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REVIEWS THIS MONTH

Samsung Galaxy Z Fold8

New design + new price = desire



Dell XPS 13 reborn

So much better than the Neo

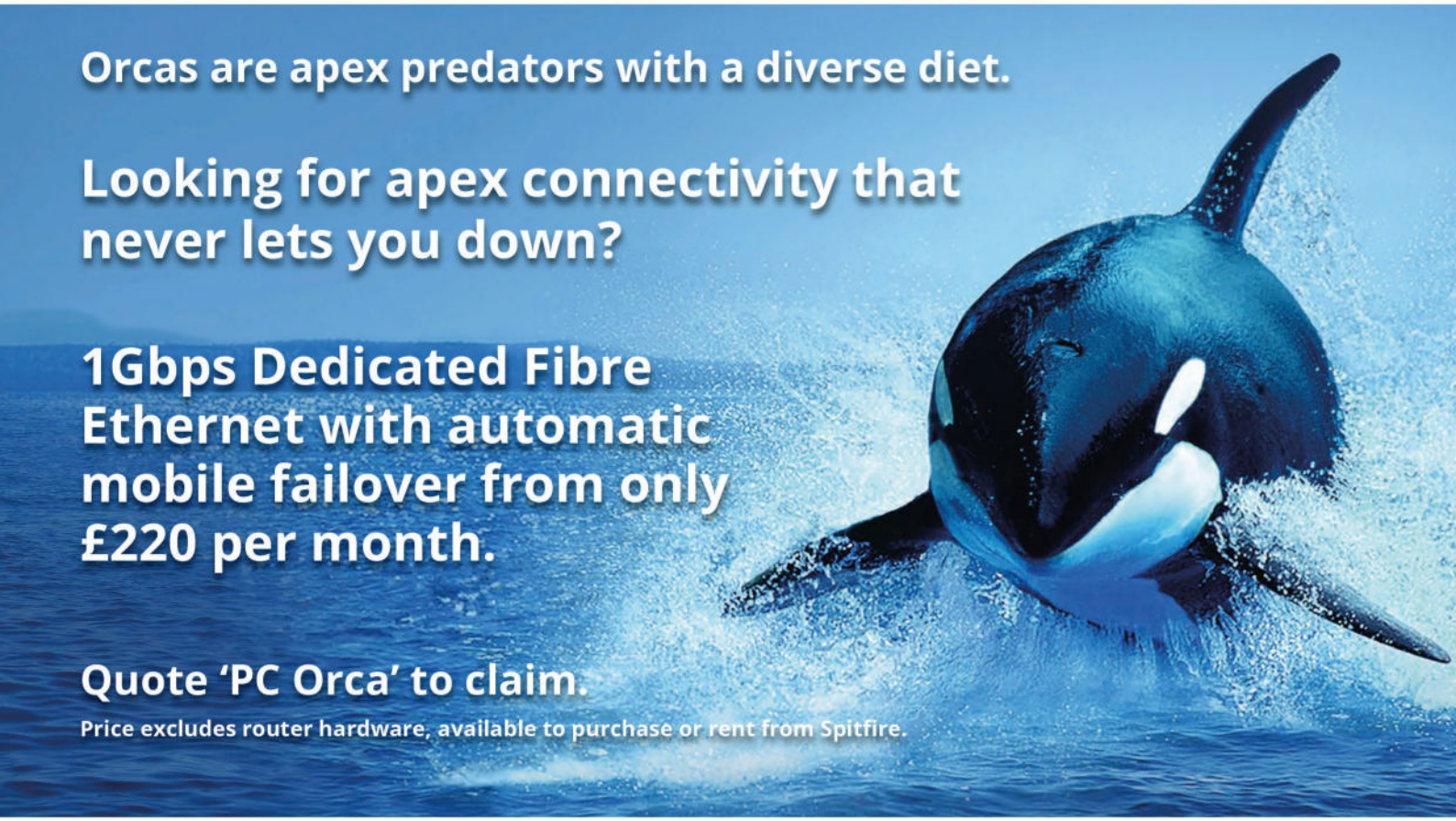


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HIGHLIGHTS THIS MONTH

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REVIEW OF THE MONTH

Samsung Galaxy Z Fold8

Welcome to a new era of smartphones. The slender "candy bar" design we're all so used to looks set to be usurped by a wider look, at least if the new Galaxy Z Fold8 and the rumoured forthcoming iPhone Ultra are anything to go by. So should you go and buy this foldable phone? Our expert was certainly impressed, not only with the all-round speed, quality and battery life of the Z Fold8, but the fact it worked so well when unfolded as both a "consumption" device – watching videos, reading books – and as a quasi laptop replacement. See if you think it's worth the high asking price on p46.



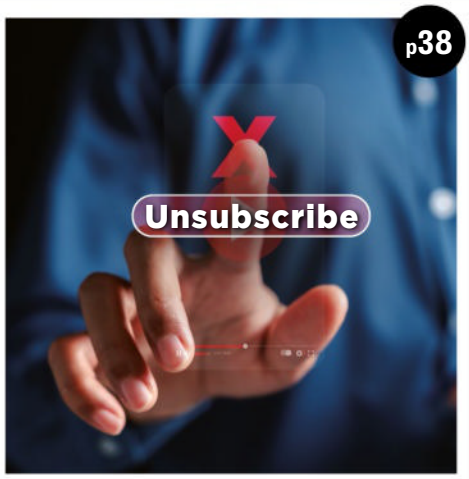
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Fed up of doing work? The tedious, repetitive jobs, that is, rather than the fun stuff. Barry Collins investigates what you can delegate to the best AI agents in the business.

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MONEY-SAVING FEATURE OF THE MONTH

Follow our advice on how to rationalise your numerous digital subscriptions – for example, PayPal offers a handy tool – and you could pay for this magazine many times over.

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Darien Graham-Smith explains why a setting you may never have heard of could be messing up your internet connection. And reveals how to regain control.

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Charles Sturman, CEO TechWorks

There are plenty of reasons to be optimistic about the UK's semiconductor industry, explains the CEO of trade body TechWorks, but more work needs to be done if we're to fulfil our potential.



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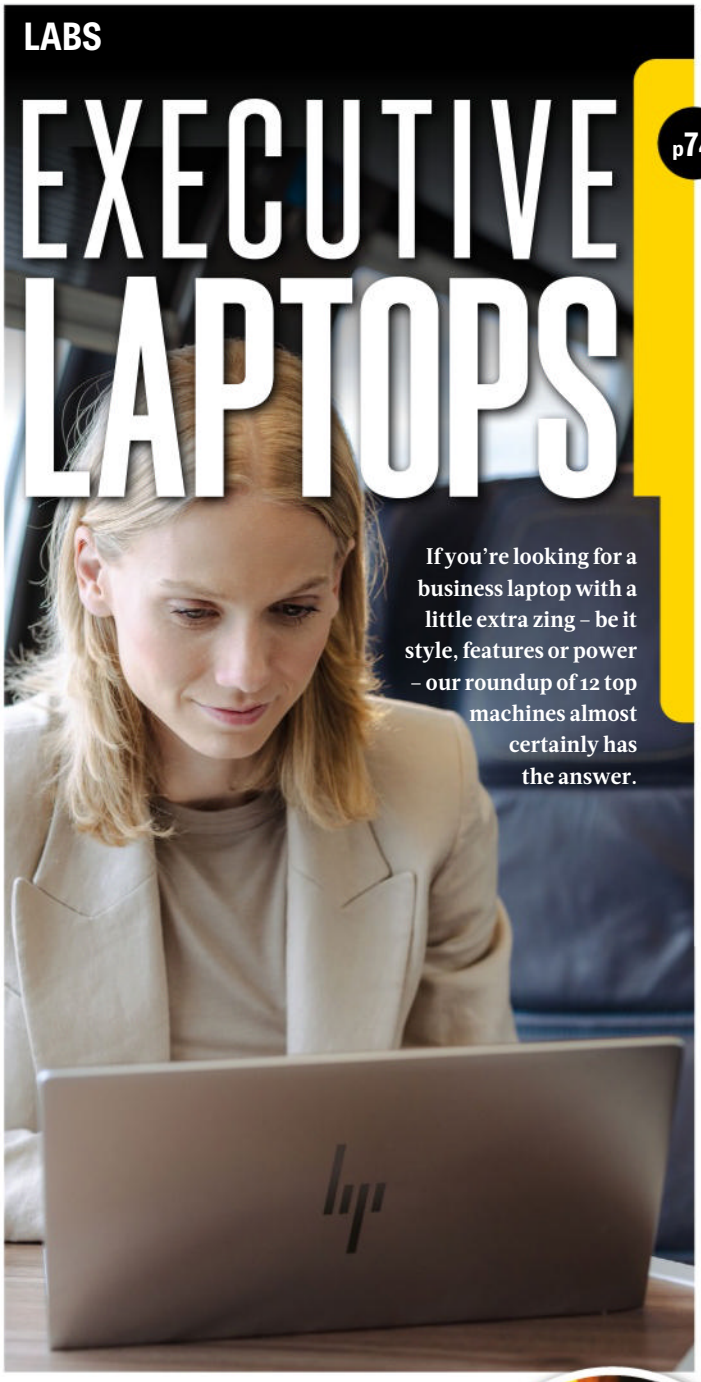
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The Framework Laptop Pro: an easily repairable, truly upgradable computer

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Britain's got talent, so let's use it

It's so easy to be negative about the United Kingdom's prospects, to look through red, white and blue-tinted glasses and yearn for the so-called glory days, but that's a baited trap. Pints will never again be 90p, Buck's Fizz won't win next year's Eurovision song contest, our coal mines won't roar magically back into action.

But that doesn't mean we can't be a nation that actually makes things. In fact, we already do. For instance, did you know that we have over 20 semiconductor fabs in the UK? Neither did I until reading our interview with the CEO of TechWorks, Charles Sturman (*see p12*). We're not going to rival Taiwan any time soon, but high-end fabrication expertise is here in abundance.

Nor should we forget that this is a country where international students come to learn at our universities. Keeping our focus on engineering and technology, we have the University of Oxford, University of Cambridge and Imperial College London sitting in the top ten rankings. Only the USA has more.

That means each year we're pumping out graduates at the top of the technological food chain, many of whom will be delighted, I'm sure, to stay in this country if we give them the opportunity. And there is already plenty of that: I've visited several universities that are doing a great job of creating exciting technology, with innovation hubs at every turn.

We're also finally taking national-level supercomputers seriously. Last year saw the full launch of Isambard-AI at the University of Bristol, currently the 13th fastest computer in the world, while work has begun on a £750m supercomputer at the University of Edinburgh that promises to be 50 times faster than ARCHER2, the supercomputer it replaces, which currently sits just outside the top 100.

Big questions remain. We have a new prime minister who has sent ambiguous signals about the value of technology in his vision of the UK: on the one hand we have an AI minister with a seat at the cabinet table, on the other the dismantling of the Department for Science, Innovation and Technology. And while I applaud Andy Burnham's drive to place as much value on a technical education as an academic one, the current crop of young adults have never found it more difficult to find a job.

Ultimately, though, we're making a mistake by concentrating on the short term. It's the long term that matters. Back in 1989, Ireland pulled out all the stops to attract Intel to its shores, and its fabrication plant situated half an hour's drive from Dublin has since enjoyed around €30 billion of investment. Intel announced a further €5 billion of funding in July. That plant employs around 5,000 people, including many highly technical jobs. But it's taken time, patience and a generation's worth of effort by the Irish government and IDA Ireland (an agency that attracts inward investment) to make this happen.

There is a lot we can learn from Ireland, but none of this involves the ripping up of our own institutions. We have talent, a long history of innovation and a great work ethic. Now we must stop looking backwards and start looking forwards.

Tim Danton
Editor-in-chief

CONTRIBUTORS



Barry Collins
We're pretty sure Barry didn't get ChatGPT to write this month's feature on how to delegate work tasks to AI agents. For one, there were too many typos. Find out what works and what doesn't on p26.



Phil Muncaster
Of all the palaces in all the world, David Green had to walk into Blenheim. His motivation: to build a digital twin and help renovate Winston Churchill's birthplace, as Phil reveals on p34.



Adam Shepherd
To paraphrase Heather Small, what have you done today to secure your business's data? Not quite so catchy as the original, but Adam provides five five-minute fixes that might make you proud on p104.



Olivia Whitcroft
Using *Fawlty Towers* as her inspiration, Olivia aims for *Mastermind*, special subject stating the bleedin' obvious when it comes to setting up contracts – whatever you do, don't mention Brexit. See p116.

EDITORIAL
EDITOR-IN-CHIEF
Tim Danton: editor@pcpro.co.uk
EDITORIAL FELLOW
Dick Pountain
ASSOCIATE EDITOR
Darien Graham-Smith
NEWS AND FEATURES EDITOR
Barry Collins
FUTURES EDITOR
Nicole Kobie
BONUS SOFTWARE EDITOR
Nik Rawlinson

ART & PRODUCTION
ART DIRECTOR
Paul Duggan
FREELANCE DESIGN
Bill Bagnall
PRODUCTION EDITOR
Steve Haines

CONTRIBUTING EDITORS
Steve Cassidy
Lee Grant
Dave Mitchell
Jon Honeyball
Rois Ni Thuama
Olivia Whitcroft
Davey Winder

CONTRIBUTORS
David Crookes
Matt Evans
Andrew E Freedman
Simon Handby
Phil Muncaster
Tony Polanco
Tom Pritchard
Mike Prospero
Adam Shepherd
Mark Spoonauer
John Velasco
Ben Wilson
Dashiell Wood

ADVERTISING
GROUP ADVERTISING MANAGER
Ben Topp: ben.topp@futurenet.com
ADVERTISING MANAGER
Alexandra Thomas:
alexandra.thomas@futurenet.com

PRODUCTION
PRODUCTION MANAGER
Nola Cokely

CIRCULATION & SUBSCRIPTIONS
CIRCULATION MANAGER
Emma Read
SENIOR CAMPAIGN MANAGER
Juber Ahmed
DIRECT MARKETING EXECUTIVE
Lewis Smythe

LOGOS & REPRINTS
ENDORSEMENT LICENSING MANAGER
Ryan Chambers:
ryan.chambers@futurenet.com

What is the favourite or most useful thing that you subscribe to and why?

"It's a hot tie between Duolingo and the *New York Times* games app. Having largely abandoned social media, I use both to provide those tiny dopamine hits we all crave – and to keep my brain learning."

"I hate to say it, but it's ChatGPT. I know its answers aren't always fully reliable, but the ability to explore ideas and information conversationally – and even interrogate images and photos – is absolutely transformative. (It doesn't hurt that the AI is fully fluent in Japanese... and I'm writing this from Japan.)"

"Bitwarden is by far the most useful thing I subscribe to. Fuss-free password management on all my devices and it only costs about £15 per year for the Premium sub."

"My favourite subscription is the Substack to LondonCentric as it actually does journalism about the capital. I pay more for it than I would for a physical newspaper."

"Podcasts. They keep me entertained when I'm cooking, teach me things when I'm walking into town, and help me drift off when I can't sleep. They've totally taken over from radio for me."

"*PC Pro*, obviously. With *Private Eye* a close second."

"The easy answer is Office365 – but that's most definitely not my favourite. Instead I'll say YouTube Premium, even though I still get creator-embedded ads, which should be banned."

"It is, without doubt, my AI. I've just whizzed up a mind map to show someone the inner workings of my brain. I know... there's no putting that toothpaste back in the tube."

"Head to **authory.com/DaveyWinder** to find out. This means I no longer need to maintain a website or a backup of all my published work, as it's all done automatically and thrown onto a searchable page that anyone can visit."

"*PC Pro*, of course. Readly is also invaluable despite the awful revamp removing some of its most useful features."

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Storm warning



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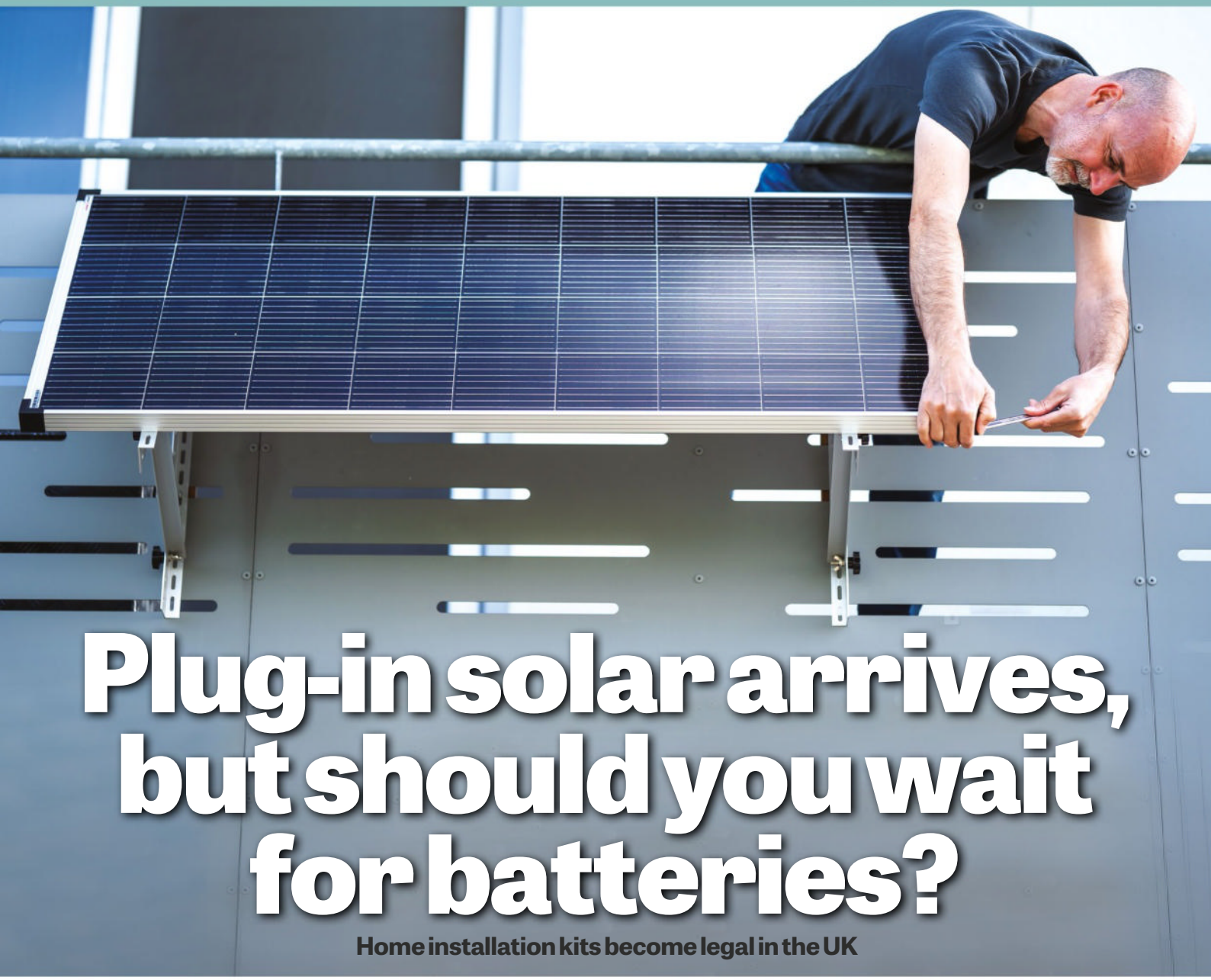
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Briefing

Background and analysis on all the important news stories



Plug-in solar arrives, but should you wait for batteries?

Home installation kits become legal in the UK

At the end of the sunniest summer the UK has ever known, the government has made it legal for plug-in solar kits to be used in this country for the first time. But even if UK households have missed out on an opportunity to harvest all that free summer energy this year, experts are questioning whether the kits are safe or whether the bigger cost-saving opportunity will come with plug-in batteries instead.

Plug-in solar kits are primarily designed for those who can't have solar panels attached to their roof: people who live in apartments, for example, who can hang solar panels off their balconies, or tenants whose landlords don't want permanent panels fitted.

The kits are designed to be self-installed without a professional electrician – something that experts have raised eyebrows at. As the name suggests, they plug straight into one of the home's three-pin power sockets, and appliances in the home will automatically draw from the solar power first, with any shortfall pulled from the grid as normal.

> "A maximum output of 800W won't be enough to power appliances such as dishwashers"

With the government regulations imposing a maximum output of 800W, it won't be enough to power hungry appliances such as dishwashers or tumble driers, but could make a modest difference to people's bills. The government's own impact assessment estimated that consumers could save £110 per year if using a well-sited, south-facing setup, with 30 degrees tilt, falling to £70 a year for 90-degree

vertical tilt (such as a balcony rail) on an east/west-facing property.

Given that starter kits are likely to cost around £500, that could mean it's seven years or more before the initial outlay pays for itself. An instant solution to the cost-of-living crisis this is not. Still, every little helps, and as the government's own press release announcing the scheme stated, it helps accelerate its "plans for more clean, homegrown energy that the UK controls to ensure energy sovereignty and security".

Safety concerns

Plug-in solar is described as "completely" safe on the website of power company Octopus Energy, which has long been one of the champions of renewable energy. And indeed the government's own safety report published in June this year concluded: "Based on the evidence, the study recommends that plug-in PV be enabled for consumer deployment within a clearly defined product and notification framework."

However, some experts aren't so confident. Mark Coles, head of technical regulations at the Institution of Engineering and Technology (IET), points out that older residual current devices (RCDs), which are designed to cut the power supply if they detect leakage current, "weren't designed for electricity flowing back into the circuit, which is the case for plug-in solar units".

"This can stop the RCD from tripping when it should, meaning it may not protect you during a fault," he said. "Many legacy RCDs are Type AC and may not adequately deal with DC currents from electronic equipment such as PV inverters. Direct current leakage can reduce RCD sensitivity, sometimes described as 'blinding', which may impair fault detection and increase the risk of electric shock under certain circumstances."

There's also nothing hard-wired that will prevent consumers overloading their supply with more than the 800W of output prescribed by the government regulations. The government's own safety report admits it didn't test this scenario, creating doubt over what might happen if consumers choose to ignore the regulations in a bid to save more money on their bills.

"This raises questions around, for example, whether multiple units could affect RCD functionality and whether all units would cease generating quickly enough following disconnection," said Coles.

The IET is therefore calling "for consumers to have their electrical installation checked by a competent electrician before connecting a plug-in solar PV unit, to ensure that the wiring and protective devices are suitable," Coles said.

> "An instant solution to the cost-of-living crisis this is not. Still, every little helps"

Bring on the batteries

Bigger energy bill savings for consumers might be possible when the government permits plug-in battery systems to be used in the UK, too. These take advantage of the variable smart tariffs now offered by many of the power companies, charging the battery when power is cheap (normally overnight) and feeding it back into the house when electricity is at its most expensive (normally peak evening hours). It's not only a cost-saving; it helps to smooth out demand on the grid, potentially helping to lower demand for gas and other non-renewables.

Rob Hallifax, co-founder of Windfall Energy, is one of those companies waiting in the wings for the government to sign off on the regulations for plug-in batteries. The company has a free-standing 2.5kWh battery ready to roll out as soon as the government rubber-stamps the regulations, which he expects to happen in the next few months.

He said his company looked at solar when it first started, as both he and his co-founder live in London flats. "I don't have a balcony," Hallifax said. "He actually does have a balcony, but as part of his leasehold he's not allowed to put stuff on it."

Hallifax also claims the cost saving of batteries will be much bigger. "We're looking at up to £250 per year," he said, although the first Windfall battery costs £1,000, so it will take around four years to pay for itself. The company provides a ten-year warranty on the battery.

Hallifax believes plug-in batteries will be restricted to the same 800W maximum output as solar panels. "800W is basically three amps, which is such a tiny amount of power that it just is not really enough to cause any issues," Hallifax said. "In the worst extreme case where people have bad wiring, then it's no more risky, in fact probably less risky, than plugging in a fan heater or other sort of electronics that draw far more power."

Coles, again, is less confident, claiming "the same principle needs to be considered for plug-in battery systems [as for plug-in solar], as these would also introduce bidirectional power flow into domestic electrical installations".

Refurbs big winners from RAM crisis

Smartphone sales slump, but there are bright spots for some

Consumers are turning to refurbishers to alleviate the smartphone price crunch caused by the RAM crisis, according to research from FDM CCS Insight.

While sales of new smartphones slumped by 7% in the second quarter of this year, the organised secondary market (excluding peer-to-peer sales such as eBay auctions) continued to grow by 3%.

The big factor here is money, with the average price of new smartphones surging by 13%, forcing consumers to scour the secondary market for bargains. However, sourcing enough second-hand equipment could soon become a bigger problem for the refurbishers.

"The secondary market has always been supply constrained," said FDM CCS Insight analyst Ben Hatton. "Typically, that trading comes through 'buy a new phone, sell me your old one', and so as that declines, then there is even more acute supply pressures on the market. That is the major drag at the moment."

Despite the wider market challenges, Apple reported iPhone sales revenue (not units) increased by 22% in its most recent quarterly earnings, a record increase for the June quarter. However, the company warned that sales will dip next quarter due to supply constraints.

There's a limit to how far Apple can push consumers with price increases, too, warned Hatton. "There's no doubt that Apple will probably have to take some form of margin hit, but it's in a position where it can upload it onto consumers more readily than other players," he said.

Unlike Apple, Samsung plays at both the low and the high ends of the smartphone market, and Hatton believes the company is uniquely placed to aggressively attack the low-end sector because Samsung also manufactures its own memory.

Samsung is in a position where it can "perhaps be a little bit more aggressive than some of the other players, particularly your Chinese Android brands that don't have that kind of shielding," said Hatton.

"[Samsung] can still stay quite aggressive throughout the price tiers, and I think that's what we're seeing it do in terms of using the A-series to start really dominating that sub-£500 segment."



Ramageddon has hit sales of new smartphones

Tasty British chips

Charles Sturman, TechWorks

British semiconductor firms are thriving, but need more help



The UK semiconductor industry could be worth more than £17 billion by the end of the decade, which may come as a shock to many people who barely know it exists.

Semiconductors were identified as one of the six "frontier technologies" in the UK government's Modern Industrial Strategy, published last year, but a new report from trade body TechWorks says more needs to be done to let this industry exploit its potential. We talked to TechWorks CEO Charles Sturman to find out what the industry is asking for.

PC Pro: Does the UK semiconductor industry fly under the radar because people associate semiconductors with massive multinationals such as Intel, AMD and Qualcomm?

Charles Sturman: We are the trade body for semiconductor electronics companies. We started in 1996, and back in 1996, there were quite a lot of semiconductor companies in the UK and globally. Back in the nineties, typically if you designed a chip, you made it and sold it, it was all under one roof: so-called integrated design manufacture.

If you look where we are today, there's been a massive rise in the so-called fabless chip companies, where you use outsourced manufacturing, which is characterised by TSMC in Taiwan. And over the 30 years, we've seen the rise of some incredibly highly valued businesses like AMD, Intel, Nvidia and so forth, and all the while TSMC has grown on the back of that manufacturing service.

> "In the UK we suffer because we won't back long-term investment"



LEFT Plessey Semiconductors in Plymouth focuses on microLED display technology

The UK is often characterised as lots of really good research and innovation, but then we fail to scale it into high-volume commercial businesses, right? And I think that there is some truth in that, but people are very quick to dismiss what the UK can do.

If you look at, for example, the US or Asia, you'll find some of those companies will invest in early-stage chip companies because they see an opportunity and a long-term growth potential. But I think in the UK we suffer because we won't back long-term, patient capital investment into these deep tech areas.

PC Pro: Give us some examples of British semiconductor technology that merits such investment.

Charles Sturman: International investors are looking at UK companies and going, wow, the next big thing is going to be neuromorphic computing based on analogue processing, or it's going to be photonic interconnect, or it's going to be optical compute, and we've got companies in the UK that are global experts in that.

What we learned by doing the primary research and talking to all the companies is there is a really rich seam of next-generation developments in basic physics science, as applied to semiconductor technology. And these companies are looking at markets that are either recently emerging, just opening up now,

or perhaps they're not even there for another two to three to five years.

For example, we have companies in the UK working in silicon carbide, which is the de facto high-power semiconductor material for electric vehicles [and] electric power grid. Even now, people are starting to build electric aeroplanes and helicopters. But gallium nitride, GaN, has been used in those wall-plug blocks that you power your iPad with, because it's really efficient. You can make really small wall plugs that don't get hot. GaN is starting to overtake silicon carbide.

And then people are starting to look at diamond, because diamond as a material has even better wide bandgap properties than either of those two materials, and there's all of that going on in the UK right now. We've got silicon carbide, we've got GaN, we've got researchers in universities working on diamond.

PC Pro: Given that many of the raw materials for processors are not found in the UK, how much of a potential risk is that?

Charles Sturman: It is a problem. The world's getting more and more partisan and these are all bargaining chips.

It's important to realise that there's quite a range of different rare earth and raw materials used in the semiconductor industry. A semiconductor fab uses quite a range of different gases. Generally speaking, the gases are available from a number of different countries and different suppliers.

But some of the metals that are used in creating the layer stack deposition of the materials onto the wafer are really difficult to get hold of. And that can be a problem. We don't have in the UK much in terms of rare earth materials. On the other hand, America does, Canada does, and this is why we need to build strong international relationships with the friends we have.

China is difficult right now to deal with. They have a lot of rare materials in China, which is unfortunate for us. But... we have something like 25 semiconductor fabs, four or five OSAT [outsourced semiconductor assembly and test] packaging companies, and we have another two or three research and technology development companies working with semiconductor processes. So, we have quite a bit of capability and those companies I've just touched on are doing okay. They're not having a problem getting hold of the materials.

PC Pro: Your report showed the way this industry is spread right across the UK, very evenly split across the country. The new prime minister has spoken about devolution and reviving manufacturing. How could that apply to the semiconductor industry?

CAN WE FIND THE TALENT?

Aside from potential shortages of raw materials and a lack of investment in the sector, another big challenge the TechWorks report identified is the perennial skills gap. Specific gaps include a lack of technicians and equipment engineers, the report claimed.

In the short to medium term, that gap could be filled by easing restrictions on talent visas, which have fallen victim to the government's immigration clampdown. "We need to bring talent in from overseas to help us," said Sturman. "Silicon Valley was built on that immigration. Of course, right now Silicon Valley is struggling because it's really difficult for them to do it." The "of course" in that sentence refers to the current US government's anti-immigrant policies.

Tailoring education to local demand, something the new prime minister has spoken of, is also key, according to Sturman. "We need more kids to get excited about STEM and go and do a degree in electronics or physics," he said. "Then we need more of those kids that do those degrees to want to go into the semiconductor microelectronics sector."





LEFT TechWorks' report, "Semiconductors: Powering the Technologies of Tomorrow", can be found at tinyurl.com/385techworks

Charles Sturman: As you can imagine, I watch political events quite closely and I almost spat my coffee out when I saw the report that we're going to reindustrialise the UK. Yes, please, Andy, let's get on with it!

We have strong regional pride and representation across the UK. If you follow the semiconductor industry in the UK at all, you'll know that the Welsh are very vocal about their capabilities, and they should be because they have dozens of companies that are incredibly valuable to the UK economy and are globally relevant, such as Vishay, IQE, KLA.

If you go up to Scotland, we've got companies working in photonics, in power electronics and sensor technology. There's probably eight to ten fabs in Scotland. And then we had Plessey building the world-class microLED technology in Plymouth, Devon.

The fabs in the UK are, of course, legacy. They were built maybe 10, 20, 30, 40, 50 years ago, and it's very expensive to build a fab. Once the fab's there, you would be really dumb to not use that. So typically, if a company decided it was going to exit the market or exit the UK, there will be somebody who will walk in and say, "Okay, I'm going to buy that fab. I'm going to turn it into a business."

PC Pro: So what are you looking for from the government?

Charles Sturman: It's about investment into the sector to scale up the businesses. Semiconductors are the new oil, right? It's the next arms race. Any emerging technology – AI, quantum, cryptography – depends on chips. If you can get an edge over the other guy in the design, architecture, fabrication of that chip, you will beat them, and therefore it's worth investing to have some leverage.

A lot of countries are investing quite heavily into the sector with public money. The UK government finds it difficult to put money on the table for industry because that would be seen as a subsidy, although most other countries just throw money at the industries they really care about. They've done it for years. Europeans do it, the Americans do it, and yet good old Britain doesn't like to do that. Well, we need to start doing that.

The A-List

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

PREMIUM LAPTOPS

Apple MacBook Pro

Class act from £1,999

from apple.com



Now upgraded with M5 Pro and M5 Max options to go along with the M5 update last year, this versatile laptop – available in 14in and 16in form factors – can be configured to meet your demands. The M5 Pro is arguably the sweet spot, but whichever you choose you're buying a powerful, creative, work-focused laptop.

REVIEW **Issue 380, p52**

Apple MacBook Air M5

No design changes as the Air moves from M4 chips to M5, but if you want a premium laptop its all-round performance and 15-hour battery life make this a great choice. **From £1,299 from apple.com**

REVIEW **Issue 380, p54**

Dell XPS 14

Dell brings back the XPS name and mojo thanks in part to Intel's Core Ultra Series 3 CPUs: choose the Ultra X7 358H for power, the Ultra 7 355 if you want battery life of more than 20 hours. **From £1,599 from dell.co.uk**

REVIEW **Issue 379, p56**

Samsung Galaxy Book6 Ultra

The price is jaw-dropping, but so is the performance. A stunning 16in OLED screen, Core Ultra X7 chip and RTX 5060 or 5070 graphics mean it lacks for nothing. **From £2,999 from samsung.com**

REVIEW **Issue 379, p61**

BUSINESS LAPTOPS

Lenovo ThinkPad X1 Carbon Gen14

Business class from £2,089

from lenovo.com



Lenovo has somehow made the world's classiest 14in laptop even classier, from the ultra-repairable design (now anyone can replace the battery) to the top-tier performance – especially if you opt for the Core Ultra X7 version – and gorgeous OLED panel.

REVIEW **Issue 383, p64**

NEW ENTRY

Asus ExpertBook Ultra

Taking full advantage of Intel's Core Ultra Series 3 chips, the Asus packs a glorious 14in tandem OLED screen, around 17 hours of battery life and all the power you need. **£2,400 from asus.com**

REVIEW **Issue 379, p58**

NEW ENTRY

Asus ZenBook Duo (2026)

Two stunning 14in OLED screens and a detachable keyboard mean this can be a laptop on the move and an all-in-one when you reach your destination. **£3,000 from asus.com**

REVIEW **Issue 385, p82**

Dell XPS 14 (2026)

Superb build quality, compact design and a brilliant webcam make this an attractive choice for executives – and you can tailor the spec to match your needs. **From £2,033 from dell.com**

REVIEW **Issue 385, p84**

CREATIVE & GAMING LAPTOPS

Lenovo Legion 9i Gen 10

All-out-power from £4,150

from lenovo.com



Lenovo knows exactly how to squeeze out every last ounce of power from its components, and even though that comes at the expense of bulk and weight (3.5kg) the sheer quality, expandability and glory of the 18in 4K+ panel make it worth the money.

REVIEW **Issue 382, p75**

Alienware 16X Aurora

A superb choice if you want portability and power – although it tops out at an RTX 5070 Ti. Compared to big-name rivals, it's good value too. **From £2,149 from dell.com.**

REVIEW **Issue 382, p73**

Medion Erazer Major 16 X1

Don't expect stunning finesse, but it's fantastic value: £1,800 buys you a Core Ultra 9 275HK, 32GB of RAM, 2TB SSD and RTX 5070 Ti. **From £1,500 from laptopsdirect.co.uk**

REVIEW **Issue 382, p76**

Razer Blade 16 (2026)

All the key ingredients of a Razer creative laptop: sleek looks, relatively light 2.1kg weight and top-quality components throughout. **From £2,100 from razer.com**

REVIEW **Issue 382, p77**

EVERYDAY LAPTOPS

NEW ENTRY

Dell XPS 13

Pure quality from £899

from dell.com



Even though the price is higher than we had hoped when announced at CES, the quality found in this 13.3in laptop means it beats all its budget rivals, including the cheaper MacBook Neo, thanks to its superior build quality, touchscreen and backlit keyboard.

