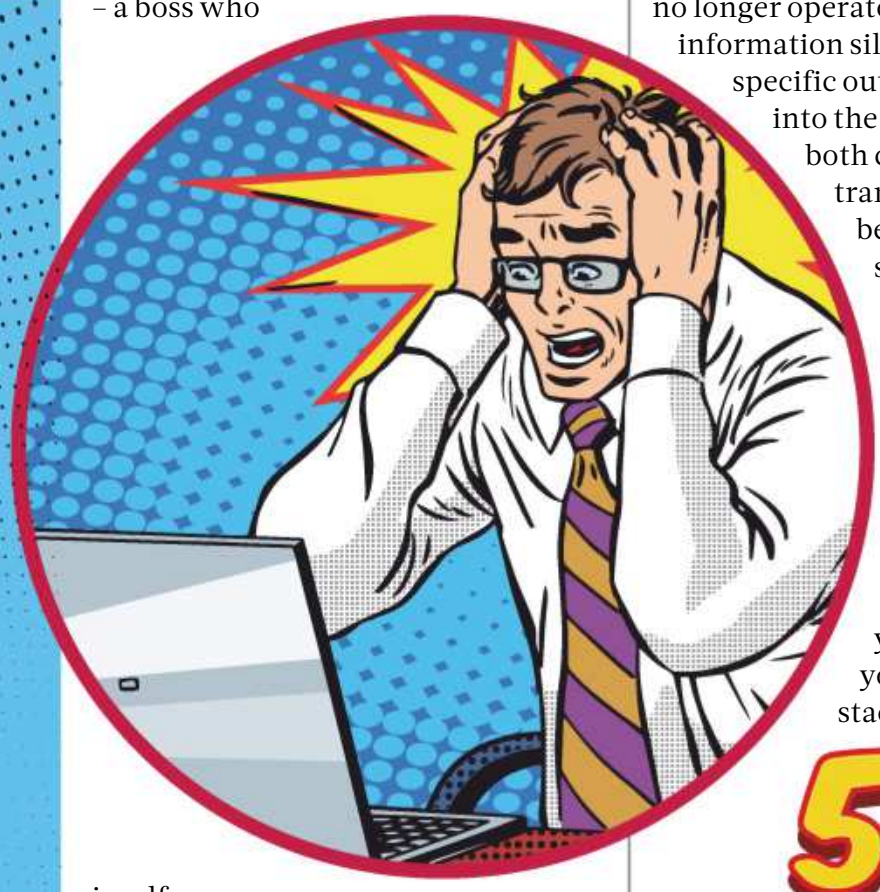
expensive flurries of activity at inconvenient times.

Outsourcing isn't a silver bullet here. Contract out the ongoing development of your core business apps and what comes back may well be just as non-compliant, just as vulnerable and just as retro as your old in-house code. However, you can at least reduce the friction of switching by timing it intelligently. If you were preparing to upgrade to a new platform anyway, taking the opportunity to migrate to an outsourced, cloud-hosted platform instead doesn't involve much additional upheaval.

And, once you have made the initial leap into the cloud, you're in a much stronger position to move on again should the need arise. Certain outsourcing relationships can feel rather abusively one-sided, but when it comes to the cloud, we can thank the founding fathers for foreseeing the value of portability.

4 YOUR IT FUNCTION ISN'T FULLY UNDERSTOOD

We've already discussed the hands-on, do-it-all boss, but there's another type of leader who can also be a hazard, albeit a well-meaning one, to a growing business – a boss who



is self-deprecatingly awkward around the IT department. You know, the sort who will stand up at the company Christmas lunch and warmly declare "I don't know how these guys have kept it all running so well…"

Back when IT was a nascent function that organisations could either take or leave, this might have been quite charming, and plenty of people still laugh along with the idea that bosses know nothing at all about what the guys in the basement are doing. But today IT is part of the fundamental fabric of every business – and if the boss isn't on top of what the nerds are doing, it implies that they're being given too much autonomy and not enough management.

This can lead to some very inefficient organisations and practices, since the IT department will inevitably have its own priorities and instincts. It also raises the danger that, if relations grow sour, "accidents" can happen. In a poorly managed environment, a scorned ex-employee could do an alarming amount of damage on their way out.

The solution isn't to ditch the whole team in one brutal swoop. Leaving aside the ethics of such a move, handing over your entire network to a single external services provider is a risky leap. I have lost count of the number of small businesses whose site and domain registrations have been held hostage by a small, stroppy outsourcer looking for some extra cash.

A better approach is to hang onto your valuable, experienced IT nerds, but engineer a situation where they no longer operate as a de facto information silo. Blending a few specific outsourced functions into the mix will enforce both consistency and transparency. It might be something as simple as setting up a new, empty server, or applying updates to live systems: a good external specialist will be doing these same jobs with 50 other clients, and indeed will be able to tell you a lot about how your own processes stack up.

5 YOUR IT ROADMAP IS LONG

When a business runs its own apps and its own website, it's natural to take a gradualist approach to development. For reasons of caution and practicality, enhancements and upgrades tend to be incremental improvements on what you had before, and project timelines are measured in years.

That's all very sensible and manageable – but switching to an outsourced solution puts you on the

fast track. You get systems that have been tried and tested by dozens of clients, a development team that's scaled up accordingly, and a head start on both research and implementation. Working on your own, it might take you years to plan out of a system for extending your accounts and expenses systems onto a smartphone app, and who knows how long beyond that to implement it. In the meantime, you're stuck trying to pair up sticky notes and crumpled receipts, while your rivals are simply snapping their paperwork and heading off to their next meeting.

"Hang onto your valuable, experienced IT nerds, but engineer a situation where they no longer operate as a de facto information silo"

This may be a slightly facetious example, but it illustrates an important truth. Right now there's a lot of talk floating around about standards for code and communication, making up a whole movement called Industry 4.0. It sounds like jargon, and it is, but there's a significance to the fact that it's two whole version numbers on from what was being touted in 2014 (which focused mostly on Internet of Things, smart manufacturing and smart cities).

The point is that the industry advances at a hell of a rate – much faster than a small, in-house development team can ever be expected to keep up with. As the edges of IT expand, innovators and investors are constantly working on new, transformative ideas. Some of them have the potential to transform your business, and if you hesitate to embrace them, you're only holding yourself back. Sometimes you have to admit that it's better to give up on the slow road and join everyone else on the hype-wagon.

Headless CMS

What's the use of a CMS without a front end? Steve Cassidy finds out how it could make a lot of sense for your business

A "headless CMS" – is that one that doesn't have an interface? How do we use it, then?
Well, there are ways of interacting with a service other than sitting down in front of a GUI and clicking the mouse. The idea of a "headless CMS" reflects the realisation among web developers that updating and managing online content is much more efficiently done by scripts talking to APIs than by having people sit down and manually operate what is, after all, merely an abstraction of those same APIs.

What's the advantage of running a CMS in this way?
The key benefit is automation. Computerisation was always supposed to free up humans from repetitive chores to focus on more productive pursuits. If you're paying workers to go through tiresome maintenance tasks for a dozen sites on a daily basis then something's wrong. It's poetic, perhaps, that the web kids have found that the way forward has been to ditch flashy front-ends and go back to a much more old-fashioned context.

Neat – but where would we get a headless system from?
You already have the system. What you need is a way to drive it with scripts rather than clicks, which will probably involve a certain amount of bespoke coding. Many headless systems are actually based on established platforms that were originally designed to be used via the GUI: there just isn't much need to do that, once your scripts are up and running.

"If you're paying workers to go through tiresome maintenance tasks for a dozen sites on a daily basis then something's wrong"

What would we be giving up if we were to go headless?
Portability could well be a casualty. Headless systems come in many flavours, and they don't all interoperate cleanly. If your service provider abruptly vanishes, and you need to throw up 200 holding pages on AWS for all your domains, you'd better know how the APIs you're using differ from Amazon's.

Customisation can also become harder. If you're running hundreds of sites, each one probably has its own visual and behavioural tweaks. This fits poorly with a headless approach, which is about reaping the rewards of repeatability. If that's an obstacle for you, have a serious think about your workflow before laying a finger on your CMS.

Isn't this going to be a lot more expensive and complicated than an out-of-box CMS?
It's certainly not a project to be knocked off just after the Christmas party. There will be upfront costs, and the consultants who can help you write the code are definitely in demand right now. There are rewards to be reaped, though, especially if you're expanding. Set things up right and you can run 500 sites with pretty much the same management input as 200.

Can we be sure that the upheaval will be worth it?
It's a good question, but pause to think about the journey rather than the destination. The parts that make up a functioning headless CMS are valuable in themselves; every step you take towards making it work is one that makes your code more compliant and consistent. The bottom line may not show it right away, but the exercise as a whole can only be good for your business.

... and why not go serverless too?

Obviously a CMS has to run on some sort of hardware, but that doesn't need to be a dedicated server. "Serverless" systems are designed to use only a lowest-common-denominator set of API calls, so they'll run on almost any public or private cloud platform. "Server agnostic" would be a more accurate descriptor, but a less intriguing one.

A serverless CMS is the natural complement to a headless interaction model; the challenge is getting there. It's unlikely that your super-complex site with customer chatbots and credit card services is going to migrate neatly into a serverless, cloudburst-capable deployment context. But as with going headless, there's value in merely working through the thought experiment, figuring out what won't work, and interrogating why it needs to be done that way.

Indeed, while the road to cloud portability has its twists and potholes, it's one that's been been well mapped out by those who've gone before. And since it's all about API calls, you can work your way towards compliance by perusing the cascade of errors in the log file.

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JON HONEYBALL

"It ceases to be. It is an ex-Pencil. It isn't even any good as a pencil on real paper, given it has no carbon tip"

Jon discovers a piece of Apple technology that dies if you don't keep it charged, buys a new Kindle and upgrades to the new, dark macOS Mojave

It's been a very bitty month. Lots of little things going right, and quite a few going wrong with my tech.

Let's start with a tablet theme. In a way that will doubtless get friends rolling their eyes and saying "Oh Jon…", I managed to lose my 12in iPad Pro. It was somewhere, but I wasn't quite sure where. The problem with the iPad, as with other tablets, is that its form factor means it's very easy to lose in a pile of magazines. And there it was, tucked into a pile of *Octane* and *Evo* back issues waiting to be read.

I fired it up only to discover it was now a long way out of date. Upgrading it to iOS 12 required pushing the update in via cable from iTunes on a desktop computer. The over-the-air update downloaded, but didn't work for me. I took the opportunity to flatten the device and start again, so this wasn't a big deal. Getting it back up and running was simplicity itself, and once I had logged in and created the appropriate accounts, my already-purchased software started downloading and installing.

At this point, I realised I needed the Apple Pen. Or Pencil or whatever silly name Apple chose for it. I checked the pairing instructions, which basically said "shove its Lightning connector into the socket on the iPad and follow the instructions". I tried this and the Pencil was recognised and pairing completed. And then, almost immediately, the Pencil disconnected. No worries, I thought, the battery must be a bit low. I left it plugged in for a few hours to recharge.

Jon is the MD of an IT consultancy that specialises in testing and deploying hardware
@jonhoneyball

When I came back I tried the pairing method again. Yet again, it paired and then dropped the connection. Intrigued, I went on a web hunt. And lo and behold, this is not a rare phenomenon. If you don't keep the Pencil adequately charged then it simply fades away and dies. No amount of attempted recharging will resurrect it. It ceases to be. It is an ex-Pencil. It isn't even any good as a pencil on real paper, given it has no carbon tip. It's reduced to being a good tool for stabbing the designer of this silliness in the eye.

Who on earth came up with a design that means the Pencil can simply expire after some months of inactivity? There's no power button, so you can't turn it off to retain charge. There's no way to force-reset and make it wake up, at least none that I've found. The only solution appears to be to buy another one which, at the grand sum of £89, is something I'm loathe to do in a hurry.

To be honest, I won't miss it much. The touch interface of the iPad itself is so good that the Pencil is really only of use to those who have an inner David Hockney, and I can assure you that my artistic skills are not in that league. The keyboard cover works extremely well, reminding me just how good a travelling device this is.

That's especially true when I installed Parallels Access, which lets me remote-control back to my desktop computers from my iPhone and iPad, as I discussed last month. It works well, and I'm starting to use it a lot on my iPhone 8 Plus and now iPad Pro.

The other app I installed was Kindle. You might think I'm a nerdy bookworm, consuming a tome every few days. I probably should be, and I won't dispute the "nerd" bit. But bookworming is not something I do. While I confess I have just bought a copy of *The Art of Electronics* by Horowitz & Hill (simply because I can't find my 30-year-old edition,

"It's reduced to being a good tool for stabbing the designer of this silliness in the eye"

LEFT The touch interface of the iPad itself is so good that the Pencil is really only of use to those who have an inner David Hockney

Jon Honeyball
Opinion on Windows, Apple and everything in between – p110

Paul Ockenden
Unique insight into mobile and wireless tech – p113

Lee Grant
Why you don't need to throw away your old laptops – p116

Davey Winder
Keeping small businesses safe since 1997 – p118

Steve Cassidy
The wider vision on cloud and infrastructure – p120

having been reminded of its existence by a reader last month – *see issue 290, p29*), it's a heavy tome to haul around.

The latest and much-awaited edition of *High Performance Loudspeakers* by my good friend Martin Colloms was something I really wanted as a reference book, despite the £55.55 price. Then I spotted I could have it as a Kindle ebook too. This I had to have, despite the £52.77 price, because I knew it was something I'd dip into on my phone in idle moments waiting for planes, trains and automobiles. And just think of the money I saved by not buying a new Apple Pencil.

The Kindle app on the iPhone 8 Plus works well enough, despite a few less-than-obvious quirks in the UI. It's better still on the iPad Pro, but you'll always be confounded by the battery-life issue, and the inability to work outdoors in bright sunshine.

(As an aside, in the lab we have a tool from a totally different industry to help evaluate sunlight reflection on the screens of laptops, tablets and phones. I wanted a consistent light source that was bright enough but had a colour spectrum that was very close to sunlight. 3M makes just such a product, aptly named "Sun Gun". This is aimed at the high-end car-paint marketplace, used by people who need to examine paint under the most critical conditions. Anyway, wave the Sun Gun at most displays and you either get a harsh hard-edged reflection, or that foggy diffused mush that spreads over much of the screen.)

Back to Kindle. I decided to bite the bullet, and like most New Year's resolutions started in September, decided it was time to get a real Kindle, with the proper paperwhite display and long battery life. It should be arriving later today, and I want to pile all of my electronic documentation onto it, within reason. Whether it stands the test of time is something I can't predict. But I know I ought to be reading more, and hopefully this will help.

RIGHT The Sun Gun is a great tool for evaluating sunlight reflection on laptop, tablet and smartphone displays

An hour later – the Kindle Oasis has arrived. It's tiny, somewhat smaller than I was expecting, but considerably more portable than a tablet. I'm taking it away on my weekend road trip and will report back.

macOS Mojave

macOS Mojave is out. The latest in a long line of OS X versions has taken a significant step, and one quite close to my heart. The new "Dark" mode pushes most screen furniture to a dark grey/black colour. Why do I care so much? Because it makes the display look considerably closer to the old NeXTStep platform, which is the great, great grandfather of Mojave, and where black and dark grey featured heavily.

Having said that, I'm not yet totally comfortable with it. It's quite a shift after decades of looking at black text on white backgrounds in file finders, OS UI components and so forth, to now have them as mid-grey text on a black background. The same is true for all the windows furniture, such as borders and title bars. Maybe I'm just so used to the old way that the new one isn't yet settled in, but I find myself losing windows more easily. I'll give it another month, but may end up reverting to the white default.

ABOVE The macOS Dark mode looks like the old NeXTStep platform, but takes a bit of getting used to

"iOS has been cranked up a gear, too, with the release of the new iPhones"

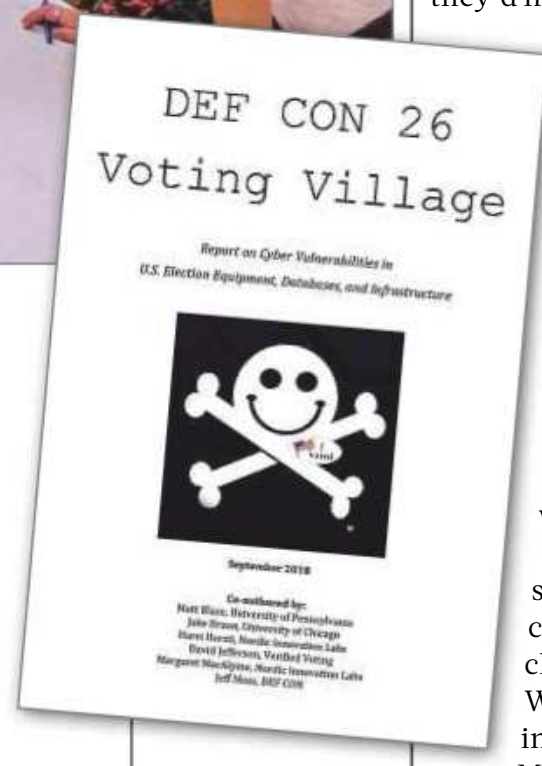
Other changes are numerous and mostly small in detail. I like the integration between the iPhone camera and the Mojave desktop, meaning I can take a photo straight into the desktop platform from my phone. Little touches like this add up.

Some apps have been updated for Dark mode, but one notable exception so far is Microsoft Office, whose whiteness stands out like a pale Englishman on a sunny Mediterranean beach.

As you'd expect, there are some underlying structural challenges for developers to incorporate into their code. I confess I was little surprised to get a warning about Adobe's "Application Manager Utilities" tool not being compliant. The warning says it isn't optimised for your Mac and needs to be updated; that it won't work with future versions of macOS and needs to be updated to improve compatibility. I'm certain Adobe is aware of this, but I'm surprised it didn't fix it in time for the general release of Mojave.

It's not just macOS that has had a new release. iOS has been cranked up

BELOW I'm surprised Adobe hadn't fixed its issue before Mojave's general release



LEFT **If you want a chilling read, get hold of the report from the latest Defcon Voting Village hacking session**

a gear, too, with the release of the latest iPhones. I've updated my iPhone 8 Plus and, as I mentioned last month, have resisted the Shopping Accident that would result in a purchase of the new iPhone Xs Plus Big Whopper. Some of my objections to the iPhone X have been fixed – for example, you can now have multiple faces recognised by the security system. So it looks like some of the obvious and egregious issues have been sorted.

I'm particularly pleased with the integration of its password manager. I'm a 100% convert to password-management tools. I accept that they're not perfect, but they must be better than using "orange1234" on every website you've ever visited. Making this open to tools such as Dashlane increases the security and usefulness of the platform as a whole.

Defcon hacking of voting machines

If you want a truly chilling read, get hold of the report from the Defcon Voting Village hacking session, where electronic voting machines used in American elections were opened up to attack and hacking. Head to **pcpro.link/291def** to download the PDF. The more I read, the more depressed I got with an industry that appears to have no morals, no integrity and no design skills.

Want to use an Access database as a storage file? Go right ahead. How about Zip drives? Yes, Zip drives – they were a bad idea 25 years ago, and they most certainly haven't got better in the meantime. This dinosaur-ware features at the core of one of these devices. The litany of bad design and ineptitude was so great that I sat down to read it with a fresh mug of coffee, and I confess it had gone cold by the time I reached the bottom of the report. It was untouched because I was too transfixed by the horror stories within. If anyone thinks that this sort of technical solution meets any sort of adequacy test, then they're smoking something quite strong.

Surface Go choking hazard

After the rave review given by editor Tim to the new Microsoft Surface Go on the *PC Pro* podcast a few weeks ago, I decided to give it a try. It's just the same as all the other Surface devices I've tried, including my well-reported Surface Book, except it's smaller. At £379, it's not particularly expensive, although the larger-storage £509 version is undoubtedly a better bet. The keyboard is £100 unless you want Platinum, Burgundy or Cobalt Blue, where it is £125 and frankly taking the mickey.

As an aside, the first paragraph in the keyboard's instruction manual says: "Be aware of Hearing Loss Symptoms. Stop using the device and have your hearing checked if you experience any hearing loss. You hear ringing in your ears, your speech sounds muffled, sound seems dull and flat."

This seems odd because the keyboard action is a very quiet dull thud. Maybe if the action was similar to the old IBM clacky keyboards, then they'd have had a point? But since the instructions go on to warn you about it being a Choking Hazard (for those with big mouths?) and not to use it in Potential Explosive Atmospheres, I guess hearing loss is the least of our worries.

Am I the only person who gets annoyed by this drivel? I probably am, because I confess I'm probably the only poor sucker who actually reads this stuff.

Anyway, I needed to do some work at a "DOS" command prompt, and the old clunky hassle of the onscreen Windows keyboard raised its incredibly ugly head. I know Microsoft is between a rock and a hard place here, but using legacy apps, especially command-line tools, on Windows Surface devices in Touch mode can be a really unpleasant experience. I don't know how to resolve it, other than to use something else entirely.

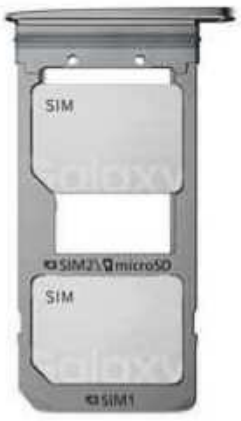
Dual SIM in Samsung

In one of those "oh, duh" moments, I spotted that my new Samsung phone could take two SIMs. I dug into the UI

BELOW **Is the Surface Go keyboard really a risk to hearing?**

and found it clearly and quite cleverly supports choosing which "line" to use for each type of service. It all seems quite seamless. I have a T-Mobile PAYG SIM for USA in there along with my Vodafone SIM, and I'll be trying this out when I'm in Denver, Colorado.

Apple's move to eSIMs is interesting, but I'd be more intrigued by a complete move to eSIM where everything could be provisioned on the fly. Especially if I could buy a pay-as-you-need eSIM when travelling. International roaming has got much easier in recent years, but having a local phone number can be a huge help. Try making a reservation at a posh restaurant in America and hear the gasp of breath when you give them a number starting with +44.



ABOVE Samsung's dual-SIM setup is clever and works seamlessly

Privacy settings in websites

I'm getting very tired of websites throwing up privacy settings pages which then make it very hard to say "go away and respect my privacy". I'm especially annoyed at one which says: "You can set consent preferences for each individual third company below". There is a very long list where you can set each one, clearly hoping you will get bored in the process.

It then goes on to say: "In some cases, companies may disclose that they use your data without asking for your consent, based on their legitimate interests". At this point, I start to twitch, growl and get rather angry. What about my legitimate interests? Am I of no interest here, and merely something that this website can pawn off to these third parties?

That this is from the website of a sister publication to *PC Pro* resulted in me getting very cross indeed. I made my position clear to The Powers That Be and in fairness they have listened and assure me that changes are afoot. But I'll keep an eye out to make sure they stay true to their word.

jon@jonhoneyball.com

PAUL OCKENDEN

"Much of my home-brew monitoring kit comes with a pocket-money price tag"

The tools available for monitoring and optimising heating systems can be applied to business uses, too

A throwaway comment at the end of my column in issue 286 seemed to spark interest from several readers. I mentioned that I'd been using an Orange Pi Zero to monitor my boiler. I'd assumed I was the only nerd who likes to plot graphs of flow and return temperatures to optimise their heating system, but it turns out I'm not alone. A few of you asked for more details, so I thought I'd write a bit about my setup and the various forms of monitoring that I use.

Don't glaze over if you have no interest in heating efficiencies, as this has all kinds of other applications. Home automation has many overlaps with industrial control and monitoring – it just operates at a much lower price point! Exactly the same techniques can be used when looking for hot spots and optimising the climate control in a server room, for example, or monitoring a production line in a small factory. You'll find many commercial systems available for such business uses, of course, and some are excellent. However, they usually cost tens or even hundreds of thousands of pounds. Much of my home-brew monitoring kit comes with a pocket-money price tag.

Those of you whose memories stretch back as far as issue 251 might remember me mentioning that I use Honeywell's Evohome system for central-heating control. It goes one step further than most other internet-controlled thermostats by allowing you to set temperature schedules on a room-by-room basis, by individually controlling each of your radiators, underfloor heating systems and other heat sources. As a result, you don't end up heating bedrooms during the day or living rooms overnight. It also uses a "proportional" control system rather than the crude on-off oscillation of a traditional thermostat, so overall comfort levels are significantly improved. In fact, although many people buy Evohome to reduce fuel bills, I find comfort improvements to be a far more significant benefit.

Paul owns an agency that helps businesses exploit the web, from sales to marketing and everything in between

@PaulOckenden

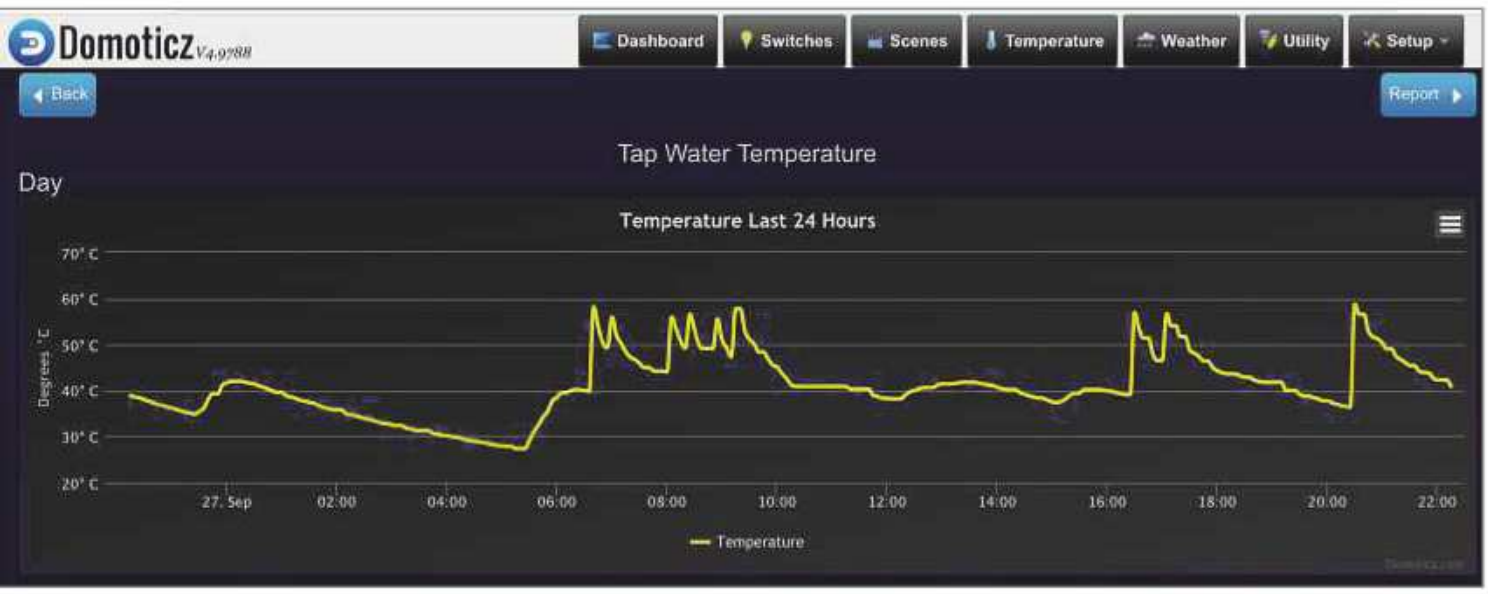
"Home automation has many overlaps with industrial control and monitoring"

BELOW Honeywell's Evohome allows temperature schedules on a room-by-room basis

If you simply want to monitor room temperatures, there's a lot you can do without buying any other kit. The starting point for Evohome is a couple of APIs from Honeywell that allow you to extract your setpoint and zone temperatures. If rolling your own scripts is your thing, a good starting point is the "watchforstock" client you'll find at **github.com/watchforstock/evohome-client**.

If you'd prefer something a bit more plug and play, the easiest approach is Domoticz (**domoticz.com**). This great software will do so much more than log and graph temperature, if you need it to. And it runs on pretty much anything – Windows, Mac, Linux, you name it. Many people run it from a Raspberry Pi, but I have it running in a VM on my Qnap NAS. (You can run Domoticz natively on many flavours of NAS, but I prefer the added flexibility that comes from hosting it in a virtualised copy of Ubuntu.) Find how to get it talking to Evohome's API at **pcpro.link/291dom**.

You can even go one step further and install a USB device called an HGI80. This "sniffs" all of the in-house Evohome RF traffic (the system operates at 866MHz using a proprietary protocol called Ramses II). It gives you a more real-time view of your system, potentially with greater accuracy. If I'm honest, it's not really



necessary – room temperatures don't usually change very quickly, and so the API is fine for most people.

Domoticz isn't just for Evohome: it has interfaces to other thermostats and smart heating systems, including Nest, and once you have it set up you'll be able to graph your temperatures over time. You can start to learn how quickly your rooms heat up, how your building is affected when the outside temperature is colder, what difference the wind direction makes, and so on, all of which will allow you to optimise your heating schedule.