REVIEW **Issue 385, p56**

Acer Swift Go 14 AI (AMD)

This stylish and light 14in OLED laptop packs a sprightly AMD Ryzen 7 chip and a large battery for all-day life. Part code NX.JDAEK.001. **£720 from johnlewis.com**

REVIEW **Issue 383, p84**

Lenovo Yoga Slim 7x Gen11

The Snapdragon X2 Plus version is a bargain, with plenty of power, slim design and 20 hours of battery life – but upgrade to the 2,880 x 1,800 OLED. From **£1,050 from lenovo.com**

REVIEW **Issue 384, p56**

Apple MacBook Neo

If you're on a budget or looking for a secondary device then the Neo is an extremely capable all-rounder with a sharp screen. **From £699 from apple.com**

REVIEW **Issue 383, p86**

CHROMEBOOKS

Lenovo Chromebook Plus Gen 10

MediaTek AI power for £549

from lenovo.com



Simply the best Chromebook around thanks to a gorgeous 14in OLED screen and AI-enhanced skills courtesy of the MediaTek Kompanio Ultra 910 CPU. Add a well-built aluminium frame, 1.2kg weight and all-day battery life for the win.
REVIEW **Issue 374, p54**

Acer Chromebook Plus 516

If you can't afford the 15.6in Samsung Galaxy Chromebook Plus then Acer's Chromebook Plus 516 makes a solid but less beautiful alternative – as reflected in its price. The 15.6in screen provides plenty of space on which to work, and it proved a fast performer in our tests.
From £399 from acer.com
REVIEW **Issue 371, p90**

Lenovo Chromebook Plus 2-in-1 Gen10

A very likeable Chromebook thanks to premium build quality, a fantastic keyboard and solid performance from the Intel Core 3 N355 CPU. Its battery life isn't the best and the screen won't produce cinema-grade colour, but it's remarkable for the price. **£456 from amazon.co.uk**
REVIEW **Issue 384, p62**

MINI PCs

Minisforum X1 Lite

Balanced beauty for £655

from minisforum.uk



Bearing in mind the cost of RAM and storage, to pack 32GB of one and 1TB of the other into a compact one-litre mini PC like this reflects superb value. Especially as the Ryzen 7 processor is a great all-rounder, bringing gaming into play.
REVIEW **Issue 381, p87**

Geekom A5 Pro

Half the size of the Minisforum X1 Lite, Geekom's A5 Pro also cuts down the power on offer – but you still get a 1TB SSD to accompany the Ryzen 5 7530U processor and 16GB of RAM. It doesn't consume much electricity, either, and delivers enough grunt for everyday tasks. **£513 from geekom.co.uk**
REVIEW **Issue 381, p85**

Lenovo ThinkCentre M70q Gen6

The ThinkCentre is designed for business rollouts, with a slim desktop rather than cube design that takes up minimal space. It offers plenty of customisation options and management tools, plus a decent spec for the money. **As reviewed, £583 exc VAT from lenovo.com**
REVIEW **Issue 381, p86**

ENTHUSIAST PCs

CyberPowerPC Analog U7 RTX SY3127

Style and power for £2,500

from tinyurl.com/384cyberpower



The stylish chassis is the star, complete with analogue controls for the array of RGB fans, but what a set of core specifications for the price: Intel's Core Ultra 270K Plus CPU, a GeForce RTX 5080, 32GB of RAM and a 2TB SSD.
REVIEW **Issue 384, p46**

PCSpecialist Vortex FE

This no-compromise PC pairs Intel's excellent Core 7 Ultra 270K Plus processor with 64GB of RAM, a 2TB Gen5 SSD and a GeForce RTX 5090, all wrapped up in a cool case – in both senses of the word. And it can be delivered the next day. **£4,499 from tinyurl.com/383vortex**
REVIEW **Issue 383, p68**

Wired2Fire R7 RTX 5070 Lumia Vanguard

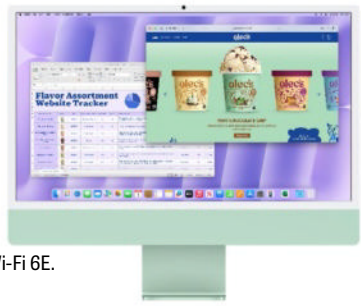
Built with value for money and future expansion in mind, this Ryzen 7 9700X system – with an RTX 5070 card, 2TB SSD and 32GB of RAM – performs extremely well in 1440p games and is a great all-rounder too. **£1,599 from wired2fire.co.uk**
REVIEW **Issue 382, p57**

ALL-IN-ONE PCs

Apple iMac M4

M4 power from £1,499

from apple.com/uk



Anyone hoping for a 27in iMac will be disappointed, but everyone else should be delighted by this M4-powered all-in-one with its 24in 4,480 x 2,520 IPS panel. It's fast inside and out, too, with Thunderbolt 4 and Wi-Fi 6E.
REVIEW **Issue 364, p48**

Lenovo Yoga AIO 27i Gen10 (Intel)

This elegant all-in-one packs in everything most people need, including an Intel Core Ultra 7 255H processor, 16GB of RAM, a 1TB SSD and a solid 27in 120Hz IPS panel. Since our review it has been updated with Core Ultra Series 3 chips and a new name (Yoga AIO i Gen11). **£1,290 from lenovo.com**
REVIEW **Issue 374, p59**

Lenovo Yoga AIO i Gen11 Aura Edition (32in Intel)

Quite simply one of the most desirable PCs around, with a striking upside-down "V" design that's built around a glorious 31.5in 4K OLED panel. With a Core Ultra X7 358H inside, it's powerful too – including capacity for playing demanding games.
£2,544 from lenovo.com
REVIEW **Issue 384, p52**

CREATIVE WORKSTATIONS

Scan 3XS GWP-A1-TR64

64-core 'ripper for £11,000 exc VAT

from scan.co.uk/3xs



Scan takes advantage of AMD's new 9000-series Ryzen Threadrippers, the 64-core 9980X, to deliver a monster of a workstation that topped almost all of our performance charts. It's helped by an RTX Pro 6000 Blackwell card and 128GB of memory. It's even a quiet runner.
REVIEW **Issue 373, p93**

CyberPowerPC Ultra R9X Pro

In pairing AMD's Ryzen 9 9950X3D2 with an RTX 5090, CyberPowerPC has created a gifted workstation – one strong in game creation, rendering and data science tasks. And thanks to the white Lian Li Lancool 217 chassis, it even looks good. **£3,759 exc VAT from tinyurl.com/382cyberpower**
REVIEW **Issue 382, p58**

HP Z2 Mini G1a workstation

Built around AMD's powerful Ryzen AI Max+ Pro 395 processor with 128GB of unified RAM, this versatile workstation can be used for everything from creative tasks to running LLMs with up to 128 billion parameters. **As reviewed, £2,280 exc VAT from hp.com**
REVIEW **Issue 374, p60**

TABLETS

Apple iPad Pro (M5)

M5 power from £1,199

from apple.com/uk



While the iPad Air remains a great alternative, there's no arguing with the quality and all-out power provided by Apple's top-end tablet. And the tandem OLED panel is simply the icing on the cake.

REVIEW **Issue 376, p84**

Apple iPad Air M4

Like the MacBook Air, this year's iPad Air update features minimal changes, with the biggest boost being to performance (you also get Wi-Fi 7 and Bluetooth 6). We'd still like a 120Hz screen, but otherwise the iPad Air's quality and hardware options make it a great alternative to the Pro.

From £749 from apple.com

REVIEW **Issue 380, p71**

Honor MagicPad 4

The MagicPad 4 rewrites what you can buy for around £500 – once you apply the £100 discount voucher. It comes with a glorious 12.3in OLED panel, it's fast, and it lasts for hours on a single charge. The bundle deal also includes a top-quality keyboard and a stylus.

Bundle, £649 (£549 after voucher) from honor.com

REVIEW **Issue 380, p70**

EVERYDAY PHONES

Fairphone 6

The eco-friendly choice from £499

from fairphone.com



Unique among phones for its five-year warranty and the ease of repair and customisation, this mid-range phone will last for years. There's even a microSD slot! Its CPU and camera are nothing to shout about, but this is a clear winner for sustainability.

REVIEW **Issue 375, p52**

Honor X5c Plus

We bought this bargain 4G phone for a feature on ultra-cheap products, expecting it to be below par. Instead, we were left wondering how Honor squeezes so much out of the components, with solid performance, a decent camera and big battery.

£79 from amazon.co.uk

REVIEW **Issue 383, p43**

Google Pixel 10a

It's great to see Google sticking to the £499 price of its budget phone, even if that means it has last year's G4 chip. Still, it's fast enough, supports all Google's latest AI features, and the 6.3in display is superb. Plus you get seven years of OS updates and a new, flat design.

From £499 from store.google.com

REVIEW **Issue 380, p78**

PREMIUM PHONES

Samsung Galaxy S26 Ultra

Private caller from £1,279

from samsung.com



The world's most feature-packed phone – it still integrates a stylus – now includes a highly effective privacy display along with ambitious agentic AI features that actually work. It's packed with quality throughout, from the blisteringly fast CPU to the 6.9in AMOLED panel.

REVIEW **Issue 380, p74**

Apple iPhone 17

With a superb optical zoom, brilliant cameras, excellent all-round performance and a surprisingly generous amount of storage – 256GB for £799 – we think there are fewer reasons than ever before to "go Pro". Other than battery life, which may push power users to upgrade.

256GB, £799 from apple.com/uk

REVIEW **Issue 375, p70**

OnePlus 15

Once again OnePlus delivers a no-compromise Android phone for a price that the big names struggle to match. You're buying the latest Qualcomm chipset, a slick and gorgeous 6.8in panel, a top-quality set of cameras and battery life that genuinely stretches over two days.

£849 from oneplus.com

REVIEW **Issue 376, p72**

24IN TO 27IN MONITORS

NEW ENTRY

Asus ProArt Display OLED PA279CDV

4K OLED wonder for £649

from asus.com



This 27in 4K monitor wowed us with its punchy colours, perfect contrast (courtesy of OLED technology) and superb accuracy – plus accurate calibration for sRGB and DCI-P3 spaces. It supports daisy-chaining, too.

REVIEW **Issue 385, p63**

BenQ MA270S

This 27in 5K panel – and 5K equates to an astonishingly sharp 5,120 x 2,880 resolution – is a superb alternative to the Apple Studio Display. It packs an equally high-quality panel, but BenQ doesn't charge extra for the adjustable stand or anti-glare screen.

£900 from scan.co.uk

REVIEW **Issue 384, p79**

AOC U27E4CV

Make sure you check the exact name before you buy, because the U27E4CV stands out from its sister 27in models (with confusingly similar model names) for its good-quality 4K IPS panel, built-in networking and USB-C docking. It really is quite exceptional value.

£240 from ballicom.co.uk

REVIEW **Issue 384, p78**

30IN+ MONITORS

HP Series 7 Pro 732xk

IPS Black brilliance for £720

from hp.com



This brilliant 31.5in IPS Black monitor is in hot demand, but it's worth waiting for if it goes out of stock with a rich, colourful panel that produces gorgeous whites – plus all the connectivity you could need.

REVIEW **Issue 384, p92**

Eizo ColorEdge CG3100X

This 30.5in monitor is ideal for creators, designers and editors for whom colour range and accuracy is everything. You pay for the privilege, and for extremely high build quality, but also a built-in calibrator that will keep colours accurate forever. This is a multi-year investment. **£4,999 from wexphotovideo.com**

REVIEW **Issue 384, p90**

Iiyama ProLite XCB3497WQSNPH

If you can't afford the Eizo or HP, Iiyama offers a business-friendly curved monitor that delivers for day-to-day image quality. It's packed with connectivity and features too, including RJ45 wired networking, a USB-C hub and even a webcam.

£350 from scan.co.uk

REVIEW **Issue 384, p93**

WEBCAMS

Insta360 Link 2 Pro

Perfect tracking for £239

from amazon.co.uk



Brilliant image and audio quality, a smooth two-axis gimbal that means you're always in the frame, fast autofocus and excellent subject tracking make this 4K webcam a great choice for office workers or lecturers alike.

REVIEW **Issue 378, p60**

Logitech Brio 105 for Business

While you can buy 1080p webcams for a third of the Brio 105's price, they won't hold a candle to the Logitech webcam's quality – especially in low-light conditions, such as one candle. It's also easy to manage, for businesses and individuals.

£45 from logitech.com

REVIEW **Issue 360, p77**

Logitech MX Brio 705 for Business

Consistent image quality in all lighting conditions coupled with top build quality and nifty features – such as a presenting mode for items on your desk – make this a fantastic all-round choice. It's only be nudged out of top position by the superb Insta360 Link 2 Pro. **£219 from logitech.com**

REVIEW **Issue 356, p68**

HOME OFFICE PRINTERS

Epson EcoTank ET-4956

Ink tank excellence for £366

from amazon.co.uk



Shipping with 5,500 pages' worth of colour ink and 15,100 of black works out at 6p per colour page even factoring in the price of the printer. At 16pmm for high-quality prints, and a 30-sheet ADF, it's a clear winner.

REVIEW **Issue 377, p89**

Brother DCP-T780DW

If the Epson EcoTank ET-4956 is too expensive, consider Brother's first attempt at a refillable inkjet. It's keenly priced, but still includes a 20-sheet ADF, easy-to-use screen and its print and scan quality – while not quite up to the Epson – are strong.

£249 from from ballicom.co.uk

REVIEW **Issue 377, p86**

Canon i-Sensys LBP243dw

Everything you could want from a mono laser printer – although note that it doesn't come with a scanner – the LBP243dw produces excellent results at speed. You also get Wi-Fi and wired networking. **£186 from printerbase.co.uk**

REVIEW **Issue 365, p88**

WORKGROUP PRINTERS

Canon i-Sensys MF664Cdw

Colour laser MFP for £284 exc VAT

from printerland.co.uk



You're getting so much for your money here: a large, intuitive touchscreen; high-quality colour prints at 20ppm and higher; even a 50-page ADF. Respectable running costs (2.6p mono, 10.6p colour) clinch the deal.

REVIEW **Issue 377, p87**

HP Color LaserJet Pro 4202dw

This 33pppm colour laser printer – there's no scanner or fax – delivers excellent mono prints for a reasonable 2.1p per month, and even though each colour page is comparatively expensive at 12.1p you will be delighted with the results.

£330 exc VAT from hp.com

REVIEW **Issue 379, p74**

Canon i-Sensys MF754Cdw II

Plentiful features, fast print speeds and good output quality at an affordable price. The smart Application Library is capable of streamlining repetitive tasks, and Canon's focus on security will appeal to businesses that want strict access controls. **£348 exc VAT from printerland.co.uk**

REVIEW **Issue 380, p102**

WIRELESS ROUTERS & MESH WI-FI

NEW ENTRY

TP-Link Archer BE550

Affordable Wi-Fi 7 router, £180

from amazon.co.uk



This is a brilliant and affordable Wi-Fi 7 router that packs five 2.5GbE ports. These, together with 6GHz support, mean you'll enjoy superb wired and wireless performance everywhere, and it even comes with a wide set of features.

REVIEW **Issue 371, p70**

Netgear Orbi 770

If you want to upgrade to Wi-Fi 7 and need a mesh setup, this is the best option yet. Speed and range are both excellent, with a twin-pack covering 420m², and connectivity is superb: four 2.5GbE ports on the router, two 2.5GbE ports on the satellites. **2-pack, £480 from amazon.co.uk**

REVIEW **Issue 364, p70**

TP-Link Archer BE3600

This dual-band Wi-Fi 7 router can't match more expensive rivals for speed or range, but it's a fine choice for a three-bedroomed house and packs a surprising number of high-end features – including VPN services and granular QoS options.

£75 from amazon.co.uk

REVIEW **Issue 385, p68**

BUSINESS WI-FI

NEW ENTRY

DrayTek Vigor 2767ax

Secure Wi-Fi 6 for £192 exc VAT

from broadbandbuyer.com



The Vigor 2767ax is the perfect partner for small offices seeking a versatile business router with the best WAN redundancy features. It delivers a wealth of security measures, the integral Wi-Fi 6 AP offers secure hotspot services and it all comes at an incredibly low price.

REVIEW **Issue 379, p103**

Ubiquiti Networks UniFi U7 Pro XG

This Wi-Fi 7 access point is furiously fast, superbly built and great value. You'll need to factor in the cost of a cloud gateway, but it's worth it as you won't find a better wireless management and monitoring solution at this price. **£158 exc VAT from broadbandbuyer.com**

REVIEW **Issue 377, p100**

Zyxel NWA30BE

The Zyxel NWA30BE is ideal for small businesses, pop-up shops and offices that want on-demand Wi-Fi 7 services. It's a cinch to deploy, delivers impressive performance and is perfectly priced for the target market. And despite the price, there are plenty of management options **£83 exc VAT from amazon.co.uk**

REVIEW **Issue 385, p101**

PERSONAL & MICRO-BUSINESS NAS APPLIANCES

TerraMaster F2-425 Plus

Demon-like speed for £400

from amazon.co.uk



Whether you use its two 3.5in bays or three NVMe drive slots, this appliance is built for speed, with chart-topping performance in almost every area and dual 5GbE network ports.
REVIEW **Issue 379, p87**

Synology DS725+

Excellent performance, Synology's slick OS and the wide array of apps make this two-bay appliance a great choice for power users and micro businesses alike, especially if you want the flexibility of expanding to more bays in the future.
£400 from amazon.co.uk
REVIEW **Issue 379, p85**

UGreen NASync DH4300 Plus

This four-bay appliance is terrific value and easy to use. It's not the quickest, and Synology NAS appliances beat it for app choice (there's no Plex or WordPress), but if your priority is secure storage then it's a great choice.
£311 from lambda-tek.com
REVIEW **Issue 379, p86**

SMB NAS APPLIANCES

Ugreen NASync DXP8800 Plus

Dual 10GbE for £1,100 exc VAT

from amazon.co.uk



Short on apps – other than core ones for backup and storage services – but you're buying an incredible hardware package for the price. Build quality is exemplary, a Gen12 Intel Core chip speeds it along and you have pairs of 10GbE ports plus Thunderbolt 4 and more.
REVIEW **Issue 380, p101**

Ugreen NASync iDX6011 Pro

Excellent value, this superbly built NAS delivers a remarkably powerful hardware specification – including a 16-core Intel Core Ultra 7 255H – that will appeal to power users and stands out for its versatile AI features.
Diskless, £1,900 exc VAT from nas.ugreen.com
REVIEW **Issue 381, p102**

Synology RS2825RP+

Teams up a superior hardware package with a big storage capacity and delivers it all at a good price. Synology's drive compatibility policies are annoying, but it's fast and the DSM software delivers an unbeatable range of storage management and data security features. **Diskless, £2,453 exc VAT from broadbandbuyer.com**
REVIEW **Issue 380, p100**

VIDEOCONFERENCING

Jabra PanaCast U30

All-in-one solution for £591 exc VAT

from best4systems.co.uk



A top choice for businesses seeking an affordable all-in-one VC solution for small spaces, based around a 4K camera and 6-mic array. It's easy to use, offers a powerful set of AI-driven viewing modes and can be locally and remotely managed.
REVIEW **Issue 384, p102**

Owl Labs Meeting Owl 5 Pro

The Owl 5 Pro takes everything we loved about the Owl 4+ and delivers it to larger organisations that require a permanent meeting room solution. Video quality is outstanding, speaker tracking is fast and smooth, and the range of dynamic views will impress.
£1,999 exc VAT from owllabs.co.uk
REVIEW **Issue 383, p103**

Insta360 Connect

Insta360 makes an impressive entry into the videoconfencing market, with the Connect offering a wealth of features for a competitive price. Dual cameras deliver great video quality and fast tracking, it offers a versatile range of viewing modes, and the whiteboard feature adds even more value. **£1,666 exc VAT from amazon.co.uk**
REVIEW **Issue 376, p99**

SCANNERS

Plustek eScan A450 Pro

Digitising wonder for £938 exc VAT

from midwich.com



SMBs with big scan demands and a desire to integrate with Microsoft 365 and SharePoint will like the eScan A450 Pro's great speeds, top output quality and tight security.
REVIEW **Issue 382, p100**

Brother ADS-4700W

A natural choice for businesses that want a desktop scanner with a good balance of features, speed and value. It includes an extensive software bundle, makes light work of walk-up scan operations and provides great cloud support. **£340 exc VAT from printerbase.co.uk**
REVIEW **Issue 382, p98**

Ricoh ScanSnap iX2500

Perfect for SMBs and home workers that want speedy desktop scanning at a great price. The ScanSnap software and user-friendly touchscreen team up to make scan operations a breeze, and Ricoh's smart ScanSnap Cloud service adds extra levels of versatility. **£319 exc VAT from printerbase.co.uk**
REVIEW **Issue 382, p101**

UTM APPLIANCES

DrayTek Vigor 2928

Smart security router for £242 exc VAT

from broadbandbuyer.com



Stunning features and protection measures for a great price. WAN redundancy services and multiple 10GbE ports make it ideal for remote sites that need secure, always-on internet.
REVIEW **Issue 384, p98**

WatchGuard Firebox T145-W

Enterprise-class gateway security measures at an affordable price. Integrated Wi-Fi 7 services make it even more versatile, and it's easily managed from WatchGuard's cloud portal. **Appliance with 3yr Total Security Suite, £3,152 exc VAT from broadbandbuyer.com**
REVIEW **Issue 384, p100**

Zyxel USG Flex 200H

A powerful yet affordable security appliance at a great price. The Gold Security Pack offers an impressive set of protection measures, and Zyxel's Smart Sync feature delivers unified local and cloud management. **Appliance with 1yr Gold Security licence, £790 exc VAT from broadbandbuyer.com**
REVIEW **Issue 384, p101**

SECURITY SUITES

Eset Small Business Security 19

Perfect for smaller firms as it offers an affordable set of easily managed endpoint and ransomware protection measures, and it's easy to deploy. **5 devices, 1 year, £138 exc VAT from eset.com**

REVIEW **Issue 380, p103**

Norton 360 Deluxe

Packs plenty of features at low prices – if you buy from a third-party store. Note the generous 50GB cloud backup service that comes with 360 Deluxe. **3 devices, 15 months, £10 from store.pcpro.co.uk**

REVIEW **Issue 375, p90**

Avast Ultimate

Buy from a third-party store and you'll get top levels of antivirus protection and a superb set of features – including a solid VPN – for a great price. **10 devices, 2 years, £30 from store.pcpro.co.uk**

REVIEW **Issue 375, p84**

VPNs

Surfshark

Blisteringly fast in all our tests, consistently excellent in our streaming tests and great value at £1.54 per month if you buy the multi-year deal. **2yrs 3mths, £42 from surfshark.com**

REVIEW **Issue 382, p88**

Windscribe

Not the cheapest by any stretch, but if you place privacy at the top of your priority list then this Canadian service delivers – plus international streaming works well and it won't hike its prices. **1yr, $69 from windscribe.com**

REVIEW **Issue 382, p89**

Proton VPN Free

While Proton's VPN Plus is also a great choice, if you're looking for a freebie then choose this VPN for its fast connections (or alternatively Windscribe if you need to choose territories). **Free from protonvpn.com**

REVIEW **Issue 382, p90**

LINUX DISTROS

Ubuntu

A fine choice for Windows switchers thanks to its familiar design, with regular six-monthly updates and a Long Term Support version. **Free from ubuntu.com**

REVIEW **Issue 367, p92**

Fedora Workstation

One of the longest-established distros, and with a strong link to Red Hat Enterprise Linux, Fedora Workstation will particularly appeal to business migrators. **Free from fedoraproject.org**

REVIEW **Issue 367, p85**

Linux Mint

There's a good reason this is a popular choice for Windows 10 refugees, including a familiar "Start menu", and it's easy to give it a trial before committing. But consider Zorin OS, too. **Free from linuxmint.com**

REVIEW **Issue 367, p86**

CLOUD FILE-SHARING

Progress ShareFile Premium

SMBs that require secure, seamless file sharing and collaboration with external clients will love Progress ShareFile Premium as the smart new client hub lets them present highly professional services. **£19 exc VAT per user per month billed yearly from sharefile.com**



REVIEW **Issue 379, p100**

Tresorit Engage Business

A top choice for businesses sharing confidential data, and the Engage platform adds extra appeal. **Engage Business plan, from £144 exc VAT per month billed yearly from tresorit.com**

REVIEW **Issue 379, p101**

NETWORK MONITORING

Progress WhatsUp Gold Enterprise

Its flexible device-based licensing plans make this a great choice for SMBs. It's easy to deploy, good value and its highly configurable web console delivers a wide range of network monitoring services. **50 devices, £1,488 exc VAT per year from whatsupgold.com**



REVIEW **Issue 378, p101**

AdRem NetCrunch Enterprise 15.3

Simple to deploy and manage, the central console is easy to use, and its smart monitoring packs present a wealth of valuable information. **From £3,875 exc VAT per year from adremsoft.com**

REVIEW **Issue 378, p98**

VOIP SERVICES

3CX Phone System 20

Our top choice for businesses that want total control over their VoIP services. The variety of plans and flat licensing fees are very affordable, deployment options are abundant, and we love the new agentic AI features. **Hosted Enterprise/AI, 16SC, £1,155 exc VAT per year from 3cx.com**



REVIEW **Issue 381, p98**

TelephoneSystems.Cloud

An affordable VoIP service with no hidden costs or lengthy contracts. It's easy to manage and offers a wealth of call-handling features. **From £11 exc VAT per user per month from telephonesystems.cloud**

REVIEW **Issue 381, p100**

CLOUD/HYBRID BACKUP

Barracuda Backup 3024

This hybrid backup solution of appliance and cloud services is a great choice for SMB data protection as it's easy to deploy, includes unlimited client support and its high storage potential makes it a solid long-term investment. **Appliance with 3TB storage, from £3,096 exc VAT per year from barracuda.com**



REVIEW **Issue 383, p98**

IDrive Business

Geared up to protect on-premises systems and remote workers, IDrive Business is easy to use and provides plenty of optional cloud-to-cloud backup services. **5TB, £78 exc VAT per month (first year) from idrive.com**

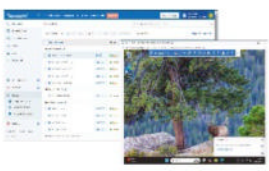
REVIEW **Issue 383, p100**

REMOTE SUPPORT

NEW ENTRY

LogMeIn Resolve Advanced

An AI-powered virtual assistant is the star player, making light work of mundane support tasks, while this cloud-hosted solution delivers tough access security and includes essential endpoint protection services. **From 25 devices, £48 exc VAT per month billed yearly from logmein.com**



REVIEW **Issue 385, p98**

NEW ENTRY

247connect

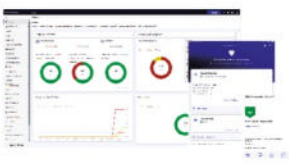
NetSupport shows its experience with 247connect. Its cloud-hosted solution is easy to use, secure and comes in a range of price plans. **From £180 exc VAT per operator/year from 247connect.cloud**

REVIEW **Issue 385, p96**

ENDPOINT PROTECTION

WithSecure Elements Endpoint Security

An impressive range of protection measures all managed from a single web portal. Platform support is excellent, the modular design makes it simple to customise, and it's priced right for SMBs. **100-499 workstations, £37 exc VAT each per year from withsecure.com**



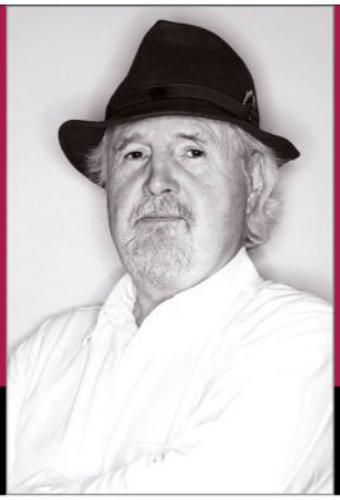
REVIEW **Issue 375, p101**

Sophos Central Intercept X Advanced

Impressive endpoint protection measures and security features, and it's all easily managed from one of the best cloud portals on the market. **50-99 users, £52.88 exc VAT each per year from broadbandbuyer.com**

REVIEW **Issue 375, p99**

A Substack named Mobius



Dick Pountain is editorial fellow of *PC Pro*. He does often feel as though he's entered another dimension, but that's just from watching the news. Find him on Bluesky at @dick-pountain

The days of having a simple website for one's digital creations have long gone, with Dick now opting for a backup-unfriendly Mobius strip approach

I try to avoid reminiscences in this column, but today I'm performing one, because as I typed the above headline a flash of memory prompted me to do a search. Sure enough, 15 years ago I made reference to a 1950 sci-fi short story called "A Subway Named Mobius". Its author, AJ Deutsch, imagined a future New York subway system where adding an extra line drove the connectivity past some critical point, after which trains and passengers start disappearing into another dimension. I mentioned this as an allegory, because I'd just built my own website and added links from it to Flickr, Facebook and a couple of other social media sites, and was feeling a bit bewildered. At that time the comparison felt like a comical exaggeration, but today it feels almost realistic.

I still have my Google website (because it's still free), although after deliberately keeping it looking very spartan for many years I recently revamped it with pictures and colours in an attempt to make it a little more modern. I still have my Flickr account too, now with 2,000+ photos, and I still socialise on Facebook every day. I've even overcome my revulsion and started posting pics on Instagram. But the biggest change of all is my move to Substack. The incessant silting-up of my Facebook feed with ads and AI slop has caused many friends to leave, and meanwhile Substack has become a more attractive place for my political commentary, as I explained to readers of my blog "Caustic Comments".

"I've copied most of my online work to Substack," I wrote. "The Substack platform may have plenty of faults and foibles, but like it or not, over the past two years it's exploded as the online place for political comment. It's taking the place once occupied by Twitter, which – renamed as X – has become a horror-show mouthpiece for Elon Musk. In fact, Musk is the main reason for Substack's own explosive growth, thanks to a mass migration of US academics and commentators displaced by his 2025 DOGE shenanigans. An attraction for such digital refugees is that Substack provides the means to get paid for podcasts and essays, though I'll not be charging for my own stuff.

"I've also established a presence on Bluesky, which was explicitly founded as a progressive replacement for Twitter – however, it lacks the big guns and tends toward being inundated by cats and anime."

The problem is that Substack's bizarre user interface is contradictory. It can appear either as a doom-scrolling stream like Facebook or X, or alternatively as a website with a custom layout that you can make resemble a magazine or a newspaper page with stories and pictures. I prefer the latter as it lets me choose the most popular pieces from my blog, my book reviews and even lectures I've given, and display them on one screen.

I also include a link back to my old website, which completes the Mobius strip. My old site has become a hub for all my content, though much of it's also accessible, some even stored, on Substack too. I have content on at least nine separate platforms – Flickr, Facebook, Bluesky, Substack, Blogger, YouTube, Bandcamp, Soundcloud and Instagram – and probably several others I've forgotten.

> "Whether to regard all my creative efforts as scattered or as distributed is largely a subjective matter"

> "Good luck to young folk who buy Lambos thanks to TikTok channels, but the thought of having to make a video a day strikes me as cruel punishment"

Sometimes I think about this and panic over the question of backups, but at other times I feel fine about it. Were Google, Facebook or Substack to join the ranks of the enshittificators and start charging, or even go bust and disappear, it feels almost comforting to have so many baskets for my eggs. I do take full offline backups of my Google content (including Gmail) using the Google Takeout facility, which contain links to all of the other sites and could, with some effort, be moved to another host. The picture and music content is all still held locally on my hard drives, too. The loss of my Facebook history would be irritating but hardly fatal. So, whether to regard all my creative efforts as scattered or as distributed is largely a subjective matter.

The downside is that such a "distributed" oeuvre is hard to make other people aware of. I disregard kind offers by the various platforms to raise my visibility by paying for ads. In fact I pay for as little of my online activity as possible – It would be too strong to say I treat online activity as a hobby, but neither do I see it as a living. Good luck to young folk who buy Lambos thanks to TikTok channels, but the thought of having to make a video a day strikes me as cruel and unusual punishment.

dickpountain.substack.com

AI needs to learn how facts work

AI overviews confuse consensus with facts and it's only going to get worse, but in good news... no, there is no good news



Nicole Kobie is *PC Pro*'s Futures editor. If her transcripts with these bots ever leak, it will be very embarrassing with regards to her temper and use of profanity.
@njkobie

Here's an aphorism that's often told in journalism classrooms: "If someone says it's raining, and another says it's not, your job isn't to quote them both, but to look out of the window and find out what's true." Perhaps this story should also do the rounds in computer science classrooms, because AI developers need to hear it.

Large language models work by generating answers based on patterns. That means oft repeated information is deemed most worthy. That's contrary to how Google search worked, for a long time at least, with an attempt to give high-quality sources precedence. When Google added AI summaries to results, meaning users no longer had to click through for data, most of that information came from Wikipedia, which is a decent enough source as far as the internet goes.

We humans do this sort of thing naturally. If you want to know when a restaurant is open, you could trust the information pulled in by Google Maps, but if you wanted to be sure, you'd check the website directly – or even better, pick up the phone and ask. We inherently understand sources, and front of house staff count as experts.

> "This story should do the rounds in computer science classrooms, because AI developers need to hear it"

This all came to a head for me in the worst place possible: an airport. While juggling multiple small pieces of wheeled luggage and entertaining a small child, I searched online for the location of the indoor playground in the terminal of Heathrow we were stumbling through.

Google's AI Overviews returned a confident answer, and because I was balancing so many objects and desperate to sit, I trusted that answer rather than clicking through to the source page. You can see where this is going. Because of an LLM, I marched a four-year-old across Terminal 4 to gate 1A, which we found to be utterly devoid of children's entertainment.

So I went directly to the source: Heathrow's own website. That terribly made website requires opening up a fiddly map to see the play-place location, which is actually near gates 15 and 16. This was on the other side of the terminal from where I'd taken us, because of course it was.

This happened because gate 1A was the former location, which meant there were oodles of blogs and social media posts and other digital content sharing that fact. Years upon years of material, all claiming gate 1A was the hallowed location of free child entertainment. But all that data was now out of date.

AI Overviews doesn't seem to consider the date of information; if all the posts after a certain date give a different location, it stands to reason that something has changed. Instead, it saw that 1A is the consensus online.

This problem isn't restricted to Heathrow. On our return, I attempted to find out what at V&A East might appeal to children. The Stratford location of the museum only opened in April, and my search was a few months later. AI Overviews repeatedly told me I was looking for the Young V&A – I wasn't, I've been there, stop gaslighting me – or V&A Storehouse, which is nearby to V&A East. An argument ensued and I'm not proud of my language.

This is made all the worse by Google cramming AI into as many aspects of search as possible. Somehow, Google needs to teach its AI how to metaphorically look out of the window to see if it's raining.

And this is about to get a whole lot harder, for AI developers, search providers, and us humans. One story doing the rounds at the moment concerns *Time* magazine running ads on its website that aren't meant for people's eyes but for machines: the marketing material is optimised to produce positive AI chat results via this hidden content. That means ChatGPT, AI Overviews and the rest could surface an answer that has been unduly influenced, while clicking through to the site won't reveal the real source of the information. It's like SEO, but for AI.

> "Rather than attempting to extract data from Heathrow's map, ChatGPT was giving me information from the Swedish version of the website"

This is already happening, in an odd little way. My husband was looking for information about a sushi restaurant and kept being given data that didn't match the website; that's because the bot was reading the Danish website. Because it can do that, effortlessly. The same happened to me while researching this column, seeing if other AI systems would be tripped up in the same way as Google's search summaries (spoiler: yes). I asked ChatGPT to look directly on the official website, ignoring all others, and it kept telling me that Heathrow said it was gate 1A. After accusing it of lying, I told it to quote the text from the page.

Finally, it became clear: rather than attempting to extract data from Heathrow's difficult-to-read map, ChatGPT was giving me information from the Swedish version of the website, which hadn't yet been updated with the new gate. We need AI to "look out of the window" for real facts, but here – not in the Nordics.

work@nicolekobie.com

Annoyed about Android



Barry Collins is not available for Android phone repairs. Do not email him at barry@mediabc.co.uk.
@bazzacollins

The user experience of low-end Android phones is dismal, and it's nothing to do with the hardware: this is all due to Google, Samsung and Meta

The phone rings. It's my partner's mother. This is a bad sign. Gail doesn't ring me for a chat, she's got a perfectly good daughter for that; she rings me because something's gone belly-up with a piece of technology.

"Hello, hello, can you hear me?"

"Yes, I can hear you, Clem Fandango." (Note to self: don't try *Toast of London* one-liners on octogenarians. They don't get it, no matter how much it amuses oneself.)

Once we get over the Clem Fandango nonsense, it emerges the reason Gail's not certain the phone's connected is because her screen is full of pop-up messages warning her the handset is riddled with viruses and other such nonsense. When I finally get my hands on the thing, it reminds me of the scene in *The IT Crowd* where Jen asks Roy to install a browser on her laptop and he discovers a desktop full of banners, pop-ups and widgets, and tells her: "It's infected – if this were a human being I'd shoot it in the face."

After roughly a fortnight, I manage to close down enough windows to find the Settings screen and look at the list of installed apps. It seems Gail's turned into a hardcore gamer, because she's got more games than Hamleys installed on this thing. Except she's never heard of most of them. She's downloaded one Solitaire app from the Play Store to while away a few minutes, one of those "free" games that are interrupted with "DOWNLOAD NOW" ads every six seconds. She's clearly clicked on one of those and now her Samsung A14 is the silicon apocalypse.

> "She's clearly clicked on one of those ads and now her Samsung A14 is the silicon apocalypse"

I uninstall about 20 offending apps, but there are a couple that refuse to budge. Given there's no way of knowing what these apps are up to in the background and that Gail relies on the phone for online banking, we decide the safest thing to do is buy her a new phone, tell her to never download anything again ever, and set about the A14 with a blow torch.

Just as I'm about to finish my eighth cup of tea and leave Gail with her new phone, she says: "Christine wondered if you could pop in and look at her phone? It's not working properly." Give. Me. Strength.

Christine too has a Samsung A-something that (we subsequently discover) she's been paying EE £35 a month for the past God knows how many years, making it more expensive than a BMW 5 Series. Christine's phone hasn't succumbed to the pop-up pandemic, but it is running out of storage: 98% full, according to the settings. Of the 32GB of storage the phone has available, about 18GB of it is helpfully labelled as "other".

Dr Google suggests this might be cached data that can be flushed by holding the power and volume up buttons, chanting the name of every *Blankety Blank* presenter and downing a pint of goat's milk, but no joy: the cache partition refuses to wipe.

Never mind, because I can see the Facebook app is swallowing almost 4GB(!) of data by itself. If I flush that out, it should free enough storage to make the phone semi-responsive again. In the Settings app I press "clear app data" and... nothing happens. OK. So having first checked Christine still has her Facebook password (of course she does, it's the same as all her other passwords), I try to delete and reinstall the app. Except I can't delete it either. Because it's one of the apps that comes bundled with the phone. Doubtless courtesy of a slice of wedge from Meta, users can't remove it. Facebook and its ever-expanding pile of crud are stuck on this phone, short of resetting the entire handset to factory settings.

> "These phones are being drop-kicked into obsolescence because the big tech firms are too lazy, or too greedy, to deal with their obvious problems"

How the John F Kennedy is this allowed to happen? Why does Android make it so easy for malware writers to hijack people's phones, especially when they've only downloaded apps that came from the supposedly vetted Play Store? Why can't Facebook control the ridiculous bloat of its own app? Why is Samsung preventing users from deleting apps that shipped with its handset? All three of these massive tech companies should be embarrassed.

But then, what's the alternative? The people most likely to buy these low-end Android handsets are those on low incomes or the elderly. Many can't afford an iPhone, so they're stuck with the same dismal user experience, because if it's not Apple it's Android. The market's sewn up.

Even though they were old phones, there was nothing wrong with Gail's or Christine's handsets per se. They come from a generation where you don't upgrade your phone just because there's a new one out, you replace it when it needs replacing. These phones are being drop-kicked into obsolescence because the big tech firms are too lazy, or too greedy, to deal with their glaringly obvious problems. A pox on them all.

barry@mediabc.co.uk

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Readers' comments

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Cover models

I enjoyed the Retro column with its jaunt around the covermounts of yesteryear (*see issue 384, p123*). I was also reminded that in the past, when things were different, young ladies were permitted to grace the covers of computer mags, usually clutching some bit of PC kit. I think this is a tradition that should be revived, perhaps by your august columnists posing fetchingly on future covers of *PC Pro*. I'm sure that would drive circulation!

Steve McClue



ABOVE Time to upgrade the *PC Pro* cover with one of our glamorous writers?

Not so genius Apple

I just read Barry's splendid article on Apple repairs (*see issue 384, p22*). Apple Norwich quoted me around £900 to replace a standard SSD in my partner's four-year-old iMac. I got a quote for a third of that from a local independent Apple-qualified technician, so no guessing which option I chose. Apple twice said the £4,500 iMac was too old now and I should look at buying a replacement.

I made a complaint to Trading Standards, who said that as no sale had taken place there was nothing they could do. Something needs to stop this corporate machine before it runs completely out of control.

David Carter

Age verification

I read with interest Jon Honeyball's article "Kids need protection from the worst of the internet" (*see issue 383, p130*) and question whether having an online portal for age verification would actually require much extra work for the government. I have online access to my Lasting Power of Attorneys and can give organisations access to relevant details when registering those LPAs with them. Each access code is unique to the organisation and expires after a set period of time.

Could this type of system not be adapted to deal with age verification?

Deborah Sumby

Contributing editor Jon Honeyball replies: The problem is that governments are terrible at doing IT because they're usually without a clue and hand it over to organisations who are equally clueless, but driven by profit. See the Post Office and Fujitsu. Or the current disaster that is civil service pensions. We need an entirely different platform for this, which is under your control. I wrote about it many years ago in *PC Pro*, but maybe it's time to bang that drum again?