It's a good starting point, but there's so much more you can do. For me, the next step was to look at the communications between my heating system and the boiler. Until about a year ago I had an old Potterton boiler, and any control was limited to turning it on or off. I've since upgraded to a boiler controlled via an OpenTherm interface. This allows the heating system to send a target temperature to the boiler. When the house is cold it just goes at full pelt, but once the rooms approach target temperatures, the system instructs the boiler to throttle its output. This is so much better than the crude on-off cycles of my last boiler, keeping the radiators just warm enough to match the heat losses from the house, and so holding the rooms at the target temperatures. This won't be news for many, because OpenTherm has been around for a few years now – your own heating system may well be wired up this way.

My replacement boiler was an Intergas Eco RF. It combines mechanical simplicity with all kinds of techie control stuff, which appealed to me. On the mechanical side it only has four moving parts, with none of the usual diverter valves or pressure switches (the things that always go wrong with combi boilers) and is designed for 20+ years of usable life. But control-wise, it has sensors all over the place and there's a full diagnostic interface available via an app and an API. It's a Dutch company, but the boilers are well supported here.

Back to OpenTherm. Although its primary purpose is to pass a target temperature to a boiler, there's so much more to the protocol than that. For example, the boiler can transmit fault and system information back to the heating controller. Most controllers ignore things like this, but I thought it would be useful. There are a couple of commercial OpenTherm monitoring and diagnostic tools available, but these are mainly aimed at manufacturers of boilers and heating controls, and cost thousands.

Thankfully there's an alternative. A chap called Schelte Bron created a fully open-source gateway for monitoring (and manipulating) communication on an OpenTherm bus. You'll find full details on **otgw.tclcode.com**. His device sits between the controller and the boiler, sniffing data in real-time. Having been around for a while, the hardware design and the associated firmware and software are now mature and fairly bug-free.

It's a bit home-brew, though. Various people will sell you the PCB Schelte designed, some even including a bag of components to solder onto it, but you've got to be a pretty dedicated hardware hacker to get this all up and running. Especially as the original design just has serial communications, so you need something like an FTDI cable if you want to talk to the gateway via USB (or you can pair it with a NodeMCU for Wi-Fi communication).

If only there were an easier way... well, thankfully there is! A chap called Cyril from just outside Moscow has redesigned and improved the original OpenTherm gateway, building it as an expansion board that connects to an Orange Pi Zero. You'll find more about this project on the Domoticaforum (**pcpro.link/291cyril1**). Cyril also sells the boards fully assembled via eBay – **pcpro.link/291cyril2**.

It's a really simple way to get OpenTherm gateway up and running. You just have to download an Armbian-based image file that Cyril supplies and copy it to a microSD card. The Orange Pi Zero and attached board are powered from a simple micro-USB power supply (OpenTherm needs 24V, but the board takes care of that). I'm really impressed with Cyril's board: it's both high quality and well thought out. He told me he actually builds them by hand as the orders come in from eBay, so don't worry if stock levels look low.

Orange Pi Zero boards tend to run warm, and this remains the case here, especially if you use the official case. Yet despite the high CPU temperature, the board and Cyril's addon card both continued to perform perfectly, even over the hottest days of the summer.

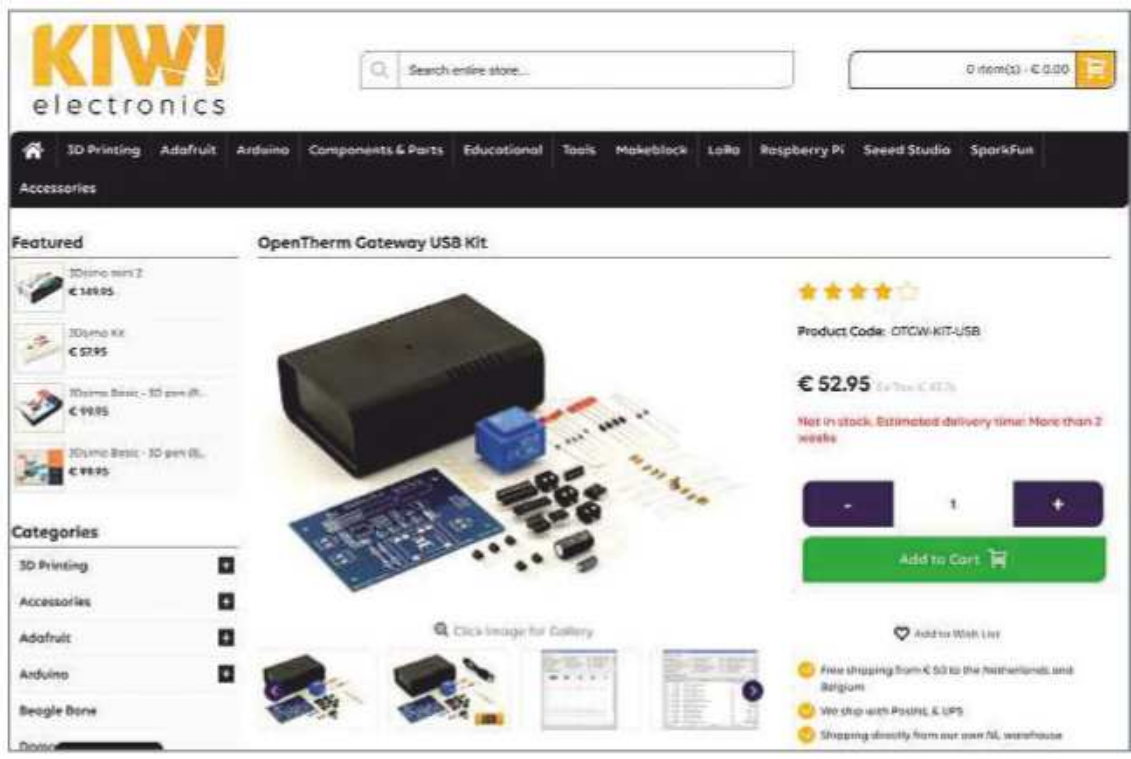
The Orange Pi Zero has an onboard Ethernet port as well as Wi-Fi. If you want to use the latter, it's easiest to make an initial wired connection, and set up the Wi-Fi from there. You'll need to use the **nmtui** command (NetworkManager text user interface). This brings up a simple menu where you need to select the option to activate a connection, then select your Wi-Fi network and enter the password. That should be it.

You can verify the wireless connection is working using the command **ipconfig-a**. You should see your new connection along with its IP

ABOVE Domoticz allows you to record and visualise temperatures and other data

"Domoticz isn't just for Evohome: it has interfaces to other smart heating systems, including Nest"

BELOW If you buy the original version of Schelte Bron's OpenTherm Gateway, it will usually need some self-assembly



address listed under wlano. If the IP address is 10.0.0.99, you should be able to open a web browser and find the OpenTherm gateway web front-end at **http://10.0.0.99:8080**. The web interface replicates most of the functions of the standalone gateway application, and you'll find further details at **pcpro.link/291open**.

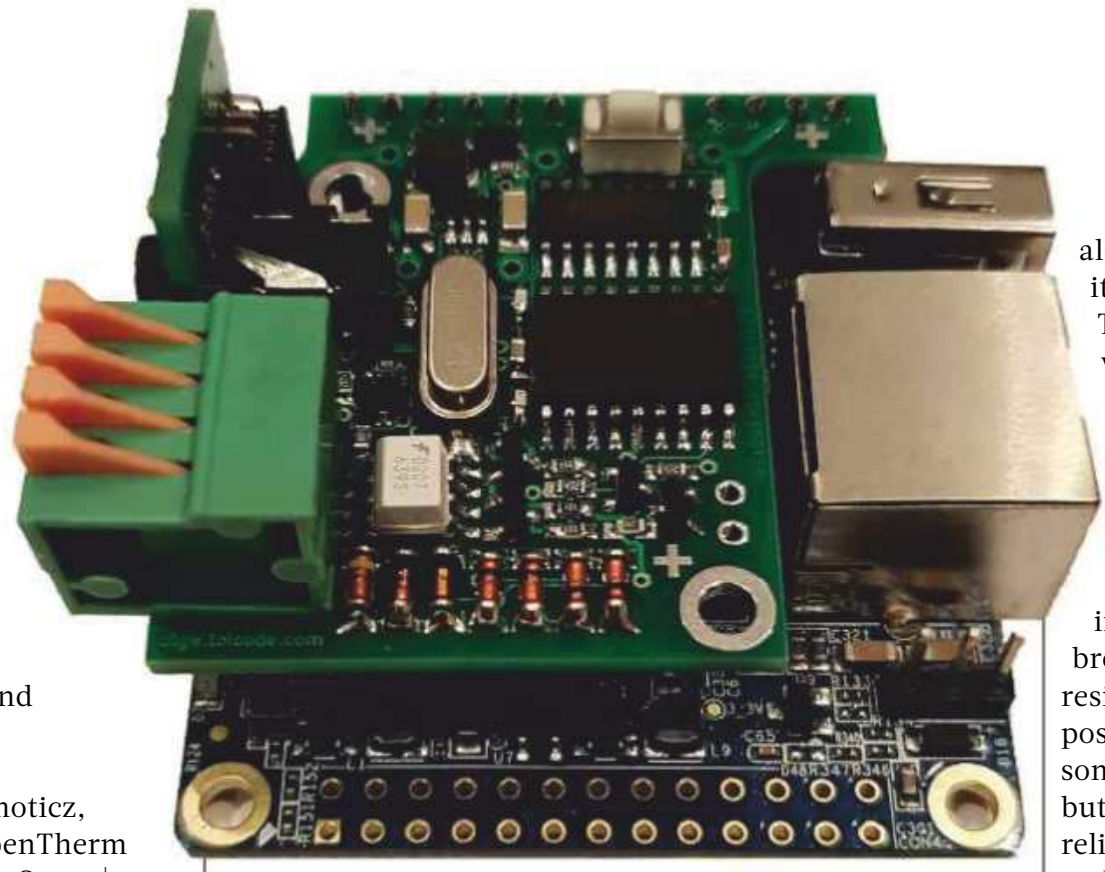
If you're running Domoticz, you can even connect OpenTherm gateway to it. Just head to Setup | Hardware then select "OpenTherm Gateway with LAN interface" in the dropdown. You'll just need to give it the IP address of the Orange Pi Zero.

The heat is on

It's all well and good pulling data from cloud APIs and sniffing control messages, but if you want to measure and record temperatures, the best way is with your own temperature sensors. These might be in the air just recording ambient room temperatures or attached to a pipe recording the heat in water flows.

There are two ways to do the latter. The "proper" way is to use insertion sensors that sit inside the pipe within the flow of the water. The poor man's version is to strap a sensor to the outside using a copper band, a jubilee clip, and lashings of heatsink compound, then cover the whole thing in insulating material. It won't react as quickly as an insertion sensor, as the pipe needs to heat up, but, if you've ever held the pipe when you turn on a hot tap, you'll know copper pipes react pretty quickly!

There's a choice of temperature sensor. The old-fashioned (although still in use) type is the thermistor, a resistor whose resistance changes with temperature. A pretty good indication that a temperature sensor is thermistor-based is that it only has two wires connecting it. A typical thermistor used for temperature sensing with be a negative temperature coefficient (NTC) device, meaning the resistance decreases as the temperature rises. One big problem is that the response is non-linear. The output is given by the Steinhart–Hart equation (**pcpro.link/291s-h**) and even if you cheat and use the simplified B-parameter equation (**pcpro.link/291b-p**), there are still logarithms involved. As a result, many cheaper temperature-sensing gadgets either use an approximated slope across a narrow range (where the error won't be too great) or lookup tables – although this means the resolution is limited by the range of values that the manufacturer has precalculated and stored.



ABOVE This is one of Cyril's OpenTherm Gateway expansion boards attached to an Orange Pi Zero

Because the typical room-temperature resistance of a thermistor is fairly high (10k or 100k ohms), you can shove them on the end of very long cables, as the additional resistance of the wire will have little effect. But another problem with thermistors is that if you want to measure ten different temperatures then you'll need ten individual analogue inputs, one for every sensor. Things can get quite crowded.

There has to be a better way. And there is! Enter the one-wire temperature sensor. Surely the most confusingly named device in the whole of the electronics world given it actually has three wires (that's how you tell one from a thermistor-based sensor). Two of those wires are a power supply, with the "one-wire" in the device name referring to the single-wire data bus. The system was developed by Dallas Semiconductor, and in temperature-sensing you're most likely to find it in the form of the catchily named DS18B20. That's not the only place you'll find the one-wire bus being used. A Dell laptop's one-wire communication allows the external power supply to talk to the computer about voltage, current and temperature, and also prove via an encrypted key that it's a genuine Dell power supply. That's why Dell laptops usually won't charge from third-party power bricks.

"This stuff has uses far beyond domestic boilers and heating systems"

BELOW The DS18B20 (shown here in its waterproof variant) has three wires, unlike thermistor-based sensors that have only two

Because the DS18B20 uses a one-wire sensor, the output is digital and so easy to decode. All single-board computers have a one-wire library available, so interfacing with these sensors is a breeze. You just need a 4.7k pull-up resistor between the data wire and the positive side of the power supply. In some cases you don't even need this, but things will work faster and more reliably if you do.

Being bus-based, you can attach multiple sensors – in theory you can just wire them all in parallel, and that's fine if you have maybe half a dozen DS18B20s on short (less than 1m) leads. But if you want dozens of these things spread around your house, then take care, because reflections in the cable can cause misreadings. You need to use unshielded CAT5 or better cable, for starters, and you should have one continuous daisy-chained cable going from sensor to sensor, rather than having a star topology with separate cables going in different directions.

Every DS18B20 has a built-in serial number. If you're using an Arduino or ESP8266-based board, then the tutorial at **pcpro.link/291ard** will show you how to find the address of each sensor.

I don't have space here to show you the code for reading multiple DS18B20s but it's simple; head over to **pcpro.link/291code**. If you use a Raspberry Pi rather than Arduino it's even easier because you can simply read **cat /sys/bus/w1/devices/28-xxxxxxxxxxxx/w1_slave** (where xxxxxxxxxxxx is the address of the sensor – they always start with 28).

Whichever SBC you use, if you want to post the temperatures into Domoticz it's dead easy. Just use a URL of the form:

/json.htm?type=command&param=udevice&idx=IDX&nvalue=0&svalue=T

IDX is the index of the sensor created within Domoticz and T is the temperature.

I hope that wasn't too nerdy. As I said at the start, much of this stuff has uses far beyond domestic boilers and heating systems. With a few DS18B20s and a Raspberry Pi, you can monitor all kinds of industrial processes.

@PaulOckenden

LEE GRANT

“Electronics with 90% functionality are bulldozed into landfill for the want of some cheap parts”

Lee explains how he resurrected two laptops that arrived in his computer repair shop with some cunning, glue and sticky-backed plastic

I bet you wish your machine was faster. Most of our clients say their machines are no longer perky, complaining startup drags on for minutes, or that several aeons will elapse before their browser renders Facebook into coherence. But the comments that really concern me are from customers who believe that, at three years old, the whole machine is probably ready for the bin. Discarded because it’s slow. Not broken, just slow. People march on Whitehall in protest at paying five pence for a supermarket carrier, but barely blink ditching a sluggish laptop into a skip.

My mission is to re-educate, reuse and revitalise, but first I’ll need help from Microsoft, as Windows 10 has developed a weight problem. It’s gone a bit “Vista”, and the real-world effects of its gluttony is felt in the lower-spec systems found in most homes.

Windows 10 was launched as the Elvis Presley of operating systems – cool, slick and nimbly thrusting on even the most modest of hardware. However, years later, in the era of version 1803 and 1903, it’s a few fried-banana sandwiches from breaking the toilet. It needs an update, a comeback special, version 1968 (thank you Elvis fans), to show the world it hasn’t left the building.

Let me introduce Brenda’s 2015 HP laptop, which she assures me “will be going out the bleeding window if it don’t get quicker”. It runs a standard specification – Intel Core i3, 8GB of RAM, 1TB SATA drive – but Brenda’s annoyance is valid. The boot time is well over four minutes and it’s nearer to six before a web browser does anything useful. Overnight diagnostics discount any hardware faults and a glance at the software doesn’t show anything unusual. Brenda needs an upgrade.

Lee Grant and his wife run Inspiration Computers, which has been supporting home users for 15 years in Kirkheaton, just outside Huddersfield
@userfriendlypc

“Customers believe that, at three years old, the whole laptop is probably ready for the bin”

Long gone are the days when throwing extra RAM at a machine would make Windows boot faster, and upgrading a CPU on a laptop is unwise and often impossible (more on that later). The solution here is to clone the existing 1TB drive onto a smaller SSD drive so that when Brenda fires it up, her files, apps, network settings and frightening desktop wallpaper are where she left them.

SSD prices have tumbled recently, yet persuading customers that their computing world isn’t going to implode by exchanging a capacious 1TB spinner for a meagre 240GB SSD is more challenging than you may imagine.

Manufacturers tended to shove 1TB drives into everything because we’re conditioned to buying as much capacity as our budgets allow. Years of performing data transfers have demonstrated to me that most consumers use between 40GB and 80GB. Brenda’s hobby is genealogy and her slow-machine hypothesis nods at her archive of photos, birth certificates and PDFs of legal records, which have taken hours of love and dedication to collate. “I bet my machine is full.”

Used capacity of the 1TB hard drive: 32GB. We slotted a Kingston 120GB SSD into one of the external docks on our workshop machine and her existing 5,200rpm slow coach into another. A cracking program for SSD cloning is AOMEI Backupper (**backup-utility.com**). It’s free for home users and greatly simplifies the partition-resizing and -alignment processes, providing the master drive isn’t too damaged.

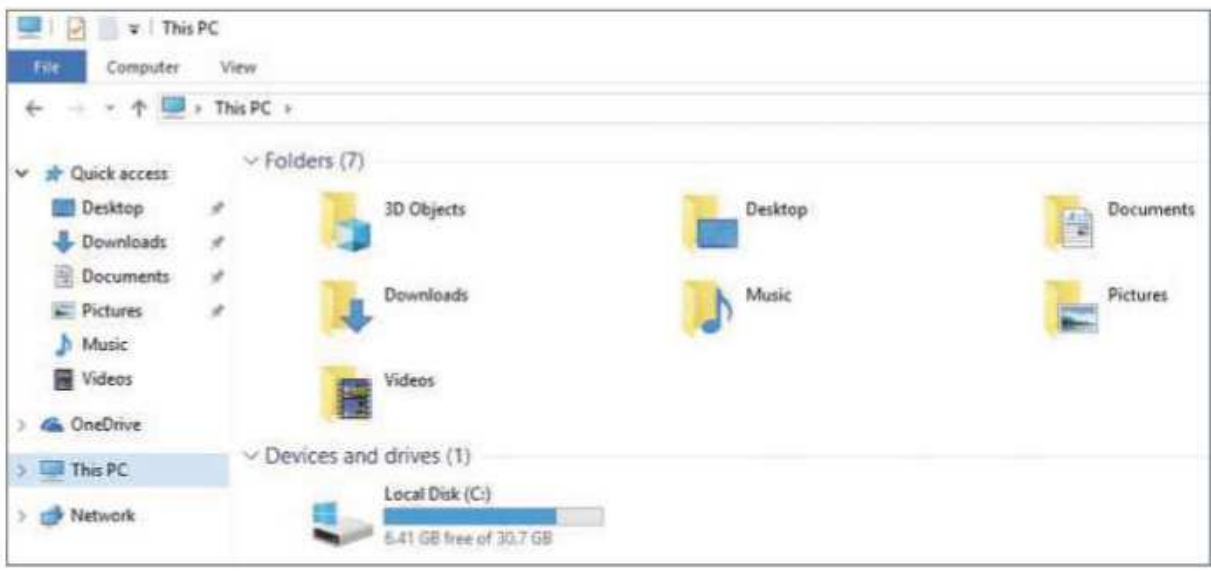
If the disk has bad sectors, creating a disk image can help. I use Acronis (enabling the option to ignore bad sectors) and either re-image straight onto the SSD or, preferably, re-image another hard drive that I test in the machine - the bad sectors may have been on an unused part of the drive. I then use the new drive as the master for the clone.

The HP starts and runs with vigour while Brenda’s double-glazing remains unshattered. As a final flourish, we erase her SATA drive, shoving it inside a USB caddy to create a useful backup drive for the genealogy research. If you squint, that’s almost recycling.

Out of storage

Drives with non-moving parts can bring users plenty of happiness, but allow me to introduce a laptop that wouldn’t complete a Windows 10 update cycle due to a chronic shortage of available drive space on the factory-fitted 32GB drive. Windows, sprinkled with a drop of internet security and a standard printer installation, had left the user with 6GB of free space. That’s wholly inadequate to facilitate major updates such as 1803 or 1903.

Windows has a solution for low-capacity machines, prodding the user to use any external device such as a flash drive or SD card as temporary storage, but this is also problematic. Unsuccessful updates using an external device seem to struggle with the rollback procedure, leaving disgruntled users with an unbootable machine. Also, the “Windows needs more storage” option is unfathomably shy. On certain machines, despite our best efforts, it just refuses to appear.



RIGHT The customer had been sold a laptop with less available storage space than the phone in his pocket

This customer was annoyed that he'd purchased such a machine, chastising himself for being distracted by its shiny case and rapid startup. The update issue was a hanging spectre compounding the realisation that the phone in his pocket had twice the storage capacity.

Time to get out the screwdrivers. The laptop showed many of the hallmarks of a modern, low-cost machine, with a single RAM slot and a 32GB eMMC chip soldered to the motherboard. Yet shining like a beacon under my inspection light was a SATA port for an optical drive.

This laptop doesn't have an optical drive, but models up the range do, and they all use the same terrible motherboard. An ancient Chinese proverb states "room for a DVD means room for an SSD", but the manufacturer clearly isn't expecting the Frankenstein I wish to construct in its cost-efficient chassis, as there's nothing to securely bolt the SSD to.

The case is also missing an aperture for an optical drive, so I can't use a hard disk/optical drive caddy: I'll need to butcher one to use the slimline SATA to full-sized SATA adapter. Doubtful the cheap plastic would survive a Dremmel attack, I opt instead for the *Blue Peter* method of sticky-back plastic and a glue gun. Follow along at home if you're with a grown-up.

Wrap the electrical insulation tape neatly around the SSD's mounting holes, then slot it into position and tack it into the case with a few drops of glue against the tape. It's not technically sophisticated, but the SSD weighs so little that it won't move. Also, should the drive need to be changed at a future date, a razor blade to the tape will release it. Don't forget to write in if you'd like the fact sheet.

The rest is simple. Using a Windows 10 boot USB (via the Windows Media Creation Tool at **pcpro.link/291win10**) I erased the 32GB eMMC and installed Windows on the new 120GB SSD, re-enabling the eMMC as a small secondary drive.

Our customer now sports a smile, but he's spent almost the original purchase price making a three-month-old unit usable. These types of machine are still on sale, so please heed the advice often repeated on the *PC Pro* podcast: a 64GB drive should be the absolute baseline in any machine you buy.

Out of pocket

Another customer wasn't anywhere near as fortunate, in a scenario that's becoming more common. On the bench is a Windows laptop with symptoms of random restarts, programs freezing and a few Blue Screens of Death. BSODs notify a user roughly which part of the system has gone bang and then do absolutely nothing about it. How about an option to "restart this machine without loading the corrupted driver that was pushed on in an update you didn't ask for and has now bricked your machine"?

The laptop had a RAM failure and a replacement module would instantly quash the shenanigans. However, this customer had unknowingly bought a machine where the RAM is soldered to the mainboard.

Apple has been doing this for years, but its limited hardware range means parts are identified and obtained more easily than in the world of Windows PCs. This faulty RAM chip requires desoldering from the motherboard before a working module can be resoldered. Micro-soldering is a specialised skill, but very often the toughest part of the repair is obtaining a working, replacement component.

This motherboard not only has the RAM soldered to it but the CPU too, and while an argument can be made for the technical brilliance, the unembellished truth is that the client paid £399 for a laptop while the replacement part, from the manufacturer, costs the thick end of £600. All to repair what would normally be a £30 RAM chip.

ABOVE I had to attach an SSD using the *Blue Peter* method – sticky-back plastic and a glue gun

"You can also feel smug that functioning electronics haven't been landfilled"

BELOW Just what you don't want: faulty RAM chips soldered to the motherboard

Another option is to buy a broken machine, hope it doesn't have a RAM fault, then spend hours cooking chips until something works. Potentially a very slow, very expensive repair using secondhand parts – and that's not how I choose to run a business.

The customer was furious at the ridiculous situation, describing it as having to replace the engine in his car to fix a hole in the exhaust that's bolted onto it. As consumers we have protections under the Consumer Rights Act (2015), but these are vaguer than ADSL speed predictions. They're also almost unenforceable in cases where the onus is on the customer to prove the fault was present in the machine at purchase.

Laptop manufacturers are building machines with the same repairability and upgradability as a mobile phone, and the crime is that electronics with 90% functionality are bulldozed into landfill for the want of some cheap parts. Economically sound but environmentally catastrophic.

My job is to repair your machine for a decent price, to keep it running efficiently until it finally explodes or is unable to fulfil its required function. At that point I pass it onto my e-waste recycler to ensure that most of your machine will be reused in the future. If you have a sluggish machine, talk to your local computer shop about breathing life into it.

A hardware upgrade will probably be much cheaper than buying a new computer and it maximises your original investment. If it's performed correctly, then you won't spend hours redownloading apps and updates, or indeed risking a nose bleed when restoring your iTunes library (one for another day). You can also feel smug that functioning electronics haven't been landfilled.

lee@inspirationcomputers.com

DAVEY WINDER

"Just because you run a small business doesn't mean you're off the attack radar"

Bringing some chronological sense back to Twitter's timeline, the threats lingering in macros, and why it's okay for SMBs to outsource security

Back in 2016, Twitter decided to phase out the sensible option of seeing your timeline (and there's a big clue right there) in chronological order. Instead, Twitter decided we'd all rather be presented with an algorithmically curated version of that timeline. A version that shows the stuff Twitter thinks you'd like to see: stuff like "top-ranked" tweets, even if they're way older than others, and retweets from people you don't follow, while hiding tweets from those you do.

By 2017 the option to opt out of this relevance-model-driven idiocy had, in any real meaning of the phrase, vanished. Nor is this curation obsession limited to Twitter: Facebook has been cursed with the same disease for years now. Here's the thing, though: while these relevance algorithms like to think they're intelligently pushing stuff the user wants to see to the front, they're actually quite dumb, just displaying old content and hiding newer and often far more relevant postings.

I have long felt that Twitter was promoting content more important to it, and to its investors, than to me as a user. I want an information-neutral timeline where *I* decide what's important to *me*. Thankfully, now I can, as Twitter has back-peddled after much user complaint. For instance, it briefly blocked the search bar filter of "filter:follows -replies include:nativeretweets", which has been widely used to force a return to some kind of sensible ordering of the timeline.

To return your Twitter feed to some semblance of sanity, go to your settings by clicking on your profile pic. From here, first select "Settings and privacy" and then scroll down past the security stuff and into the content panel, where you'll find the all-important and totally misleading "Show the best tweets first" Timeline checkbox. Uncheck the damn thing and you can get back to the days of your feed being populated in chronological order rather than a hotchpotch of algorithmically curated nonsense. Oh, and while you're here, you can also uncheck the Video autoplay option that automatically plays videos in your timeline.

Davey is an award-winning journalist and consultant specialising in privacy and security issues
@happygeek

It won't stop them playing in Moments, but it's one more Twitter annoyance sent to dev null.

Malicious macros

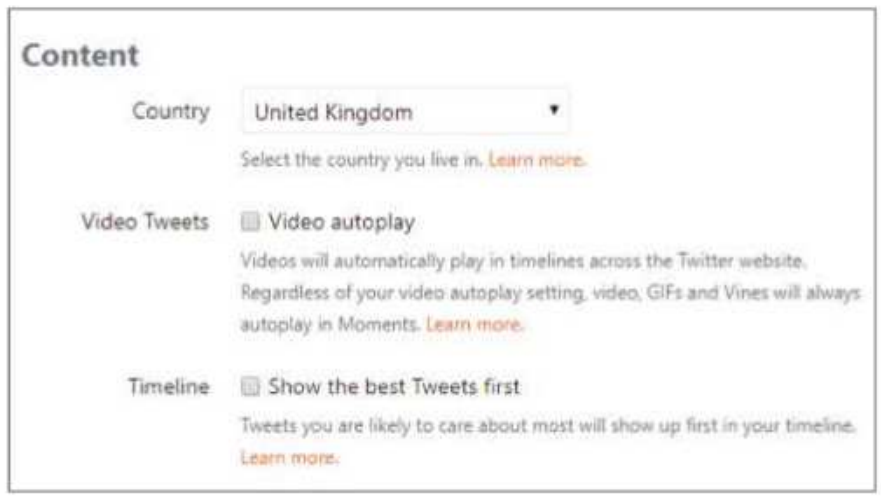
I've been writing about security for 25 years, and the first macro virus appeared in the wild within a couple of years of me starting. The Concept virus was spotted way back in 1995 when it infected Microsoft Word documents. It was actually harmless enough, in that it had no payload to speak of. Apart from displaying a dialog box with the number "1" plus an OK button, and infecting every file created by using the Save As option, it did no harm. Indeed, the name was a giveaway: this was a proof-of-concept to show how insecure macros were.