Monitors on life support

I have now discovered I am one of the 30% of *PC Pro* readers who has three monitors (*see issue 384, p25*). Hanging off a monitor stand I have three monitors in landscape mode attached to a couple of laptops that I disconnect and reconnect on the fly. Two are 29in widescreens and one is a 27in widescreen. Two of them are connected to the work laptop, and the other screen is for personal use.

On reading the monitors group test (*see issue 384, p72*) I noticed screen resolutions don't seem to have changed and my current monitors do the job even though they're quite old! Should I upgrade my monitors or do I ditch them for a 34in curved-screen monster that will display both laptops and invest in a KVM so I can switch between connected devices?

Phil Newman

Editor-in-chief Tim Danton replies: If you're happy with your monitors' quality then I see no need to change (although you might want to see how much power they're consuming). But when one fails, it's definitely worth considering a 34in widescreen as a simple replacement – just make sure it supports picture-by-picture modes as you may find this useful.

Star letter

My son is buying a flat. As we will be helping him with the deposit, we have to jump through Anti Money Laundering and Know Your Customer hoops. Fair enough. Except the solicitors all use the same services to achieve this, either Thirdfort or Infotrack.

A quick investigation reveals a privacy nightmare, sharing some of the most sensitive information I possess – passports, driving licence, bank account details and so on. Thirdfort has a long list of "trusted third parties", including AI, potentially outside the UK and EU, that they may share your data with (**tinyurl.com/385thirdfort**).

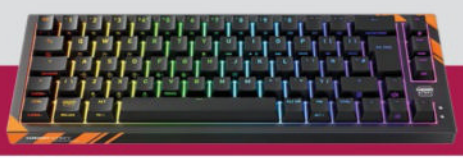
If you want to know how these "trusted" parties use your data, the solicitors refer you to those companies' policies. Even I don't propose to wade through that much smelly stuff. But at least Thirdfort makes this relatively clear; Infotrack seemed more opaque but clearly still proposed to "share" my data, almost certainly with the US.

The solicitors were unable to explain what they would need and how they would process the data. For them, these appear to be "closed box" solutions that just say yes or no. There are people complaining online of problems with these services and the solicitors will do nothing other than point them back at the service (which of course has no actual customer service people).

The service providers say they delete your data, but what about all those trusted third parties and data outside the UK?

Adam Brocklesby

Contributing editor and lawyer Olivia Whitcroft replies*: It's a good example of where two different laws are at apparent loggerheads – requirements to identify individuals (to prevent crime) battling with requirements not to overuse personal data (to protect privacy). Third-party specialists can help law firms get the balance right, but wading through layers of privacy notices with long lists of "trusted third parties" is not comforting. Rights under data protection law allow individuals to seek clarity on specific recipients and retention periods, and to raise concerns about the handling of their data. If your contact doesn't have the answer, one option is to speak with the data protection lead, and, if you have given them your data, to make a formal request for information.



This month's star letter writer wins a Cherry Xtrfy K5 Pro TMR Compact, worth €150. For your chance to win, get in touch by emailing letters@pcpro.co.uk.

***Please note this is commentary and not legal advice**

Search gone AWOL

I listened with interest to Jon Honeyball's assessment of the future of Windows search in episode 799 of the *PC Pro* Podcast. While I don't disagree with what he said, I feel he missed an important point: Windows' search functionality has been laughable for over 20 years.

Before getting involved in any of the deep complications that Jon mentions, Windows search could just do a better job at finding documents and applications stored locally. The current search offering in Windows is behind what Apple was doing two decades ago.

Gavin Hall

Cray crybaby

It was hard to read your retrospective of the Cray-1 supercomputer (*see issue 383, p123*). A few years ago I set up my own computer museum in my home office. I've got the original IBM PC 5150, the very first Apple Macintosh and tons of handhelds from Psion and other companies.

At that time, somebody offered me a Cray-1, but I had to turn it down as I had nowhere to put it. It's one of my biggest regrets to this day.

Mike Halsey

Android for the win

I enjoyed the "How cheap is too cheap?" feature (*see issue 383, p36*), but noted you specifically asked for feedback on Android tablets, so happy to oblige! I've used Android tablets for quite a few years, and now own a OnePlus Pad. I mainly use them for content consumption (YouTube, Plex, BBC iPlayer) as well as reading (PressReader, Kobo) and some web browsing and email. I've never had issues with any of these scenarios. I find Android works well and the battery life on the OnePlus Pad is superb. My uses of a tablet may be fairly mundane but I've certainly not come across any major app issues.

Alan J Robertson

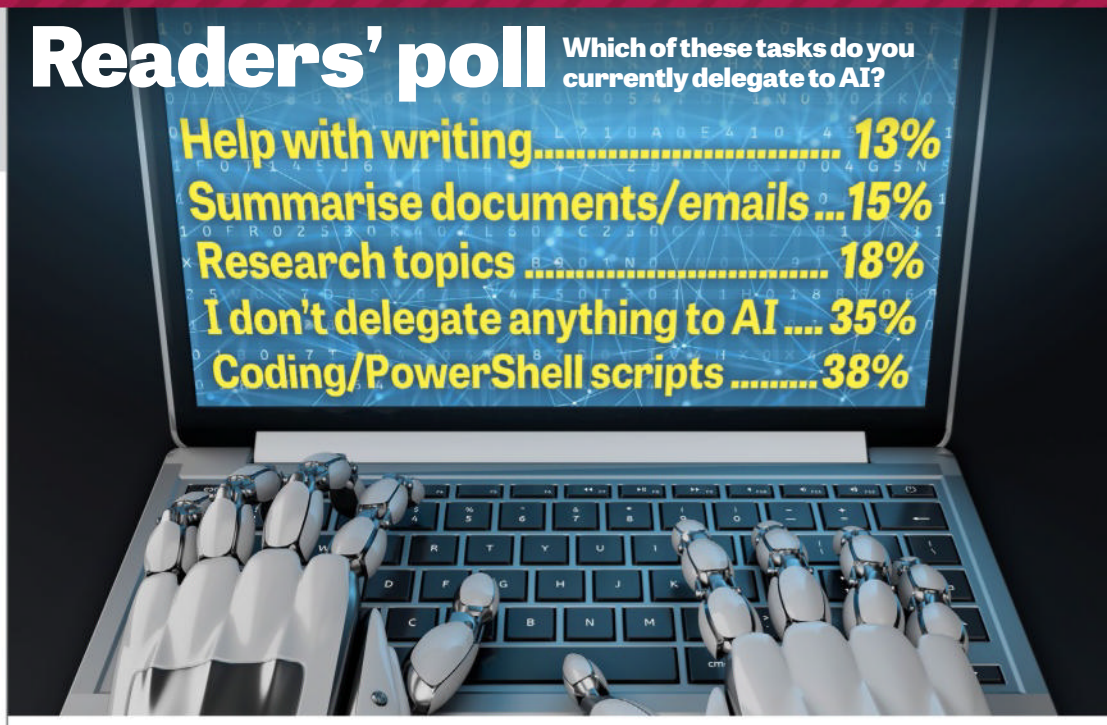
Alpine error

Although not a computer expert I have enjoyed reading your magazine for many years. My expertise is skiing, and note that Steve Cassidy's article referencing high-altitude clients (*see issue 384, p120*) shows a picture of the Dolomites near Val Gardena, Italy, not part of the Swiss Alps, which have equally spectacular mountains.

Chris Knowles

Readers' poll

Which of these tasks do you currently delegate to AI?



It turns out that we would need a huge list of topics to properly summarise how people use AI, as our readers have clearly embraced it for their individual needs. "My recent uses include getting AI to write code to tell me when portable air conditioners are in stock (answer: wait until the new year) and helping me debug why my CCTV monitor doesn't display camera live views (basically saving me from RTFM)," wrote Ian Powell, for example.

"I use Claude to access Strava and data analysis of my efforts," wrote Mike Gannon. "Now if there was an (easy) way to access my Garmin data through AI I would be a very happy bunny. The AI in both platforms is lousy and Claude is filling the gap."

Mike isn't the only one using Anthropic's AI. "Claude for writing code to get round numerous WordPress website funnies and requirements that don't necessitate a full-blown plugin," wrote Mark Robson. "ChatGPT for first drafting of blogs and articles to generate ideas and flow... of course article references need validating and checking, but saves major time doing the grunt work!"

Many people responded that they didn't use AI at all, including Tanya Taylor. "I don't delegate anything to AI. It's a long way off being trustworthy, and the environmental cost is way too high to use it for frivolity."

But to finish, we love John Hind's take. "I use AI to summarise verbose reports to bullet points so I have time to read them. The reports, of course, were created by AI padding out somebody's bullet points! So AI in effect is just inverse data compression!"

"Blogging, cos I can't write for toffee!" Kevin Price

"That's easy. Exactly NONE!" Eddie A Mihalow

"All of the above." Rob Lightbody

"I use Copilot to create posters to advertise events at work." Michael Oglesby

"Search tool on steroids." @rediffusion on Discord

"Recording patient telephone consultations and coding hospital correspondence." Peter Jones

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Join the Discord crowd for discussions and more at pcpro.link/discord

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MAKE AI AGENTS DO REAL WORK

CLAUDE AND CHATGPT HAVE FOCUSED THEIR AI ON GETTING REAL WORK DONE. BARRY COLLINS REVEALS HOW TO MAKE IT HAPPEN SAFELY

There's a huge change afoot in the AI world. Major apps such as ChatGPT and Claude are focusing less on being know-it-all chatbots, still prone to blurting out factual errors and outdated info, and more on undertaking tasks on your behalf.

The AI apps have been completely remodelled to focus on "work". What's more, they want to work directly with the files you've got stored on your computer: reading, manipulating and even creating files directly on your computer's storage. You tell the AI which files and folders you're happy to let it work with, what you want it to do with them, and watch (with slight trepidation) as it beavers away on your machine.

This so-called agentic AI can control your computer in other ways, too. For example, it can work in your web browser where it will fill out forms, perform research or complete tasks in web services on your behalf.

The AI services are becoming genuinely useful for everyday work, but it can be difficult to discern precisely what these AI agents are capable of and how they can save time on laborious tasks. This feature will give you real-world examples of how ChatGPT Work and Claude Cowork can be put to good use, how to deploy those agents safely, and how they can make a big difference to your daily grind.



MAKE AI AGENTS DO REAL WORK

HOW TO PUT THE APPS IN "WORK" MODE

Both the ChatGPT and Claude apps have seen big changes in recent months that put their "work" features front and centre.

ChatGPT used to have two separate desktops apps – the main ChatGPT app and Codex, where most of the work-like tasks were done – but they've since been merged into a single product. Now, when you open the newly combined ChatGPT desktop app, it has two modes: ChatGPT Work and Codex. Codex focuses on coding jobs, whereas ChatGPT Work can handle more of the agentic tasks, such as working with files stored on your computer. Everyday chats (for example, "Who is the CEO of Apple?") have been relegated to a link in the sidebar.

The distinction is cleaner in the Claude desktop app. It opens with a new prompt window, within which you can select either Chat or Cowork. Think of those two options as I want to know something (Chat) or I need to get something done (Cowork). Code is handled separately, in a different tab.

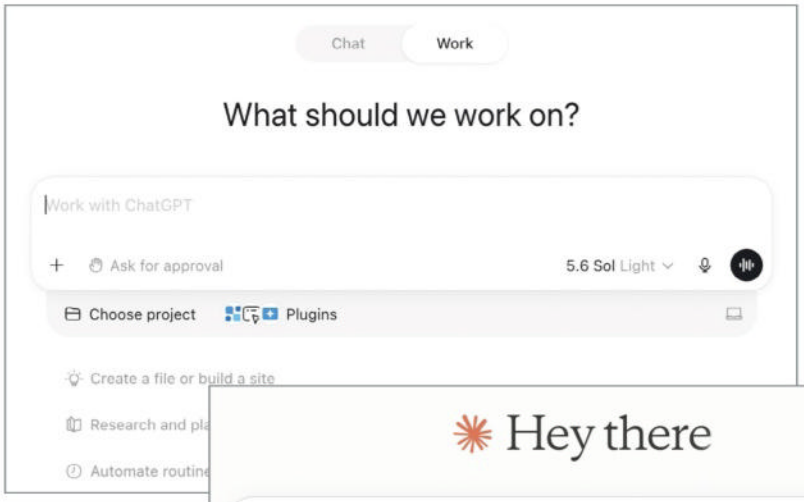
As you'll see from our box on security (*see p33*), we think it would be an act of utter folly to give the AI apps carte blanche to access and edit any folders on your computer. Your first step should be to point the app at whatever folder on your computer you want it to start working with.

WE THINK IT WOULD BE AN ACT OF UTTER FOLLY TO GIVE THE AI APPS CARTE BLANCHE TO ACCESS AND EDIT ANY FOLDERS ON YOUR COMPUTER

In the ChatGPT app, click the "Choose project" link above the prompt window. Then select "New project" and point ChatGPT at the folder containing the files you're happy for it to work with.

It's a similar process in Claude. Click the "Project or Folder" link beneath the prompt window, select "Choose a (different) folder" and select the folder you wish to work with. Claude also has granular permission controls for each job, so alongside that folder selector you'll see a dropdown menu that lets you select from three different permission levels: manually approve, automatically approve or skip all approvals. While you're starting out, the safest mode is manually approve, where Claude will seek permission every time it does something. When you've built up more trust you can move to automatically approve, where it seeks permission if it's doing something risky (such as writing to files).

Finally, before we get cracking with examples, you might want to consider only working on copies of files in a specific folder dedicated to AI jobs, rather than letting the AI loose on your work files. This way, if something goes wrong, the AI accidentally deletes or overwrites files, or screws up in any way, you've still got the original set of files intact.



ABOVE ChatGPT's opening screen now combines the main app and the Codex agent



BELOW Claude lets you select Chat or Cowork in its prompt window

ORGANISE FOLDERS

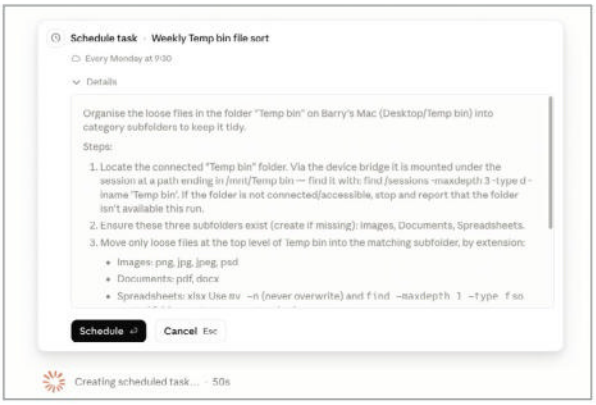
Let's start with a reasonably basic job for these tools: organising files and folders.

On our computer, we've got a folder of images and screenshots that have meaningless filenames such as SCR-2045405-memd.png, which makes them both difficult to search and to see what they contain when viewed as a file list. We're going to get ChatGPT Work to make the filenames more useful. We point the AI at the relevant folder and prompt it with:

Rename the images in this folder to reflect their contents



RIGHT Renaming image files in a folder is a simple task for AI



It takes ChatGPT 2mins 15secs to rename a folder of 13 images, to give you a sense of how long this process might take. It creates a "contact sheet" of all the images, "so I can identify them accurately before changing names", ChatGPT's thinking states, and then works through them one by one, zooming into text-heavy screenshots so it can label them more accurately.

The files are renamed with titles such as android-sim-settings.png and pc-pro-podcast-post.png (a screenshot of a social media post about the *PC Pro* Podcast), each of them accurately describing what's in the image.

Previously, we've used this technique to rename photos of runners in a marathon. We had a folder containing pictures of runners wearing race numbers, and that folder also included a list of the runners and their numbers. We asked ChatGPT to scan each photo, match the runner's number to their name on the list, and rename the files with the runner's name. It did so perfectly. You could do likewise with car registration plates, for example.

Elsewhere, we've got a folder on our computer desktop called "Temp bin", which is used to store images, documents and other files that we might need to refer back to. (It's basically a way of keeping the desktop clean of icons!) We want Claude to organise that messy folder of dozens of files into neater sub-folders, so we prompt Claude Cowork with:

ABOVE Claude organised a messy folder of various files in seconds

WE ASKED CHATGPT TO SCAN EACH PHOTO, MATCH THE RUNNER'S NUMBER TO THEIR NAME ON THE LIST, AND RENAME THE FILES WITH THE RUNNER'S NAME. IT DID SO PERFECTLY

REMOTE-CONTROL YOUR AGENTS

The jobs that the agents do when working on your computer can often take ten minutes or more to complete. What if you need to leave your desk before the job's complete? Not a problem, you can use the smartphone apps to control your agents and monitor their work remotely.

In Claude, this feature is called Dispatch and has to be switched on in both the mobile and desktop app settings. Once it is, if you click on the Cowork link in the left-hand menu you'll see a list of recent jobs you've run. You can click on those to read the latest update from the AI on a job or issue new commands. For example, in the mobile app, we ask Claude to update the property report we created earlier:

Can you research socio-demographic data for the five different property areas in the original document and add that to the file?

Claude does the research (requiring us to give permission for it to access lots of websites while doing so) and then updates the report – stored on our computer, don't forget – when it's finished. We can either read the report from our phone or wait until we're back at our desk.

ChatGPT has a similar feature, called Remote. You'll need to activate this in settings, and you can even let ChatGPT remotely control any apps on your computer, although we'd strongly advise against this (*see "Secure your agents" on p33*).

As we explain on p32, when ChatGPT produced a Mailchimp newsletter for us, it saved that newsletter in draft and awaited permission from us to send. From our phone, we could access the draft in the Mailchimp app, ask ChatGPT to make any changes necessary remotely, and then either press Send ourselves or ask ChatGPT to do it.

Note that for both these remote apps to work, your PC/Mac will need to be left on. The apps can't wake a computer from sleep.

Catchment and socio-demographics

The five properties sit in three very different catchments. The headline comparison:

Area	Population	Median age	Affluence indicators	Visitor economy
Brighton & Hove (Ditchling Rd, Elm Grove, Church St)	277,103 city-wide (2021 Census)	38	Median salary ~£39k; ~33% private renting (highest outside London); ~34,000 students across two universities	12.2m visits in 2024; £979m direct visitor spend
Lewes (Cliffe High St)	~17,300 town (2011); ~99,900 district (2021)	48 (district)	Avg town sold price ~£522k; 45% of local adults in managerial/professional work; 52% degree-educated	4.46m district visitor trips (2023); 2.6m station entries/exits 2024/25; Bonfire Night ~40,000
Chichester (North St)	31,729 city (2021); 124,100 district	48 (district)	Avg district house price £427k (Apr 2026) — highest of the three; 27% aged 65+	5.04m district trips, £317m direct spend (2022); Festival Theatre 348k+ tickets 2024/25; retail catchment ~407,000

Brighton is the youngest and most transient catchment of the three: a median age of 38, more than a quarter of residents aged 18–34, around a third of households privately renting (the highest share outside London) and some 34,000 students between the two universities. Within the city, though, the three sites differ markedly. The Ditchling Road property sits in Round Hill, a settled, comparatively prosperous neighbourhood (in the less-deprived third of England on the 2025 deprivation indices) with a heavily 20–39 resident profile. Elm Grove is grittier: its immediate area

ABOVE We set Claude to work remotely on this task using the mobile app

Can you organise the files in this folder into relevant folders (such as images, documents etc) to make it easier to navigate? Don't touch existing folders within Temp bin.

Within a minute, it had reorganised the folder, creating sub-folders for images, documents and spreadsheets. It left any existing folders untouched, as requested.

Of course, this is a one-off action. Any new files added to that folder will remain unfiled, but we can create a scheduled task so that the AI tidies up our Temp bin every day or week, for example:

Can you create a scheduled task to run this process every Monday at 8.30am?

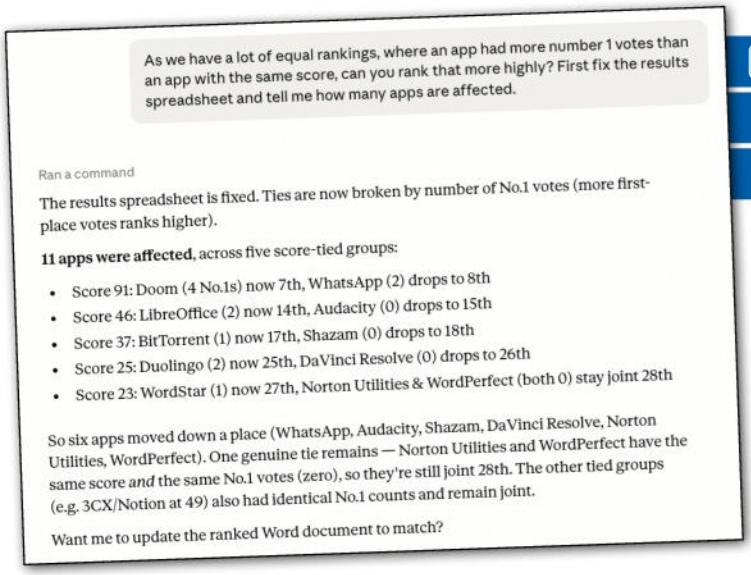
That's created, with the same stipulation that files already in folders aren't touched, but that new pictures will be shuffled into the images folder, for instance. This is all laid out in instructions that we have an opportunity to edit before we approve them and create the scheduled task. It will run at that time every Monday morning, provided the laptop is switched on.

WORK ACROSS MULTIPLE FILES IN A FOLDER

The example we're going to show you here is how we used Claude Cowork to help us with our recent "The best 50 apps ever" feature (*see issue 384, p26*). Of course, unless you're planning to set up a rival magazine (we don't advise it), you're never going to use AI for precisely this purpose. But it's a really good example of the ways in which you can use Cowork/Claude Work to generate files on your computer and work with multiple different files in a folder.



MAKE AI AGENTS DO REAL WORK



CLAUDE DID AS IT WAS ASKED, DILIGENTLY CALCULATING THE FINAL SCORES FOR EACH APP AND PUTTING THE LEADER-BOARD IN A SEPARATE SHEET IN THE SAME WORKBOOK

You may recall that this feature required a dollop of reader interaction. We ran a live podcast involving readers in which we narrowed down our 100+ apps longlist to the final 50, and then we asked readers to vote for their favourite apps in that top 50 to decide the final order.

The reader poll was created using Google Forms, the results from which were squirted into a Google Sheet. We exported that sheet and saved it locally in a folder containing other files related to the feature, such as a list of the top 50 apps and the copy for the feature (which was all written by humans, for the avoidance of doubt).

First, we wanted Claude to help us calculate the order of the top 50, so in Cowork we pointed it at the folder and asked:

In this folder, you'll find a spreadsheet that contains all the votes for PC Pro*'s top 50 apps of all time poll. Participants were allowed to rank up to ten apps, in order of preference. Can you total up the scores for each app, awarding 10 points for the app that was a person's first preference, down to 1 point for a tenth preference. Total these scores in a separate sheet in the same workbook.*

ABOVE Claude anticipated our next move when we asked it to rate the top 50 apps

Claude did as it was asked, diligently calculating the final scores for each app and putting the leaderboard in a separate sheet in the same workbook. We manually checked a sample of the calculations to make sure Claude hadn't screwed up the maths, but all was fine. Previously, we'd probably have spent ten minutes writing Excel formulae to do those calculations; now we could get the job done in a fraction of the time.

There was a slight issue, though. Two of the apps didn't get any votes at all, and so they didn't appear on the leaderboard. We could manually go through and find them (and it probably wouldn't have taken much longer), but here was a chance for Claude to show how it can work across multiple files in a folder:

In the folder you'll see a file called 'top 50 apps alphabetical'. Find the two apps that didn't get any votes and add them to the bottom of the results sheet in joint 49th place.

Claude located the two missing apps and added them to the leaderboard spreadsheet in less than ten seconds.

Before the results were in, we'd largely written the mini-profiles of the 50 different apps for the feature, but the apps now needed to be put in the correct order. Previously, that would have been a tedious cut-and-paste job, now it was made much simpler.

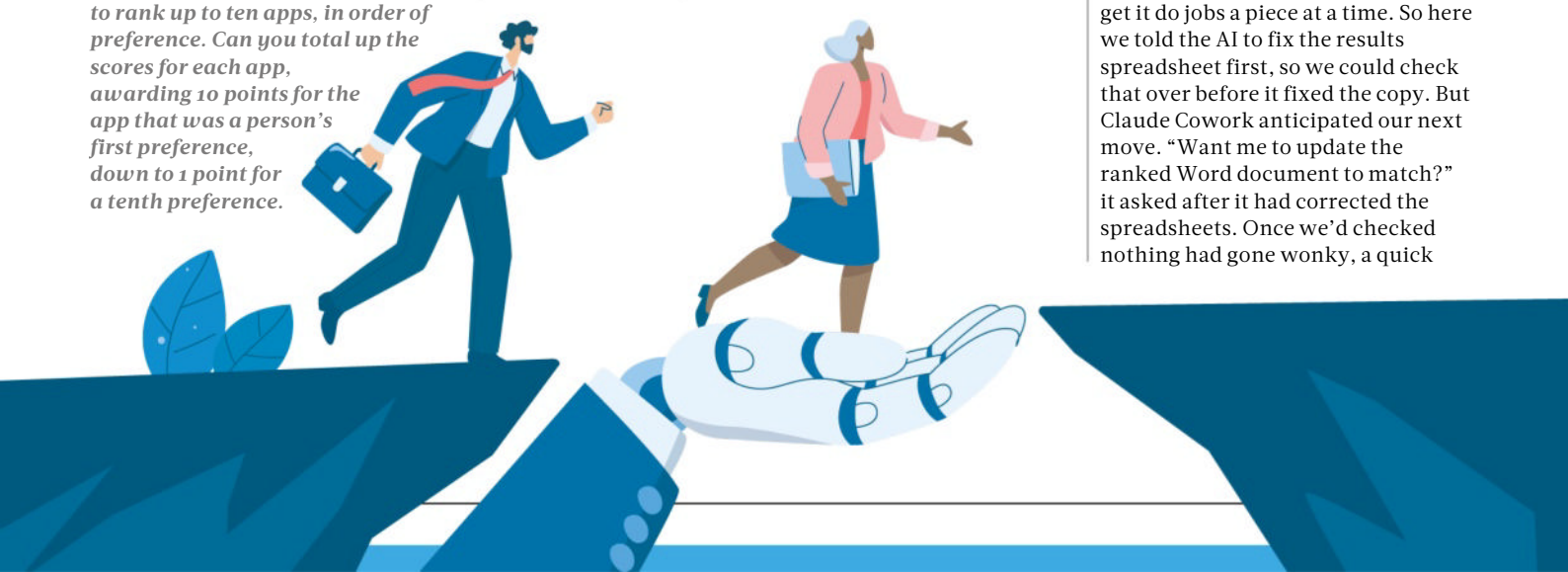
In that folder, you should see a Word doc called '384 Features Best 50 apps'. That is all the copy for the feature, but it's in alphabetical order by the name of the app.

I want you to take the rankings in the spreadsheet created above and put the copy in order of ranking. So Excel should be first, Word second etc. Ahead of each app's title, I want you to put its position in the chart, ie, (1. Excel).

Cowork fixed the copy in less than a minute, wiping a tedious, time-consuming job off our to-do list. Once we started checking over the copy to make sure Claude hadn't bodged the job, we noticed that we had a lot of apps that were tied on the same scores, which didn't make for a very satisfactory chart, so we asked the AI:

As we have a lot of equal rankings, where an app had more number 1 votes than an app with the same score, can you rank that more highly? First fix the results spreadsheet and tell me how many apps are affected.

It's always good practice with AI to get it do jobs a piece at a time. So here we told the AI to fix the results spreadsheet first, so we could check that over before it fixed the copy. But Claude Cowork anticipated our next move. "Want me to update the ranked Word document to match?" it asked after it had corrected the spreadsheets. Once we'd checked nothing had gone wonky, a quick



RETAIL PROPERTY COMPARISON

Five freehold high street opportunities in Sussex

Prepared for Barry Collins | 21 July 2026

This report compares five freehold retail properties currently on the market, based on the agents' brochures (Flude, Jacobs Steel and Stride & Son) supplemented with checks against current government guidance on business rates and energy-efficiency rules. All figures should be verified before any offer — in particular, three of the brochures quote rateable values from superseded rating lists (see the business rates section).

At a glance

Property	Guide price	Retail area	Income / ERV (pa)	Gross yield	Rateable value & est. rates 2026/27*	EPC
132 Ditchling Road Brighton BN1 4SG	£85,000	328 sq ft	Not stated (sold subject to existing leases)	n/k	RV £3,650 (2026 list) Nil with SBRR; ~£1,395 without	B (48)
135 Elm Grove Brighton BN2 3ES	£160,000	487 sq ft	£10,000 (let to office occupier)	6.3%	RV £4,650 (2023 list) Nil with SBRR	E (111)
22 Cliffe High Street Lewes BN7 2AH	£375,000	680 sq ft	£20,000 (let to Oxfam) ERV £30,000	5.3% now 8.0% at ERV	RV £20,250 (2023 list) ~£7,700 at RHL multiplier (no SBRR)	C (58)

Investment Ranking

Rank	Property	Why it ranks here	Main risk	Score
1	22 Cliffe High Street Lewes, BN7 2AH	Best all-round investment case if the Oxfam lease position is clean and the ERV uplift is achievable.	Lease may now be close to expiry or holding over, so tenant intentions and repairing obligations matter.	4.4 / 5
2	36 Church Street Brighton, BN1 1RL	Best pure trading-location play; attractive for an owner-occupier or investor confident of rapid letting.	No current income, so underwriting depends on lease-up period, fit-out, incentives and vacant holding costs.	4.0 / 5
3	46 North Street Chichester, PO19 1NF	High-quality town-centre pitch with useful upper-floor flexibility, but it needs a rent valuation before ranking higher.	Brochure does not provide ERV, formal floor area, lease evidence, or planning status for upper-floor alternatives.	3.8 / 5
4	135 Elm Grove Brighton, BN2 3ES	Reasonable income relative to price, with possible reversionary value from the short lower-ground flat lease.	Weakest EPC position; office use may not capture retail footfall, and VAT is applicable per brochure.	3.3 / 5
5	132 Ditchling Road Brighton, BN1 4SG	Cheapest entry price and best EPC, but the missing lease/rent data makes it a due-diligence case rather than a frontrunner.	Price looks attractive only if lease terms, residential title structure and actual rents support the investment case.	2.9 / 5

confirmation prompt was all we needed to complete the job.

Again, this is a workflow that you're never going to use. But everyone's workflows are different. This example illustrates how you can get the AI to work across multiple files in the same folder, and even keep them all in sync when changes are made.

CREATE COMBINED REPORTS

Both Claude Cowork and ChatGPT Work are very good at taking a selection of documents you've got stored on your computer and turning them into something new.

ABOVE Both Claude and ChatGPT were able to combine multiple reports

For example, we've downloaded a selection of estate agent brochures for high street retail properties to our computer. We pointed both ChatGPT and Claude at the folders and then entered the following prompt:

In this folder, you'll find brochures for five retail properties my company is considering buying. Create a new document comparing the five properties, including desirability of location, potential rental income, business rates, EPC, and anything else of relevance to a high street retail business.

CHATGPT PRODUCED A SIMILAR REPORT, ALTHOUGH IT TOOK IT UPON ITSELF TO RATE THE VARIOUS PROPERTIES, WHICH WE DIDN'T REALLY ASK FOR

Claude Cowork asked a couple of follow-up questions, including which format we'd like the document to be in and, crucially, whether it should supplement the information stored in the brochures with other relevant information it can gather online. That underlines an important point: Cowork/Work modes aren't restricted to using information they can find on your computer; they can still conduct online research to improve output.

Claude produced a smart document that leads with an "at-a-glance" comparison table that lists the various properties, their guide price, retail area, rateable value and other useful information, before diving into detail on each of those categories. The benefits of letting Claude access the internet for extra research are evident, because it points out that the business rates regime changed in April 2026, meaning some of the info in the brochures is outdated, and that the rates are actually lower than stated in several of the brochures – although (as Claude itself advises) that's information you're going to want to double-check for yourself.

ChatGPT produced a similar report, although it took it upon itself to rate the various properties and give advice on which to purchase, which we didn't really ask for. It too used online research to discover the rates information is outdated, although it did make a mistake in the descriptions of one of the properties, confusing a high score on the Energy Performance Certificate (EPC), with being the "best", when it's actually the reverse. It did get it correct elsewhere in the document, but it's a reminder that AI can still make daft errors.

Another key thing to note here is that both created the new document in the existing folder on our computer. We're not going to have to search through hundreds of past chats to locate the document in a week's time as it's stored on our computer, in the same folder as the property brochures.



MAKE AI AGENTS DO REAL WORK

Other examples of how you could use the AI services to combine documents is turning weekly or monthly reports from your teams and departments into a single report, or merging financial information from different subsidiaries or departments into a consolidated spreadsheet.

CREATE SKILLS FOR REPEATABLE TASKS

Let's say we're constantly looking at retail properties to acquire, as in the example above. If we're going to ask the AI to run the same process on future sets of brochures, we ideally don't want to be entering the same prompt time and again. Also, if we'd corrected or refined any of the processes when we first ran the prompt, such as correcting ChatGPT's arbitrary decision to rate the properties for us, we don't want to have to make the same corrections every time.

Both Claude and ChatGPT have an identically named solution for this: skills. These can be thought of as prompt macros, allowing you to save a set of instructions and run them again in the future.

At the end of our conversations with Claude/ChatGPT about the property reports created above, we asked:

Can you create a skill to repeat this task in future?

Claude asked us a few follow-up questions, such as whether we wanted to use the same skill for other types of commercial property, not only retail, while ChatGPT just got on with the job.

When they were done, both delivered a document in markdown language that outlined the process they'll repeat the next time we run the task. Claude even showed that it had learned from the online research it did during the first run, so that mistakes aren't made on subsequent runs. For example, on business rates its skill document notes: "Business rates multipliers for the current billing year in the relevant nation (England has had multiple multipliers since April 2026, including lower retail/hospitality/leisure ones – a shop and an office with the same RV pay different amounts). Search e.g. 'business rates multipliers <year>' and prefer gov.uk or a local-authority page."

You can read through the skills markdown documents and ask Claude/ChatGPT to correct anything, before saving the skill.

The next time you want to run the process, you just select the relevant folder on your computer and type the backslash (/) followed by the name of the skill. Both Claude and ChatGPT auto-complete skill names, so when we type "/pro" our /property-comparison skill appears in the pop-up menu, ready for selection.

Compare UK commercial property particulars (brochure PDFs) and produce a professional Word comparison report covering location desirability, income and yield, business rates, EPC/MEES position, and deal-specific risks. Use this whenever Barry provides two or more property brochures, particulars, or listings — retail, office, industrial or mixed-use — and wants them compared, appraised, ranked, or summarised for a purchase or letting decision. Trigger it even for loose phrasings like 'which of these should we buy', 'look at these properties', 'compare these units', 'summarise the brochures in this folder', or when a folder of agent PDFs is connected and a comparison or shortlist is implied. Do NOT use for residential house-hunting or for Sussex property-market news roundups.

UK Commercial Property Comparison

Turn a set of agents' brochures into one decision-ready Word report. The value of the report comes from three things the brochures alone don't give: figures verified against *current* rules (brochures routinely quote stale rates regimes), cross-property comparison on a like-for-like basis, and a clear-eyed list of what each brochure *doesn't* say.

Workflow

1. Gather and extract

Locate the brochure PDFs (connected folder, attachments, or ask). Extract text with `pdftotext -layout` per file. If a PDF yields little or no text it is image-based — render pages (`pdftoppm -jpeg -r 150`) and read them visually.

Ask (or infer from context) the buyer's intent before analysing: owner-occupation, investment, or both changes which properties look attractive. If unstated and the user is present, ask; if unattended, cover both angles.

For each property, capture: address and postcode; asking price/guide and tenure; floor areas (note the basis: NIA/GIA/ITZA if given); current rent and/or ERV, tenant identity, lease start/length and break/expiry dates; rateable value **and which rating list it comes from**; EPC band and numeric score; use class; VAT status; anything sold off (flats on long leases), conversion angles (STP/STNC), and the brochure date and agent.

ABOVE Claude and ChatGPT both use "skills" to repeat tasks in future



YOU CAN SEE WHAT THE AI SERVICES ARE DOING IN YOUR OPEN BROWSER WINDOW, AND IT'S QUITE MESMERISING TO WATCH

THE BROWSER AGENTS

Aside from accessing files on your computer, both Claude and ChatGPT can take direct control of the Chrome browser via their extensions. This obviously ratchets up the risk profile even further, not least if Chrome is your default browser and it's logged into services. However, both Claude and Chrome are cautious when it comes to prodding around in the web browser, generally seeking the user's permission before they do anything that could have consequences.

To give you an example, we asked both services to create a newsletter for us using the Mailchimp service, which we'd already logged into and had open in a browser tab. We used the following prompt for both:

Can you create a Mailchimp newsletter promoting the Lewes FC Supporters Club Super Summer Raffle, details on this link: [link was provided here].

You can see what the AI services are doing in your open browser window, and it's quite mesmerising to watch. ChatGPT scanned details of the raffle from the link, then used the option to create a new newsletter in Mailchimp. Although the option to use a previous newsletter's template was available on screen, ChatGPT decided to write its own HTML template – which was fine, but not in keeping with our previous house style.

When it had finished we asked ChatGPT to change the design to reflect that of previous newsletters, and it set about doing this the right way (opening a previous campaign and duplicating the design), but it seemed to get snagged by a Mailchimp survey pop-up that prevented it editing the content. At the third attempt, it actually completed the newsletter in our

SECURE YOUR AGENTS: STAYING SAFE WITH AI

Letting AI amend files or folders on your computer is doubtless risky. Although both Claude and ChatGPT are pretty good at sandboxing their agents, only allowing them to work in specific folders, that depends on you applying the right security settings.

Claude is more tightly controlled than ChatGPT. You can only use Cowork in the folders specified in prompts, although you can stipulate that certain folders are "trusted Cowork folders", meaning you won't be prompted for permission when Claude wants to run a job in those. To check if you've (accidentally) given a folder trusted status, open the Claude desktop's app settings, click Cowork and select "Manage alongside Trusted Cowork folders" to check the list of trusted folders.

As stated previously, it's a good idea to set up folders that are specifically designated for running AI jobs, rather than running those tasks on your regular work folders, in case something goes wrong. Make copies of files and stick them in the AI folder, so that you've always got the original files to fall back on if something does go awry.

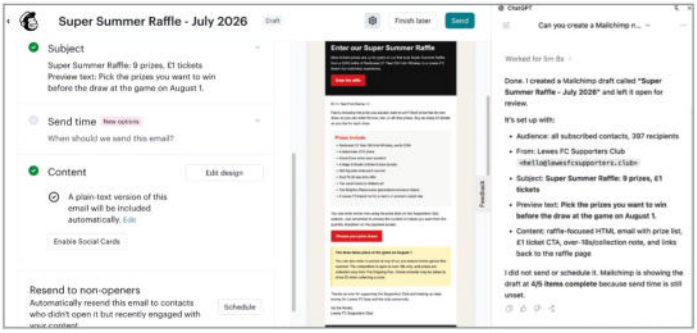
ChatGPT gives you the potential to let the AI run wild on your computer, and that's not something we'd recommend. In the ChatGPT app settings, under the General tab, there are three permissions levels. The default is sensibly set to "ChatGPT can read and edit files in its workspace" and "ask for additional access when needed". However, there's also a Full access option that means ChatGPT can "edit any file on your computer and run commands with network [sic], without your approval". To be fair, ChatGPT warns that this setting "significantly increases the risk of data loss, leaks or unexpected behaviour", so if you're still foolhardy enough to let the AI do as it pleases, you can't say you weren't warned about the consequences. You might want to double-check these settings from time to time, to ensure permissions haven't shifted.