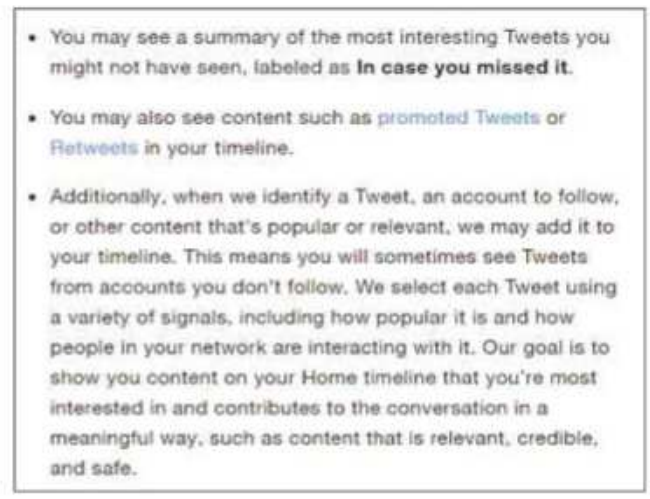
It took a further five years, and countless more variants of macro malware, for Microsoft to disable macros by default in Office (from Office 2000 if my memory serves me well for a change). This isn't the same as saying the macro malware threat died 18 years ago. It didn't. In fact, some research from Cofense Intelligence landed in my inbox as I was preparing to write this column and reminded me that macros remain a preferred malware-delivery mechanism. According to that research, Office documents laden with malicious macros were the single most popular malware delivery mechanism, accounting for 45% of all delivery mechanisms analysed across the month of August.

I would like to say I'm surprised, but that would be a porky of truly Trumpian proportions. The truth of the matter is that most cybercriminals are lazy and will take the easiest and cheapest route to compromise that is on offer; you don't get a much lower barrier to entry than a macro via an email attachment. Why so? Well, it's shockingly common to find that Office macros are enabled anyway and, if not, the threat actor only has to get the recipient to indulge in a single click.

This is where the problems start: the user won't be aware of anything being amiss in the first scenario, and a time-constrained or stressed user can bypass any inconvenient security block with that single mouse click anyway. Of course, the macro itself isn't the malware but rather the script that kickstarts the infection chain. As Cofense says: "macros, used as such, are embedded Visual Basic scripts typically used to facilitate either the download or direct execution of further payloads". Those further payloads, according to the Cofense research data, seem to be loaded towards banking trojans currently; in particular the Geodo malware. That said, ransomware was also represented across the attack data and shows all types of threat actor are still making good (or bad, depending upon which side of the attack fence you are sitting) use of macros.

So, what can the SMB do to mitigate against the macro threat?





BELOW LEFT Two Twitter checkboxes that are better left tickless...

BELOW RIGHT Thanks, but no thanks – I'd rather see a raw and unfiltered timeline

Actually, quite a lot, and it's really very easy to mitigate: disable macros across the enterprise and you're good to go. Simple in theory, but the business reality is rather more complex than that. The practical problems enter the mitigation question as soon as you realise just how many businesses (hint: a bloody great wodge of them) still require macros for their processes to function. So, blocking documents at the perimeter gateway isn't really an option, no matter how effective that one security step would be.

This doesn't necessarily mean that filtering is a non-quacking mallard when it comes to macro threat mitigation. What it does mean is switching from a binary blacklist or whitelist mindset. It demands, in other words, a bit of grey thinking. Grey-listing is where unknown documents and emails can be temporarily rejected while at the same time caching the original. The way these things are defined within the SMTP RFCs means that all legit servers will try again, while most (although admittedly not the more advanced threat actor) low-grade attackers won't bother.

Of course, grey-listing alone will never be enough. Any mature security strategy has to consist of multiple layers to stand any real chance of being effective. In my never humble opinion, an absolutely essential layer is user education in the form of ongoing awareness training, instilling an understanding in staff that they're part of the solution rather than part of the problem.

If you use Office 365 client applications, Microsoft has now added support for its Antimalware Scan Interface (AMSI) – perhaps best known as providing a communications conduit between applications and installed (and supported) security products to enable runtime scans of memory buffers.

AMSI is also now pretty effective against the macro malware threat, as the Office 365 integration brings scripting engine integration with it. Working seamlessly with JavaScript, PowerShell and VBScript engines – in other words, the most commonly used for running code with embedded Office macros – AMSI protects against the malicious script-based threat.

There's a good write-up of this by the Microsoft Secure Team at **pcpro.link/291mac**, but the tl;dr version can be summed up by the following cobbled-together snippets: "Windows Defender Advanced Threat Protection leverages AMSI and machine learning to combat script-based threats that live off the land. The Office VBA integration with AMSI is made up of three parts: (a) logging macro behaviour, (b) triggering a scan on suspicious behaviour, and (c) stopping a malicious macro upon detection. When a potentially high-risk function or method is invoked, Office halts the execution of the macro and requests a scan of the macro behaviour logged up to that moment, via the AMSI interface. The AMSI provider (antivirus software) is invoked synchronously and returns a verdict indicating whether or not the observed behaviour is malicious. If behaviour is assessed malicious, macro execution is stopped. The user is notified by the Office application, and the application session is shut down to avoid any further damage."

ABOVE The first thing I recommend you do when installing Office? Switch off macros!

Don't panic, it's okay to outsource security

One of the things I hear far too frequently when wearing my consultancy hat is the tired line that "we're too small to be a target of cybercriminal intent". As well as being long past its sell-by date, and often used as an excuse for having neither adequate budget nor security posture, the line is demonstrably inaccurate. Just because you run a small business – and most of my clients are at the smallest end of the SMB spectrum – doesn't mean you're off the attack radar. Oh, and just because you don't *think* you've been targeted doesn't mean you're safe; it could easily be that you haven't noticed an attack thanks to that lack of an effective defensive strategy.

"Just because you don't think you have been targeted doesn't mean you haven't been"

BELOW AMSI doing its stuff to protect against the malicious macro threat

If Elton John were writing this column, he'd have probably already started singing *Circle of Life*. He isn't, though, and nobody wants to even read about me singing, let alone hear me, so I'll just state (again and again) that small business is very firmly on the criminal radar.

This is for a number of excellent reasons. First, there's the security budget, or comparative lack of it. The cybercriminal fraternity rightly identifies this as meaning many smaller businesses can't afford the latest security products nor have access to a security operations centre, be that in-house or outsourced. That single fact immediately makes the smaller business an attractive attack option. When this is coupled with attackers increasingly adopting a privilege escalation and lateral movement strategy, with the ultimate target not necessarily your data but rather that of an organisation you are contracted by, the reasoning starts to become pretty clear. There's money to be made by attacking SMBs,

Continued from previous page

otherwise the bad guys simply wouldn't bother.

One recently published research report from the Appstractor Corporation entitled *Under Attack: Assessing the struggle of UK SMBs against cyber criminals* suggests less than half of UK SMB decision-makers think they can adequately protect themselves from attack. One of the major concerns highlighted in this independently researched report was that SMBs often find themselves in a perceived void between products aimed at the consumer and larger enterprises, where cost- and deployment-effective options are few and far between.

You'll note I said perceived, as this isn't actually a reflection of reality. At the smallest end of the SMB graph – the sole proprietors and those with a handful of employees – quite often products aimed at consumers will either scale up or there'll be a "small business" or "professional" option that provides the basics well enough. Things do get fuzzier as you move further up the scale, but there are still plenty of products and services that cater specifically to this market and that will provide technical help with deployment.

The real problem comes down to budget once again, with too many folks just not prepared to invest enough in securing their network environments and data. I always try and push these businesses in the direction of managed service providers, where security-as-a-service is provided without the need for expertise in-house. There's still a cost hurdle to overcome, but it's easier to sell the security-sceptic boss on a fixed budget for skilled operators and up-to-date defensive and incident response systems than on the often-spiralling cost of a DIY approach without the in-house skills to properly deploy and operate it.

Sure, outsourced security isn't a silver bullet that makes you immune to the cyber-werewolf threat. However, I'd rather spend to defend with people who know what they're doing, than opt for the all-too-often adopted option of low-cost, no-frills and no real idea what they're doing.

davey@happygeek.com

STEVE CASSIDY

"Would I seriously believe a server, if bought today, would actually last for 11 years?"

A Lotus Notes server that survived 11 years of active use as it readied for life in the cloud, and how E-shelter is harnessing AR... and Lego

"Hi Steve, it's Brenda." It sounded like a perfectly normal voicemail message. "You might not remember me, I work at...". I hate voicemail. If you travel around and trigger roaming on your phone, it can take days for voicemails to catch up with you - and even longer for deletions of voicemails to be correctly represented. One might be excused from feeling a little frustrated that this is still an issue as we head into 2019, but that wasn't my concern at this stage. My concern was that everybody I talk to knows not to leave me voicemails, so why was the mysterious Brenda calling me?

The last time we had talked was back in 2007. Brenda is the office manager of a small industry association I'd helped to move out of the systems envelope of one sponsor organisation and into a more independent existence. Not a difficult job, but there were some intricacies, especially around its in-house, Lotus Notes-based database. I migrated the system to a new server and a separate security framework; Notes loves being secure, and in this case most of the effort went into turning off all those features completely.

Then an unexpected tragedy intervened: the CEO passed away.

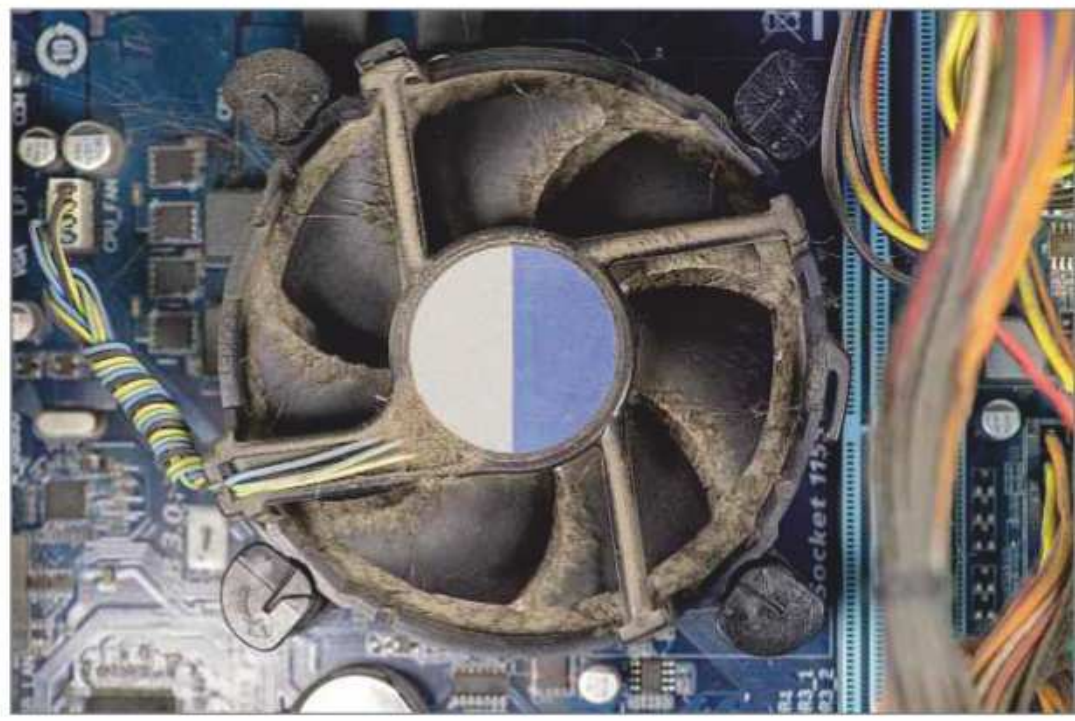
I was going to be a bit glib there, and carry on about what this meant for me, but having written the words, I think they need to be left there as a line on their own. The impact was enormous, of course, in terms of the organisation. The CEO of a professional body has to be on top of the issues that beset his or her profession, and be one step removed from them at the same time. The CEO must function as a regulator, a fundraiser and a team leader; not an easy position.

I have no evidence whether these stresses were contributory to the situation, because even after a polite few months' pause in contact, we never heard back from them. I had a hunch the reason for this was quite simple. When a body like this loses the chief exec, it's also likely to lose the lead sponsor organisation, triggering rounds of musical chairs in various positions. The relationship essentially cooled off.

Steve is a consultant who specialises in networks, cloud, HR and upsetting the corporate apple cart
@stardotpro

So here we are a decade later and Brenda is on the phone. I was off on a trip at E-shelter in Frankfurt, which I cover later in this column, when she called, so it was from the bucolic retreat of Oberwesel, beside the Rhine, that I overcame the ludicrously antediluvian limitations of voicemail, and made personal contact. Brenda was as in-control as ever, but with a mildly anxious undertone. The database I'd migrated was still operational – but not 100% perfect.

There was a project going to move the whole thing to the cloud, of course – but due to the long-term nature of a lot of its relationships, the organisation couldn't let go of the old system. Mostly because its new-wave cloud hotshots had absolutely no idea how to access – much less read or repair – its old Lotus Notes databases. When the first errors started cropping up, they'd called the development people



BELOW My client's server kept going for 11 years in a dust-light environment: could dust, rather than time, be the biggest killer of computers?

and begged for some help. However, it rapidly became clear that what they were getting wasn't in-depth knowledge, but rather "phone a friend and hope it's all okay". Attempts to run repair utilities with users still logged in, without first taking a safe copy of the file, are a big red flag to any grizzled IT troubleshooter, irrespective of the brand or format of the database in question.

A visit seemed to be in order. When I got there, I found that despite many assurances about being in "the cloud", they weren't just running the same database I'd put together: they were running the same hardware. Small HP server, RAID5 of SAS hot-swap disks, probably 74GB apiece. That machine had sat there, handling their network needs, for 11 years.

I know what you're going to say. Do a fractionally worse job, Steve, and you would have had a decent living wage out of them. Actually, I don't agree, because the whole assumption about on-premises servers and support contracts is that, somehow, the passing of hands over the casing and a bit of mouse-wiggling by a nerd staves off the type of failures that leave the business owner hyperventilating outside, while the nerds sniff the capacitor smoke around the server inside. I've found this an absurd way to do business, because the whole notion of continuous support and care requires the nerd to buy into the customer's idea that "computer voodoo" really works.