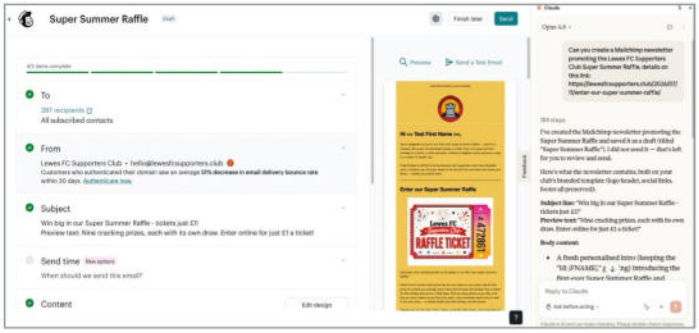


ABOVE ChatGPT designed a magazine cover in InDesign without any help

Under the Computer Use settings, ChatGPT also provides an "Any App" setting that "lets ChatGPT control apps on your computer". It means what it says. When we temporarily enabled this setting, we were able to use ChatGPT to open and control Spotify, the Apple App Store and even apps such as InDesign: we sat slack-jawed, as ChatGPT used InDesign to create a fashion magazine cover that we asked for.

To be fair, ChatGPT asked for permission before opening any app on our computer, and macOS also sought permission before ChatGPT was allowed to control each app, but this setting strikes us as too potentially dangerous to leave on permanently. Maybe switch this setting on temporarily if you want to experiment with using ChatGPT in a specific app, but switch it off again after use.





house style, and also did all the housekeeping jobs such as changing the subject line, choosing the senders list and so on. Crucially, it didn't send the newsletter – it deliberately left it in draft for us to review before sending to subscribers.

It wasn't a bad effort: there were a few formatting things we'd tweak and the copy was a bit wooden, but it would take a few minutes to fix.

Claude was better. It took the option to use a previous template, made a better fist of the formatting and created a very presentable newsletter at the first time of asking.

ABOVE **The AI agents did a pretty good job producing our newsletter**

There was the odd glitch and thing we'd change, but nothing major. It even read the previous newsletter and kept in a part of the content that listed pre-season games, because you could enter the raffle at those games, which is very smart. Again, Claude did all the form-filling on subject lines, send times and so on but didn't press the send button, leaving it in draft for us to review.

CRUCIALLY, CHATGPT DIDN'T SEND THE NEWSLETTER – IT DELIBERATELY LEFT IT IN DRAFT FOR US TO REVIEW BEFORE SENDING TO SUBSCRIBERS

This is a good example of how the AI bots can perform sophisticated web-based jobs without much supervision. You could use them to fill in web forms with data stored in documents/spreadsheets; to perform tasks such as filling in booking forms; or to do sophisticated searches that require lots of filtering and drop-down menus, such as finding cars or flights that meet a specific criteria on comparison sites.



PRESERVING THE PALACE PIXEL BY PIXEL

Phil Muncaster meets the team that has built a digital twin of 300-year-old Blenheim Palace to save it for generations to come

Crumbling masonry, invasive lichen, corroded iron: all things you might expect to find at Blenheim Palace, which was built more than 300 years ago. What you might not expect to encounter is a head of innovation. Yet David Green and his team are taking a surprisingly digital-first approach to preserving the country house where Winston Churchill was born.

With a background in business analytics, Green has spent years using data to improve operations, increase revenue and make the palace more welcoming for visitors. But his biggest challenge has been to preserve the UNESCO World Heritage site from time's inexorable advance. The Blenheim Palace Heritage Foundation, which owns and manages the 12,000-acre estate in rural Oxfordshire, spends millions on its upkeep. Green's task was to find a way to lower these costs through more efficient use of the decades of data at his team's disposal.

"Visitor income makes a small profit, but not enough to cover the cost of restoration and conservation, so we have to think smart," he told *PC Pro*.

The answer was to develop a digital twin in collaboration with researchers from Oxford University and Bentley Systems' Cesium business. The project is already saving significant sums and accelerating the palace's net zero journey. It's a template that Green hopes could help to transform heritage sites around the globe.

DROWNING IN DATA

Green has been with the foundation for more than a decade. During that time, he's helped to build data lakes for live reporting and develop an AI-powered visitor-management system. This involved the rollout of IoT technology to generate real-time information on footfall.

"Alongside that and all of this data, I thought 'how can this be applied to the other key challenges?'" he explained. "When we started looking at the building itself – and the bits that are deteriorating – we really wanted to get a granular understanding of the physical asset, the built heritage."

There was a hard-nosed financial calculation behind these efforts. Blenheim Palace spends £4m a year on restoration and conservation and has just completed a £12m roof project, while annual energy costs reach around £650,000. To help fund the preservation of the building for future generations, amid the ravages of climate change, Green understood the need to trim these "huge costs".



BELOW David Green hopes the project will serve as a template for heritage sites around the world

The challenge was making sense of all the data being generated by more than 30 platforms and 600 IoT sensors at the site, as well as useful information from historical surveys hidden in the archives. Green wasn't impressed by much of what he saw on the market. "You've got photogrammetry to stitch 3D models together, but really all you end up



with is a whizzy model," he said. "It doesn't add any value. What we wanted to do is combine the physical and the digital together to have a single source of the truth. It wasn't about having tech for tech's sake."

Green tried a variety of IoT platforms for viewing sensor data, and apps such as Nira for viewing 3D assets. But most tied data back to the sensor, not the location. "This is never a good idea, because sensors can be moved or break," he said. "Our concept was to link data to the location. Context is so important."

Eventually, a decision was made to build a bespoke platform; one that would also stand a good chance of getting buy-in from the architects and built heritage experts Green and his team were working with. "We just didn't have enough information to bring together to make any smart decisions. So that led us to saying, building our own is the only way forward," said Green. "That way, you're not taking a platform that's shoehorning heritage into it. We don't change the architectural model. We use [the architects'] naming conventions. And we build the platform to support all of those things."

With help from the Heritage Innovation Laboratory Oxford (HILO) and Oxford Brookes University, the team started by creating a building model in Autodesk Revit comprising more than 14,000 individual elements. Next came Cesium's 3D Geospatial Platform, chosen for its open standards (3D Tiles) and performance.

"We take your data, such as David's very complex and heavy design model out of Revit, and we give users like him the ability to stream that performantly into a browser or runtime engine with all of the surrounding contexts, such as geospatial context and IoT context," Cesium's head of business development, Alex Paulson, told *PC Pro*. "This gives users a comprehensive twin that enables them to essentially take action."

ABOVE The digital model of the palace was built using Autodesk Revit

USERS SIMPLY CLICK A PART OF THE PALACE TO VIEW SENSOR READINGS AND RISK LEVELS

The digital twin provides a single place where the conservation, built-heritage, maintenance and estate, and innovation teams can see the condition of the building in context. Users simply click a part of the palace to view sensor readings, risk levels, material types and what's been repaired before.

A key part of this context is provided by historical data extracted from archived documents by AI. "It was about taking old documents and using AI to process those documents using 'document intelligence'," said Green. "This effectively strips out key components of the document – mentions of risk, delamination, priority of works and so on. If we go back 100 years, we didn't have reference codes. So, what we do through AI is extract the information and then apply it to the model."

From a day-to-day perspective, IoT sensors feed automated alerts, so when environmental thresholds such as temperature, humidity and CO_2 are breached, teams can respond proactively before damage sets in. Regularly conducted conditional surveys, master plan surveys and ad hoc surveys are used to keep the model up to date.

"For us, it's very much about a good application of 3D technology," said Green. "Where it really comes into its own is when you want to report things like stone failure or you want to see the condition of sections of the building down to very small granular detail. You simply can't do that in a 2D environment. It also replaces hunting through multiple platforms and folders, which is a big day-to-day win."

FAILING STONE

The project wouldn't have been possible without the input of Oxford University's HILO team, which has worked with Blenheim Palace for four years. The partnership began with a series of "demonstration-scaled projects" focused on aspects of stone failure in the fabric of the building.

"One was focused on lichenology: thinking about whether or not lichen is particularly destructive to the stone and whether it could be an indicator of stone health," explained project manager Sterling Mackinnon. "Another considered the corrosion of the embedded iron cramps. These are very much the bones of the building. When moisture gets inside the building and corrodes that embedded iron, it swells up to unbelievable sizes and causes fracturing. This is a health and safety concern and an expense for conservation efforts."

A final project involved the HILO team combining data from these initiatives with centuries of restoration history in a single relational database "that could then lead to predictive solutions for problems like stone failure". Together, this information forms a critical layer of intelligence which users can drill down into via the digital twin – whether it's parts of the building flagged as high-risk for corrosion-driven failure, or early-warning signals related to lichen species.

"HILO's research gives the twin its 'why does stone fail here?' intelligence – it's not just a 3D shell, it's grounded in real heritage science," Green explained. "And the team's archive digitisation programme is exactly the historical maintenance record now tied into the model."

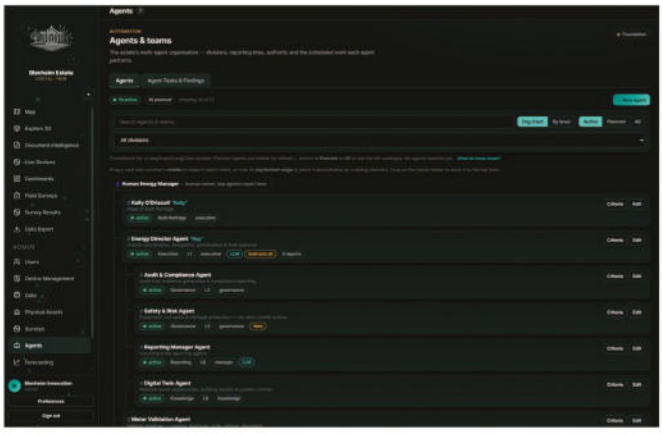
Automated IoT-based alerting, and the detailed information consolidated in the twin, ensures teams can be more proactive about maintenance, too. "Instead of reacting to visible stone fall, a team can filter the model by 'most urgent restoration needs from the latest risk assessment' and plan work around genuine priorities," said Green. He claimed that this approach should reduce restoration costs by up to 10%.

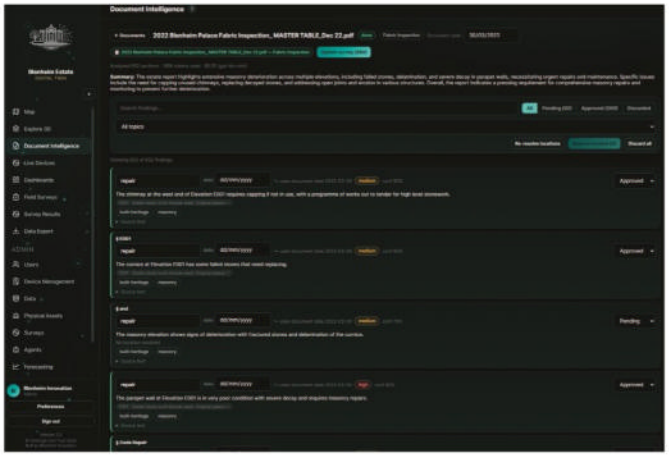
The digital twin also saves heritage and other teams countless hours that would otherwise be spent trawling through the archives for restoration reports. "Many of the current savings in time and money come from access to the 3D model, the ability to share the model externally and to extract data from documents and automatically apply them to the model," said Green. "We expect the digital twin to increase savings over time as we start to understand the building even more."

However, it wasn't the maintenance costs that convinced the Blenheim bosses to make the investment in the twin technology, but the energy savings. "I put my

ABOVE Data is collected from over 30 platforms and 600 IoT sensors at the site

BELOW AI agents monitor the data generated by the building's systems





hand up and said, 'I'll save you 20% of energy [consumption] with the digital twin," said Green. "And that's what we're doing across the board."

In some parts of the estate the figure is more like 46%, he added. But how does this work in practice? "The twin gives a precise, real-time view of energy use tied to the actual building and wider estate, so we can spot inefficiencies and optimise systems through smart controllers rather than running things on blanket schedules," Green explained.

"We also use predictive analytics to predict what energy we should be using right now and alert to deviations. Practically, that means tuning heating, ventilation and building systems to real occupancy and conditions instead of fixed timers. No comfort or conservation trade-off, just cutting waste."

This has been made possible in part thanks to AI agents. These autonomously monitor the information generated by building systems to change the set point of the boilers and adjust other key settings. Predictive simulations are an important part of this process, because sensors are fallible, Green explained.

"We're looking at patterns of similar days, and what's likely to happen in the future," he continued. "As the sun comes around the north-east corner or south corner, we know it's going to increase the room temperature in a particular spot. But the building management system isn't going to do anything because the sensor's hidden behind a curtain."

From such seemingly mundane measurements and prosaic decisions, the palace team is incrementally edging towards net zero. Blenheim is targeting carbon net zero by 2027, and the twin is helping in that journey "because you can't optimise what you can't measure", Green said.

"Our results from the Estate Office showed the approach works, and the task now is scaling it across the estate," he added. "True net zero is of course about making as many reductions as you can. On scopes 1-3, energy is a small amount of carbon compared to visitor travel, but still a necessary focus area for us."

DRONE WELFARE

It seems like the Blenheim Palace team is only just getting started. Drone-based field surveys are the next big step. The plan is to send up a drone every day or week to scan the building and take photogrammetry, from which it will keep the digital twin up to date. Teams will then compare images between new and old surveys and prioritise jobs accordingly.

Also on the roadmap is improving the granularity of the twin, to grow from 50,000 elements to as many as 100,000. "This will enable us to go deeper into architectural detail and down to interior household items – tapestries, furniture, plants, etc – so the twin captures the collections and more of the infrastructure, not just the shell," Green said.

Predictive maintenance is another project that will continue to gather speed. "Our machine-learning models will be trained to spot patterns in stonefall, water ingress and exfoliation, moving us toward genuinely predicting failures before they happen," he added.

Green's passion for the project is partly guided by the fact there are no second chances here. You can't rip it up and move on if it doesn't work. "My job and everyone else's is to leave the palace in a better state than we found it," he said. "We're not going to sell this building and move to another country, or move to London and reduce our costs. It's going to be here. Our job is to learn as much about the building to conserve it for future generations."

MY JOB AND EVERYONE ELSE'S IS TO LEAVE THE PALACE IN A BETTER STATE THAN WE FOUND IT

However, there is a bigger picture too. "It's very unusual in heritage context to have this, but what it's allowed us to do is build a product," said Green. "And with digital twin, our latest version is something that is 'commercialisable'. With the help of Cesium, I think we can take this to other heritage sites. We can share and protect and improve more buildings around the world in the future. That to me is the most exciting part of all of the stuff we're doing."

Blenheim Palace has survived some remarkable threats over the past few hundred years. It's emerged unscathed through two world wars and multiple funding crises that imperilled the maintenance of the vast estate. The hope is that, with the help of technology, it will survive the most cataclysmic disaster of all: climate change. And maybe help a few other heritage sites do so too.

WINNING WITH TWINS

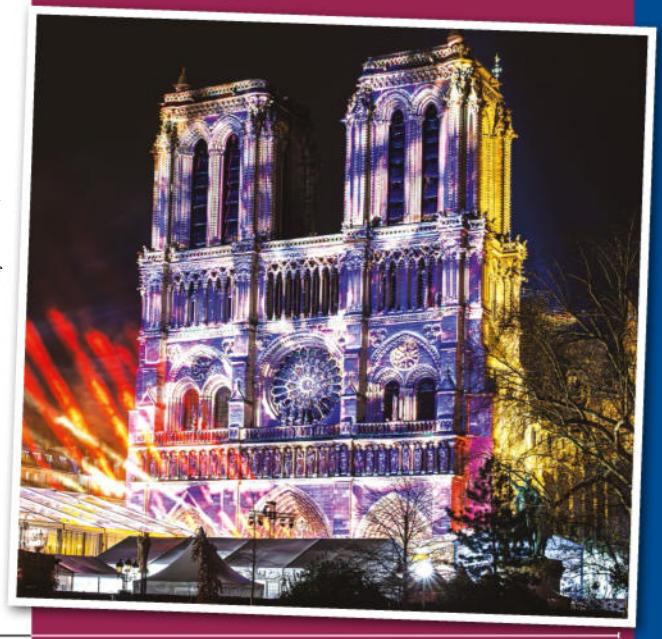
Digital twins are found in industries as diverse as manufacturing, healthcare and utilities. But even within the heritage sector, Blenheim Palace is by no means the only grand old building to benefit from digital innovation. There are plenty of other emerging success stories.

Notre-Dame Cathedral was restored after the devastating 2019 fire in part thanks to a digital twin project. Autodesk's BIM software and Dassault Systèmes 3DExperience platform built a virtual reconstruction of the building, using 3D laser scans taken by architectural historian Andrew Tallon almost a decade earlier. New laser scans enabled teams to survey the extent of the damage, and the digital twin helped by stress-testing the proposed works under various virtual conditions. It provided plans from which more than 1,000 artisans and builders were subsequently able to reconstruct the fire-damaged cathedral.

Nvidia, the Municipality of Bologna, the University of Bologna and CINECA came together in 2023 after experts labelled the Italian city's iconic leaning Garisenda Tower at "high risk" of collapse. The digital twin they developed processes data from over 100 physical sensors in the tower for real-time monitoring. Predictive analytics help simulate various scenarios and test the impact of mitigations.

Experts have also deployed digital twin technology at the 3,000-year-old Tuscan city of Volterra. In this case, laser scans, drones and photogrammetry were used to construct the 3D model, which now tracks physical deterioration and aids the study of ancient architectural techniques. The model also provides an indelible digital record from which the city could be constructed in the event of a catastrophe. As is usually the way, the project was a collaboration between local authorities and tech companies; in this case, Autodesk, Leica Geosystems, Case Technologies, Epic Games and Cintoo.

BELOW **Notre-Dame Cathedral in Paris was rebuilt following the catastrophic fire in 2019 with the help of a digital twin**



GET YOUR SUBSCRIPTIONS UNDER CONTROL

A few monthly subscriptions can mount up to a big expense. Nik Rawlinson offers advice on cutting your outgoings and getting the best value from the services you keep

Subscriptions can be a win-win. The service providers get steady ongoing revenues, while consumers benefit from flexible payments you can manage and pause to suit your needs. The problem is that once you set up an automatic payment, your continued use of a service quickly stops being a conscious decision. With no action on your part the ongoing charges quietly stack up, and you can end up wasting hundreds without even realising it.

On these pages we'll look at ways to track what you're currently paying for, reduce your outgoings and manage subscriptions more easily in the future. It's not necessarily about cancelling every paid service – the key is to work out what each subscription is really worth to you, and only pay for the things that justify the cost.

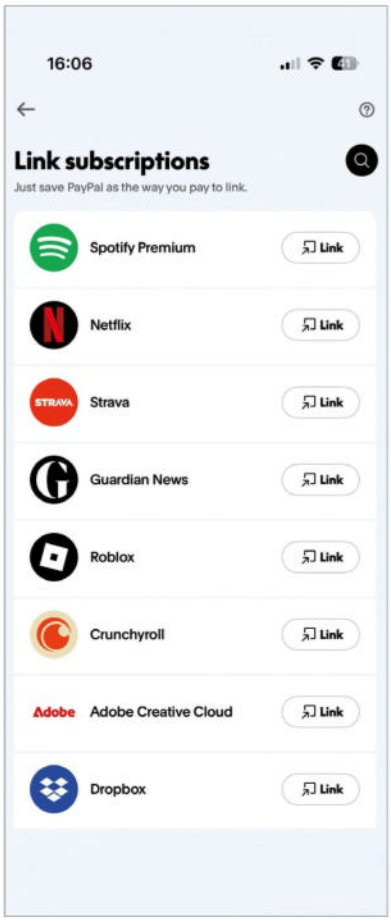
Audit your commitments

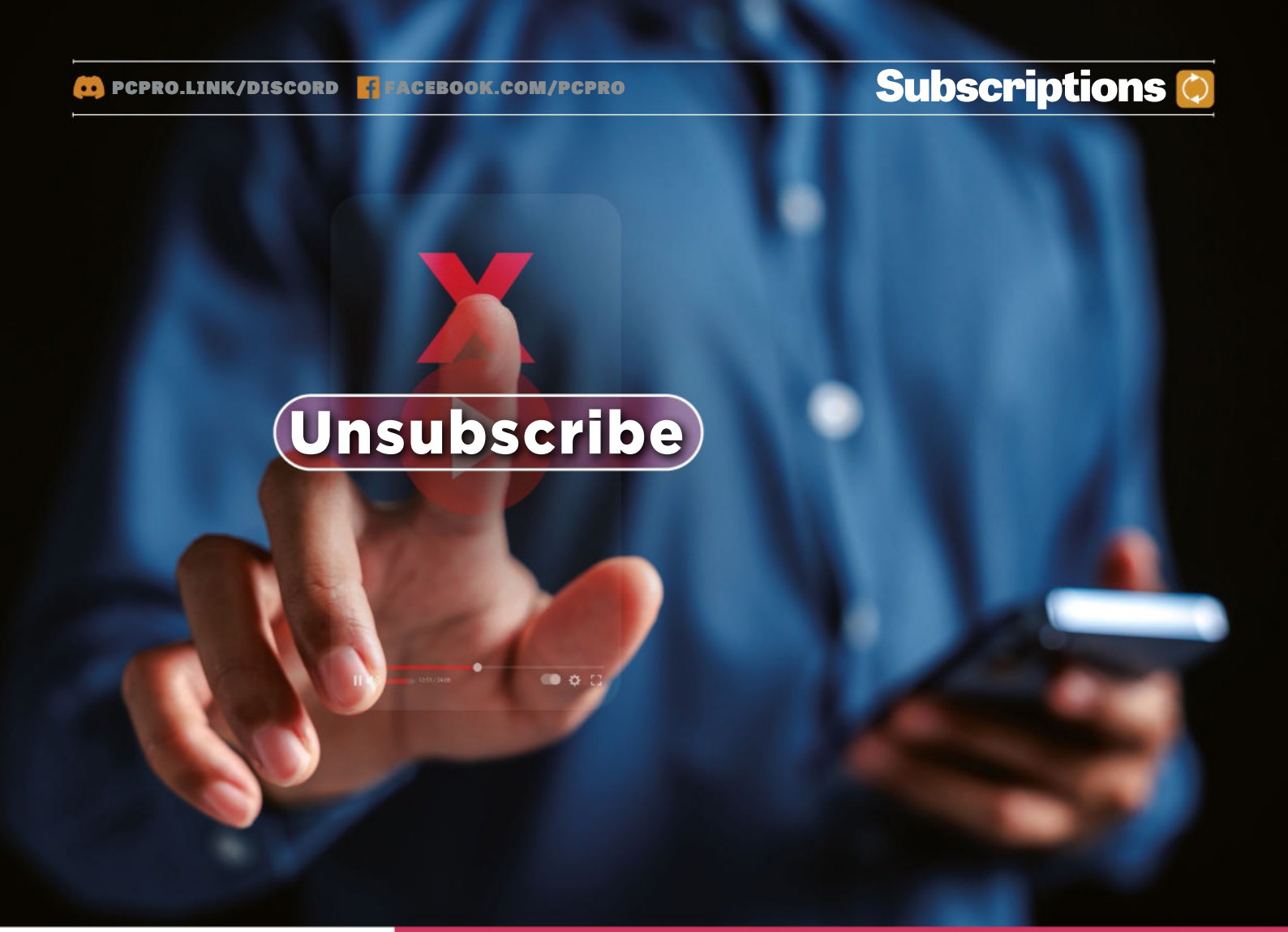
A good start is to compile a complete list of all the different services you subscribe to. Most people have never seen all their subscriptions collected into one place, because their different subscriptions come from dozens of disconnected sites and services. Don't try to put this list together from memory: even if you think you have a good sense of what you're paying for, it's easy to overlook apps and services you only use in particular contexts, and to forget about subscriptions that renew annually or are spread across multiple payment methods.

A better approach is to log onto your bank website and export some recent statements, ideally covering the past two years or more. Skim through the outgoings and you should be able spot anything that comes around every month; keep an eye out too for anything that recurs annually. If you don't want to do this in the old-fashioned way, with a print-out and a pen, this is the sort of task AI chatbots are very good at – just upload the CSV or PDF files and ask the AI to identify all recurring subscriptions.

Bear in mind that the merchant name that appears on your bank statement won't always match the software or service you're paying for. You may be able to figure out what a subscription is by searching your email inbox for the name shown on the statement, or for the value of the monthly debit. You can also track down subscription information in

RIGHT PayPal has dedicated tools for managing recurring payments and subscriptions





your inbox by searching for terms such as "renewal", "cancellation", "subscription", "receipt" or "invoice".

It's also worth checking third-party payment services. PayPal has its own subscription management page, which conveniently lists any preapproved payments, including recurrent ones – and lets you cancel any you no longer want to approve with a click. Then there are app platforms such as the Apple App Store and Google Play, which can manage recurrent payments for a wide range of apps and services. Like PayPal, both platforms offer dedicated subscription dashboards that list every recurring payment handled through their app stores.

Although the goal is to build a complete overview of your subscriptions, it's not the end of the world if you overlook something. There are probably plenty of big potential savings that can be easily spotted, so you're still in a good position to benefit from the exercise.

What are you paying for?

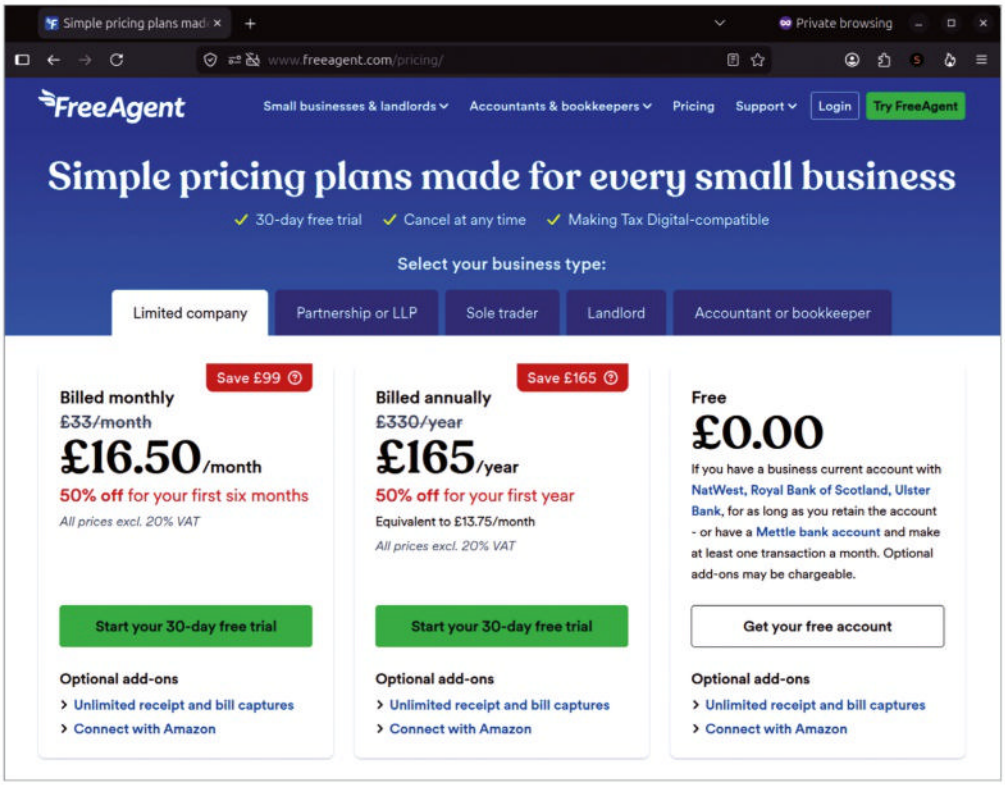
Now you know which products and services you're subscribing to, it's time to ask yourself why you're paying for them – that is, what are the specific features that justify this particular ongoing subscription? It's easy to keep on paying for a product or service just because you're used to having it around, but that doesn't mean it's the best tool for the job, or the most economical one.

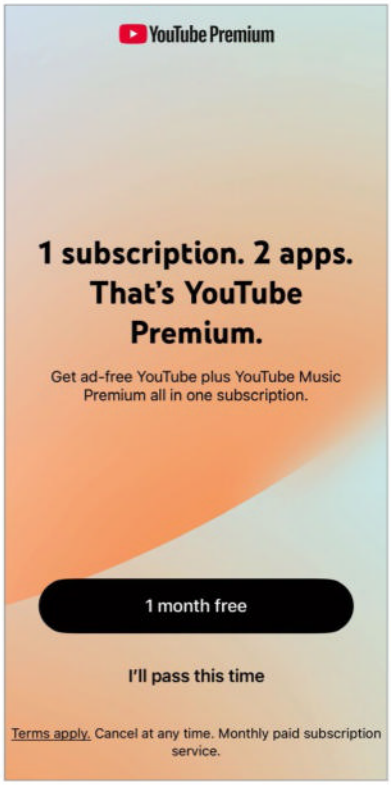
Perhaps the most obvious examples are Word, Excel and PowerPoint. For many of us, these tools have been productivity cornerstones for decades, but nowadays third-party alternatives like the free LibreOffice are broadly compatible, and most spreadsheets use the same formulae as Excel. If you're thinking of renewing a Microsoft 365 subscription, it's worth stopping to ask yourself exactly why you're doing so: the question isn't "am I using this subscription?", but "why shouldn't I cancel it?"

It's easy to keep paying for a product or service just because you're used to having it around

Sometimes there are good arguments for sticking with a subscription. Switching to a different platform is often far from effort-free: for example, moving from Adobe Creative Cloud to the free Affinity suite (**affinity.studio**) can save you a lot of money, but you'll need to get used to different tools and shortcuts, and a different overall approach to the creative workflow. You'll need to decide for yourself whether the upheaval of moving to a free platform is justified by the potential saving.

If you're not sure whether you really need a subscription or not, you can simply let it lapse and see how you cope without it. It might take you a morning to get accustomed to a new way of working, but after that you may find that you barely miss the subscription. Or you might find that there's one specific feature you miss, which could help you decide for yourself whether it's worth the money, or help you identify a cheaper approach that does what you need. That might not even necessarily be a different product – sometimes you can





save money by finding a different way of paying for a subscription service.

Keep the subscription, but pay less

Before cancelling anything, it's worth looking into whether there's a way to get the same service more cheaply. For example, ISPs and mobile phone providers often bundle in cheap access to streaming services such as Netflix or Spotify as part of a contract. If you use FreeAgent to manage your small business accounts and payroll, signing up for business banking with NatWest Mettle and making at least one transaction a month means you get your FreeAgent subscription for free.

Alternatively, see if you can downgrade your service to cover just the features you need. For example, if you absolutely have to use Excel for a specific purpose, could you manage with the free web app? The same logic applies to all sorts of services, from password managers to AI assistants. Many people pay for premium tiers even though they could get by perfectly well on the free service.

Cloud storage in particular is a good candidate for this, as the amount of storage you're using is entirely in your hands. If you archive any files you haven't accessed in the last six months to local storage, you may be able to downgrade your online plan.

Another way to reduce costs is to opt for an ad-supported tier. Spotify offers an ad-supported free account, and you can downgrade a Netflix subscription from Premium to Standard with adverts; you can still watch almost the full Netflix library, and while it's limited to 1080p and two simultaneous devices, it slashes the monthly cost from a maximum of £18.99 to only £5.99 per month.

Once you've applied these considerations to all the subscriptions on your list, you can divide them into three groups – keep, downgrade and cancel. Before you start actually unsubscribing, though, there's one final precaution: make sure you won't lose anything you can't replace.

Have you secured your data?

Clicking the cancel button doesn't just mean you lose access to the services you were previously paying for – it might also mean losing access to the data you've stored in them. Unless you're absolutely certain you'll never want to refer to that information in the future, it's a good idea to download a copy before you cancel. We suggest you do this before you initiate the cancellation procedure, so you can confirm that the data is safely in your own hands before you get cut off.

Before cancelling, it's worth looking into whether there's a way to get the same service more cheaply

ABOVE LEFT Mettle customers making a single qualifying transaction each month can use FreeAgent for free

ABOVE RIGHT Subscriptions often include useful extras, but they're only worth paying for if you use them

The procedure for this depends on the service. Look for an export dashboard through which you can submit a request for your data and, once you receive the files, check them to make sure you've actually got what you wanted. This doesn't just mean checking that the filenames are correct – make sure you can actually open the files in whatever software you plan to use. For example, Affinity can import InDesign files saved in IDML format, but not native INDD documents, so if you've downloaded your files in the latter format, you'll have to use InDesign to convert them before it stops working for you.

Neglecting to do this could mean you're left with files you have no way of opening; it could even have legal ramifications, if for example you're exporting your company accounts from a cloud-based accounting platform, and end up being unable to access required reporting data.

Time to cancel

When you're finally ready to cancel your unwanted subscriptions, the process might be very easy: Norton, for example, lets you cancel any product subscription with a single click in your online account dashboard. Where subscriptions are processed through an app store, you can usually cancel them there,

FLEXIBLE SUBSCRIPTIONS FOR SMBs

When you're subscribing to services for a team, you can often mix and match licences to suit your organisation's changing needs. For example, Google Workspace licences can be moved between different members of the workforce, depending on individual users' needs, and Google AI is similarly provisioned on a per-user, per-month basis, rather than per tenant. This type of flexible licensing can be particularly valuable to smaller businesses where responsibilities are fluid and employees come and go.

While it does take some time to calculate who needs what, that investment can be recouped through cost savings. After all, checking who really needs the services that the organisation is paying for, and who could manage with a cheaper tier, is part and parcel of managing your ongoing subscriptions.

without having to engage directly with the provider.

Not all subscriptions offer such an easy process, however – they may use intentionally complicated procedures designed to discourage you from closing your account, or "dark patterns" that try to trick you into staying. Don't assume that just cancelling your direct debit will do the job: stopping your payments without cancelling the associated service can sometimes leave a contract in place, and fees still due.

Indeed, although the idea of cancelling with a click is appealing, it's not always your best move if the service still has some value to you. If there's an option to talk to a sales agent – either on the phone or online – it's well worth getting in touch and asking if they can do you a deal. Frequently they'll offer you a reduced renewal rate to get you to stick with the service. (In fact, it's always worth trying this even if you're not seriously intending to cancel at all.)

If you're tempted by a special deal, make sure you fully understand the implications. By accepting, you may be agreeing to a minimum subscription term, with the special price applying only for a limited period. Because such deals aren't usually advertised publicly, take notes throughout any calls and screenshot online chats so you have a record of what was discussed and agreed.

A mindful subscription strategy

Once you've tamed your current set of subscriptions, it's worth thinking about how you can make life easier for yourself in future. One thing to consider is how you pay for subscriptions and renewals going forward: paying by credit card rather than debit card is often a sensible move, as it gives you strong protections if the service lets you down, including the possibility of a refund processed directly by the card issuer.

You might also use what you've learnt about your own habits to make different choices about future subscriptions. For example, if you're someone who likes to hop back and forth between services, you won't want to tie yourself into long contracts; conversely, if you're happy to commit for two or three years at a time, you can reap big discounts on things like VPNs and security tools. If you're looking for long-term storage, pCloud (**pcloud.com**) frequently offers generous discounts on its lifetime plans – at the time of writing, it's offering 2TB of cloud storage for £299, with nothing more to pay, ever.

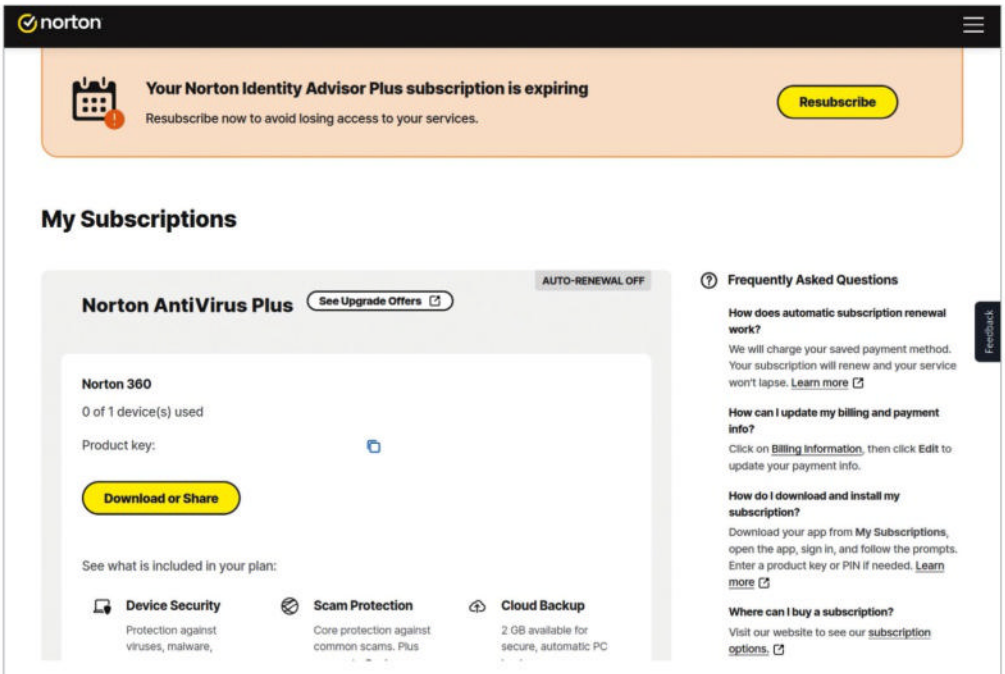
Where possible, it's always a good idea to cancel automatic renewal as soon as the subscription begins

There are also some practical steps you can take to help you stay on top of your subscriptions. First, use a dedicated email address exclusively for new sign-ups; this will make welcome emails, invoices and renewal reminders easy to locate, and should also make it easier to notice when messaging stops or changes.

Where possible, it's always a good idea to cancel automatic renewal as soon as the subscription begins (unless this incurs additional fees or immediately terminates your access). Don't worry about losing access at the end of the term: the provider will almost certainly make contact and urge you to renew when the time comes. In fact, they're more likely to offer discounts if they can see that they're about to lose you as a customer.

If you can't disable renewal at the start of a contract, create a calendar alert that reminds you to cancel when the renewal date is getting near. Don't leave this too late – with some annual subscriptions you may need to cancel 14 or 30 days before renewal is due, or you'll be on the hook for an entire additional year. As well as ensuring you don't get bounced into continuing the contract, an early warning gives you time to review whether the service is worth continuing and compare alternatives, rather than making a rushed decision.