That said, back in 2007 I'd moved these guys into a nice new managed office suite. By 2018, they'd moved a few floors up. It's an unusual environment, in that it's clean, and the carpet tiles are durable and well laid. You might wonder if I've lost my mind, but I do wonder whether what kills servers in the end is mostly dust, heat and poor power supply.

But that's partly academic, because these guys are nothing if not determined to get everything into "the cloud". This desire makes me puzzled, because I always associate cloud with variable demand; the readiness of a business to invest extra cash when it needs extra power. The one thing you can say about a database that's been on the same server for 11 years is that it doesn't suffer unduly from variable load.

If the whole migration had landed up in the cloud in 2007, then how long might the system have run without being disturbed, up inside some hosted environment? Very likely somewhat short of 11 years, if only because the underlying server OS is Windows 2003, which Microsoft officially deprecated some years ago. Then there's the database layer: IBM's treatment of Lotus Notes users has been particularly weird, even for IBM. Very likely the version it's using from 2007 isn't current and certainly isn't licenced – in that I doubt it has kept up the cover required to receive free upgrades, even assuming that this modus operandi is still available.

The original proposition for cloud hosting was that servers were painfully expensive things, when properly accounted for. I can see how this idea might have arisen, because in the years just prior to the credit crunch I had seen a number of pricing exercises inside a very large bank, for machines of equivalent workload to the one still humming away for my friends. Including a share of IT personnel budget, premises costs, insurance, licensing and so on, each server cost the bank a quarter of a million pounds. Based on that kind of number, no wonder there's an appetite and justification for switching to managed services. But that kind of number is a synthetic, loaded estimate, driven more by the 100,000 personnel in the bank than by the fundamental cost of the machinery. Once you come back down to places with less overhead, less headcount, and less dead-headed accounting practices, the numbers that propose cloud as a solution don't stack up.

This is because servers have not been left just the same as they were back in 2007. If you accept that a move from Windows Server over to Red Hat Enterprise Linux won't be a hardship (because there's a Lotus Notes Server install for that platform), then licencing costs dwindle considerably, and sensible modern machinery such as the Fujitsu Primergy TX1330 (**pcpro.link/291fuj**) start to look like a realistic option.

However, I can't help looking at that old HP and its heavy SAS disks and thinking: would I seriously believe something like that, if bought today, would last for 11 years?

ABOVE Here's the dream of a cloud-based database, but sometimes a physical server in your office offers far better value

"IBM's treatment of Lotus Notes users has been particularly weird, even for IBM"

BELOW Moving to Linux makes modern servers such as the Fujitsu Primergy 1330 much more affordable

I know smaller-form-factor, enterprise-grade 2.5in drives are much better than the old 3.5in ones could ever be, so why is it that I've had more failures inside my own network at home using "better" and newer storage technologies – all promising extra longevity – than through all the years that this machine just quietly got on with its job?

I suspect the right answer will be to make use of the killer smart feature that kept so many people using Notes for so long: it replicates things. Show two Notes servers a network link and they will figure out how many files they have in common, and make sure those files are up to date with edits made on both servers. If it seems likely that cloud hosting is the only good solution, then my fix will be to have not one cloud Notes host, but two, which talk together constantly. Doing this in Notes has been dead easy ever since the initial release in 1991, allowing multiple replicas of a database to be kept on multiple cloud-located VMs, even if they're based on different operating systems.

While this deals with the issue of likely causes of cloud outages, it's still going to be quite an expensive configuration, bringing with it some specific failures that are a result of the replication process itself. Despite the fact that this is what the customers want, I don't think I'll be the only one regarding the server in their offices with some affection and nostalgia, the day its 11-year run comes to an end.

Augmented rack-ality

E-shelter is one of *those* hosting companies. You know, the type of business that rents you space in a serviced building so your stuff is visible on the internet. Quite often, such businesses generate an impression of all working to the same spreadsheet, with a stern devotion to competition by driving down the price of services that are so standardised they make unleaded gasoline look positively exotic. However, on this occasion I was there to see a bit of a breakthrough: a room that lets your network guys show their board exactly what it is they've bought, or what they could buy if they made the right investment.

This room is gratifyingly real, if you've ever been to a hosting centre before. It has a cold-aisle deployment of about 30 or so racks, filled with various different build-outs from the usual suspects in rackmount-server manufacture. It's inside the main rack floor building at E-shelter, not separated in a sub-building or some twisted cloud version of a show home. It's very loud with the rush of the chillers. There are a few concessions to humanity, such as tall stools and a shelf to put your laptop on, but you wouldn't want to stay in there for more than about 30 minutes.

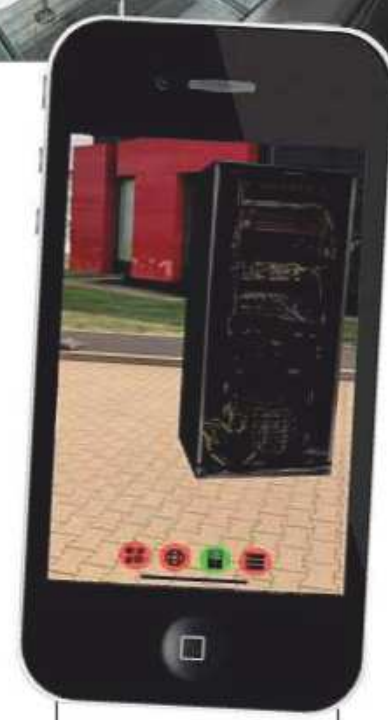
Which is fine, because E-shelter has taken a leaf out of WeWork's playbook: you can rent a slot in the data-centre space for a presentation, and you can also hire rooms in other parts of the site with much more human priorities, including coffee machines, chairs, videoconferencing flat screens and cameras. But the value of that demo-room concept is not to be denied – most attempts to explain cloud portfolios, rack costings or server farm designs to the people paying for them are doomed to an agonising breakdown in people's ability to hold a 15-entity, 7-server, cloudburst-friendly system design in their heads while simultaneously thinking about budgets.

Personally, I think if you can't juggle that lot you shouldn't be in business, and definitely not in a business that expects to use cloud resources – but I don't make the rules. E-shelter has been looking very carefully at whether those unspoken rules are any good, when it comes to helping the DevOps person in the mid-sized business persuade their boss that this is where a competitive edge is to be found.

Its fix to this problem? Lego. E-shelter is making a complete Lego model of its site, with cutaway sections on the buildings to show the racks inside and some "zoomed-up" sections for detailed views. I thought this was completely brilliant and wanted to see it, but it turned out the Lego guy wasn't in that day, which led to another revelation: there is such a thing as a professional Lego modelmaker. E-shelter's comes in and advises on what can or can't be done, what it might look like and what the advantages are of architectural models.

But that's not all. In front of every rack, sunk in the raised floor tiles, is a little serial number plaque the size of a hockey puck. E-shelter has a smartphone app that, when you point your phone camera at the red roundel of the plaque, suddenly draws a virtual view of the nearest rack on the screen of the phone. You can open the door without opening the door. You can see immediately which machines are "yours" (green) or not (red). For some of them you can even bring up a character-mode console window and type commands, read log files, and all that good stuff.

For me this almost looks like AR's killer app – the use that gives people an idea what to do with the technology, instead of having to rely on goofy pop-up dinosaurs and heavily posed mock-ups of automatic car-control systems. For one thing, it makes a half-ton of fully populated rack into something you can look at from all angles without touching a thing; for another, it crosses that important conceptual-to-physical boundary that E-shelter and I believe is getting massively in the way of businesses actually understanding what's been done with their money.



ABOVE E-shelter's AR app lets you see inside your rack without opening the door

"The field in which AR has a breakthrough is the one we've all been working in for the past few decades"

A few days later, I was in sunny Newbury, having passed through all of Vodafone's security measures to hear a few choice words on 5G, and see a demonstration that just stepped over the line between futuristic optimism and smoke-and-mirrors. But that's not important: what really struck home was the CEO's mention of an augmented reality app that tells the engineers working on Vodafone's sizeable national fibre backbone which wires are live and which fibres are dark, when they're trying to remedy some issue with the hardware.

Now, a two-sentence mention in the middle of a speech that was more focused on football is not of the same nature as E-shelter's living immediate demo on my tour guide's smartphone, but there is no doubt that the industry has suddenly seen a proper use for AR. The remaining question in my mind is, how do they log physical modifications to a rack, and what's the input format? It seems to me that, to be really valuable, stereoscopic cameras would be a minimum requirement – and as the football part of Vodafone's demo showed, even with all the 5G bandwidth in the world and a hexoscopic, 360-degree artificial model-making camera rig, the output still looks like a sci-fi special effect from a 1980s BBC drama.

I asked for pictures of the Vodafone AR rack and cable management app, but none arrived before my deadline. Don't read too much into that: all I care about right now is the rather odd idea that the field in which AR has a bit of a breakthrough, with a serious and useful operations-driven function that people will be able to grab and run with immediately, is the one we've all been working in for the past few decades. I suspect it won't be long before people are absolutely barred from unlocking a rack without one or another AR view of what's inside to show what they are and aren't allowed to touch. No cartoon dinosaurs involved.

cassidy@well.com

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Futures

We explore the trends and technologies that are set to shape the future

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Power devices with movement
How your kinetic energy could power a smartwatch p128

AI in health:

How the NHS is testing neural networks in hospitals

Artificial intelligence is being trained on NHS data to address a wide range of diagnostic and treatment challenges. Nicole Kobie reveals three projects that are testing whether AI really works for health

Spotting damage to the eye, predicting heart trouble, tracking progress of a disease – we depend on doctors to do all of this, but now they're getting a helping hand from artificial intelligence.

AI is already at work helping NHS doctors diagnose via a series of trials in hospitals with the likes of Google's DeepMind, and the results are published in serious medical journals. The NHS is the perfect testing ground for such work, with its wide range of patients, availability of data for training and its desperate need to cut costs while improving services to manage an aging population.

Cynical? That's fair: AI in medicine is a much-hyped area for startups, but these trials highlight the importance of data privacy and evidence-based medicine, where researchers find out if their mooted solution is an actual improvement for patients. Plus, these trials show how AI is often used best: for small, niche problems with floods of data to churn through.

Here's how AI could help your doctor keep you from going blind, losing the ability to walk, or suffering cardiac arrest.

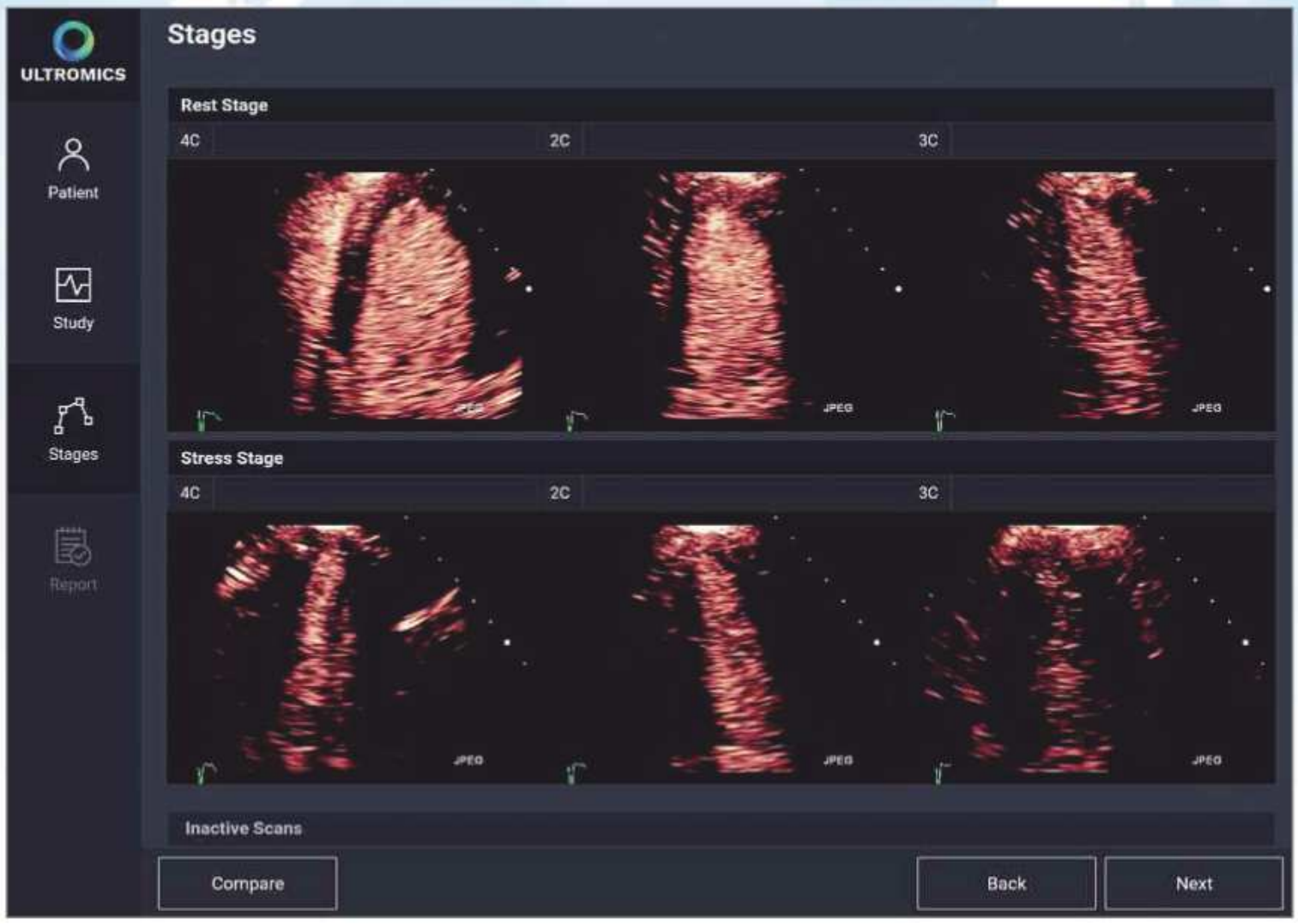
Seeing more, faster

Ophthalmologists such as Dr Pearse Keane – a consultant at Moorfields Eye Hospital NHS Foundation Trust and NIHR Clinician Scientist at the UCL Institute of Ophthalmology – spend hours staring at eye scans. These scans, called optical coherence tomography (OCT), can take hours to interpret, meaning fewer patients can be seen and slower times before diagnosis and treatment.

"The number of eye scans we're performing is growing at a pace much faster than human experts are able to interpret them," Dr Keane explained. "There is a risk that this may cause delays in the diagnosis and treatment of sight-threatening diseases, which can be devastating for patients."