Finally, try to make a regular habit of auditing your existing subscriptions and exploring your options for each one. Cancelling or downgrading subscriptions takes a little effort, but if you do it regularly the task becomes far less daunting. More importantly, regular auditing changes your relationship with subscriptions: rather than treating renewal as the default outcome, it forces every recurring payment to keep on proving that it's still providing good value, and gives you an opportunity to quickly spot and ditch the ones that aren't.



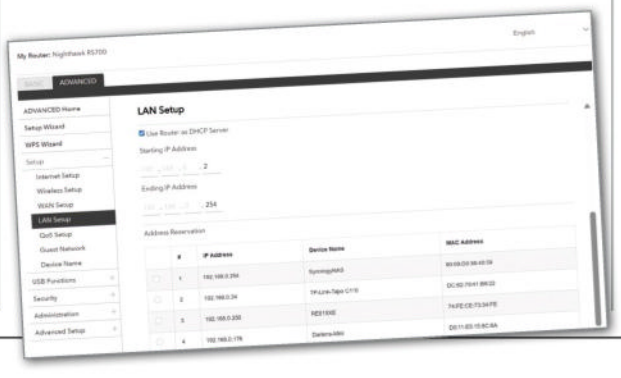
BELOW Some providers make cancellations straightforward, but don't assume they'll all be this easy

IS CGNAT SCREWING UP YOUR INTERNET ACCESS?

An invisible ISP setting could be interfering with your broadband connection. Darien Graham-Smith looks at the problems that carrier-grade network address translation can cause – and what you can do about them

If you haven't heard of CGNAT, that's understandable. It stands for carrier-grade network address translation – hardly the industry's sexiest bit of jargon – and it refers to an internet addressing system that applies at the ISP level, rather than inside your own network. This means CGNAT isn't something most people need to think about – until their personal website stops working, or their VPN server becomes mysteriously inaccessible.

These are the sorts of frustrating issue that CGNAT can cause; in other scenarios it might prevent you from connecting to a personal server from outside your home network, or block access to a home security camera when you're away. Unfortunately, CGNAT isn't something you can directly control, but you can make life easier for yourself if you understand what it is, and how to work with it.



BELOW Your router assigns an IP address to every device on your network, but they all share a single internet address

WHAT IS CGNAT?

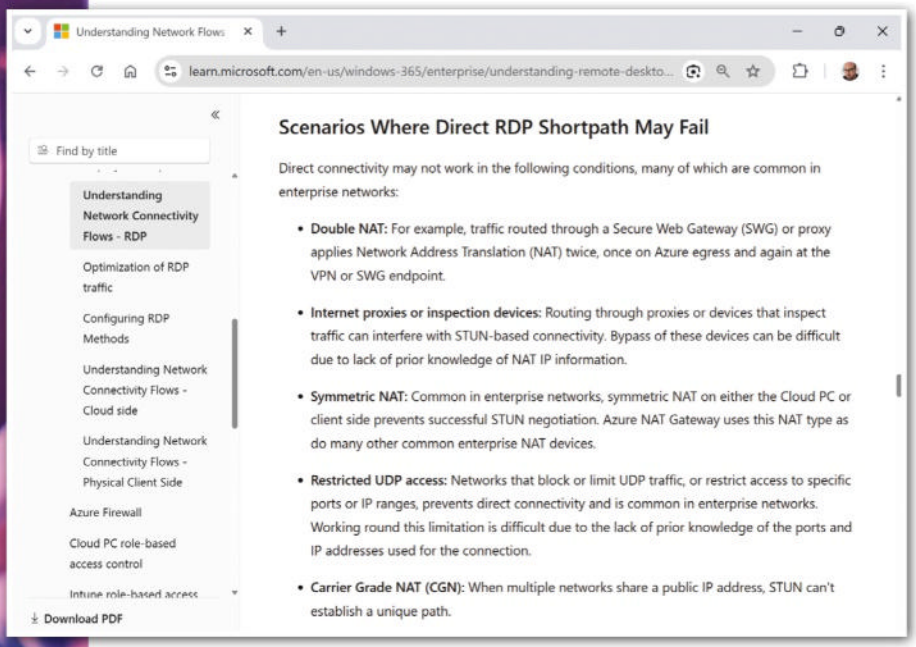
If you have a domestic UK internet connection, you're almost certainly already using network address translation within your own network. This means that your router assigns a unique internal IP address to each device within your home network, and connects them all to the internet under a single external IP address assigned by your ISP. When a local device wants to connect to an online resource, the router automatically translates between the internal and external addresses as needed, so that each device appears to have its own individual hotline to the internet, even though in reality they all share one public address and one connection.

CGNAT works in exactly the same way, but one step further upstream. If your ISP uses CGNAT, the external IP address that's assigned to your home broadband line may itself be shared across multiple properties. You won't normally be aware of this, though, as the ISP gateway takes care of directing data packets to the right subscriber. As far as your router can tell, it's business as usual.

WHY ARE ISPS USING CGNAT?

CGNAT is necessary because – as we've been banging on about for a very long time – IPv4 addresses are a limited resource. The basic address





ABOVE Remote desktop services are a classic example of tools that fail if they can't make a direct connection

format, ranging from 0.0.0.0 to 255.255.255.255, can accommodate a hard maximum of around 4.3 billion addresses, and while that seemed like a lot when the system was invented in the early 1980s, it's not nearly enough for everybody to have their own unique public address. CGNAT helps ISPs get around this by using a single address for dozens or hundreds of subscribers.

Not every ISP uses CGNAT. Big names such as BT, Sky and Virgin have a large enough pool of reserved IPv4 addresses that they don't currently need to use address-sharing tricks for regular home broadband. But very few providers are willing to promise that they'll never use it, and as more and more devices and premises come online, CGNAT could become the norm for us all.

ABOVE ISPs may have no option but to use CGNAT as more and more people get online

YOU JUST HAVE TO ACCEPT THAT INBOUND CONNECTIONS AREN'T GOING TO REACH YOU, NO MATTER WHAT PORT THEY'RE ON

Wait, I hear you cry – wasn't IPv6 supposed to save us from this scenario? Well, yes it was. IPv6 is big enough for every device in the universe to have its own unique address, with no need for any sort of address translation. Unfortunately, adoption of this next-generation technology is stuck at an impasse, because there are many pockets of the internet that still rely on IPv4, such as older websites, cheap IoT devices, small-scale VPNs and long-running game servers. To ensure access to these resources, ISPs need to maintain support for IPv4 alongside IPv6. And that means there's no particular pressure on legacy services and devices to switch to IPv6.

Therefore, even though IPv6 has been supported by mainstream routers and operating systems for more than a decade, it's clear that IPv4 isn't going anywhere, and CGNAT is likely to remain a fact of life for the foreseeable future.

WHAT PROBLEMS CAN BE CAUSED BY CGNAT?

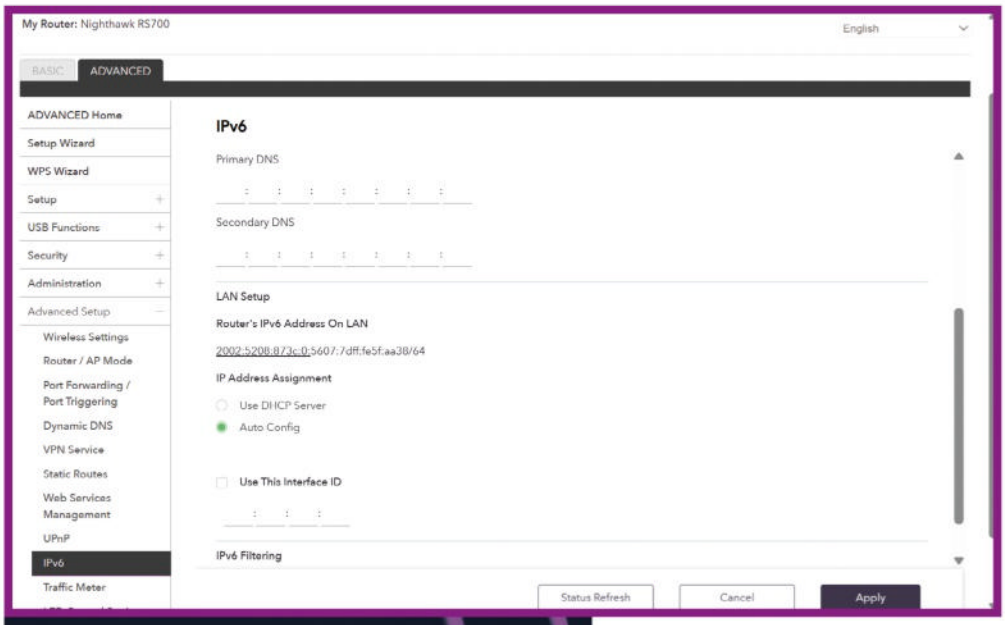
CGNAT solves a problem for the ISPs, but it can create headaches for users. To understand why, let's look at a lower-level problem that sometimes arises with router-based NAT. Most of the time, the address translation on your home network works seamlessly: when you access a web page from your iPad or open an online game on your laptop, the router can track the connection and route the data packets appropriately.

However, problems arise when the connection comes from the other direction. For example, imagine that a friend opens up a web browser and enters your external IP address into the address bar. When the connection request reaches your router, there's no way for the router to know which network client it's intended for – so all it can do is drop the connection, or let it time out. If you want to enable inbound access, the way round this is to manually set up port-forwarding rules, telling the router that incoming connection requests on a particular port should always be forwarded to a particular local device.

The situation is basically the same with CGNAT. The ISP's gateway can track connection requests coming from your router and direct the responses back to it, but if a remote client tries to initiate a connection to your external IPv4 address, the ISP won't know whether to direct it to you or to your next-door neighbour who shares the same address. The connection just gets dropped – and the frustrating thing about CGNAT is that, since you don't control the ISP gateway, there's no way for you to set up port-forwarding rules, or any other sort of routing instruction. You just have to accept that inbound connections aren't going to reach you, no matter what port they're on.

This has implications for all sorts of online services. If you're running a web or FTP server on a personal computer, it won't be accessible from

RIGHT If you can use it, IPv6 lets you circumvent issues caused by CGNAT



outside your network. If you have a VPN server running on your router, to enable remote access to your home network, you won't be able to connect to it. Security cameras that stream video using the Real-Time Streaming Protocol (RTSP) won't be reachable from outside your network. Sometimes the disruption may be frustratingly inconsistent: for example, you might be able to join online gaming tournaments that are hosted on a central server, while peer-to-peer play against friends is unreliable or unavailable. And if some other internet user gets blocked from an online service for any reason, you might find you're barred too because you share their IP address.

WHAT STILL WORKS DESPITE CGNAT?

Although CGNAT can cause problems, its impact isn't as wide-ranging as you might expect. The majority of domestic internet usage is user-initiated, and most households on CGNAT will probably get by just fine without encountering a problem.

Even if you do want to run interactive services on your home network, CGNAT isn't necessarily a deal-breaker. Many services that you'd think would require inbound connectivity actually work just fine in a CGNAT environment, including a good range of remote-desktop tools, commercial VPN platforms, home security hubs, communications tools such as Zoom and mainstream smart-home gadgets such as Amazon Ring and TP-Link Tapo devices.

This is because these tools don't rely on direct, point-to-point connections. Rather, they use a central public server, to which your computer or smart device maintains a latent always-open connection. When you want to access that device remotely, you can do so via the public server, which relays the connection over its existing link to the target computer.

This approach gets around the major limitation of CGNAT, and it can also bypass other hindrances such as firewalls – which is a big reason why the operators do it. However, services like this often come with subscription fees to cover the cost of running the server, and normally give you a lot less control than you'd get with a fully self-hosted solution. Relaying packets through a third-party server can also affect overall performance, which might be frustrating for real-time services such as remote desktop access.

IF SOME OTHER INTERNET USER GETS BLOCKED FROM AN ONLINE SERVICE, YOU MIGHT FIND YOU'RE BARRED TOO BECAUSE YOU SHARE THEIR IP ADDRESS

WHAT CAN YOU DO ABOUT CGNAT?

If you want to wholly sidestep the issues raised by CGNAT, your first thought might be to pick an ISP that doesn't use it. But this isn't a dependable long-term strategy: as we've noted, no matter who you choose, there's no guarantee that they won't start using the technology at some point in the future.

A more robust approach is to move your network services away from IPv4. Although IPv6 is a long way from becoming the default internet protocol, it's widely supported: if, for example, you have a web server running on a desktop PC on your home network, you should be able to reach it over the internet using its IPv6 address, or a domain name mapped to that IPv6 address. Since IPv6 addresses are globally unique you don't even need to set up a port-forwarding rule on your router, although you probably will need to configure your router's firewall to allow IPv6 connections to that particular client. Because IPv6

CGNAT OR DOUBLE NAT?

If you're experiencing CGNAT-type symptoms – inbound connections not working, local services showing as inaccessible from your phone and so forth – don't rush to blame your ISP. If there's more than one router or Wi-Fi access point running on your home network, your problems could be down to a "double NAT" configuration.

This is where the main router assigns an IP address to the secondary one, and then that router hands out its own addresses to connected devices – effectively setting up a subnet, with its own IP address range, within your own home network.

As with CGNAT, double NAT doesn't cause immediate obvious problems. Everyday tasks such as browsing the web, checking email and streaming video should work just fine. But any clients sitting behind the secondary NAT gateway will be inaccessible from outside your home network, just like CGNAT.

Thankfully, double NAT problems are usually easy to fix. The simplest solution is to go into the second router's administration portal and switch it from "router" mode into "access point" mode. It will then continue to ferry traffic back and forth, while allowing the main router to handle addressing and internet access for the whole network. Alternatively, you can configure port forwarding on both routers to ensure that specific inbound connections are passed forward, through both gateways, to the correct client.



RIGHT A second router can extend your Wi-Fi signal, but it can also cause NAT-related issues



ABOVE **A CGNAT ISP may be able to offer you a unique IP address for a small supplement**

makes every device on the internet directly addressable, external access is usually blocked by default, to prevent hackers from scanning and poking at every corner of your network.

The downside of an all-IPv6 approach is that both you and the person connecting to your server need to be using an IPv6-aware operating system and network stack. That's probably fine for a website, but could limit your options if, for example, you want to log into a personal media server from a smartphone, or you're trying to set up remote access to IoT devices such as smart cameras and automation hubs.

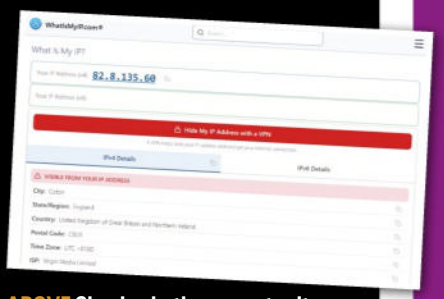
Believe it or not, the most reliable way to get around the limitations of CGNAT might be to sign up with an ISP that's already embraced the technology – that is, one that has an established CGNAT policy and offers specific solutions for subscribers who want a unique address. For example, Hyperoptic (**hyperoptic.com**) will give you a static public IPv4 address for £5 per month on top of your regular bill, while Community Fibre (**communityfibre.co.uk**) offers a dynamic address for £4 a month. Since the latter isn't static, it might change from time to time, but you can use a dynamic DNS service such as **dyn.com** to register a custom domain name that always points to your router's external IPv4 address.

The website ISPreview runs a periodic roundup of UK ISPs, detailing which ones use CGNAT and whether a unique public IP address option is available, as well as confirming support for IPv6 – you can find the latest update, dated 2024, at **tinyurl.com/385cgnat1**.

WORKING AROUND CGNAT WITH TUNNELLING

If you can't get a unique public IP address – or it's not cost-effective to do so – a final option is to set up your own publicly accessible IP tunnel. There are several providers offering such services: internet giant Cloudflare includes tunnelling in its free service plan for personal and hobby projects.

HOW DO I KNOW IF I'M ON A CGNAT CONNECTION?



ABOVE **Check whether remote sites agree with your router as to what your external IP address is**

If you're not sure whether your ISP is using CGNAT, there's a simple test you can try. First, open your router's management interface and check its internet address; then, visit an external IP-checking site such as whatismyipaddress.com and look up your public address. If it reports a different IPv4 address to the one your router thinks it's using, that's a strong clue that you're behind a CGNAT gateway.

The address reported by your router can be revealing, too. The range of IPv4 addresses between 100.64.0.0 and 100.127.255.255 is officially reserved for CGNAT-type configurations, so if your router reports an internet address in this range, that's strong confirmation that you're using a shared connection.

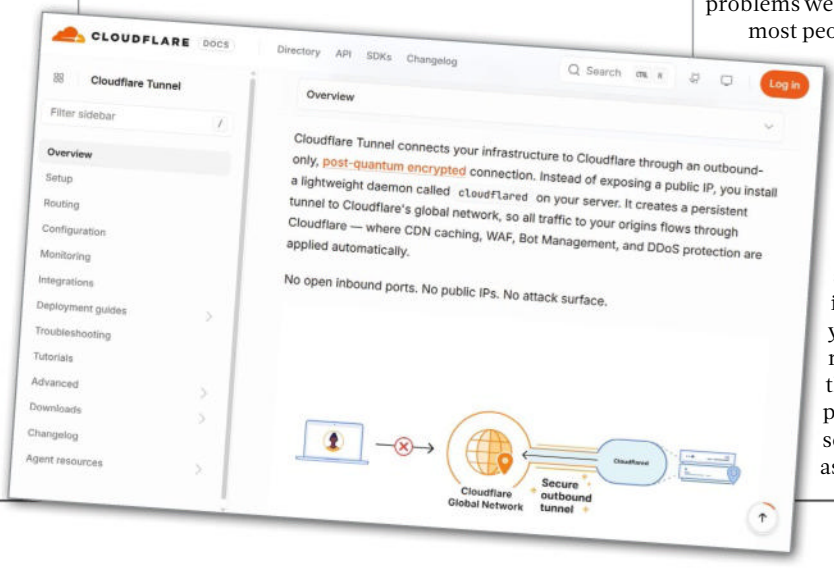
In some cases your router might report an internet address in the ranges 10.x.x.x, 172.16-31.x.x or 192.168.x.x. These are reserved for regular NAT, so seeing one of these indicates that, while you're not on a large-scale CGNAT connection, you're still behind some sort of double NAT configuration – and because you don't control the primary router, you're likely to face the same issues as you would with a full CGNAT setup.

This type of IP tunnelling works in much the same way as relay services, by installing a small agent that runs on your personal device and maintains an always-open connection to a remote virtual server. That server has its own public IPv4 address, and



can be configured to forward connections on specific ports to your client – so from outside of your network, more or less everything works as if the external IPv4 address were directly assigned to your personal device. In fact, it's a more secure solution, because any unwanted attempts to scan for open ports or probe your OS for vulnerabilities will hit the tunnel server rather than your own machine.

BELOW **Cloudflare offers IP tunnelling services you can use for inbound access**



As with a relay server, however, using a tunnel means that the connection takes a more roundabout route, which can affect latency and overall performance. User reports suggest that Cloudflare Tunnel can add between 50ms-200ms of latency, which could have a noticeable effect on games and interactive services.

The other potential hurdle is that setting up a tunnel server is a little more complicated than just double-clicking on a setup file. Cloudflare's service is designed for enterprise IT environments, and you'll need to set up permissions and configuration files manually from a Command Prompt or using PowerShell – see **tinyurl.com/385cgnat2**.

If all of this technical talk is stressing you out, don't panic. If you're not currently experiencing the problems we've described above – and most people won't, even if they are on a CGNAT connection – then you can let the matter lie, for now at least. If you want to run your own services on your home network, trying out IPv6 is a possible solution that doesn't involve dealing with your ISP. Failing that, be reassured that you have the option of leasing a public IPv4 address, or setting up a tunnel service as a final resort.

Reviews

The biggest, best, most exciting products in technology – reviewed and rated

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Samsung Galaxy Z Fold8

A wonderfully compact design, eye-popping displays and smart AI features – it lacks a telephoto zoom, but that's okay



PC PRO RECOMMENDED

SCORE ★★★★☆

PRICE 256GB, £1,416 (£1,699 inc VAT)
from samsung.com

I've reviewed foldable phones since the first Galaxy Z Fold, and there's something "just right" about the Galaxy Z Fold8 that I've never felt before.

Perhaps it's because it's so light. Maybe it's the wide front display, and the two distinct orientations for watching video and reading on the inside screen. It might be the much less noticeable crease, an anti-reflective coating for the main display, or genuinely useful AI features that take advantage of the wide canvas. Samsung has made trade-offs, such as no telephoto zoom lens, but this feels like the future of foldables.

Passport-like design

The Z Fold8 is about the same size as a passport, which makes it easy to slip into a pocket. And at 201g, this is the lightest book-style foldable available. My only criticism is that I found it a more awkward shape in my front pocket when walking.

Still, I love the 10:16 front display for scrolling through TikTok videos, and there's plenty of room for typing with two hands. Reaching across the display with one hand can be a stretch, but overall using the Fold8 feels more natural than the taller Fold8 Ultra (*see p48*). The Fold8 also unfolds almost perfectly flat.

As for colours, the Fold8 comes in lavender, graphite and cream, with a pistachio option exclusive to buyers at **samsung.com**.

Anti-glare display

If the crease on foldable phones has always bugged you, the Galaxy Z Fold8's main 7.6in display should bring a smile to your face. The crease is much less visible than before.

Samsung says it achieved this by pairing a titanium alloy film with a titanium base plate, with micro-perforations that allow the display stack to adhere flush to the plate with virtually no air gaps. But the bigger deal for me is the anti-reflective coating. This drastically reduces glare when viewing the Fold8 outside.

ABOVE The future of foldables: the Fold8 is Samsung's best yet



ABOVE Samsung apps take advantage of the 4:3 aspect ratio inside screen

The main display has a 4:3 aspect ratio, which means smaller black bars above and below the display when watching videos compared to the squarer 8in Fold8 Ultra. The viewing area itself is actually smaller, but somehow I found watching TV shows and films more immersive.

The other big benefit comes when you flip the Fold8 around into portrait mode, with a 3:4 aspect ratio proving to be a better option for surfing the web and reading ebooks or comics – something I absolutely loved doing on the Fold8.

Helpful AI (no, really)

The Samsung Galaxy Z Fold8 even has useful AI features. My favourite is Now Nudge, which prompts you to open a related app in Split View without having to leave the app you're using.

For example, I received a text asking if I was free for dinner next Friday at 7pm. A little calendar icon appeared, and when I tapped it

the Calendar app opened in split-screen mode.

Then there's My FanCam. When editing a video with multiple people in the frame, you can select a subject, and the Fold8 will crop in and "follow" that person throughout the clip. You can even choose the aspect ratio. This is great for parents and concert lovers who love to share on social media, although it only works on humans – and only one at a time.

Snappy performer

Powered by a Snapdragon 8 Elite Gen 5 for Galaxy chip, the Galaxy Z Fold8 offers performance on a par with the Galaxy S26 Ultra (*see issue 380, p74*). I mowed down countless enemies in *Call of Duty Mobile* and raced around tracks in *Asphalt 8* without seeing any slowdown.

The Fold8 is also a multitasking champ. I could run up to three apps on screen at once without noticeable lag. For example, I scrolled through my inbox in Gmail while streaming tracks on Spotify and zooming in on photos in the Gallery app with not a hint of a wobble.

As the graphs show, it performed superbly in our lab tests, too. We only compare it to other foldables in the tables, but it beats even the iPhone 17 Pro Max (*see issue 375, p71*) on multicore performance in Geekbench and in the 3DMark benchmark.

Solid battery life

All the new Samsung foldables offer a silicon carbon battery, which allows for more capacity without adding thickness to the phone. The Fold8 has a 4,800mAh battery, compared to the Fold7's 4,400mAh Li-ion unit.

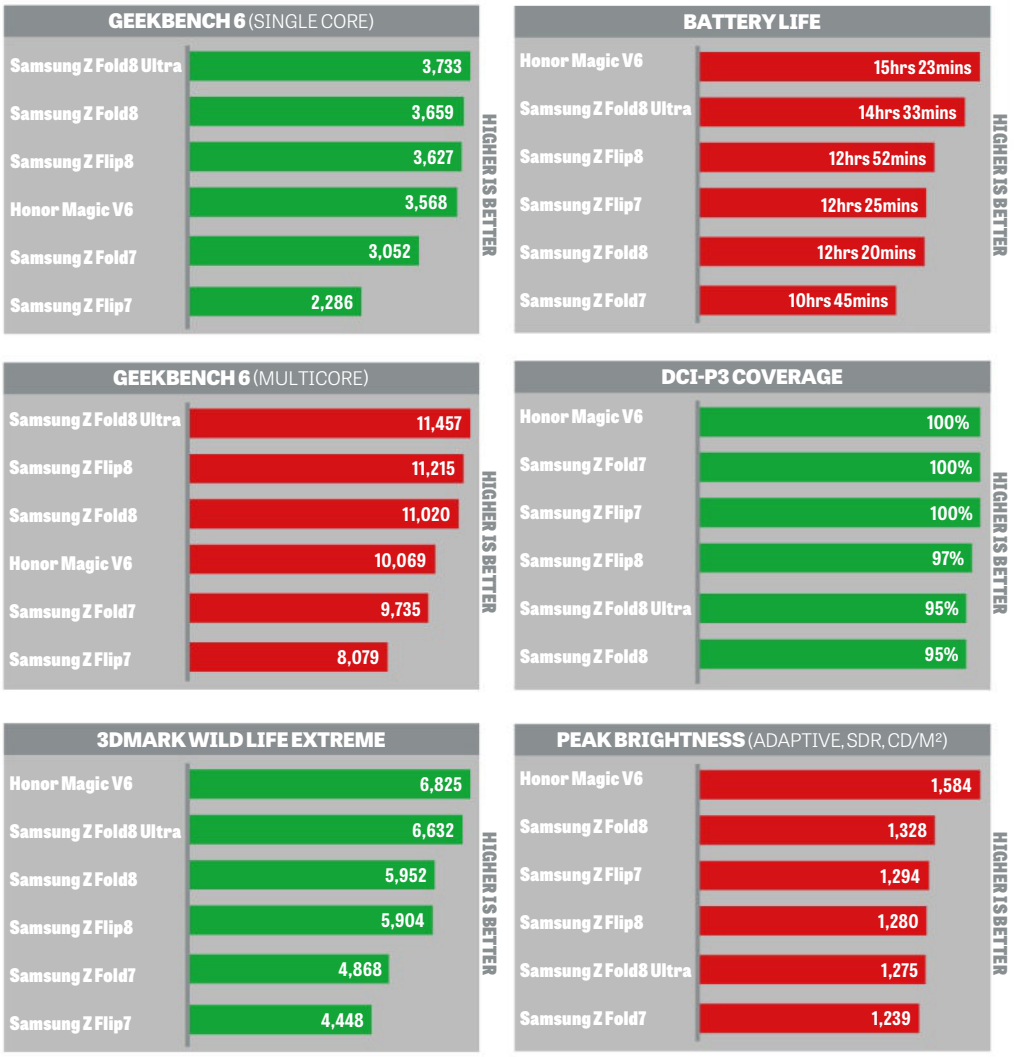
In our battery test, which consists of web surfing over 5G, the Fold8 lasted a solid 12hrs 20mins. That beats the Fold7 by more than 1.5 hours. I've been using the Fold8 as my daily phone for weeks, and on days with moderate usage – which includes streaming Spotify over 5G, checking Slack/email and watching videos on my commute – I'm typically down to about 50% by the time I get home.

Still, other foldables last even longer. The Z Fold8 Ultra's 5,000mAh battery lasted 14hrs 33mins in our tests, while the Honor Magic V6 (*see p52*) with its 6,600mAh battery proved enough for two days' life.

The Z Fold8 benefits from fast 45W wired charging, reaching 70% after 30 minutes. Wireless charging is strong at 20W, but you must buy a magnetic case if you want Qi2 charging, as magnets aren't built into the phone.

Camera mix

I have mixed feelings about the cameras on the Galaxy Z Fold8.



Not having a telephoto zoom when you're spending this much on a smartphone seems like a con, but in practice the dual cameras are so good, and Samsung's processing so strong, that I only noticed the difference compared to the Z Fold8 Ultra at 10x zoom.

The 50MP ultrawide lens is particularly strong, even better than the iPhone 17 Pro Max when I compared ultrawide shots of a beach. The green trees in the background popped that fraction more, and there was clearer detail in the rocks along the sand.

"Powered by a Snapdragon 8 Elite Gen 5 for Galaxy chip, the Galaxy Z Fold8 offers performance on a par with the Galaxy S26 Ultra"

Samsung has also improved the low-light "Nightography" feature on the Fold8. I saw this when I took a shot of a clock tower, with brighter and crisper results than before.

I don't have any complaints about selfies from the Z Fold8, with all the detail and colour you could want. What's more, you can always flip the display around and use the main 50MP wide camera to take selfies.



BELOW The crease on the main 7.6in display is barely visible

Apps are lagging

A good number of apps have already been optimised for the Fold8's wide display. In Gmail, you can see your inbox on the left and the content of your messages on the right. And in TikTok the comments appear on the right side of the display while the video plays on the left. Spotify looks slick, too, with your playlists on one side and play window on the other.

However, some apps feel like stretched phone experiences. Slack should have your contacts on the left and messages on the right instead of super-wide conversation



windows, for instance. While the iPhone Ultra isn't out yet, you know there's going to be a better app experience from day one.

Other downsides

Unfortunately, you're stuck with the same IP48 durability rating on the Galaxy Z Fold8 as the Fold7. That means this device can withstand being submerged in water for 30 minutes but isn't dust-resistant. In an iFixit teardown, in which the foldable is given a light sprinkling of sand, the results weren't pretty. The hinge started making "truly awful crunching and grinding noises, and the phone stopped opening normally", according to iFixit. Be very careful if you're taking this phone to the beach.

The Galaxy Z Fold8 once again eschews the S Pen. While I've never been a heavy user, such a wide canvas is an invitation to doodles and note taking.

"I appreciate that the crease is less visible and the anti-glare coating, as well as the strong performance and solid battery life"

Final word

The Galaxy Z Fold8 keeps growing on me. It's lighter and more compact than the Fold8 Ultra, and the main display is big enough for split-screen multitasking and binge watching.

I also appreciate the less visible crease and the superb anti-glare coating, as well as the strong performance and solid battery life. Features like Now Nudge make sense on a foldable, too. On the other hand, I begrudge losing a telephoto lens and worry about the lack of dust resistance.

But for now, the Galaxy Z Fold8 is the foldable to beat.

MARK SPOONAUER



ABOVE The Fold8's passport-like form factor grew on us over time

SPECIFICATIONS

8-core (4.7GHz/3.6GHz) Qualcomm Snapdragon 8 Elite Gen5 SoC • 12GB/16GB RAM • Adreno 840 graphics • 7.6in foldable 120Hz AMOLED screen, 1,848 x 2,448 resolution • 5.5in cover 120Hz AMOLED screen, 1,248 x 1,972 resolution • 256GB/512GB/1TB storage • IP48 • 5G • dual 50MP rear cameras • 10MP front camera • Wi-Fi 7 • Bluetooth 6 • 4,800mAh battery • USB-C 3.2 Gen2 connector • Android 17 with One UI 9 (7yr OS updates) • folded, 82 x 9.7 x 124mm (WDH); unfolded, 161 x 4.5 x 124mm (WDH) • 201g • 2yr RTB warranty

RIGHT The minimised crease isn't the only improvement Samsung has made to the screen



PC PRO RECOMMENDED

Samsung Galaxy Z Fold8 Ultra

The telephoto camera is disappointing, but the Ultra is a big upgrade in terms of performance and battery life

SCORE ★★★★☆

PRICE 256GB, £1,583 (£1,899 inc VAT)
from samsung.com

In keeping with the rest of its flagship phones, Samsung's foldables are going Ultra. And the company insists this isn't a simple rebranding, with real changes behind the scenes to lift this from last year's Galaxy Z Fold7 (*see issue 372, p48*).

It starts with the larger battery, which at 5,000mAh is 600mAh more capacious than the Fold7's. Here, Samsung is taking advantage of denser silicon carbon technology compared to lithium ion.

During our custom battery life test, which involves web surfing over a 5G connection and setting the display to a brightness of 150cd/m², we recorded a battery life of 14hrs 33mins. That's almost four hours more than the Z Fold7 and more than two hours longer than the passport-shaped Galaxy Z Fold8 with its 4,800mAh battery.

This longevity was backed up by my experience living with the Z Fold8 Ultra. I regularly went to sleep without plugging in the foldable to recharge overnight because I knew it would still be alive the next morning. The fast 45W wired charging meant I could plug in the Ultra while getting ready, comfortable in the knowledge that it would recharge enough to get me through the day. Samsung reckons the Z Fold8 Ultra can reclaim 67% battery after half an hour of charging, but I found the battery actually hit 76%. Prefer wireless charging? The upgraded Qi2.2 protocol offers up to 20W speeds, up from last year's 15W.

Major league performance

This year marks the first time that Samsung has used the custom "for Galaxy" chipset in a foldable phone. Normally Z Fold models use a fast but not quite cutting-edge Snapdragon chip which, while no slouch, isn't as powerful as the Galaxy variant. And it showed in our benchmarks, where all three of the new Samsung foldables (which share the same "for Galaxy" chipset) performed superbly.

Geekbench 6 benchmarking saw the Z Fold8 Ultra score 3,733 on single-core testing and 11,457 in the multicore tests. That's up from

3,052 and 9,735 on the Z Fold7. It was a similar story in 3DMark, with results up by around a third.

When playing *PUBG Mobile*, I found that the Z Fold8 Ultra could handle the highest graphics and performance settings without suffering any ill effects. What's more, it could run through a game without noticeably heating up.



Screen boost

When it comes to screen upgrades, the biggest talk has been about the minimised crease – which is true. But that's not the only upgrade Samsung has on offer. The Ultra now boasts an even brighter display, rated to output up to 3,000cd/m², paired with a new anti-reflective coating.

It hit a maximum of 2,687cd/m² in our HDR tests, which may not be as high as Samsung says (this is typical for all manufacturers' claims when we reach the thousands), but remains one of the highest figures we've seen when displaying HDR content.

But big numbers are worthless if they don't show their worth in the real world. During our testing we experienced abnormally long periods of sunny weather, which is ideal for testing the capabilities of bright, anti-reflective screens. Not only could I use the Z Fold8 Ultra in direct sunlight without issue, the screen is bright and clear enough that I could still see exactly what I was doing while wearing sunglasses.



(Mostly) great cameras

The Z Fold8 Ultra includes the same 200MP main camera lens as the S26 Ultra (*see issue 380, p74*) and Z Fold7, alongside a new 50MP ultrawide angle camera. No surprise, then, that the Z Fold8 Ultra takes great photos.

The 200MP main lens even shines when compared to the iPhone 17 Pro Max (*see issue 375, p71*), with a sharper and clearer image. That's especially true if you zoom in and look at the smaller details.

At first glance ultrawide angle photography doesn't look too different to the Fold7, but the 50MP resolution bump reveals details – such as stonework on a building – that are blurred on the Fold7. But the most discernible difference comes in low light, with the Fold8 Ultra gaining access to the ProVisual engine found in the Galaxy S26 Ultra. Photos sometimes look darker than the Z Fold7's, but they also capture a heck of a lot more detail in the process.

There are three areas where Samsung can still improve. One is macro photography, with the Fold8 not always focusing on what's directly in front of the lens. The other is selfies, with the 10MP lens failing to pick up the same level of detail as the iPhone 17 Pro Max.

Then we come to the biggie. Put simply, the Ultra's 10MP telephoto lens isn't up to the job. Photos look okay at first glance, but when I compared the Fold8's results to the S26 Ultra's – which uses a 50MP sensor – I started to wonder if it was worth zooming in at all. This was particularly apparent in a 10x zoom photo of a cat, with the Fold8 Ultra producing fuzzy results while the S26 Ultra clearly captured the cat's fur.

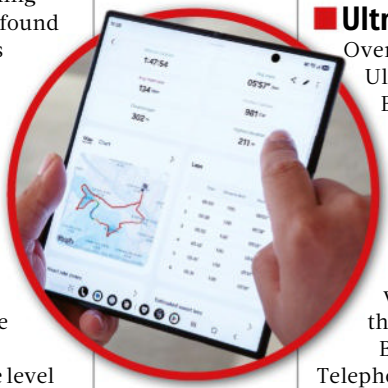
Good AI, no stylus

We cover the new AI features found in both the new Fold phones in our Z Fold8 review, so I shan't repeat that here. The only thing I'll add is that I love My FanCam, which takes your existing videos and lets you hone in on a single person and turn them into the main character. It works with all videos you've shot, even those not filmed on a Galaxy phone, and so far I haven't found a single video featuring human beings that it doesn't like. The same can't be said for animals, unfortunately.

It's annoying that Samsung has tweaked the design of the Fold8 Ultra so that Fold7 cases don't fit, but without any notable benefit. You still don't get support for styluses or for magnetic wireless chargers.

To rub a little extra salt in, Samsung is charging £100 more for the Fold8 Ultra than the Fold7, and isn't luring early buyers with the promise of 512GB of storage for the price of 256GB as it has done in previous years. An effect of rising RAM and SSD prices, for sure, but Honor discounts its Magic V6 (*see p52*) and heavily undercuts Samsung in the process.

"Samsung has delivered an Ultra phone worthy of the name. Battery and performance have made huge leaps forward"



ABOVE You'll have no problems seeing the Fold8 Ultra's screen when the sun shines

Ultra mixed

Overall, Samsung has delivered an Ultra phone worthy of the name. Battery and performance have made huge leaps forward, to the point its foldables now largely match their non-folding counterparts.

Likewise the improvement in screen technology is a big win for users, especially those that live in spots with lots of sun.

But there are problems. Telephoto quality is appalling for a phone that costs this much, and the missing S Pen is still noticeable. Worst of all is the increased price, which is just the latest in a long line of Galaxy price increases, which makes those basic flaws sting even harder.

The Z Fold8 Ultra is still a great addition to the Galaxy lineup, but I hope for even more from 2027's inevitable Z Fold9 Ultra. **TOM PRITCHARD**



RIGHT The Fold8 Ultra has more traditional dimensions than the Galaxy Z Fold8

LEFT Both battery life and performance have been improved

LEFT The 200MP main camera shines, but the telephoto lens is a letdown

SPECIFICATIONS

8-core (4.7GHz/3.6GHz) Qualcomm Snapdragon 8 Elite Gen5 SoC • 12GB/16GB RAM • Adreno 840 graphics • 8in foldable 120Hz AMOLED screen, 2,256 x 2,504 resolution • 6.5in cover 120Hz AMOLED screen, 1,080 x 2,520 resolution • 256GB/512GB/1TB storage • IP48 • 5G • triple 200MP/50MP/10MP rear cameras • 10MP front camera • Wi-Fi 7 • Bluetooth 6 • 5,000mAh battery • USB-C 3.2 Gen2 connector • Android 17 with One UI 9 (7yr OS updates) • folded, 72 x 8.9 x 158mm (WDH); unfolded, 158 x 4.1 x 143mm (WDH) • 215g • 2yr RTB warranty

Samsung Galaxy Z Flip8

Powerful and easy to view the bright displays outdoors, but only a minor upgrade on last year's release

SCORE ★★★☆☆

PRICE 256GB, £958 (£1,149 inc VAT)
from samsung.com

If you want to observe the creeping effect of inflation in tech, look no further than Samsung's Flip phones. In 2021, the entry-level Flip3 cost £949. Then it crept up to £999, before settling at £1,049. This year, with the excuse of rising RAM and SSD prices, it's jumped to £1,149. That might be acceptable if the product had jumped in quality, but instead it has plateaued. And this is coming from someone who loves flip phones.