"AI in medicine is a much-hyped area, but these trials highlight the importance of data privacy and evidence-based medicine"

As part of a trial with Google's DeepMind, Moorfields is testing the use of two neural networks that have been trained on existing patient data to spot the symptoms of ten diseases on OCT scans – including macular degeneration – and suggest care. Over the past two years of the five-year trial, scans were read by the AI as well as examined by clinicians. So far, the AI is accurate 94% of the time – about the same as a clinician, according to a paper in *Nature*. "If we can diagnose and treat eye conditions early, it gives us the best chance of saving people's sight," Dr Keane said. "With further research



it could lead to greater consistency and quality of care for patients with eye problems in the future."

One aspect of the neural network that's unique is it tells physicians how it came to its diagnosis, showing where it spotted eye disease on the scans, and gives a percentage rating on its own confidence of accuracy, essentially letting it tell clinicians if it's unsure or certain. Plus, the AI can be used with any OCT scanner; it's not limited to any specific device, so can be used more widely and is future-proofed against upgraded hardware.

Further research is needed to ensure the system helps improve patient care, as is regulatory approval. When those boxes are ticked, Moorfields hopes to offer the system for free for five years to all of its 30 hospitals.

In addition to helping spot eye disease more quickly, the research could help support other AI projects. DeepMind has cleaned up Moorfield's dataset, which has been "de-identified" to help protect patient privacy, meaning it can be used for research in other areas.

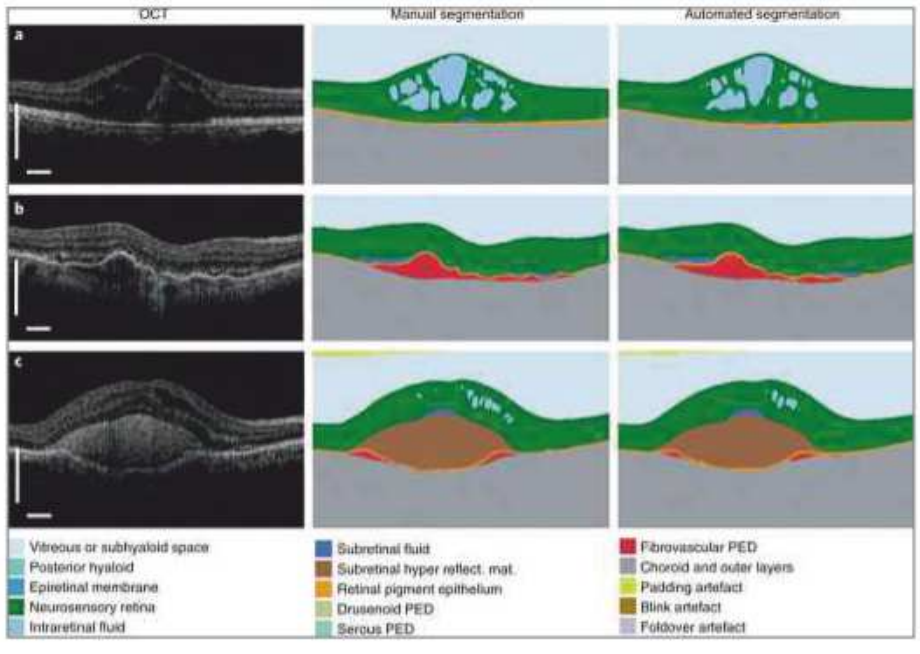
Have a heart

Heart health is a major challenge for the NHS. Some 60,000 heart scans happen annually, but as many as 12,000 are diagnosed incorrectly, meaning patients aren't given preventative treatments or undergo unnecessary surgeries. To help, researchers at John Radcliffe Hospital in Oxford are trialling a machine learning system across six cardiology units that looks for details in scans that doctors can't always spot, helping to predict a heart attack in the future.

It's been developed by a University of Oxford spin-out company called Ultromics, which is led by Dr Paul Leeson, professor of cardiovascular medicine at the university. The system was trained on 120,000 echocardiogram images from Dr Leeson's own patients over a decade, who were tracked to see if they went on to have a heart attack. The researchers claim it can improve diagnostic accuracy to better than 90% by spotting heart changes that are invisible to the naked eye. "As cardiologists, we accept that we don't always get it right at the moment," Dr Leeson said. "But now there is a possibility that we may be able to do better."

ABOVE Ultromics' machine learning system has been trained on 120,000 echocardiograms

"It can improve diagnostic accuracy to better than 90% by spotting heart changes that are invisible to the naked eye"



BELOW The two neural networks at Moorfields can help spot eye disease on OCT scans

Wearable diagnosis

Duchenne muscular dystrophy is a muscle-wasting disease; children who are diagnosed normally lose the ability to walk by age 12 and have an average life expectancy of only 30.

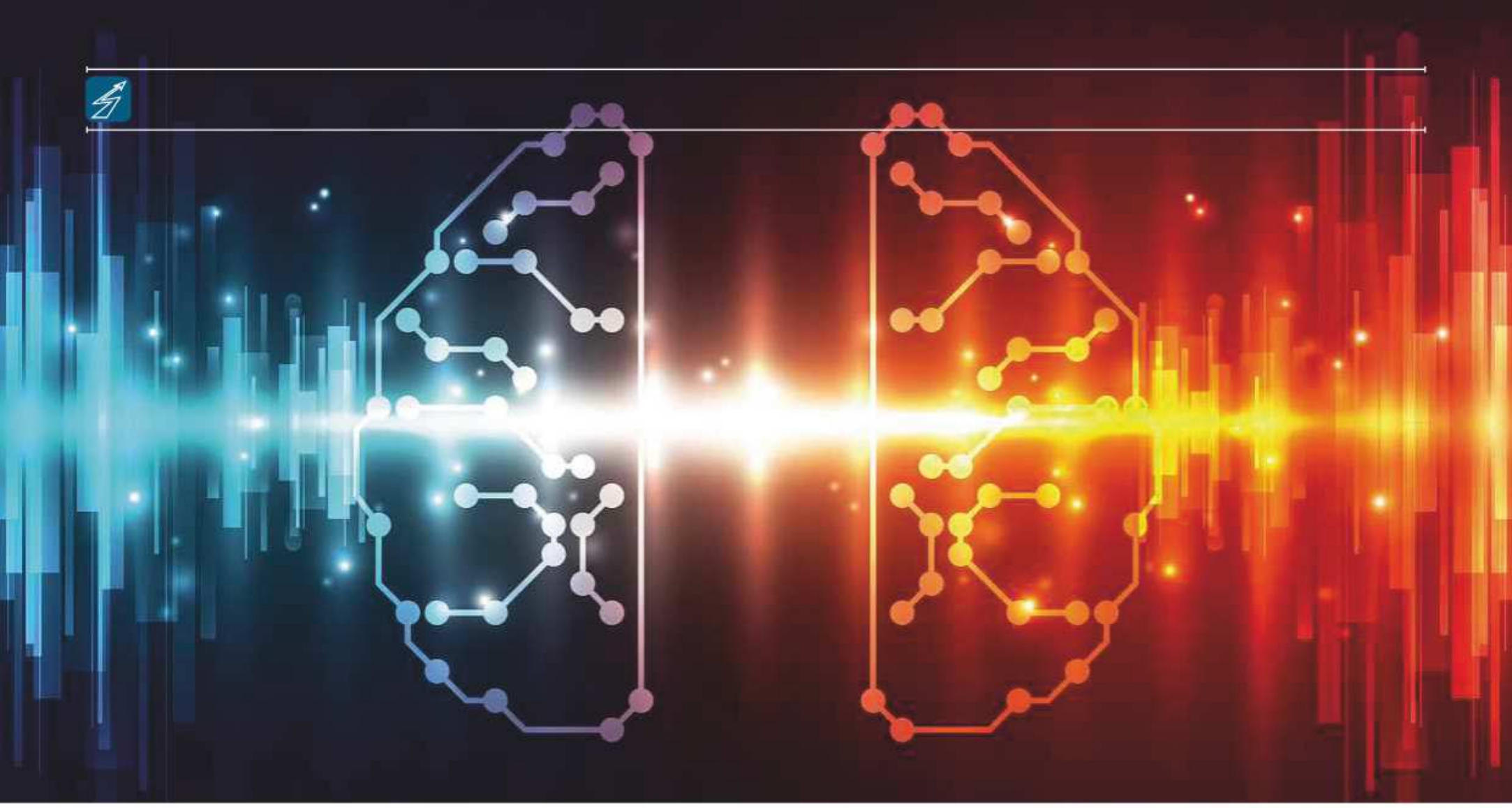
Experts at Great Ormond Street Hospital (GOSH) and Imperial College London (ICL) are hoping to improve treatment via a movement-tracking bodysuit worn 24 hours a day, as well as fitness-tracking wearables. "The suit is like having your own personal neurologist studying you all day and night," explained Dr Aldo Faisal, from ICL's departments of Computing and Bioengineering.

Those sensors will collect an unwieldy amount of real-time data. To help sift through it, researchers are turning to AI to pick out patterns and uncover if treatments are effective. That will make it easier for physicians to see if new treatments are working, which the researchers hope will reduce the costs of clinical trials.

At the moment, doctors assess whether a treatment is working "by eye" – they look and hope they can tell the difference. That's particularly difficult with degenerative diseases that progress slowly, such as Duchenne, said Professor Thomas Voit, Director of the NIHR GOSH Biomedical Research Centre.

"Currently clinicians gauge a patient's mobility and motor capacity against scales rather than using permanently quantifiable measures," he said. "However, in this project, we will develop devices empowered by AI that can automatically assess patients in a real-world setting and thereby significantly accelerate drug development for Duchenne."

If successful, the wearables plus AI combination could help patients find the right treatment, as well as speed up drug development – welcome news for the 2,500 Britons suffering from the disease.



Playing games with mind-reading machines

Computers that can be controlled through brainwaves have been around, but basic, for decades. Nicole tries to look into the future

MACHINES CAN READ our minds, but that doesn't mean your deepest secrets are at risk of being overheard by a laptop. Researchers have long struggled with brain-computer interfaces, in the hope of reducing our reliance on input methods such as keyboards or touch, as well as to give people unable to speak another way to communicate.

Such technologies – brain-to-computer (BCI) and brain-to-brain interfaces (BBI) – aren't new. Research first started in the 1970s at the University of California by Professor Jacques Vidal, and has since focused on physical rehabilitation, such as moving limbs and regaining speech after a stroke.

There are also efforts to help with communication. Ten years ago, a *PC Pro* journalist let a machine read his mind at the CeBIT tech show (thankfully all that was on his mind was a "hello, chums"). More recently, Elon Musk's startup Neuralink has started work on implantable BCIs called "neural lace".

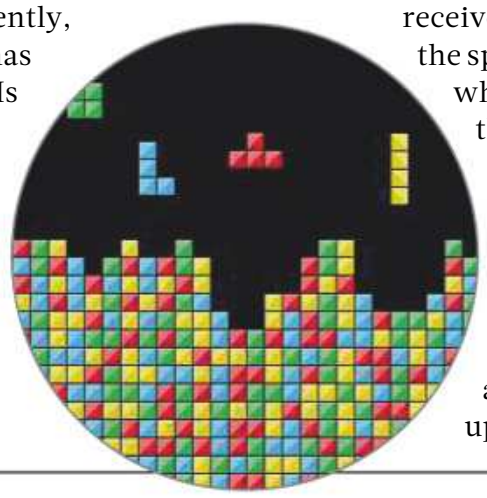
BrainNet

The latest leap forward is using computers to help one human communicate with another without opening their mouths: researchers at the University of Washington have managed to extend that BBI network to three people. "In BrainNet's design, we scaled the brain-to-brain to a many-to-one model, and can be easily scaled up to many-to-many with sufficient hardware," explained one of the researchers, Linxing Jiang, in an email to *PC Pro*.

"Such interfaces could also be used by people with brain injuries who are paralysed and unable to communicate"

That brain-based social network used electrical sensors to capture brain signals into an electroencephalogram (EEG), then used transcranial magnetic stimulation (TMS) – magnetic fields to tweak nerve cells – to transmit the information into the receivers' brains.

The system was tested via a *Tetris*-like game: senders sat in one room looking at a screen of falling blocks and had to transmit to the receivers which way to rotate it to fit the spaces. To tell their partners whether to rotate the block or not, the senders changed the signals given off in their brains. That's easy to do: when we stare at a light, our brain mimics the frequency, so on either side of the display were LEDs, one flashing at 15Hz and the other at 17Hz. That signal was picked up by the receivers in the other room via TMS. "Our next step will focus on improving the information transmission efficiency and exploring new ways to use TMS to encode information other than on motor and visual cortex, such as semantic knowledge," added Jiang.



BELOW BrainNet let players control a *Tetris*-like game – with their minds

Future uses

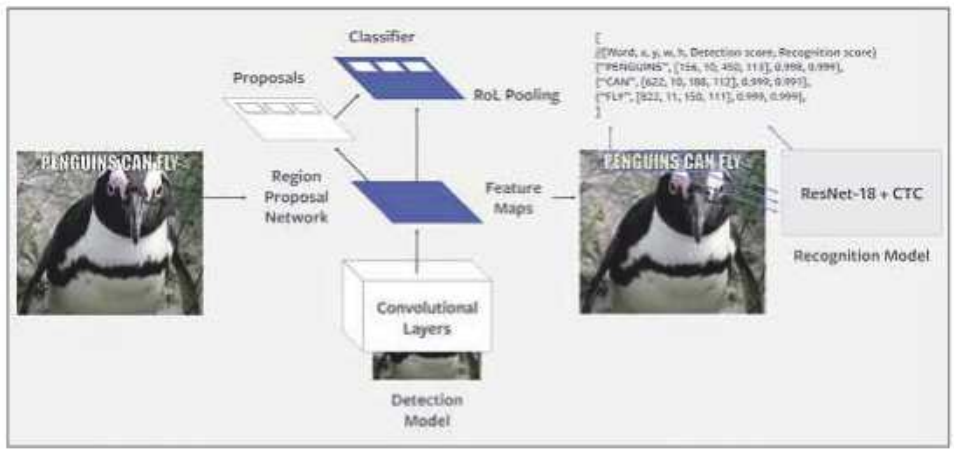
Of course, more work is needed to extend how much data we can communicate. "Current BBIs are extremely limited in terms of the amount of information transmitted between brains and rely heavily on special hardware, preventing practical use cases," noted Jiang.

Research is focused on how such technologies could help people with medical conditions preventing speech. "Such interfaces could also be used by people with brain injuries who are paralysed and unable to communicate, for [whom] decoding and encoding information from the brain directly might be the only way for them to communicate," said Jiang.

It's clear how BCI and BBI could be extended. "As technology advances, we see brain-to-brain interfaces opening up futuristic ways for communication," said Jiang. No longer will we need to fumble with autocorrect in WhatsApp – we'll simply mind-meld with our friends.