You have four colour options: pink, graphite, cream and mint, which is an online exclusive. The pink shade of my review unit is charming, but the mint option is the standout choice.

One reason Samsung can defend this year's price hike is the big upgrade in processor. Samsung made a surprising switch last year with the Z Flip7 (*see issue 372, p50*) by using its own Exynos chip, but the return to Qualcomm's flagship silicon gives the Z Flip8 its most important hardware upgrade.



In Geekbench 6, the Flip8 delivered a single-core score of 3,627 and a multicore score of 11,215, compared to 2,286 and 8,079 for the Flip7. It also outpaces the Motorola Razr 70 (*see issue 382, p50*), which scored 2,886 and 8,982.

Graphics performance tells a similar story. In 3DMark Wild Life Extreme, the Z Flip8 notched 5,904, with an average frame rate of 35fps. By comparison, the Z Flip7 ran at 27fps while the Razr 70 matched it with 35fps.

Despite there being no physical changes to either display, I'm happy to report that the main 6.9in AMOLED screen is noticeably when showing HDR content, reaching a peak of 2,150cd/m². It's a solid step up from the Z Flip7's HDR peak of 1,989cd/m², but still trails the Razr 70's 2,332cd/m². All three cover similarly impactful colour ranges, but I wish Samsung had added the same anti-glare coating as on the new Z Fold8 series as reflections are still problematic.



BELOW The screen is brighter, but this doesn't feel like a huge upgrade on last year

Even though the camera hardware remains largely unchanged, the Z Flip8 continues to be one of the best pocketable vlogging setups you can buy. A big reason for that is its flip-phone form factor, which allows you to prop it up on any flat surface, like a built-in tripod, or bend it to a 90-degree angle to hold like a classic camcorder. One software addition makes it even better: Horizontal Lock is now built into Super Steady mode, removing jitters when recording. It crops the image slightly to achieve that gimbal-like stability, but handheld clips look surprisingly professional.

As before, the outer FlexWindow paired with the rear cameras lets you easily preview the frame as you record, while also delivering much better selfie captures than a standard front camera. Compared to larger notebook foldables, it's also still far more intuitive to hold with one hand while keeping an eye on your shot.

Taking photos with the Galaxy Z Flip8 feels almost identical to using its predecessor. That isn't a surprise as they share the same 50MP main camera and 12MP ultrawide, and in general the results are strong: plenty of detail, good colour balance and strong handling of dynamic range. The only difference I noticed was when shooting in near pitch-dark conditions, with far better shots of the night sky, for instance.

Battery life moves in the right direction, but only by a hair. The Z Flip8 logged an average time of 12hrs 52mins in our battery-drain tests, edging the Z Flip7 by half an hour. It uses the same silicon-carbon technology as the new Z Folds, so it's a shame that Samsung didn't improve the capacity from 4,300mAh (the same as the Z Flip7's lithium-ion battery). The Motorola Razr blew past both Samsung clamshells with a runtime of 16hrs 20mins.

Unlike the new Folds, the Z Flip8 remains capped at 25W for wired charging, and charging times are barely faster than the Z Flip7's – it reached 59% in 30 minutes compared to last year's 55%.

Software upgrades again feel underwhelming. One UI 9 offers the same strong level of multitasking and productivity Samsung's custom experience has continually delivered. However, there are only a few new AI tricks, including more multimodal tools, enhanced Flip Shot shooting options, and minor updates to both Now Brief and Now Nudge.

The outer FlexWindow, in particular, feels underutilised despite bringing more apps and basic actions to the cover screen. Aside from minor widget updates and basic app support, Samsung hasn't introduced any breakthrough features here. I was hoping for more Galaxy AI tools, but you don't even get the same AI-tracking My FanCam feature found on the Z Fold8.

"The Flip8 remains one of the sleekest and most refined clamshell foldables, but its generational leaps are getting harder to see"

LEFT The Flip8 is available in graphite, cream, mint and pink

The Samsung Galaxy Z Flip8 remains one of the sleekest and most refined clamshell foldables, but its generational leaps are getting harder to see. On one hand, the return to Qualcomm silicon delivers impressive performance gains, the screen gets a big brightness boost and video features such as Horizontal Lock make it an even more formidable tool for vlogging. If you're coming from a Z Flip5 or an older slab phone, these upgrades are enough to warrant buying it.

However, when paired with a £100 price hike, Samsung's baby-step approach is tough to defend, especially in the face of increasing competition from the Motorola Razr series. **JOHN VELASCO**



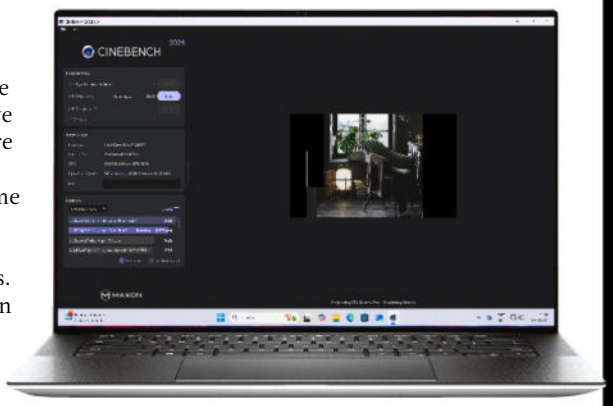
ABOVE The outer FlexWindow feels underutilised despite supporting more apps and basic actions

SPECIFICATIONS

8-core (4.7GHz/3.6GHz) Qualcomm Snapdragon 8 Elite Gen5 SoC ● 12GB RAM ● Adreno 840 graphics ● 6.9in foldable 120Hz AMOLED screen, 1,080 x 2,520 resolution ● 4.1in cover 120Hz AMOLED screen, 948 x 1,048 resolution ● 256GB/512GB storage ● IP48 ● 5G ● 50MP/12MP rear cameras ● 10MP front camera ● Wi-Fi 7 ● Bluetooth 5.4 ● 4,300mAh battery ● USB-C 3.2 Gen2 connector ● Android 17 with One UI 9 (7yr OS updates) ● folded, 75 x 13.1 x 86mm (WDH); unfolded, 75 x 6.1 x 167mm (WDH) ● 180g ● 2yr RTB warranty

How we test

Laptops and PCs



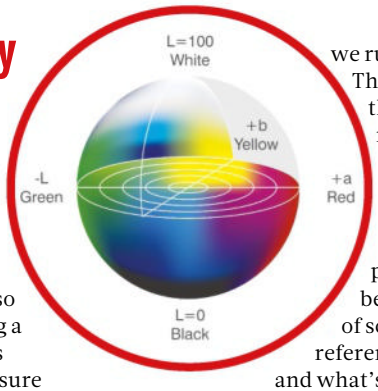
We run a selection of benchmarks on all the PCs and laptops we test. Where possible, we use a cross-platform test so we can compare Windows and macOS machines, which is where both Geekbench and Cinebench come into play. Both push the CPU to its limit, exposing how well cooled a system is.

We run extra tests for Windows systems. We use PCMark 10 to benchmark systems in office tasks, content creation and basic tasks such as web browsing and video calls. We also run 3DMark Time Spy and *Shadow of the Tomb Raider* as a minimum. We test laptops and PCs that include discrete graphics with a range of games, such as *Borderlands 3* and *Dirt 5*.

For laptops, we test battery life with Wi-Fi on and the screen brightness set to 150cd/m². We fully charge the laptops and drain them until they reach 5%. For Windows laptops, we will use a mix of PCMark 10's light-use and video-based tests, or a web surfing benchmark where a laptop automatically visits sites until the battery dies. We also use this test for MacBooks.

ABOVE We put PCs and laptops through our intensive set of benchmarks

Screen quality



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



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

LEFT We use a Display i1 colorimeter to measure sRGB gamut coverage and Delta E

Phones and tablets

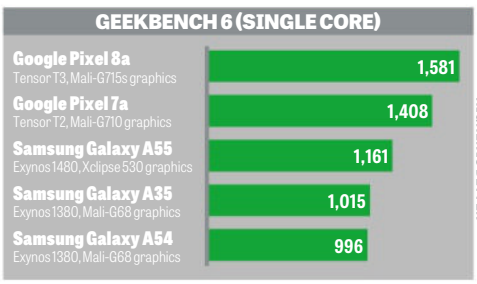
We run a selection of publicly available benchmarks on all the phones and tablets we review. First, we run Geekbench 6. This is a good test of the processor and memory in particular, and include both a test for single-core and multicore performance. See below for a selection of scores to provide a reference of what's good... and what's not so good.

We also run 3DMark Wild Life test to give a measure of gaming performance.

We test tablet battery life by playing a full-screen video until the battery runs out with the device. To simplify the test, we use Airplane mode. We set the brightness to as close to 150cd/m² as we can get in the device's settings. We also put phones through a set of real-world and labs-based tests.

BELOW We play a video with the screen set to 150cd/m² to test battery life





What our awards mean

Recommended
This, quite simply, is a product we 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 p14. It's 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.

Tinyurl.com links

Throughout the magazine you'll see tinyurl.com 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 may 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 that 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.

Honor Magic V6

Having spent months with the V6, no other foldable can touch it for durability or battery life

SCORE ★★★★½

PRICE £1,250 (£1,500 inc VAT) from honor.com (after voucher applied)

Samsung may be stealing the foldable phone headlines due to the Galaxy Z Fold8 (*see p46*), but there are plenty of reasons to consider the Honor Magic V6 instead. Not least price: Honor is now offering a £500 voucher that slashes the headline price from £2,000 to £1,500, which undercuts the 512GB equivalent of the Galaxy Z Fold8 Ultra (the Magic V6's natural opposition) by £369.

But it's a mistake to focus on price. There are many areas in which the V6 betters Samsung's foldables, with the first being market-leading durability. I've taken plenty of foldables for a spin, but I've always maintained that I'd never buy one. Why? Because these devices are often too fragile. I'm clumsy with my phones and regularly drop them onto floors and often into water; there's no way I'd splash out on a premium foldable only to see it turned into a damp paperweight.

The Honor Magic V6 is the first foldable I've tested that bucks that trend. In its review documentation, Honor recommended not to baby the phone – I was encouraged to take it out and about without a case, use it in the rain and so on. I've been doing exactly that and, after four months of use, it still looks brand new. With its IP68 and IP69 ratings, it also offers the highest level of water protection you'll find.



Top design

Despite this ruggedness, the Magic V6 is incredibly thin when unfolded, coming in at only 4mm, with a durable aluminium chassis. The back material depends on your choice of colourway, with the Red and Gold version using vegan leather, while the Black and White editions feature a smooth fibre composite.

Whether you're using it folded or unfolded, this is a good-looking phone. Multiple people complimented me on the device completely unprompted and were eager to learn more about it – something I can't say has happened with any other mobile I've used.

Like most Chinese flagships, the rear of the phone features a large octagonal camera bump, which isn't going to be to everyone's taste. I like how it looks, though, and appreciate the subtle tactile texture on the ring around it. The bump is also smaller than that of the Honor Magic8 Pro (*see issue 378, p72*), which means that it's less likely to rest under your fingers and get covered in smudges.

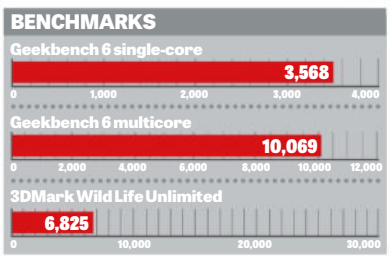
Honor has also improved the hinge. It's much quieter and smoother than its previous designs, helping the phone feel more premium and sturdy.

Honor keeps things refreshingly simple when it comes to buttons with the Magic V6. There's a small volume rocker and a power button on the right-hand side, and that's your lot. They're well placed for one-handed operation and feel pleasantly clicky. My only real gripe is the fingerprint reader built into the power button, which sometimes requires a few attempts to unlock successfully.



ABOVE The Magic V6 is a durable foldable with superb displays both inside and out

LEFT A slightly raised camera bump on the rear may irritate some



Glorious displays

Both displays are excellent. The 6.5in OLED outer screen has a 1,080 x 2,420 resolution with a fantastic 2,000cd/m² peak brightness (and an absurd 6,000cd/m² with HDR content), which ensures that it stays visible in even the harshest light.

It uses Honor's Anti-Scratch NanoCrystal Shield coating, which kept the screen looking pristine throughout my months of testing. That's despite my removing the screen protector it came with, as this picked up annoying marks very quickly.

There's one other potential annoyance too. Despite the rectangular shape of the folded phone, the outer screen uses rounded corners, presumably to give it symmetry with the inner one. This sometimes interferes with navigation; squarer corners are surely better.

The inner display itself is an 8in foldable OLED panel surrounded by impressively thin plastic bezels. It's almost as bright as the external one, with a 1,300cd/m² peak brightness (or up to 5,000cd/m² with HDR). It's just as sharp as you would expect, with a 2,352 x 2,172 resolution, and Honor deserves credit for how closely calibrated both of the displays are: they're practically identical in terms of colour, making it natural to flick between the two.

"After four months of use, it still looks brand new. With its IP68 and IP69 ratings, it also offers the highest level of water protection you'll find"

Both the inner and outer screens feature an adaptive 120Hz refresh rate, too, which is fantastic for smoothly scrolling apps and social media websites.

Lastly, you absolutely don't need to worry about an ugly crease spoiling your view with the Honor Magic V6. There is still a fold that you can feel if you really examine it with your fingers, but it's practically invisible in regular use unless you hold your phone at specific side-on angles or look closely on a totally blank screen. Honor says the tough UTG flexible glass has an SGS Imperceptible Crease Certification, and it really shows. Or rather, it doesn't. This is the first foldable I've used where you can truly forget that it's even there.

Camera questions

On paper, the Magic V6's cameras aren't as strong as those of the Honor Magic8 Pro, but they're still very capable compared to the rest of the wider foldable category. The rear camera offers a three-lens setup, with a 50MP ultrawide, 50MP wide and 64MP telephoto lens.

The Honor's photos are bright and poppy by default, which is great for capturing the mood of summer days. They also offer plenty of detail, which comes into its own when dealing with busy scenes or if you're trying to capture foliage.

The telephoto sensor offers a 3x optical zoom alongside a digital zoom. With 64 megapixels to play with it performs considerably better than the Samsung Galaxy Z Fold8 Ultra with its 10MP telephoto lens, which will be reason alone to choose this phone over its Samsung rival for many. It even performs well in low light and challenging lighting setups, such as concerts with strobe effects.



Both the front and inner display have the same 20MP wide sensor, which does a good job with selfies – but the results are overprocessed.

There are plenty of software features to try out on the Magic V6, including AI-powered colour filters and different photo watermarks. The ability to display the photo that you're taking on the front screen is also brilliant for group settings.

Finally, the Honor Magic V6 has strong video-shooting capabilities and can capture 4K video at 60fps.

As good as it the V6's camera setup is, though, the results are overall less impressive than the images I've taken with the Honor Magic8 Pro and its 200MP main lens.

Meets speed needs

The Honor Magic V6 is powered by Qualcomm's flagship Snapdragon 8 Elite Gen5 processor, so it should come as no surprise that the performance of the Magic V6 is incredibly strong across the board. It's paired with 16GB of RAM, which is more than enough for serious multitasking. I rely on my phone for productivity tasks such as note-taking, transcribing and document editing while I'm on business trips, and my flow was never broken by sudden reloads when flicking between multiple apps – even ones that I hadn't opened for some time.

Gaming performance is also excellent. It almost goes without saying that casual titles such as *Plants vs Zombies 3* or *Warhammer Combat Cards - 40K Edition* (two games I admit I've been spending an embarrassing amount of time playing recently) are totally flawless. More demanding titles, including my go-to *Zenless Zone Zero*, run beautifully at the maximum settings as well.

The Honor Magic V6's sole performance problem is running hot, leading to eventual slowdown in games. I also found it struggled during the recent UK heatwaves, feeling hot in my pocket and struggling to run even Google Maps smoothly in direct sunlight.

Luckily this had no effect on battery life, which has been superb throughout my testing. The 6,660mAh lithium polymer cell offers more than enough juice for a full day, even if you play demanding games. I use my phone constantly, yet I regularly go to bed with 25% left.

With light use, you could easily stretch to two days on a single charge. Despite Samsung's switch to silicon-carbon technology for the batteries in its Z Fold8 series, and the increase in capacity as a result, Honor still wins in this area.

Soft touch

I'm a big fan of MagicOS 10, Honor's Android 16-based operating system. The design is certainly Apple-inspired, but as an ex-iPhone user I find it both visually appealing and easy to use. It has a liquid-glass-like aesthetic, with sleek, semi-transparent menus and rounded buttons.

You get all the visual flair of using an iPhone, but with all the additional customisation options that you'd expect from the Android ecosystem. New icon packs, themes and a range of preset options can be selected from the built-in themes app. You can even disable the transparency effects throughout the OS if you want something that looks more like traditional Android.

Smart features make daily operation smooth, too. For instance, an AI tool recommends images that would be well suited for your lock screen, while AI-powered widgets use context to suggest the app that you're most likely to want to use. I also like the ability to generate or rephrase text and Honor's surprisingly good translation feature.

Not all the AI tools are winners. The AI Settings Agent (which allows you to type or speak sentences such as "turn off Bluetooth" to change key settings) is laughably useless, while the so-called AI Memories App appears to be a screenshot tool with the word AI slapped on it.



ABOVE The fold is imperceptible unless you hold the phone at a certain angle

LEFT The 50MP ultrawide, 50MP wide and 64MP telephoto lenses take bright pics

Magic or Galaxy?

Samsung's eighth generation of foldables is a huge upgrade, and unlike Honor you have options when it comes to models: in the UK, we're only being offered the 512GB model.

"The 6,660mAh lithium polymer cell offers more than enough juice for a full day, even if you play demanding games"

However, as I stated at the beginning of this review, there are reasons to choose the Honor beyond price. One is that it supports stylus usage, which neither Z Fold model can match. It's also slimmer and uses a design that's proven to be durable, based on its very similar predecessors. But perhaps the biggest reason is battery life, where Honor remains the market leader for foldables. **DASHIELL WOOD**

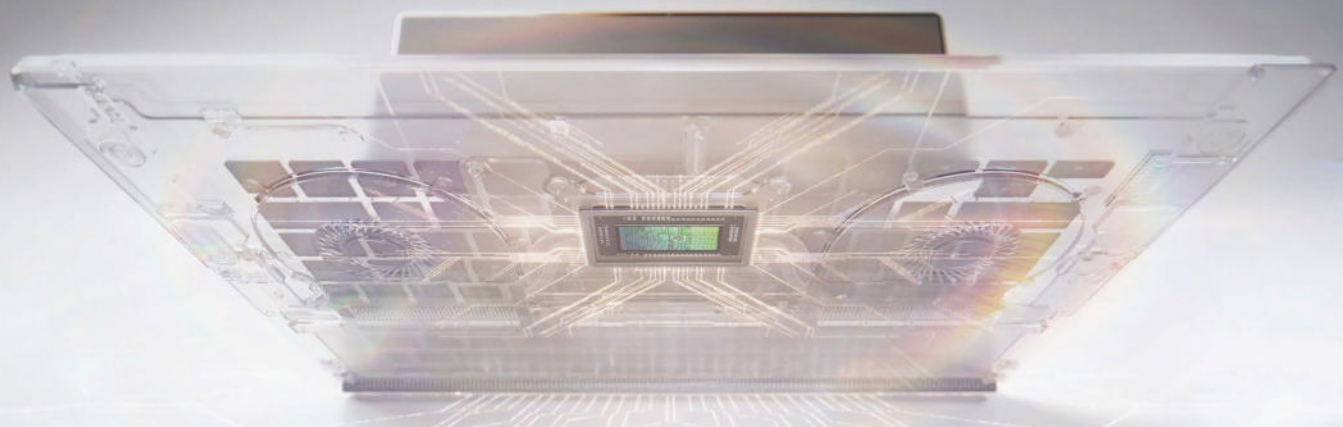
SPECIFICATIONS

8-core (4.6GHz/3.6GHz) Qualcomm Snapdragon 8 Elite Gen5 SoC • 16GB RAM • Adreno 840 graphics • 8in foldable 120Hz OLED screen, 2,172 x 2,352 resolution • 6.5in cover 120Hz OLED screen, 1,080 x 2,420 resolution • dual nano SIMs • IP68/IP69 rating • 512GB storage • triple 50MP/64MP/50MP rear cameras • 20MP front camera • Wi-Fi 7 • Bluetooth 6 • 6,660mAh battery • USB-C 3.2 Gen1 connector • Android 16, MagicOS 10 (seven major updates) • folded, 75 x 8.8 x 157mm (WDH); unfolded, 147 x 4 x 157mm (WDH) • 219g • 1yr warranty

SCAN

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Up to
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Built for Agents and AI

CUDA, the software that accelerated the world's AI, runs natively on RTX Spark.

All-Day Battery Life

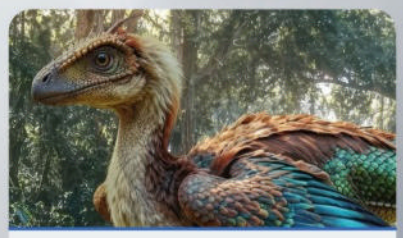
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Game Ready

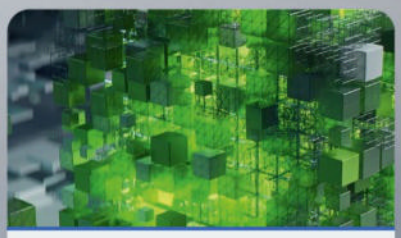
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Gamers

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SCAN

Dell XPS 13

The price is higher than we expected, but the quality on offer makes this a superior choice to the MacBook Neo

SCORE ★★★★★

PRICE 8GB RAM, £749 (£899 inc VAT) **from dell.com**



At CES, Dell announced that the new XPS 13 would be a true MacBook Neo rival, albeit for $100 more: $599 for students, $699 for the rest of us. Dell didn't quote a UK price, but we naturally hoped that it would be similar. Alas, no: the XPS 13 starts at £699 for students and £899 for the rest of us. That compares to £599 and £699 for the MacBook Neo even after its recent price rise.

But let's not write off the XPS 13. Unlike other laptops in its price range, it doesn't skimp on high-end features. Instead of cheap plastic, the XPS 13 has a sturdy CNC aluminium chassis that both looks and feels high-grade. It's also the thinnest XPS and lightest laptop ever, weighing around 200g less than the MacBook Neo. Despite this, the frame barely flexes.



Measuring 201mm deep, 297mm wide and a mere 12.7mm tall, it's built for travellers. For comparison, an A4 page is exactly that width and 9mm longer. Nor will you notice the XPS 13's 1kg weight in a backpack. Dell also includes a slim 65W USB-C GAN adapter, which takes up barely any space.

Ergonomic advantage

The 13.4in display is impressive for a sub-£1,000 laptop, thanks in large part to its sharp 2,560 x 1,600 (2.5K) resolution. It's a departure from the dull, low-res panels found in many affordable laptops, reaching a peak of 411cd/m² in general use and a fraction more – 420cd/m² – when displaying HDR videos and games. That's lower than the 500cd/m² that Dell claims, but I'll let that slide as HDR videos still look great on this panel.

Don't expect amazing colour reproduction, with the XPS 13's display geared towards the sRGB colour space rather than the more vivid DCI-P3. We measured 100% coverage of the sRGB gamut and 113% volume, while DCI-P3 coverage sat at 80%. That's fine – almost identical to the MacBook Neo, in fact – but if you turn to our Labs on p74 you'll see that punchier panels are out there.

Then there's the touchscreen. I don't often take advantage of touch support on laptops, but always appreciate it when it's there. This feature is notably lacking from the MacBook Neo, and indeed any MacBook. I found the touchscreen to be just as responsive as the touchpad, never failing to register my gestures.

Finally, in terms of ergonomics, we come to the keyboard, which gives you just enough space to type comfortably. Unlike the current XPS 14 (*see issue 379, p56*) and XPS 16 (*see issue 381, p62*), this 13in model swaps a lattice-less keyboard for a more traditional keyboard deck. I don't mind typing on the Dell XPS 14 and XPS 16's keyboards, but the XPS 13's wide key spacing and separated key caps are more natural. And unlike the MacBook Neo, the XPS 13's keyboard includes a backlight.

Going Wildcat

The XPS 13 again diverges from the norm by including Intel's new "Wildcat Lake" family of CPUs. These are built using the same 18A technology as Panther Lake Core Ultra Series 3 chips and share much of the same architecture, but differ because they use two P-cores and four Low Power Efficiency LPE-cores. They also lose the "Ultra" name, so our test system includes a mere Intel Core 5 320 CPU, with two P-cores and four LPE-cores.

ABOVE Super slim, portable and sturdily built, the XPS 13 is a great budget laptop

LEFT The aluminium lid has a welcome lip that contains a pretty decent 1080p webcam

Intel also strips down the GPU, with this variant of Intel Graphics including two Xe-cores compared to four in the Core Ultra 7 355. And one more thing to be aware of: if you buy the 8GB version of the Dell XPS 13, it uses single-channel memory. You'll need 16GB of RAM to take advantage of the dual-channel memory, and that adds £150 to the price.

You can see what difference that makes in the graphs opposite. Not so much in Geekbench 6, which is a measure of CPU performance, but in the real-world Handbrake video conversion test, and it also gave a significant boost in our gaming tests. We only show *Borderlands 3* and 3DMark Steel Nomad in the graphs, but we saw the same boost in *Civilization VI: Gathering Storm*, with 29fps for the 16GB model versus 24fps. And in *Shadow of the Tomb Raider*, the 8GB version stuttered to 1fps at 1080p compared to 11fps for the 16GB version.

"The 13.4in display is impressive for a sub-£1,000 laptop, thanks in large part to its sharp 2,560 x 1,600 resolution"

To complete the comparison, the Dell 14S (*see issue 384, p54*) with a Core Ultra 7 355 inside shows the benefits of two additional P-core and four Xe graphics cores. What we don't show is *Civ VI* and *Tomb Raider* scores, where it reached 40fps and 19fps respectively.

We can also make a sweeping generalisation that you can expect very similar performance to the MacBook Neo with its A18 Pro chip, while the Apple M5 is in a different league entirely. It's just a shame, then, that the Air's



BELOW The laptop's two USB-C ports are of the speedy 10Gbits/sec variety

starting price has rocketed to £1,299 – also in a different league.

But all these results are merely benchmarks. The XPS 13 handled my workflow without issues, and I'd say I reflect a typical office worker. It also didn't get too hot under strain. So, while tasks such as video editing and gaming are too demanding for this laptop, it's more than capable for everyday work and video streaming.

Disks and battery

In our battery life test, which involves continuous Wi-Fi web surfing with the display set to 150cd/m², the Dell XPS 13 lasted 14hrs 26mins. In fact, our 16GB review sample kept going for almost 15 hours (the difference is likely due to different batches of battery). While that's short of the 20+ hours we saw from the Dell 14S, it's a fine result for an affordable Windows laptop and isn't far off the 13in MacBook Air.

We don't normally talk about disk performance, but it's worth highlighting that Dell spends more on the drive inside the XPS 13 than Apple does with the MacBook Neo. That showed in the Blackmagic Disk Speed test, with the 512GB SSD inside the XPS delivering 3,714MB/sec sequential reads and 5,027MB/sec writes. The Neo was stuck at around 1,500MB/sec in both tests. The MacBook Air, by comparison, delivered results closer to 6,500MB/sec.

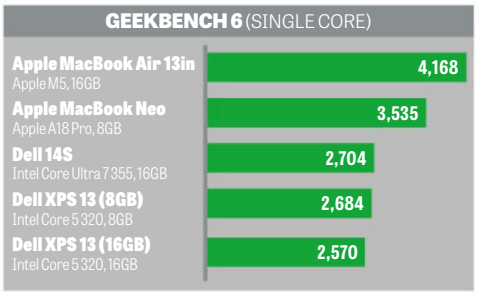
Connectivity-wise, the XPS 13 gives with one hand and takes with another. It's amazing to see Wi-Fi 7 and Bluetooth 6 in such an affordable laptop, so full applause here. But it also has only two USB-C ports, and remember one of those may be required for charging. While that's a disappointment, they're both USB 3.2 Gen2 (10Gbits/sec), compared to the Neo's single USB 3.2 Gen2 port and older USB 2.

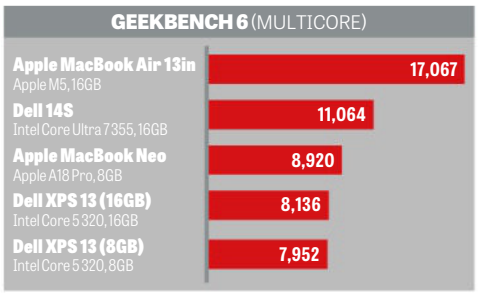
There isn't a 3.5mm headphone jack either, which is disappointing. But even here I find it difficult to complain, because the quad-speaker setup with 8W total peak output is far better than rival Windows laptops. To be super critical, the middling bass isn't ideal for music lovers, but it goes loud and in general you should be surprised in a good way.

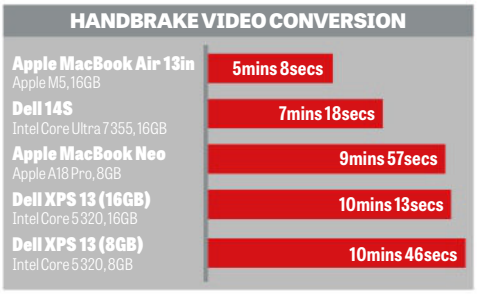
Final touches

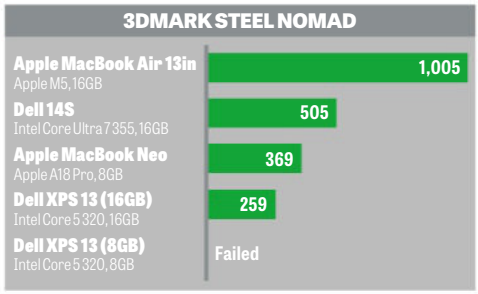
Before I come to the verdict, I have to thank Dell's designers for creating a laptop with a handy lip on the lid. I've often complained about the lack of this design element in other XPS laptops, so it's great to see this here for single-handed use.

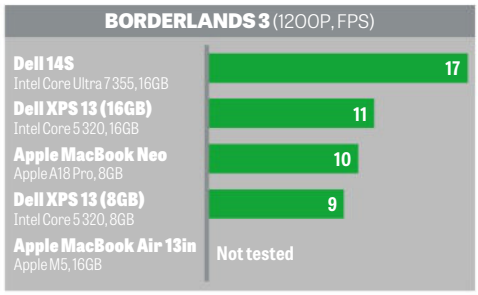


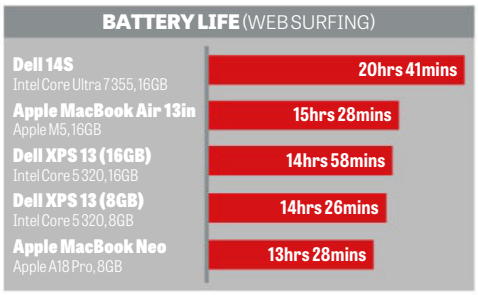


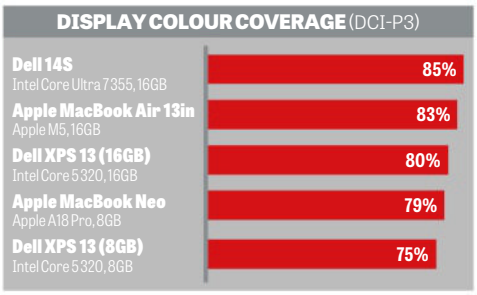


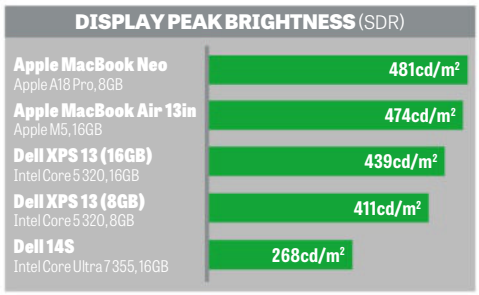








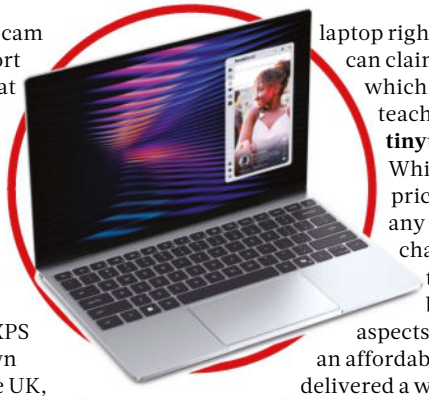




The lip contains a 1080p webcam with dual-array mics and support for Windows Hello. It's great that Dell avoids the cheap 720p webcams budget laptops have been known for, but don't expect to look your best during video calls. In particular, it tends towards being blurry and washed out, making me look pale in calls.

So, should you buy the Dell XPS 13? The answer to this boils down to your budget and needs. In the UK, it only comes in two configurations: one with 8GB RAM for £899 and one with 16GB RAM for £1,049 (oddly, this doesn't come with a charger). You can't opt for more storage than 512GB, although that may change in the future.

If that's enough for you, then this is arguably the best budget Windows laptop right now, particularly if you can claim the education discount, which is open to students and teachers (see if you qualify at **tinyurl.com/385students**). While I don't welcome the price "rise", I didn't expect any PC manufacturer to challenge the MacBook Neo this fast or this well. By bringing the finest aspects of the XPS laptop line to an affordable laptop, Dell has delivered a winner. **TONY POLANCO**



ABOVE The wide key spacing and separated key caps make typing a real pleasure

LEFT Sadly there's no 3.5mm audio jack, but the speakers almost make up for that

SPECIFICATIONS

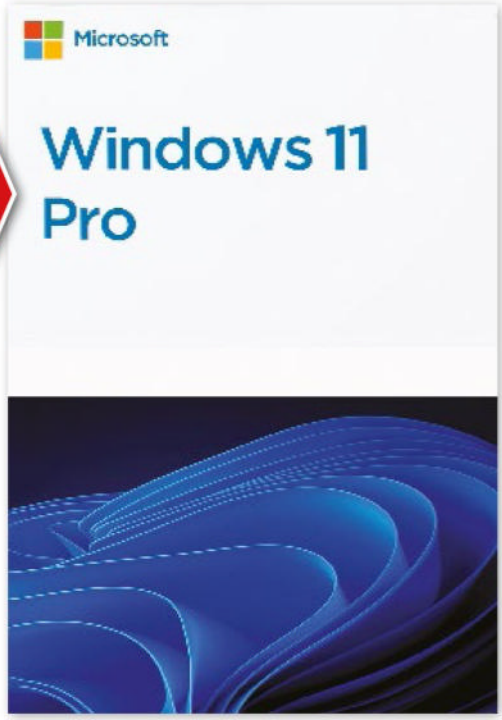
6-core (2 P-cores, 4 LPE-cores) Intel Core 5 320 processor • Intel Graphics • 8GB LPDDR5X-7467 RAM • 13.4in 120Hz IPS touchscreen, 2,560 x 1,600 resolution • 512GB M.2 PCIe Gen4 SSD • Wi-Fi 7 • Bluetooth 6 • 1080p IR webcam • 2 x USB-C 3.2 Gen2 • 52Wh battery • Windows 11 Home • 297 x 201 x 12.7mm (WDH) • 1kg • 1yr on-site warranty • part code: cndx1326001cc

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Word 2024 builds on Word 2021 with much better image support, including from a mobile phone, and support for the OpenDocument Format (ODF) 1.4. It's easy to apply a range of visual effects to text, SmartArt graphics help build impressive diagrams, and you can edit pictures from within Word, no further software required.

Excel 2024 gains new text array functions, a new image function so you can add pull images into a spreadsheet from various sources, and is faster. This builds on Excel 2021 features such as Sparklines.

Outlook 2024 includes an improved search function and additional options for creating a meeting, along with features such as the Conversation view and Quick Steps – simple macros that carry out multiple Outlook actions at a click – that debuted with Office 2021. Elsewhere, PowerPoint 2024 includes the function to record live camera content straight into your slide, export your slides as a video, and adds closed captions for audio and video.

See "What's New in Office 2024" **(tinyurl.com/whatsnewoffice)** on the Microsoft website for detailed information.

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Alienware 15 (DA15265)

A Ryzen 7 CPU and RTX 5050 deliver solid frame ratees, but the single-channel RAM and dim display disappoint

SCORE ★★☆☆☆

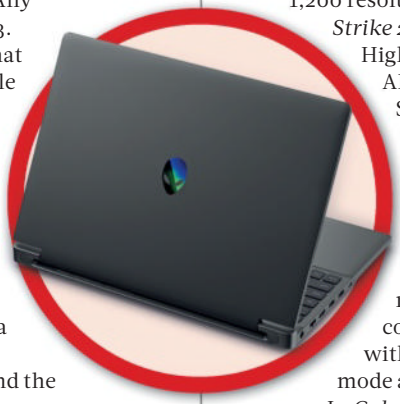
PRICE As reviewed, £1,217 (£1,460 inc VAT) from dell.com



This gaming laptop saves pennies by using older CPUs, as shown by the use of an AMD Ryzen 7 260 here. If you prefer Intel, Dell sells a twist on the Alienware 15 with its previous-generation chips.

The Ryzen 7 260 is built on AMD's previous-generation Zen 4 architecture and ranks as the second-fastest CPU in the Ryzen 200 Series. It's no sluggard, then, but the scores in Geekbench 6 put it below the original Asus ROG Ally handheld from 2023.

It doesn't help that Dell provides a single 16GB DIMM here; in fact, you can only order the Alienware 15 with one (either 8GB, 16GB or 32GB). It's quite easy to remove the base cover and add a second SODIMM yourself, though, and the battery, speakers and wireless card are all replaceable by end users, too.



You can also replace the SSD, but it makes sense to order the 1TB option by default. While the 512GB unit was fast – 7GB/sec reads and 6GB/sec writes in CrystalDiskMark – there was only 332GB of free space on the Alienware's first boot. After installing four games, I was out of space.

Dell sent us the option with an RTX 5050 GPU, but you can save money by opting for an RTX 3050 or 4050, or go up a notch with the RTX 5060. Your choice has an effect on the CPU, though, as the Ryzen 7 260 is only offered with the RTX 4050 or above.

So, with our RTX 5050 in place, how fast was the Alienware 15 in games? At the panel's native 1,920 x 1,200 resolution, *Counter-Strike 2* recommends High settings with AMD FidelityFX Super Resolution. And it delivers. On Dust II, the frame rate remained around the 165fps target – the screen has a 165Hz refresh rate – when connected to power with the Performance mode active.

In *Cyberpunk 2077*, at the High preset with ray tracing and upscaling disabled, the Alienware 15 consistently achieved 60fps baseline in the game's built-in benchmark. The game supports DLSS 4.5, and setting Super Resolution to Balanced and Multi Frame Generation (MFG) to 4x in the "Ray Tracing: Low" preset saw the laptop average 171fps.

PUBG: Battlegrounds generally runs above 60fps with the High preset at render scale 100, but you can push it to 165fps or higher by switching to the Medium preset and further lowering some settings. Similarly, *Apex Legends* can reach 165fps after tweaking some settings.

However, the laptop's fans were extremely loud throughout. Switching to Alienware's Stealth mode reduced the fan speed, but no amount of graphical tweaks brought them down to a comfortable level. You'll have to get used to wearing headphones when gaming. And despite the fans working as hard as they can, the keyboard still gets warm during gaming.

In terms of design, the Alienware is a mixed bag. It has a plain exterior aside from the iridescent alien head logo and thick air vent panels underneath, but its most striking first impression is how heavy it is at 2.3kg. Its 15.3in screen sits on a gapped hinge, which looks strange at first glance, but I felt air flow around the gap while it's in use, so it makes sense. Don't expect glorious colours: it covers 63% of the sRGB gamut and 45% of DCI-P3, while peaking at a subdued 301cd/m².

The backlit keyboard is unremarkable, sticking to a single colour and including a number pad that I'm sure most gamers will never use. I wish the space had been used for larger speakers. There's no significant bass response for a start, but the sheer volume of the fans overwhelms the audio anyway.

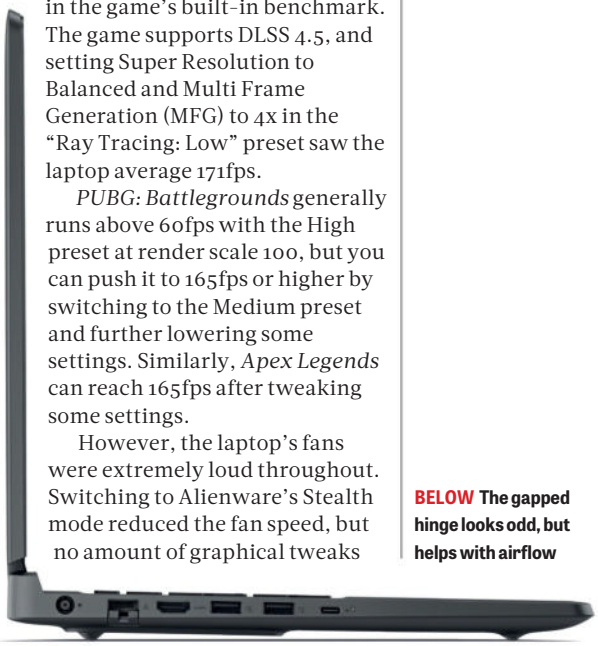
The 5.5in mechanical touchpad only clicks properly in the bottom half, but you'll probably use a dedicated mouse for most games. A 3.5mm audio jack pairs with a USB-C 3.2 Gen1 port on the right side, while a single USB-C 3.2 Gen2 is available on the left side, along with two USB-A 3.2 Gen1 ports, HDMI 2.1 and an always welcome 1Gb Ethernet port. (Note the ageing Wi-Fi 6 and Bluetooth 5.2 support.) The heavy 180W AC adapter needs an old-school barrel jack, but you can charge up to 100W with USB-C.

Battery life is poor, only four hours even with light use, but the real death knell for the Alienware 15 is that rivals offer higher specs for less money. In particular, hunt out the Medion Erazer Deputy 15 P1 (*see issue 383, p92*), with options including a 1TB SSD and RTX 5060 for the same price Dell is charging for 512GB and an RTX 5050. **BEN WILSON**

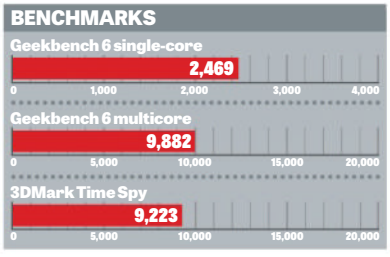
ABOVE With a poor screen and low battery life, the Alienware 15 is best avoided

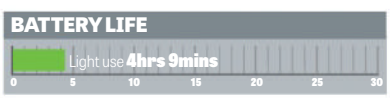
"Battery life is poor, but the real death knell for the Alienware 15 is that rivals offer higher specs for less money"

LEFT At 2.3kg, you won't want to be lugging this laptop around too much



BELOW The gapped hinge looks odd, but helps with airflow





SPECIFICATIONS

8-core (Zen 4) AMD Ryzen 7 260 processor • 8GB Nvidia GeForce RTX 5050 graphics • 16GB DDR5-5600 RAM • 15.3in non-touch IPS display, 165Hz, 1,920 x 1,200 resolution • 512GB M.2 PCIe Gen4 SSD • Wi-Fi 6 • Bluetooth 5.2 • 1080p webcam • 1GbE RJ45 • USB-C 3.2 Gen2 • USB-C 3.2 Gen1 • 2 x USB-A 3.2 Gen1 • HDMI 2.1 • 3.5mm combo jack • 70Wh battery • Windows 11 Home • 350 x 250 x 20.7-23mm (WDH) • 2.3kg • 1yr on-site warranty • part code: DA15265

Framework Laptop 13 Pro

The best Framework Laptop yet, with a sturdy design, haptic trackpad and bigger battery



SCORE ★★★★☆

PRICE Core Ultra X7/64GB/2TB, £3,170 (£3,804 inc VAT) **from** frame.work

If you want a truly upgradable laptop, you should be looking at Framework. It bakes ease of repair and upgrades into its laptops, but until now that has been at the expense of build quality. The Framework Laptop 13 Pro is a step up in class, with a CNC-machined aluminium chassis, haptic touchpad, high-resolution touchscreen and other premium features that haven't previously troubled Framework's lineup.

This makes it immediately more attractive than the original Framework Laptop 13 (*see issue 360, p58*). It has a blacked-out colour scheme as opposed to silver but, more importantly, the chassis has significantly less flex. I could bend the regular Framework laptop with just one hand. There's still flex around the display, but this improvement made me feel far more confident having the laptop in my backpack. It slides in easily, too, with similar dimensions to a MacBook Pro.

Not everything is perfect. While I like the velvety feel of the coating on the frame, it does love a fingerprint. And, with the laptop open, one area doesn't feel as premium: the bezel, which is still plasticky and attached with magnets.



ABOVE The DIY Edition of the laptop lets you install your own SSD and RAM

Upgrade mania

Framework's modularity continues in the new design. In fact, if you wanted, you could build a Laptop 13 Pro around your old Framework mainboard, Ship of Theseus style. I was sent a DIY Edition of the Laptop 13 Pro, which meant installing a Framework-supplied SSD and LPCAMM2 memory before getting started. I only needed the Torx T5 screwdriver that comes in the box.

The SSD is a standard install, but fitting the LPCAMM2 memory was a first for me. You have to be careful to align the memory with a sensitive interposer (which also happens to be slightly under a ribbon cable connected to the screen, which got in the way). You then place a memory module on top of the LPCAMM2 socket, with three screws labelled in the order you should tighten them to firmly seat it.

From there, you need to attach the input cover using a ribbon cable (taking a minute to admire the underside of the haptic touchpad and its four piezo sensors), which then snaps into place on the chassis.

Next, flip the laptop over and tighten five captive Torx T5 screws. Pop in your expansion cards, lock the slots, and voilà, you're ready to install an operating system. If you buy a prebuilt version, the OS will come pre-loaded. Otherwise, you can largely reverse any of these steps at any time to make upgrades, including motherboards.

My main word of warning is that LPCAMM2 is hard to find. You can order modules from Framework, but one of the joys of choosing a DIY laptop is to hunt out your own components. For that reason, the DIY Laptop 13 Pro doesn't make much sense unless you're keen to use your own SSD.

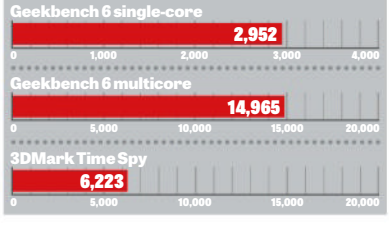
Top speeds

I tested the Framework Laptop 13 Pro in its most powerful configuration: with an Intel Core Ultra X9 388H processor and 64GB of RAM. My system also had a roomy 2TB SSD. I could have loaded Linux, but I opted for Windows 11 to best compare the system to other laptops.

In Geekbench 6, the Framework Laptop 13 Pro notched a single-core score of 2,952 and a multicore score of 14,965. That first result is similar to the same X9 chip found in the Asus Zenbook Duo (*see issue 379, p60*), but the Zenbook scored 15%

"The Framework Laptop 13 Pro is a step up in class, with a CNC-machined aluminium chassis and other premium features"

BENCHMARKS



BATTERY LIFE



higher in the multicore section, likely because of its cooling; Framework opts for a single fan. This was backed up in our stress test, where the CPU was throttled towards the end.

In Handbrake, the Framework transcoded a 4K video to 1080p in 4mins 9secs, ahead of the Duo but behind the M5 MacBook and the latest Snapdragon X2 Elite laptops.

As we've seen in other Panther Lake laptops, the Intel Arc B390 is a serious GPU. Its 12 Xe cores enabled the Laptop 13 Pro to achieve a score of 1,362 in 3DMark's Steel Nomad cross-platform benchmark, but again lost out to the better-cooled Zenbook Duo using the same chip.

Framework debuts a larger 74Wh battery on the Laptop 13 Pro. Even when powering the Core Ultra X9 388H, it ran for 15hrs 55mins in our light-use test. That would have been a creditable result in our executive laptops Labs test (*see p74*).

Touch display

The Framework Laptop 13 Pro marks the company's first custom display, along with the first time its 13in laptop has had a touchscreen (touch was previously available on the Framework Laptop 12). The 13.5in 2,880 x 1,920 panel provides a rare 3:2 aspect ratio with a variable refresh rate between 30 and 120Hz.

It's exceedingly bright, too. In the trailer for *Avengers: Doomsday*, an explosion in the X-Mansion and lightning coming from Thor's Stormbreaker axe were eye-popping. The panel measured an astounding 709cd/m² in our tests, surpassing the MacBook Pro's mini-LED screen (558cd/m²) and the OLED panel on the Asus Zenbook Duo (509cd/m2).

The Framework's display is largely on a par with the MacBook's in terms of colour volume, totalling 114% of the sRGB gamut and 81% of the more vibrant DCI-P3 space. It's a great inclusion.

The keyboard cover on the Framework Laptop 13 Pro is one large piece sitting on top of the components, like previous designs. Here, the keyboard has white backlighting and 1.5mm of key travel. The keys felt stiffer than I'm used to; one colleague liked the effect, but others might hope the keys soften after a few months of use.

As mentioned, the haptic touchpad uses four Piezo sensors to convert pressure into clicks. On the one hand, it's a huge step up from the company's mechanical touchpads, which often felt cheap, but I could sometimes see and feel the haptic touchpad flex in the keyboard deck.

Finally, we come to the pair of 2W side-firing speakers, rather than the bottom-firing speakers on the original Framework Laptop 13 design. If you're using Windows 11, you get Dolby Atmos support. They're best for personal listening: Alice Merton's "Ignorance is Bliss" only barely filled my living room. Otherwise, the vocals, guitars and drums were distinguishable and sounded good.

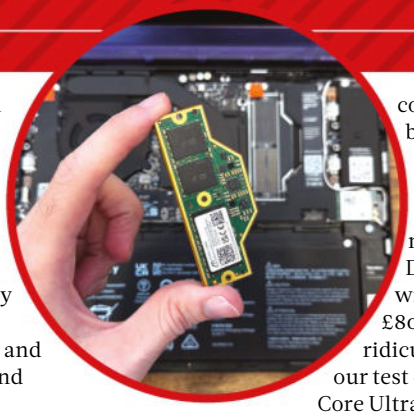
Some downsides

Let's cover some areas for improvement. The 1080p webcam on the Framework Laptop 13 Pro is serviceable, but not the best. Although colours were accurate in video and photo testing, I saw graininess in both well-lit and dark images. Additionally, this laptop doesn't sport an infrared camera for Windows Hello. Your only option is the fingerprint reader.

I would like to see an easy way to customise the keyboard. VIA's web app didn't recognise it, which is perhaps understandable when this laptop is so new, but that's a warning flag for those who like to customise everything – which surely applies to most Framework customers.

As is common, Framework sells the Laptop 13 Pro with a one-year warranty, which you can extend to three years at the time of purchase. And that brings us to the price. The DIY configuration costs £1,799 with an Intel Core Ultra X9 388H before adding in memory, storage, an operating system or any of the extras such as expansion cards.

If you had purchased all of our components from Framework, the system cost around £3,000 when I started testing it. And that was with a Core Ultra X9 388H, which isn't currently longer available due to stock issues. "We are working with Intel and expect to get additional allocation of X9," the company told me, "but we don't have timing we can communicate on when it will be available for order."



ABOVE Fitting your own memory and SSD is a satisfying task for tinkerers

And that isn't the only challenge. In the middle of testing, the price of the memory on Framework's DIY systems almost doubled, with 16GB now £239, 32GB £800 (not a typo) and 64GB a ridiculous £1,600. This pushed our test configuration, but with a Core Ultra X7 358H, to roughly £3,800. That's without an OS, as I installed my own copy of Windows.

All of which reinforces my point that it makes more sense to choose prebuilt for now. The cheapest Intel system (with a Core Ultra 5 325, 16GB of RAM and 512GB of storage) is £1,599, while AMD Ryzen AI 300 versions begin at £3,699 with 2TB of storage and 64GB of memory.

Bottom line

When Framework announced the Laptop 13 Pro, it promised a "MacBook Pro for Linux users". I'm not sure I agree. The MacBook Pro has an air of utility, while the Framework Laptop 13 Pro is more playful. That alone makes it feel different, and I don't mean it in a bad way.

"The Framework's display is largely on a par with the MacBook's in terms of colour volume. It's a great inclusion"

If it's talking purely about build quality, then Framework has a point. The Laptop 13 Pro is more premium and rigid than any of its previous offerings, while also offering a bright screen and haptic touchpad. The new silicon is also faster and more efficient than previously, even if the single fan limits its potential.

But it's the price and availability that will scare off most customers. Framework won't thank me, but I must point out you can buy an M5 Max MacBook Pro with 32GB of RAM for a similar price, which would outperform this system on multicore and graphics performance.

Then again, that misses the appeal to the niche audience this is aimed at, especially the DIY Edition. But if you happen to have parts lying around, there's no question that this design should usurp its old one as quickly as possible. **ANDREW E FREEDMAN**



BELOW The superb screen is one of the brightest you'll find on a laptop

SPECIFICATIONS

16-core (4 P-cores, 8 E-cores, 4 LPE-cores) Intel Core Ultra X9 388H • Intel Arc B390 graphics • 64GB LPDDR5X RAM • 13.5in 120Hz IPS touchscreen, 2,880 x 1,920 resolution • 2TB WD Black SN7100 M.2 PCIe Gen4 SSD • Wi-Fi 7 • Bluetooth 6 • 1080p webcam • 4 x expansion card slots • 74Wh battery • no OS • 296 x 229 x 15.9mm (WDH) • 1.4kg • 1yr RTB warranty. **Expansion cards:** USB-A (£9) • HDMI (£19) • 1GbE port (£39) • DisplayPort (£19) • microSD (£19)

Philips 24B2D5300

An intriguing idea, offering a dual-sided screen for customer-focused roles or as a shared office display

SCORE ★★★★☆

PRICE £304 (£365 inc VAT) **from** misco.co.uk



I've reviewed a lot of monitors in my time, but this may well be the oddest. It's the Siamese twin of displays, with two 24in panels placed back to back in the same housing. You may at this point be wondering why.

Here's one scenario. You're a salesperson who constantly needs to share the contents of their screen; perhaps to show different configurations of a car. The Philips 24B2D5300 allows you to clone your display so that both you and the customer see exactly the same thing without anyone needing to swivel the screen or crane their neck. Or consider the world of hospitality or healthcare, where you may want to show something publicly on the customer-facing screen while keeping your own main screen private. (This second use case only works if you're connected over USB-C, not HDMI.)

There are many customer environments where I can see this working, but Philips is also targeting space-constrained offices. And it's worth highlighting that this is an extremely compact display, measuring 130mm deep (although you'll have to find somewhere to put the chunky external power supply). If you only have room for narrow desks, Philips suggests, you can place the monitor in between two workers sitting opposite one another, with each worker plugging their computer into the relevant connectors. The two displays will now work entirely separately, with a choice of USB-C or HDMI inputs for both.



LEFT The display could earn its keep in space-constrained offices

Despite the benefits, I can't really see this working for offices. You're simply sacrificing too much for the sake of space. Due to the design's inherent nature, there's no way to tilt the monitor backwards or forwards to make it easier to see: you're stuck with it at a military-esque, snap-to-attention, 90-degree angle to the desk. Nor can you adjust the height. Short of sticking the monitor onto a stand, the top of the panel will stand around 40cm tall from the desk – so you'll almost certainly be looking down on it. The only flexible thing about the 24B2D5300 is that it swivels 180 degrees.

The panels behaved very similarly in our tests, although we found one was brighter than the other, peaking at 409cd/m² compared to 360cd/m². They cover 98% of the sRGB colour space, with a 109% volume, so we're not talking a wide gamut here. Still, colours are absolutely fine for office use, and they're accurate, as shown by an average Delta E of around 0.4. Whites look good, too.

I found only one oddity during my testing, which was contrast: out of the box, I measured this at around 300:1, compared to Philips' claims of 1,500:1. This is due to Philips activating SmartContrast – where it adjusts the amount of contrast based on what's on the screen at the time – by default, and once I switched it off the contrast became a far more natural 1,369:1.

I doubt many people will notice the difference, but it's worth digging around in the OSD to find the settings that work for you. Unfortunately, navigating the OSD is a Kafkaesque nightmare. That's partly because Philips places its faith in a navigation joystick (one for each panel), which might have worked except that pressing down doesn't move you downwards in the menu – to do that, you press left. Pressing upwards instead sends you back one step, while pressing backwards pushes you one step forward. There is a weird logic to the system, but I found it counter-intuitive.

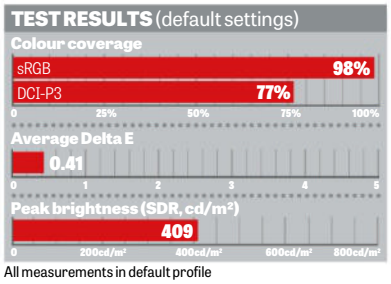
ABOVE This unique double-sided display could be ideal for customer-facing roles

There are at least handy shortcuts to switch between inputs, adjust the brightness and flip between Philips' SmartImage presets. The most useful of these is EasyRead, which adds a sepia tone, but again it's worth using Movie, Photo, Office and Gaming to see if they suit your tastes.

Philips also includes an Economy Mode, which drops the brightness to around 60cd/m2, but most people will want to stick to around 200cd/m² (roughly 45 out of 100 in Philips' settings) as this is far more readable. Besides, economy is one of this monitor's biggest strengths: with both panels at 200cd/m² it consumes 24W, pushing to 36W at peak brightness, giving a per-panel rate of 12W/18W in general use. In a large rollout, that could add up to big savings over time.

"Both you and the customer see exactly the same thing without anyone needing to swivel the screen or crane their neck"

All of which means that if the Philips 24B2D5300 meets your needs then it will do the job well. There are even neat touches such as having a pair of front-mounted USB-A ports on each side, plus a 3.5mm audio out (Philips includes a pair of 3W speakers – shared between the two monitors – but with almost non-existent bass these are of limited use). I would lean towards buying a pair of 27in 1440p monitors instead, but admit that would consume more space, more power and wouldn't look anywhere near as neat. **TIM DANTON**



All measurements in default profile

SPECIFICATIONS

2 x 23.8in 1,920 x 1,080 IPS panel • up to 120Hz refresh rate • 6-bit + FRC (16.8 million colours) • 4ms grey-to-grey response time • 2 x USB-C 3.2 Gen1 upstream (65W) • 2 x HDMI 1.4 • 4 x USB-A 3.2 Gen1 downstream • 2 x 3.5mm outputs • 2 x 3W speakers • -180° to 180° swivel • 541 x 130 x 413mm (WDH) • 5.6kg • 5yr warranty • power: 200cd/m² 24W, peak 36W

Asus ProArt Display OLED PA279CDV

Thanks to OLED technology and careful calibration, this colour-accurate display is ready for work and play

SCORE ★★★★★

PRICE £541 (£649 inc VAT) **from** asus.com

Out of the 17 monitors in our group test last month (*see issue 384, p72*), only one used an OLED panel: the stunning Lenovo Yoga Pro 27UD-10, with its 4K panel, 120Hz refresh rate and £1,299 asking price. Now we're lucky enough to get our hands on the all-new Asus ProArt PA279CDV, which offers those same core specs for half the price.

It comes pre-calibrated for sRGB, Adobe RGB and MacBook-like Display P3 colour spaces, along with BT.709, BT.2020 and DICOM. There are two slots available for user presets, and all you need is a £100 colorimeter as Asus provides its ProArt Calibration software for free.

I first tested the panel in its native colour space. Out of the box it covers an enormous 153% of the sRGB gamut, so we can safely call this a wide-gamut display, with an average Delta E of 0.65. Whites also look fantastic.



Asus's calibrated modes performed well, too. Switching to sRGB locked it down to 95% coverage with 96% volume (so a minimal 1% overspill), while P3 locked to the DCI-P3 space with 96% coverage and 99% volume. Print designers will be better served by IPS panels in creator-focused monitors, but 87% Adobe RGB coverage isn't bad.

My testing revealed one other oddity: a peak brightness of 239cd/m². Due to OLED's perfect contrast, the human eye perceives the panel as much brighter – in my view, roughly equivalent to 400cd/m² of an IPS panel. However, you can force brightness higher, to almost 300cd/m², by switching off the "Uniform Brightness" setting in the OSD, and I recommend you do so as this made no difference in my uniformity measurements.

TEST RESULTS (default settings)

Colour coverage

sRGB	100%
DCI-P3	98%

0 25% 50% 75% 100%

Average Delta E

0.65

0 1 2 3 4 5

Peak brightness (SDR, cd/m²)

239

0 200cd/m² 400cd/m² 600cd/m² 800cd/m²

All measurements in default profile



ABOVE The ProArt PA279CDV is a superb monitor for the price

The ProArt PA279CDV is capable of going brighter still, but only in HDR films and games. Asus claims it will push up to 1,000cd/m², but it only has VESA DisplayHDR 400 certification – that means it can comfortably boost to 400cd/m² and above, but not enough to earn DisplayHDR 600 certification, which is why HDR programming such as Netflix's *Our Universe* doesn't look as impactful as I've seen on other monitors.

If you love hearing Morgan Freeman's narration in its usual booming bass then I fear the PA279CDV won't impress. The pair of 2W speakers are okay for casual use, but music sounds hollow and bass is non-existent. The Yoga Pro 27UD-10 knocks it for six here thanks to its four 7W woofers and the accompanying pair of 3W tweeters.

The ProArt largely matches Lenovo's more expensive Yoga Pro for inputs and outputs, with USB-C (up to 96W compared to 140W for the Yoga), HDMI and DisplayPort inputs all sitting ready. You can also daisy-chain a second monitor via a DisplayPort out, again just like the Lenovo.

Those who dislike seeing cables may not be fans of the cut-through in the Asus's stand, though, as it sits low down and that means cables are visible unless the monitor sits at the lower end of its 130mm height adjustment range. You can also benefit from pivot mode (potentially a big boon if you daisy-chain two of these monitors), while the 30 degrees of swivel to either side is less generous than some rivals but beats Lenovo. Despite the Yoga's flexible name, it offers no swivel at all.

Asus provides a KVM for switching between connected computers, with a trio of USB-A inputs available for your peripherals along with two USB-C ports. One of each sits within easy reach on the bottom of the bezel. I would have appreciated an RJ45 port to turn this into a true docking monitor, but USB-A to RJ45 dongles are ten a penny so this isn't a disaster.

One final word on the OSD. This is a complicated affair, with Asus struggling to squeeze all the options into a sensible interface. It's worth exploring, though, as you'll find designer-friendly features such as a centre marker, the ability to highlight specific areas and a ruler.

I preferred Asus's DisplayWidget Center software, which is a great way to play around with the colour settings; there are many options, including basics such as colour temperature and the ability to adjust RGB offsets. If you like to tweak, you'll love this monitor.

PC PRO ★★★★★ A-LIST

"Out of the box it covers an enormous 153% of the sRGB gamut, so we can safely call this a wide-gamut display"

LEFT USB-C, HDMI and DisplayPort inputs make this a well-connected display

BELOW Pivot mode could be useful if you daisy-chain two of these displays



There are weaknesses here – a lack of HDR wow factor, a complicated OSD – but let's remind ourselves that it costs half the price of the Lenovo Yoga Pro 27UD-10. The Asus delivers a fantastic image in a range of colour spaces, plenty of flexibility via the video inputs and outputs, and the only notable area where it falls down against the Lenovo is audio quality. This makes it an easy recommendation and places it straight on the *PC Pro* A-List. **TIM DANTON**

SPECIFICATIONS

26.5in 3,840 x 2,160 OLED panel • up to 120Hz refresh rate • 10-bit panel (1.07 billion colours) • 0.1ms grey-to-grey response time • DisplayHDR 400 • USB-C 3.2 Gen1 upstream (96W) • HDMI 2.0 • DisplayPort 1.4 in • DisplayPort 1.4 out • USB-C 3.2 Gen1 downstream • 3 x USB-A 3.2 Gen1 downstream • 3.5mm output • 2 x 2W speakers • KVM • 130mm height adjustment • pivot • -30° to 30° swivel • -5° to 23° tilt • 621 x 202 x 396-526mm (WDH) • 5.6kg • 3yr warranty • power: 200cd/m² 42W, peak 53W

HP Series 7 Pro 734pm

A solid choice for people on constant web calls, and its connectivity is indisputable, but the price is too high

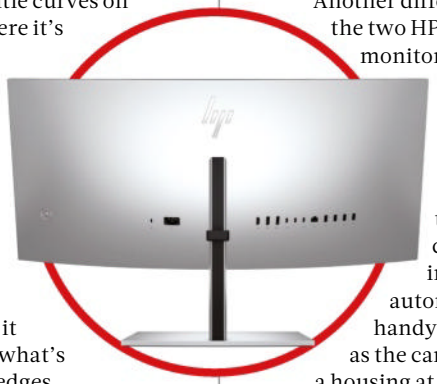
SCORE ★★★★☆

PRICE £842 (£1,010 inc VAT) **from** hp.com



Last month, the HP Series 7 Pro 732xk (*see issue 384, p92*) comprehensively won our group test of widescreen monitors thanks to its gorgeous 31.5in IPS Black display. Our only concern was availability, and sure enough it still isn't back on sale via HP's website. HP suggested we test its sister model, the Series 7 Pro 734pm, as an alternative – after all, they're both high-end Thunderbolt 4 monitors aimed at professionals.

The 734pm also uses an IPS Black panel, but a larger 34in version with a surprising amount of curvature. I'm used to seeing gentle curves on IPS screens, but here it's 1900R – so if you surrounded yourself with these monitors, the circle would have a 1,900mm (1.9m) radius. That's beneficial when you have a 34in panel, as it makes it easier to focus on what's happening at the edges.



It comes with one downside, which is a 3,440 x 1,440 resolution compared to the 4K of the 732xk. In the unlikely situation where you were using them side by side, this is noticeable – there's that slight lack of sharpness by comparison. In isolation, though, most people should be happy with 109 pixels per inch.

There's one obvious advantage to all that space, which becomes apparent when you plug two computers into the rear connectors; HDMI, DisplayPort, USB-C and a Thunderbolt 4 port are all present. At this point HP's Device Bridge kicks into action, and splits the panel into two – effectively you get two 1,720 x 1,440 displays, which is roughly a 5:4 aspect ratio. You can then share a connected mouse and keyboard between them. Or you can switch between sources in the normal way, of course.

Another difference between the two HP Series 7 Pro monitors is that the 734pm includes a webcam. This being 2026, it's an AI webcam, which means that it will centre your face in the frame automatically; a handy feature to have, as the camera slides out of a housing at the top of the display and sits there rigidly. The only way to physically move it is to move the whole display. While the stand is height adjustable, by up to 150mm, and you can tilt it forward five degrees and back 20 degrees, it's far easier to let the algorithms do the work.

The webcam is fine. I don't mean that in a dismissive way: I'd be happy to use it for daily calls, and its built-in mics will do a good job of capturing your voice. But it made my face look too red and it lacks the sharpness of the best webcams. Naturally, it only works over USB or Thunderbolt. HP packs four 3W speakers into the 734pm, and they certainly deliver for volume. They're fine (that word again) for music, but the lack of bass means I can't get too excited by them.

I'm more willing to lavish praise on the panel, which is preset to the DCI-P3 space when you first switch the monitor on. Colours look fantastic, including whites, and HP's factory calibration proved effective as it displays 91% of that colour space out of 94% volume. If you switch to the Native space – that's easy to do via either HP's intuitive on-screen display or the HP Display Center software – then you'll see the full gamut of this panel, which stretches to 143% of the sRGB colour space. You can also choose the sRGB and BT.709 colour spaces, or create your own colour preset if you have a calibrator.

More versatility comes via the numerous connectors on tap. You can daisy-chain a second monitor via DisplayPort, while there are five USB-A ports to turn this into a docking station in its own right. There's also a 1Gb Ethernet port at the rear and yet another USB-C port, this time for attaching peripherals (it can provide 15W of charge and supports up to 10Gbits/sec transfers). When you factor in HP's usual attractive styling and a solid cable tidy at the rear of the stand, it becomes clear that this could be the centrepiece of an impactful desk setup. The perfect accompaniment for one of the executive laptops we test from p74.

ABOVE **The Series 7 Pro 734pm is a fine monitor, but it's a little overpriced**

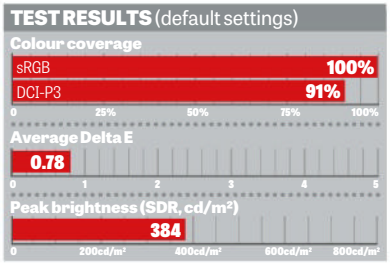
"If the price drops to £800, the HP Series 7 Pro 734pm would shoot right up to the top of my list for conferencing monitors"

LEFT **You certainly won't be left wanting for ports on this well-connected display**

BELOW **The 1900R curved screen is unusual on an IPS Black panel**



So why doesn't it walk away with a Recommended award? Primarily due to the price. At over £1,000, I think you have the right to expect a 4K (or higher) resolution panel, even taking into account the inherent cost of Thunderbolt 4 and all the extra connectors HP throws in. And if this was to be my main webcam, I would want it to be more flexible and produce a higher quality image. If the price drops to £800, and it might, then the HP Series 7 Pro 734pm would shoot right up to the top of my list for conferencing monitors. **TIM DANTON**



All measurements in default profile

SPECIFICATIONS

34in 3,440 x 1,440 IPS Black panel • up to 120Hz refresh rate • 8-bit panel (16.8 million colours) • 5ms grey-to-grey response time • DisplayHDR 400 • Thunderbolt 4 upstream (100W) • USB-C 3.2 Gen2 upstream (65W) • HDMI 2.0 • DisplayPort 1.4 in • DisplayPort 1.4 out • Thunderbolt 4 downstream (15W) • USB-C 3.2 Gen2 downstream (15W) • 5 x USB-A 3.2 Gen2 • 1GbE • 3.5mm output • 4 x 3W speakers • 5MP webcam • KVM • 150mm height adjustment • -10° to 10° swivel • -5° to 20° tilt • 814 x 267 x 395-545mm (WDH) • 11.4kg • 3yr warranty with zero-bright-pixel promise • power: 200cd/m² 31W, peak 44W

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Your bonus software

Total value this month £104

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

Avast Driver Updater 2026

- One-year, one-PC licence worth £29
- avast.com

REQUIRES Windows 7 or later; 2GB drive space; online registration

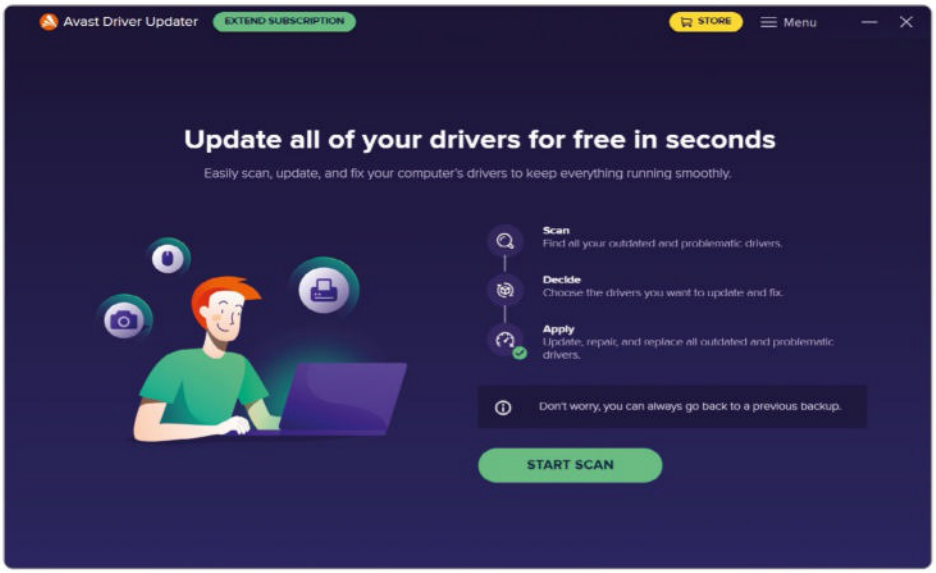
Drivers are the link between Windows and every piece of hardware you rely on. Making sure they're up to date is essential if you want to keep your PC secure and running smoothly.

Some drivers are issued once and never touched again, but others evolve over time, to introduce new features, patch vulnerabilities, cater for evolving technologies, or keep up with Windows as it develops. In many instances, new releases arrive through Windows Update, but that's not always the case, which is why you may be running older, more insecure and poorly optimised drivers.

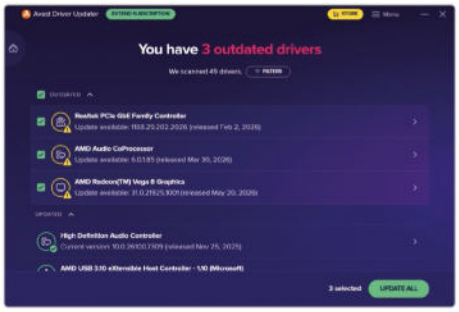
In years gone by, the only way to keep things up to date was to visit every manufacturer's website and check for patches . You'd need a full list of all the components in your machine, all the peripherals you've attached, and the version number and release date of the drivers for each. You'd then need to navigate the associated websites and check for compatible versions.

Avast Driver Updater is a far better option. Working much like Windows Update, it performs a thorough analysis of your computer and compiles a list of all of the hardware and components it finds. It then cross references the drivers for each with a constantly updated database and highlights any that are broken or out of date. It then lets you safely update or restore a version that will serve you better. Avast claims it can check over 300,000 devices, and it works seamlessly with drivers from more than 1,300 major brands, including Microsoft, Nvidia, Logitech, Sony and more. Current drivers backed up before it makes any changes so you can roll things back if necessary.

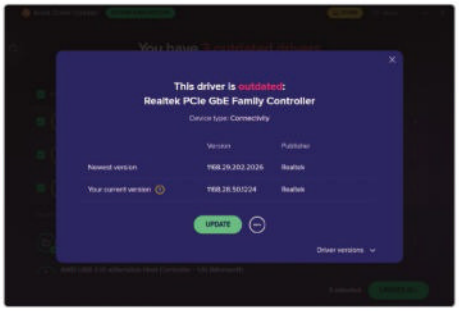
Although drivers aren't always to blame for a keyboard or mouse not behaving as it should, Bluetooth not seeing your external device or your PC starting to lag, making sure that they aren't the cause of any persistent problem is always a sensible start. With Driver Updater 2026 at the ready, you can do that far more easily, and potentially get back on track sooner.