What is...Rosetta AI?

Facebook has developed meme-reading technology, teaching artificial intelligence to understand the text layered onto images



Facebook may have started as a place we shared photos with our family and friends, but uploaded images are now as likely to be memes as snapshots. That's caused a problem for the social network – as if it doesn't have enough already, amid myriad privacy and security scandals, let alone sparking a wave of mental health challenges in younger people and contributing to the downfall of democracy. But, sure, let's focus on reading memes.

For that, Facebook has unveiled Rosetta, a machine-learning system that can analyse text overlaid onto images and video, reading it in a variety of languages. Here's how Rosetta works – and why it's more important than it may seem at first glance.

What is Rosetta? A way to hunt through billions of Facebook and Instagram images, looking for text. Those words could be overlaid, as with a meme, or part of the photo, such as a street sign or menu. Rosetta finds that text, extracts it, runs it through a text-recognition model, and tries to understand what it means using the words and the content of the photo.

How does it work? Rosetta has two stages: detection and recognition. The first part looks for text by hunting for rectangles that could be words. Then, Rosetta uses a convolutional neural network (CNN) to transcribe the word and read it. A CNN is a type of neural network, inspired by the structure of the brain, that sees images as layers and layers of matrices of numbers. Facebook is teaching it in a "supervised" manner to ensure its accuracy, starting its training with short words before building its way up to longer ones. It's a lot more complicated than that, with Facebook using a wide range of models to fine-tune Rosetta, in particular to cut back errors and minimise interference and keep everything running efficiently.

Why has Facebook built this? Perhaps Facebook has as much difficulty understanding the inside jokes of the memes flooding social media as we do. AI is promised as a solution to nigh on every problem, so why not solve the feeling of being vaguely out of touch? Snark aside, there are actually good reasons for Facebook to be able to read memes. First, it can be used to improve accessibility for those with reduced vision, by reading out the overlaid text. Second, it helps Facebook and Instagram build better photo search tools and serve more accurate personalised content in news feeds – and, perhaps, advertising. Third, understanding the text on images can help Facebook hunt down banned content, such as hate speech.

So people can get banned for hate memes? Absolutely. Rosetta will help Facebook's moderators find memes that break its terms and conditions – you'll likely have noticed that plenty of conspiracy groups and fake-news spreaders love sharing their ideas via chunky text overlaid on an image. The meme is beloved of fans of cat jokes and neo-Nazis alike, it would seem.

What's next? Facebook wants to do the same for videos. Rosetta can strip text overlaid on videos already, but going frame by frame is demanding. Plus, Facebook wants to expand the datasets to improve its success with non-Latin alphabets.

OPINION

Nicole Kobie

Can blockchain suddenly fix Brexit? Nope

Whether you're a Remainer or voted to leave, you can't ignore the problems Brexit raises for the Irish border. It's a political predicament with no obvious solution, but that hasn't stopped Chancellor Philip Hammond from spewing tech buzzwords. "There is technology becoming available" that could help, he told the Conservative Party conference. "I don't claim to be an expert on it, but the most obvious technology is blockchain." I had to check there wasn't a new series of *The Thick of It*.

Hammond isn't the first to be convinced by the seemingly limitless promise of blockchain. The digital ledger at the heart of Bitcoin has been tossed around as the solution to bullying (yes, really, via US politician Mark Cuban), a way to secure e-voting, and even to track sexual consent, as though proceeding with a partner only after hearing a clear "yes" is a challenge that requires a distributed, decentralised database.

There have been sensible suggestions for how to use blockchain, such as tracking the provenance of fish to ensure they were indeed plucked from the sea in a sustainable manner, but real-world implementations are otherwise few and far between. Had anyone asked Hammond what blockchain was, it's unlikely he could have even defined it, let alone explained how the unproven, untested tech would manage thousands of trucks passing the border daily, let alone people. It's an insult to the people of Northern Ireland that such a foolish idea is even suggested, although it's likely no more than padding in a speech designed to make Hammond appear innovative.

Politicians often see technology as a magical answer to difficult problems. They don't understand how it works, but assume the peons in the IT department can code a non-existent system into being. Sci-fi writer Arthur C Clarke famously declared that any sufficiently advanced technology is indistinguishable from magic, but Hammond at el must remember that magic doesn't actually exist. Tech takes effort and work to make solutions happen – just like politics.

@njkobie

Q&A Power your devices with your own movement

Nano generators could capture your kinetic energy to power your smartwatch, meaning a recharge is only a bit of movement away

RECHARGING DEVICES IS a pain, sending us searching for a charging point to keep our smartwatches, smartphones and other gadgets alive. But scientists at the University of Surrey's Advanced Technology Institute may have an answer: us.

Our own movement could be harvested for power using triboelectric nanogenerators (TENGs), tiny energy-grabbing devices that use contact between two different materials to produce current. Once the kinks are worked out, TENGs could be built into wearables to capture energy every time you lift your wrist to check the time, or embedded in smart, Internet of Things sensors to nab power from the wind or waves. Not only would that end the hunt for a battery pack or charging point, but it would be free, renewable and sustainable energy.

Ishara Dharmasena is a PhD student at Surrey and the lead scientist on the project. He told *PC Pro* how TENGs work and when we can expect them.

Ishara Dharmasena is a PhD student at the University of Surrey

RIGHT The eventual goal is to print the devices into fabric – meaning that you can charge your devices on the move

■ What has your research come up with?

During my PhD research, I wanted to examine the [possibilities] of harvesting kinetic movement. I looked into the nano technologies that are being developed in this area and then I figured out that triboelectric nanogenerators could work. When I started my research, the triboelectric nanogenerator field had already begun, so it is not something we have invented. It was first developed in 2012 by Zhong Lin Wang's research group at Georgia Institute of Technology in the US. They have laid the fundamentals of this field.

In our group, what we have focused on... is to make a better output. We have shown how to make the best devices and how to optimise them to get the highest power output.

■ Why are we a good source of energy?

"When walking normally, we can produce from one volt up to around 30 to 40 volts of mechanical movement"

When we are walking, when we are running, and so on, there's a large quantity of motion produced. Generally what happens is that motion is dissipated into the environment without being used. So our concept was to develop a mechanism that can capture that mechanical energy. That could be quite enough to power most of the electronics that we use today. For example, we can produce from one volt up to around 30 to 40 volts of mechanical movement when walking. If you consider the power requirements of electronic devices, those are typically less than one volt.

We produce a lot of energy – and not only human motion. Consider the machines that are operating in our environment or if you consider the movement of the vehicles or the wind. If we can capture even a fraction of that energy, it's normally enough to power most of the electronics we use today.

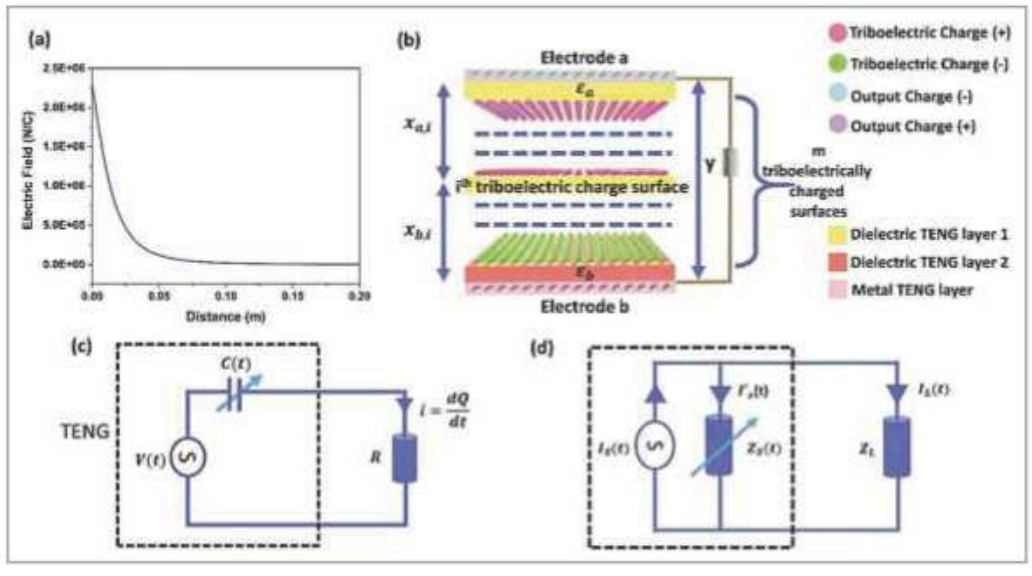
■ Would we no longer need batteries?

When you don't have the motion, you have to have some method to power the device continuously. Our idea is to combine the triboelectric technology with existing power management techniques – for example, with capacitors or with batteries. We will be using triboelectric nanogenerators to charge those energies and then when the motion is not there, we can use the stored energy to power the devices. So this can be integrated with existing technologies to make a good reliable power source.

■ What's next?

Our objective is to make these devices good enough for commercialising. There are a couple of very significant challenges that we have to address. One of them is to design the devices to get higher output power, and another one is that these devices are quite high in terms of their resistance. If we can address those issues, we believe in the next three to five years we can have a solid product in the market.

The next step is to apply the methods to practical application. The idea is to have these devices printed on a fabric... we'll use normal textile materials and do small modifications to make shirts or bands. We can wear the device and can capture the energy to power our devices.



BELOW Triboelectric nanogenerators could be used to produce current when we walk or run

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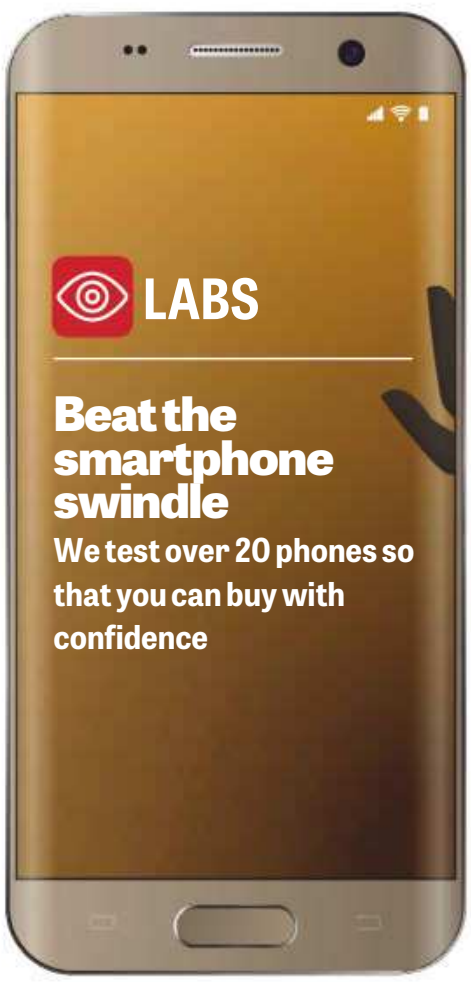

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Please note: Labs and features are subject to change

The Windows Update fiasco shows just how out of date the OS is, says Jon Honeyball

Oh dear. Poor old Microsoft released its Windows Update in October and it caused considerable upset. You know there are problems when a company as big as Microsoft pulls an update from its site, and tries to reissue it later on.

I'm in two minds about this. On the one hand, bugs will get through testing. It doesn't matter how much testing you do, there will be combinations that unexpectedly cause significant issues. You hope that your testing regime is thorough enough to have caught every conceivable outcome, but you can never be sure.

On the other hand, I'm annoyed by this update failure for several reasons. First, it deleted users' data from their computers. Now I could sit here and waffle on that all machines should be seen as disposable – that the loss of any data at any time from any computer is entirely the fault of the user. There are no excuses for lost data, and you must protect yourself appropriately. As the old saying goes, "there are those who have lost data, and those who haven't... yet". Consequently, it's very easy for me to wag my finger and say that anyone who has lost data from this update is an idiot and is culpable.

Which is fine up to a point. The way that the data has been lost, however, is somewhat troubling. Essentially, it seems that the upgrader incautiously wiped parts of the My Documents tree in the file system.

This is an area of Windows that Microsoft has fiddled with for decades. It started off simply, whereby each user had their own tree of My Stuff. Then businesses wanted to allow users to move between computers. So the idea of a roaming profile came about, where the My Stuff was synced to a server as you logged in and out. This wasn't without issues, especially if you were away from your fast local area network. Things have now progressed on to the world of syncing files to cloud services such as OneDrive and Dropbox, and the sheer quantity of data has increased almost immeasurably since the days of the floppy disk drive.

So here is my worry. Microsoft is desperately trying to weed out all of the old code in Windows, to re-architect things in a modern way. However, it's trying to do so in a way that keeps backwards compatibility working. The company has tried shifting us to platforms such as Windows RT, and now Windows S, in an attempt to restrict the complexity of Win32 applications that arguably might be seen as historical.

But this doesn't help the underlying systems of Windows itself. Windows is now so complicated that it's entirely impossible to successfully patch it and keep up to date. Bug fixing is done with one hand in mouth, because there are combinations and permutations that might simply blow up. Trying to keep everything working is like trying to spin plates on sticks. At some point, you simply run out of hands and feet to keep the plates spinning.

Unfortunately, there's no simple answer to this problem. If there were, Microsoft would have tried it. Its various efforts so far have fallen considerably short of what's required, because it's utterly terrified of making the big conceptual leap to a clean sheet. Better to keep running around like headless plate spinners than actually stand up to the core issue.

> **"Windows is now so complicated that it's entirely impossible to successfully patch it and keep up to date"**

Perhaps I'm wrong. Maybe this Windows update was just a glitch and will be quickly forgotten. Maybe normal service will resume. But the push to automatic updating, while vastly better than that zombie rot of "no updates for three years" we were subjected to in the past, still has challenges.

At what point will Microsoft draw a line in the sand and say "you know what, this is as far as we can take this platform. We need something new. Something completely clean. A total break from the past. We'll keep Windows 10 going, but that's it for feature development. We can't keep going down this spiral of ever increasing complexity"?

Many would panic at such news. Who knows what Wall Street would say. For myself, I would applaud such honesty and audacity, provided exactly the same vision came from the Office team as well. "Yes, Excel is now horribly over complicated and impossible to learn, deploy and use. We can and will do better."

Of course, this will never happen. We will keep seeing the platform patched and re-patched, and fixes thrown on top of fixes. Meanwhile, businesses will hold their breath, and hope that their internal testing before release is good enough to keep most of the nasties at bay. Those who just auto patch? Make sure your backup works properly.

Jon Honeyball is a contributing editor to *PC Pro* and has kept backups since one fateful day in the mid-1980s. Email jon@jonhoneyball.com

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