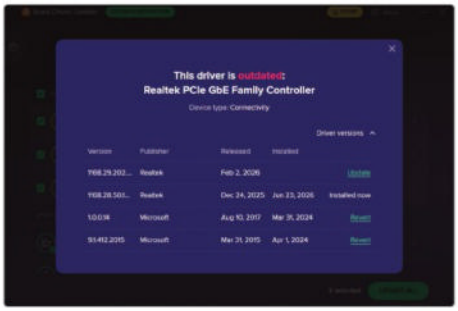
ABOVE Avast Driver Updater simplifies the task of making sure that all of the drivers for the components and hardware you rely on are the most recent releases



ABOVE When it scanned our PC, Driver Updater detected 49 drivers, of which three were out of date



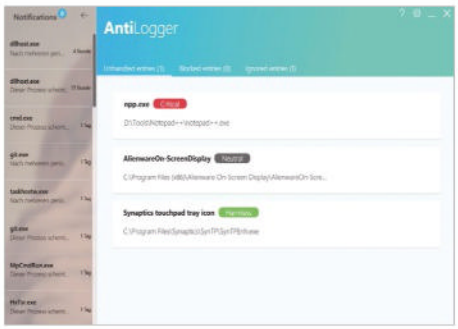
ABOVE Click any of the available updates to see further details, including the version number



ABOVE You can also retrieve earlier versions of a driver if the most recent release is causing problems

Abelssoft AntiLogger 2026

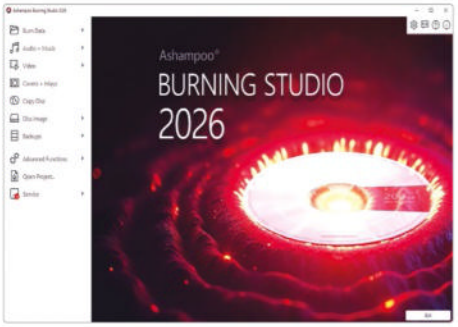
- Specialist malware hunter that detects and removes keyloggers from your machine
- Easy to use: launch AntiLogger and it immediately checks all your running processes for danger
- Run deeper scans on malicious findings, then remove or ignore discovered apps based on the results



Full product worth £10 abelssoft.net REQUIRES Windows 10 or later; 50MB drive space; in-app registration

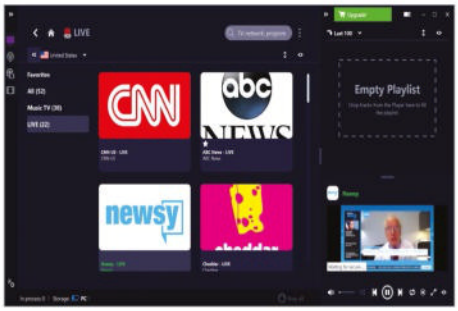
Ashampoo Burning Studio 2026

- A complete disc-burning studio for CDs, DVDs and Blu-ray discs
- Simply choose your project type, then drag and drop your source files into the interface
- Supports Autostart discs, as well as MP3, WMA, OGG, Flac, WAV, and other popular audio formats



Full product worth £25 ashampoo.com REQUIRES Windows 7 or later; 200MB drive space; in-app registration

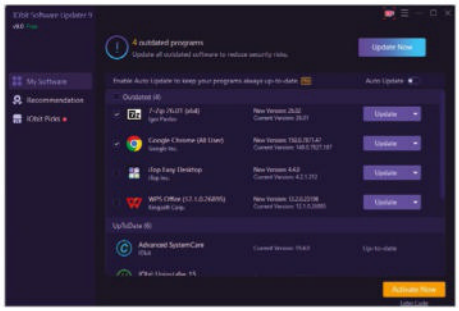
Audials TV Recorder 2026.1



Full product worth £10 audials.com REQUIRES Windows 10 or later; 200MB drive space; in-app registration

- Record streaming TV broadcasts to your PC
- Use keyword search to find the shows you want, and filter channels by country and content type
- Watch TV picture-in-picture while you get on with your work, or go full screen

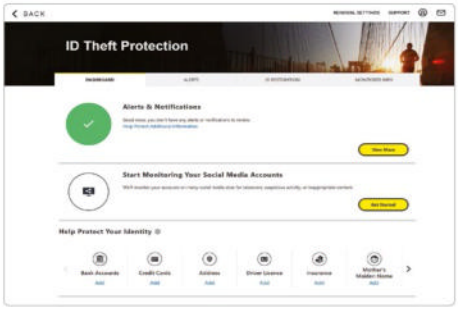
Iobit Software Updater 9 Pro



Six-month licence worth £10 iobit.com REQUIRES Windows 7 or later; 25MB drive space; online registration

- Scan for out-of-date software and compare the results to an online database
- Schedule automatic updates
- Creates a system restore point before installing updates so you can roll back if necessary

Norton Identity Advisor Plus 2026



One-year, one account licence worth £20 uk.norton.com REQUIRES Web browser or smartphone; online registration

- Watches for your personal information in forums and on the dark web
- Notifies you when it spots a match so you can take action to protect your accounts
- Also monitors social media

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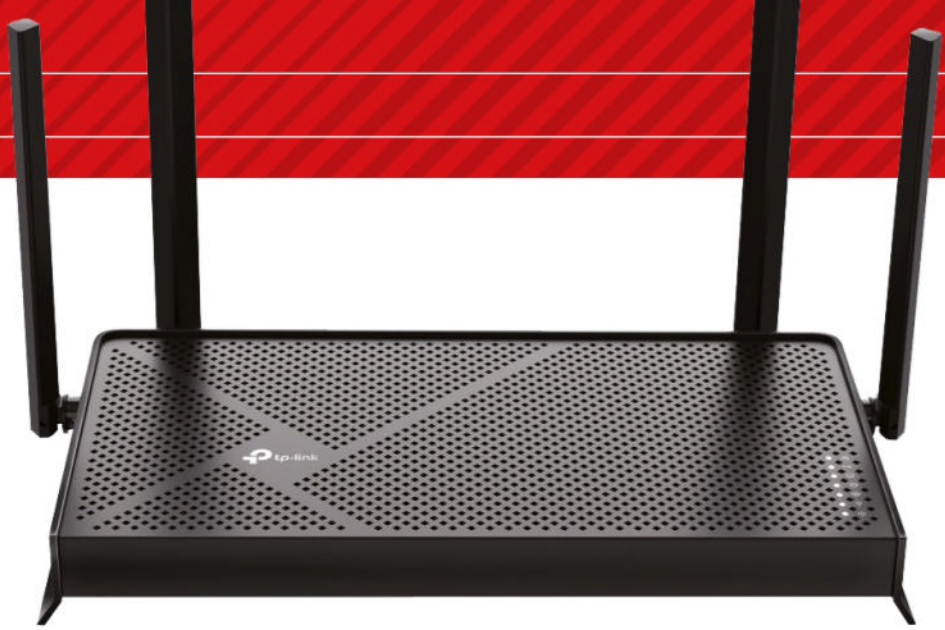
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TP-Link Archer BE3600

This terrifically affordable Wi-Fi 7 router is fast enough for most homes, and has a great set of features

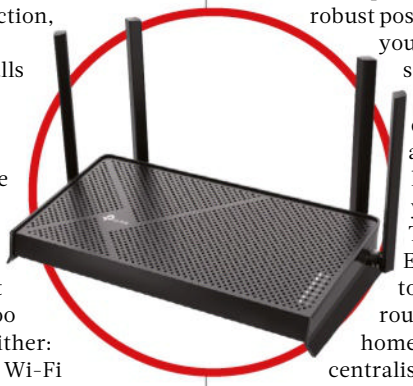


SCORE ★★★★★

PRICE £62 (£75 inc VAT)
from amazon.co.uk

The TP-Link Archer BE3600 is the cheapest Wi-Fi 7 router we've seen. At £75, it significantly undercuts our previous value recommendation, the Asus RT-BE58U (*see issue 371, p70*) – and it does so with few compromises.

At this price it goes without saying that the BE3600 doesn't support the ultra-fast 6GHz radio band – but so what? Many laptops, consoles, smart TVs and so forth don't support the higher frequency band anyway, and for those that do it's often no faster than a 5GHz connection, as it's less able to project through walls and overcome interference.



The BE3600's 5GHz radio is on the slow side, with an official maximum connection speed of 2.8Gbits/sec. But I wouldn't worry too much about that, either: across the evolving Wi-Fi standards we've had over the years, one thing that's remained constant is the fact that advertised speeds bear almost no relation to the performance you'll see in your home.

In testing, the Archer BE3600 held its own satisfactorily against any sub-£100 router, and even got close to some costing twice as much. When connecting to the router's 5GHz network from an adjoining room I measured download speeds comfortably in excess of 50MB/sec – that's full-fat megabytes, not ISP-style megabits – and even in a room at the far end of my home it kept up an average of almost 30MB/sec.

Of course, those aren't industry-leading speeds: I've seen premium routers such as the Netgear Nighthawk RS700 deliver more than 150MB/sec at close range (*see issue 353, p76*). But the Archer BE3600 is perfectly fast enough for me and my family to play games, stream videos and live our lives without giving a second thought to the speed of our Wi-Fi connection.

Performance isn't even the best thing about this router. Despite the bargain price, it uses the same firmware platform as the much beefier Archer BE550 (*see issue 371, p70*), which means you get all the network management features you could ask for. You can split or combine the bands; you can create a virtual MLO (multi-link operation) network that combines the 2.4GHz and 5GHz frequencies for the most robust possible connection; you can create a separate isolated network for guest devices, and another for smart home gadgets; and you can use TP-Link's EasyMesh system to combine multiple routers into a whole home system with centralised management.

I also love the amount of granular, per-client control you get. The built-in parental controls let you apply time limits and category-based content filtering to kids' devices, while the QoS settings let you mark specific devices as high priority and choose which types of traffic to prioritise. You can map individual clients to outbound VPN services, too – your desktop computer could be automatically routed through a server in Belize, for example, while your Roku thinks it's in New York. There's integrated support for several commercial VPN platforms including NordVPN, Surfshark and PureVPN, or you can manually configure any OpenVPN or WireGuard server.

Want more? TP-Link offers an optional active security scanning service for $36 a year, while advanced parental controls add app controls and detailed reporting for $18 a year. Even without these add-ons it's a comprehensive feature set: TP-Link deserves credit for not cutting out key features to push you towards subscription services or a more expensive model.

A final plus point is physical connectivity. A 5Gbits/sec USB socket at the back of the router lets you plug in an external hard disk and share files across your network, or make them available over the internet via a built-in FTP server. And the cherry on top is a pair of 2.5GbE ports, one for your internet connection and one on the LAN side, so you can connect a high-speed client directly to a multi-gigabit fibre connection, or attach a 2.5GbE switch and set up a high-speed subnet. That's not something we're used to seeing in this price range, and it offers a reassuring degree of future-proofing.

The Archer BE3600 isn't perfect for everyone. TP-Link says it's suitable for three-bedroom homes, so you might find it struggles to provide a good connection across your whole living space. Remember too that, while I saw good speeds when using my laptop in isolation, this router isn't blessed with infinite bandwidth, and things will slow down if you have lots of devices hammering the Wi-Fi at once. For that sort of environment, you will want a pricier router, perhaps even a tri-band model with separate 5GHz and 6GHz radios.

For a typical home, though, the TP-Link Archer BE3600 should fit the bill perfectly. It performs well, comes with a great spread of features that let you customise and extend your network services, and multi-gigabit support means it even provides headroom for the future – all for a low price. **DARIEN GRAHAM-SMITH**

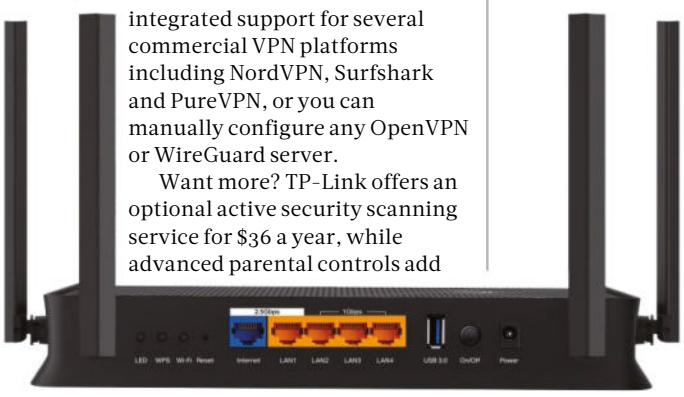
ABOVE **The Archer BE3600 is a speedy Wi-Fi 7 bargain**

PC PRO RECOMMENDED

LEFT **Speeds from the TP-Link router were right up there with far pricier models**

"TP-Link deserves credit for not cutting out key features to push you towards a more expensive model"

BELOW **Connectivity options include a USB-A port and a pair of 2.5GbE ports**



SPECIFICATIONS

Dual-band 2.4GHz/5GHz Wi-Fi 7 router • 4 x external antennas • 2 x 2.5Gbits/sec Ethernet, 3 x 1Gbit/sec Ethernet • 5Gbits/sec USB-A • 273 x 147 x 42mm (WDH) • 2yr warranty

Devolo BE6500

This innovative router can grow into a mesh system, and even switch between 5GHz and 6GHz Wi-Fi

SCORE ★★★☆☆

PRICE £108 (£130 inc VAT)
from amazon.co.uk



There are a couple of interesting things about Devolo's latest Wi-Fi 7 router. One is that – as you'll immediately see from the picture – it looks more like a mesh station than a traditional router. That's no accident: it's designed as the entry point into a mesh system, which you can build over time by buying additional units, or jump right into with a pack of two or three at the outset.

This isn't a totally new idea. We've seen dozens of routers in the past that include mesh capabilities, allowing you to buy a second unit, pair it with the first and manage them together like a purpose-built mesh. But those have almost always been router-first designs; the BE6500 embraces the cleaner, simpler mesh philosophy, with a single multicoloured status LED at the front, four Ethernet ports at the back and almost nothing else in the way of indicators or sockets.

I would have preferred more connectivity. The BE6500's WAN port supports 2.5GbE, but the three LAN sockets only run at gigabit speeds, which is limiting. I would also appreciate a USB port so I could share files over the network, or plug in a 5G dongle if my main internet line goes down. But there's no point asking for router-type features on a mesh-type platform.



The other thing that's notable about the Devolo BE6500 is its innovative switchable radio feature. Hitherto we've seen two sorts of Wi-Fi 7 routers: cheap dual-band ones that only support the standard 2.4GHz and 5GHz radio bands; and more expensive tri-band ones, which add an ultrafast 6GHz network on top. The BE6500 is the first router I've tested that supports only two radio bands, but gives you a switch in the firmware to decide whether the upper-band radio should use the 5GHz or 6GHz range. It's a clever way to gain access to the highest frequency range without paying for three separate radios.

From the spec sheet this looks like a great trick. 6GHz Wi-Fi generally supports much higher speeds than 5GHz, and here the 6GHz connection is rated at around twice the speed of the 5GHz one – that is, 5.8Gbits/sec versus 2.8Gbits/sec. So the ability to ditch 5GHz and get with the latest Wi-Fi technology seems a no-brainer.

Unfortunately, the reality is less straightforward. Although 6GHz networking has been available since early 2022, it's always been an optional part of the standard, and it's a fair bet that there will be laptops, tablets, games consoles and media streamers in your home that don't support it. In the absence of a 5GHz signal, these clients will fall back to the legacy 2.4GHz band at claimed speeds of only 688Mbits/sec. In other words, far from unleashing the best possible network speeds, switching to 6GHz may condemn most of your devices to the slow lane.

Still, you may say: at least my shiny new laptop and phone will get a super-fast service, right? Well, sort of. The trouble with 6GHz networking is that the radio waves don't project through walls or over long distances as effectively as 5GHz transmissions. When testing download speeds around my home, I found that the BE6500's 6GHz performance wasn't much faster than 5GHz at close range, and fell off more sharply at distance. There's more than enough performance here for everyday working, streaming and gaming, but the switchable radio offers no real advantage over a cheaper dual-band router.

Headline features aside, the Devolo BE6500 has a few other appealing capabilities, including a customisable firewall and the ability to set up multiple isolated networks for guests and smart home devices. On the whole, though, it's not a well-featured router; you'll look in vain for things like per-device bandwidth management, content-based parental controls or integrated VPN support. It doesn't help that the web console looks like it was inspired by the Windows 8 Start screen.

ABOVE The BE6500 is designed to be the entry point into a mesh system

"Far from unleashing the best possible network speeds, switching to 6GHz may condemn most of your devices to the slow lane"

If you're a *PC Pro* Podcast listener you may already have heard me wrestling with the question of what all of this adds up to in our regular Hot Hardware feature. I do see the appeal of a modular mesh platform that looks like it was designed for the job, rather than being just a couple of routers strapped together, and the switchable radio is a piece of genuine fresh thinking.

Sadly, in practice I find the BE6500 hardware too limiting to love, and it's hard to picture many scenarios where the 6GHz option will be beneficial. The unashamedly dual-band TP-Link Archer BE3600 (*see opposite*) makes a better standalone router in almost every respect, and is much cheaper. Or, if you're eager to move up to 6GHz then consider spending an extra £30 on the TP-Link Archer BE550 (*see issue 371, p70*); it isn't as elegant as the Devolo BE6500, but it more than makes up for that in both features and performance. **DARIEN GRAHAM-SMITH**

LEFT The BE6500 looks more like a mesh system than a traditional router

SPECIFICATIONS

Dual-band 2.4GHz/5GHz or 6GHz Wi-Fi 7 router • 1 x 2.5GbE WAN, 3 x gigabit LAN • 72 x 118 x 175mm (WDH) • 3yr warranty

Samsung Galaxy Watch Ultra2

Slimmer, lighter and simply better, this is a brilliant sequel to a fitness watch that lives up to its name

SCORE ★★★★☆

PRICE £541 (£649 inc VAT) from samsung.com

The Samsung Galaxy Watch Ultra2 looks much the same as last year's Galaxy Watch Ultra, but it feels very different. A 12% slimmer titanium body and lighter band locks the watch down better onto your wrist, so it doesn't move around as much during exercise.

Samsung calls the hexagonal casing – best shown by the photo at the bottom of this page – a "cushion". While it looks bulbous, and still isn't suitable for small wrists, it's better suited to most than 2024's enormous cuboid. The watch is snappier, too: the Qualcomm Snapdragon Wear Elite offers 32% faster CPU and 19% faster GPU speeds than last year's model, according to Samsung.



The Ultra2 has the Galaxy Watch series' standard pair of side buttons, plus the programmable "Quick Button" only found on its premium watches. This is set to opening "my exercises" as standard, while a long press can activate the watch's emergency siren, but you can assign different functions to this button.

The display is exceptional. Measuring 1.5in across, it packs 498 x 498 pixels for a super-sharp pixel density of 327ppi, and it's also incredibly bright. The brightest smartwatch I've ever used, meeting Samsung's claims of 5,000cd/m² in bright sunshine.

The Ultra2 offers all the usual smartwatch features you'd expect from an LTE-enabled watch, so you can use virtual wallets, accept calls, message, store music, use the screen as a viewfinder for a Samsung phone's camera, and even use Google Gemini via the Raise-to-Talk feature. Make a quick voice note and it can be transcribed and saved to Samsung Notes or Google Keep.



ABOVE **The Galaxy Watch Ultra2 is a great gadget for Samsung aficionados**

Samsung watches have always had strong health credentials, and the Ultra2 is no different. It retains features such as blood-pressure monitoring (this requires an inflatable cuff for regular calibration) and body composition alongside the usual heart-rate monitoring, sleep tracking, ECG scanning and much more.

New health features include Vitals, which looks at readings of five different heart-related metrics while you sleep and lets you know of any baseline deviations, a Daily Cardio Load score that estimates how much stress your exercise routine is putting your heart under, and Vascular Load, which measures stress and arterial stiffness.

And there's more. The watch is now a working dive computer – or will be when its companion app is released later this year in partnership with diving company Mares. The Trail Running profile now includes the ability to save GPX routes into the workout activity itself, so you can follow turn-by-turn directions and see maps on your watch with a swipe of your finger. Running Coach, introduced last year, makes a welcome return with its advanced analytics for runners.

Battery life is another strength, with the Ultra2 lasting 60 hours with the always-on display enabled. It estimated sleep accurately, with the watch and app correctly identifying my wake-up times during the night, and generating numbers corresponding with my energy levels.

PC PRO RECOMMENDED

LEFT **The superb display is incredibly bright and sharp**

To test GPS and heart-rate accuracy, I went on a 30-minute run with the Watch Ultra2 on one wrist, the Apple Watch Ultra 3 on the other, and a Polar H10 electrical heart-rate monitor (the gold standard for wearable heart-rate accuracy) strapped to my chest. The Ultra2, in common with most smartwatches (but not the Apple Watch Ultra 3), showed some heart-rate deviation at the beginning of a workout, but if you're exercising for any length of time your results are likely to be broadly accurate.

I also tested Body Composition, which uses the same method as the best smart scales – an electrical pulse moving through fat, muscle and water at a variety of speeds. I tested this against an industrial scale at my local gym after my run, and the ticket the scale produced showed that I was at 19% body fat. The smartwatch estimated 9%, a huge difference. It wasn't until I did the test again later that day, after hydrating and adjusting my technique by raising my arms, that the watch showed 16% – a much closer result, and within the range of deviation I'd expect from two different devices.

I also tested the Ultra2's water lock feature by dunking it in a glass of water – I've been burned before by supposed dive-ready watches – and it worked just fine afterwards.

Despite its ruggedness and adventurer-friendly features, if you're buying a watch for trails and routes then I would steer you towards Garmin. Its Fenix 8 and Forerunner 970 offer better battery life and even more advanced trail-running features (including the ability to create your own routes in-app), albeit with a less robust AI-powered interface for all your communication features.

"It's fast, it's accurate, it's got the brightest screen of any current smartwatch, and it's packed with features"

So where does this leave the Ultra2? It's fast, it's accurate (body fat niggles aside), it's got the brightest screen of any current smartwatch, and it's packed with enough features to make any smartwatch aficionado happy. It's a terrific gadget, and if you're a Samsung user looking for the best native watch for your phone's ecosystem, this is it. **MATT EVANS**

BELOW **Hexagonal casing on the rear makes the watch comfortable to wear**



SPECIFICATIONS

Qualcomm Snapdragon Wear Elite chipset ● 2GB RAM ● 64GB storage ● 1.5in 498 x 498 AMOLED touchscreen ● Wi-Fi 5 ● Bluetooth 6 ● 4G LTE ● GPS ● NFC ● 10 ATM/WR100 ● IP69K ● 800mAh battery ● Wear OS 7 with One UI Watch 9 (security updates to July 2031) ● 47 x 10.7 x 47mm (WDH) ● 62g ● 1yr RTB warranty

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Cherry Xtrfy K63W Pro Compact Ultra-Wideband

Overkill for most, but clever use of UWB tech to provide wired-like performance

SCORE ★★★☆☆

PRICE £150 (£180 inc VAT)
from currys.co.uk

Aimed at gamers who want a compact wireless keyboard that performs like a wired model, this is an ultra-wideband (UWB) device with an 8,000Hz polling rate. The idea is that you plug a puck (square but roughly the size of a Creme Egg) into your PC's USB-A port and it then uses UWB to keep a solid, interference-free connection. This avoids the busy 2.4GHz band of RF and Bluetooth but still provides a 10m range.

Regular readers will be surprised to discover that I'm not an elite gamer, but it worked perfectly. I entirely failed to drain the generously sized 6,000mAh battery too. Whether or not the delivery of wired-like wireless connectivity is worth losing the convenience of Bluetooth, which this keyboard doesn't support, is another question.



ABOVE This compact keyboard, 70% size, supports UWB for wired-like wireless

To reduce the width – this is a 70% form factor rather than the normal 75% – Cherry removes the trio of keys found at the side of most compact keyboards and merges the arrow keys with the Fn, right Shift, Ctrl and Menu keys. For example, the up arrow doubles as the right Shift key. You can set the keyboard in Standard mode, where the arrow keys won't work, Arrows mode where they will, or what Cherry calls Mod Tap mode, where the arrow keys work on short taps but act as Fn, Shift and so on if you hold on for slightly longer. I struggled with Mod Tap mode, finding it easier to switch between the modes using Cherry's slick software (you can use keyboard shortcuts too). All told, it feels like a big sacrifice for the sake of shaving around 15mm from the width of the keyboard.

BELOW The top arrow key function doubles as the right Shift key



That's a shame, because I love the feel of the Cherry Red switches, which have such a smooth action it almost feels like you're typing on auto-pilot. The key tops are large and easy to hit, and you have all the per-key RGB backlighting options you could wish for. As always with Cherry hardware, this product is built to last for years, with ABS keycaps and switches that are designed for more than 100 million actuations.

It isn't cheap, available exclusively for £180 at Currys, which means this keyboard feels like it's hitting a niche: competitive gamers who hate cables but despise Bluetooth glitches even more. **TIM DANTON**

SPECIFICATIONS

UWB wireless dongle (USB-A) • detachable 1.8m wired USB-C to USB-A cable • 70% layout • mechanical Cherry MX Low Profile 2.0 switches • ABS keycaps • per-key RGB backlight • 8,000Hz polling rate • 6,000mAh battery • 307 x 135 x 30mm (WDH) • 820g • 2yr RTB warranty

Google Home Speaker

More compact than the now-discontinued Nest Audio, but it lacks features

SCORE ★★★☆☆

PRICE £83 (£100 inc VAT)
from store.google.com

The world has moved on since Google released its previous smart speaker, the Nest Audio, in 2020. Although the company clearly hasn't spent that time honing the Home Speaker's design: it resembles a squashed Apple HomePod mini.

There are two touch-sensitive buttons on top. They're hidden in the fabric, but tap the top and two LEDs light up to show you their location. Tapping the top of the speaker will also play/pause your music. The circular ring of LEDs on the bottom changes based on the circumstance: it turns white when Gemini is listening, multiple colours when it's thinking, and orange when the microphone is off. The base also holds a physical switch to disable its microphones, which is a commendable feature. Less so is the captive power cord; break it, and you'll have to replace the whole device.

I played a variety of tracks on the Google Home Speaker, which has a single 2.3in driver, and found it produced a similar sound to the HomePod mini and Echo Dot Max. The Echo Dot Max had a slight edge; it's the only one of that trio with two speakers (a 0.8in tweeter and 2.5in woofer), which helped mid-tones stand out more than the Google Home and the HomePod mini, which has a single 2in driver. Unsurprisingly, bass was merely okay rather than good.



ABOVE The Google Home Speaker is a compact device that's not as smart as rivals

The hardware may be new, but the bigger upgrade inside is Gemini. Gemini for Home works similarly to the Google Assistant, which it usurps, so it will answer simple questions and issue commands such as "switch the lights off". But to get the most out of this speaker you'll need to pay £8 per month or £80 per year for the standard version of its Home Premium service; Google bundles six months for free.

BELOW You'll have to be careful with the fixed power cord



After six months, you may well be lured by the natural, free-flowing nature of your conversations. For example, when I asked "Hey Google, what's a good recipe for chicken wings?", Gemini responded with a wide range of options. I then asked Gemini to save my favoured recipe. It assured me that it created a note, but not where it was saved (I later found it in my Google Keep folder).

However, conversational AI alone isn't reason to spend £80 per year; the Google Home Speaker only really makes sense if you're already in the Google Home ecosystem (it also works as a hub for Matter with Google Home). Once you strip away those extra smarts, you're left with a mid-range speaker that lacks the smart home sensors of rivals. **MIKE PROSPERO**

SPECIFICATIONS

2.3in driver • dual-band Wi-Fi 6 • Bluetooth 5.4 • Gemini for Home • Thread 1.3 border router (2.4GHz) • 107 x 107 x 87mm (WDH) • 396g • 1yr limited warranty (5yr security updates)



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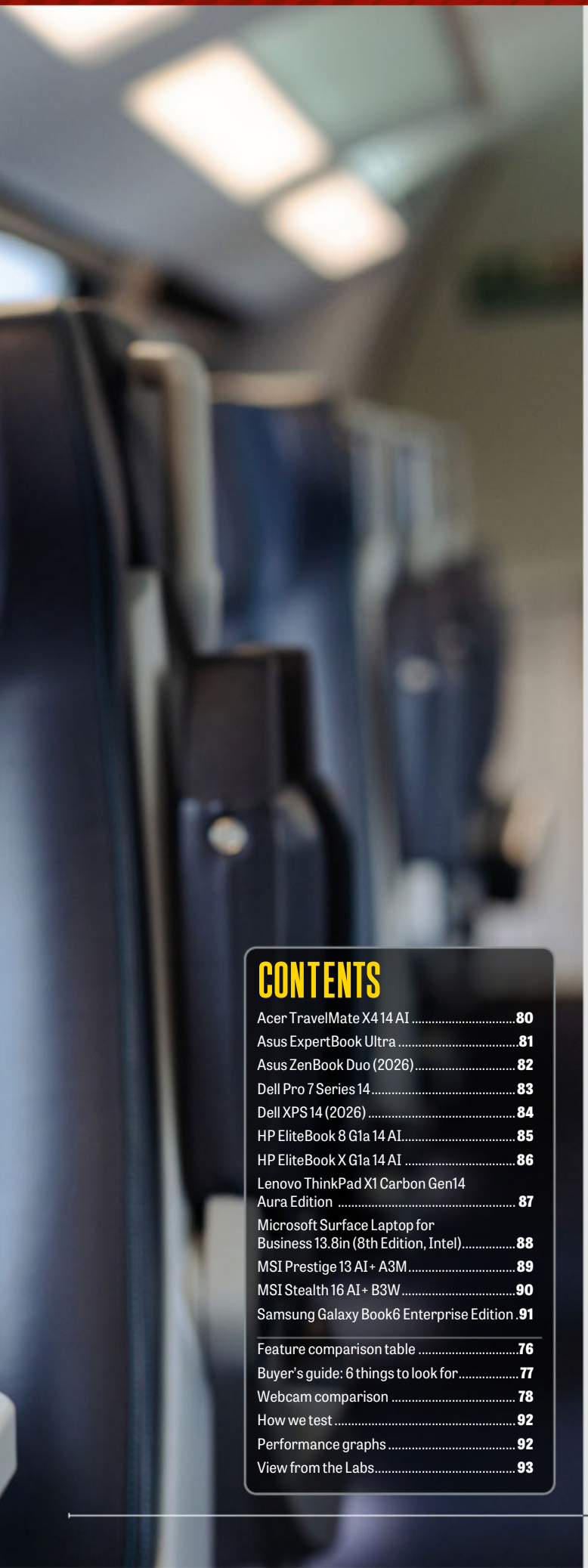
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EXECUTIVE LAPTOPS

IF YOU'RE LOOKING FOR A BUSINESS LAPTOP WITH A LITTLE EXTRA ZING – BE IT STYLE, FEATURES OR POWER – OUR ROUNDUP OF 12 ALMOST CERTAINLY HAS THE ANSWER

Business laptops have a deservedly dull reputation, but it doesn't have to be like that. On one side, you have the big brands making a concerted effort to make their offerings stand out from the crowd. On the other, a bunch of challenger brands desperate to make headway in this important and lucrative market.

For this test, we concentrate on the best the Windows world has to offer. And what a wide world that is, ranging here from sub-1kg ultraportables that are barely noticeable in a backpack to an MSI laptop that would be equally at home in a gaming/creative laptops group test. MSI reckoned the Stealth 16 AI+ B3W fitted the "executive" brief, and we'll let you be the ultimate judge.

This is also a group test that gives Intel's latest Core Ultra Series 3 processors a chance to shine. The silicon giant will surely be delighted that nine of the dozen laptops on display use its latest chips, and we see very nearly the full extent of its range. You can also see how Intel does against the best that AMD has to offer.

But whichever you choose, we can now confidently say that one of the great problems has been solved: the balance of power against battery life. Every one of these laptops should get you through a working day, even if you may have to nurse a couple through by lowering the screen brightness.

So now all you have to do is work out what your ideal laptop is. Even if you don't fit the "executive" title of this Labs, we're confident that one of this dozen will appeal.

CONTRIBUTOR: Tim Danton

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		RECOMMENDED	RECOMMENDED		RECOMMENDED	
	Acer TravelMate X4 14 AI	**Asus ExpertBook Ultra**	**Asus ZenBook Duo (2026)**	**Dell Pro 7 Series 14**	**Dell XPS 14 (2026)**	**HP EliteBook 8 G1a 14 AI**
Overall rating	★★★★☆	★★★★☆	★★★★★	★★★★☆	★★★★☆	★★★★☆
Purchase information						
Starting price[1]	£865 (£1,038 inc VAT)	£2,000 (£2,400 inc VAT)	£2,083 (£2,500 inc VAT)	£2,056 (£2,467 inc VAT)	£1,678 (£2,033 inc VAT)	£1,330 (£1,596 inc VAT)
Price of model tested[1]	£865 (£1,038 inc VAT)	£2,000 (£2,400 inc VAT)	£2,500 (£3,000 inc VAT)	£4,388 (£5,266 inc VAT)	£2,528 (£3,033 inc VAT)	£2,101 (£2,521 inc VAT)
Supplier	business.currys.co.uk	uk.store.asus.com	uk.store.asus.com	dell.com	dell.com	hp.com
Part code	NX.BPVEK.002	B9406CA-U731X	UX8407AA	xcto_p714260_cs_emea01	cnda1426003cc	A27BLEA#ABU
Dimensions (WDH)	312 x 225 x 15.9mm	311 x 213 x 16.4mm	310 x 209 x 19.6-23.5mm	316 x 226 x 10.3-16.5mm	310 x 210 x 14.6mm	316 x 222 x 11.7-15.5mm
Weight	1.3kg	1kg	1.7kg	1.3kg	1.4kg	1.4kg
Warranty	1yr RTB	1yr C&R	1yr RTB	3yr NBD on-site	1yr NBD on-site	1yr RTB
PC Pro Excellence Awards 2025 ratings[2]						
Overall satisfaction	85%	84%	84%	84%	84%	84%
Reliability satisfaction	87%	85%	85%	87%	87%	87%
Buy again	92%	91%	91%	94%	94%	93%
Core components						
Processor	Intel Core Ultra 5 226V	Intel Core Ultra 7 356H	Intel Core Ultra X9 388H	Intel Core Ultra 7 366H vPro	Intel Core Ultra X7 358H	AMD Ryzen AI 7 Pro 350
Cores[3]	8 (4P 4LPE)	16 (4P 8E 4LPE)	16 (4P 8E 4LPE)	16 (4P 8E 4 LE)	16 (4P 8E 4 LE)	8 (4P 4E)
Threads	8	16	16	16	16	16
Max CPU speed	4.5GHz	4.7GHz	5.1GHz	4.8GHz	4.8GHz	5GHz
Supplied RAM	16GB	32GB	32GB	64GB	32GB	64GB
Primary GPU	Intel Arc 130V	Intel Graphics (4 Xe cores)	Intel Arc B390	Intel Graphics	Intel Arc B390 GPU	AMD Radeon 860M
NPU rating	40 TOPS	50 TOPS	50 TOPS	50 TOPS	50 TOPS	50 TOPS
Display						
Size and technology	14in IPS	14in OLED	2 x 14in OLED	14in IPS	14in OLED	14in IPS
Resolution	1,920 x 1,200	2,880 x 1,800	2,880 x 1,800	1,920 x 1,200	2,880 x 1,800	1,920 x 1,200
Pixel density	162ppi	246ppi	246ppi	162ppi	246ppi	162ppi
Frequency	60Hz/120Hz	120Hz	60Hz/144Hz	120Hz	20-120Hz	40Hz/60Hz
Touchscreen	✗	✓	✓	✗	✓	✗
Storage						
Model	Micron 2500	Samsung PM9E1	Micron 2600	SK hynix PCB01	Kioxia BG7	SK hynix PC801
Type	PCIe Gen4 NVMe SSD	PCIe Gen5 NVMe SSD	PCIe Gen4 NVMe SSD	PCIe Gen5 NVMe SSD	PCIe Gen4 NVMe SSD	PCIe Gen4 NVMe SSD
Capacity	512GB	1TB	1TB	1TB	1TB	1TB
Empty SSD socket	✗	✗	✗	✗	✗	✗
Battery & charger						
Battery capacity	53Wh	70Wh	99Wh	70Wh	70Wh	62Wh
Charger wattage	65W	90W	100W	65W	100W	100W
Charging options	USB-C	USB-C	USB-C	USB-C	USB-C	USB-C
Webcam						
Max video resolution	1080p	1080p	1080p	1440p	4K	1440p
Face recognition (Windows Hello)	✓	✓	✓	✓	✓	✓
Privacy cover	✓	✓	✗	✓	✗	✓
Ports & connectivity						
Wireless standard	Wi-Fi 7	Wi-Fi 7	Wi-Fi 7	Wi-Fi 7	Wi-Fi 7	Wi-Fi 7
Bluetooth	Bluetooth 5.4	Bluetooth 6	Bluetooth 5.4	Bluetooth 6	Bluetooth 6	Bluetooth 5.4
Ethernet (speed)	✓ (1GbE)	✗	✗	✗	✗	✗
HDMI (standard)	✓ (2.1)	✓ (2.1)	✓ (2.1)	✓ (2.1)	✗	✓ (2.1)
USB-C	2 x Thunderbolt 4	2 x Thunderbolt 4	2 x Thunderbolt 4	2 x Thunderbolt 4	3 x Thunderbolt 4	2 x Thunderbolt 4, 1 x USB-C 3.2 Gen2
USB-A	2 (USB 3.2 Gen2, USB 2)	2 x USB 3.2 Gen2	1 x USB 3.2 Gen2	2 x USB 3.2 Gen1	✗	1 x USB 3.2 Gen1
MicroSD card reader	✗	✗	✗	✗	✗	✗
3.5mm audio jack	✓	✓	✓	✓	✓	✓
Software						
Windows version	Windows 11 Pro	Windows 11 Pro	Windows 11 Home	Windows 11 Pro	Windows 11 Pro	Windows 11 Pro
Other notable software	Acer Sensing	MyAsus	MyAsus, StoryCube	Dell Optimizer	Dell Optimizer, McAfee Business Protection 1yr	HP AI Companion, HP Wolf Pro Security Edition (1yr), myHP
Other features						
Backlit keyboard (brightness levels)	✓ (2)	✓ (3)	✓ (3)	✓ (2)	✓ (2)	✓ (2)
Touchpad dimensions (WH)	126 x 79mm	128 x 86mm	127 x 80mm	127 x 79mm	150 x 86mm	125 x 80mm
Fingerprint reader	✗	✓	✗	✓	✗	✓
Other	✗	USB-C to LAN dongle	Detachable keyboard, stylus	Optional broadband and Smart Card reader	✗	HP Sure View, mobile broadband

[1] Prices are correct at time of going to press but subject to change. [2] Laptop brand satisfaction ratings in reader-voted *PC Pro* Excellence Awards 2025 (see issue 375, p26). N/A indicates not enough feedback to give a rating. [3] P = Performance cores (Zen 5 cores in AMD's case), E = Efficiency cores (Zen 5c for AMD), LPE = Low-Power Efficiency cores








	LABS WINNER				
HP EliteBook X G1a 14 AI	**Lenovo ThinkPad X1 Carbon Gen14 Aura Edition**	**Microsoft Surface Laptop for Business 13.8in (8th Edition, Intel)**	**MSI Prestige 13 AI+ A3M**	**MSI Stealth 16 AI+ B3W**	**Samsung Galaxy Book6 Enterprise Edition 16in**
★★★★☆	★★★★★	★★★★☆	★★★★☆	★★★★☆	★★★☆☆
£1,630 (£1,956 inc VAT)	£1,741 (£2,089 inc VAT)	£1,691 (£2,029 inc VAT)	£1,042 (£1,249 inc VAT)	£2,124 (£2,549 inc VAT)	£1,536 (£1,843 inc VAT)
£2,367 (£2,840 inc VAT)	£2,083 (£2,499 inc VAT)	£2,733 (£3,279 inc VAT)	£1,042 (£1,249 inc VAT)	£2,124 (£2,549 inc VAT)	£1,624 (£1,949 inc VAT)
hp.com	lenovo.com	microsoft.com	ao.com	cyberpowersystem.co.uk	misco.co.uk
B68RGEA#ABU	Build to spec	Model 2107	A3MG-026UK	B3WH-032UK	NP764BJG-KG3UK
312 x 215 x 9.2-13.1mm	313 x 215 x 15mm	301 x 220 x 17.5mm	299 x 210 x 15.9mm	354 x 246 x 16.7-20mm	357 x 248 x 14.9mm
1.5kg	1kg	1.4kg	900g	2kg	1.7kg
1yr RTB	3yr C&R	1yr C&R	1yr RTB	2yr RTB	3yr RTB
84%	86%	84%	N/A	N/A	82%
87%	88%	87%	N/A	N/A	85%
93%	94%	96%	N/A	N/A	90%
AMD Ryzen AI 9 HX Pro 375	Intel Core Ultra 7 355	Intel Core Ultra X7 368H	Intel Core Ultra 7 355	Intel Core Ultra 9 386H	Intel Core Ultra 7 355
12 (4P 8E)	8 (4P 4LPE)	16 (4P 8E 4 LE)	8 (4P 4LPE)	16 (4P 8E 4 LE)	8 (4P 4LPE)
24	8	16	8	16	8
5.1GHz	4.7GHz	5GHz	4.7GHz	4.9GHz	4.7GHz
64GB (32GB tested)	32GB	32GB	32GB	32GB	32GB
AMD Radeon 890M	Intel Graphics	Intel Arc B390 GPU	Intel Graphics	Nvidia GeForce RTX 5070 Ti (12GB, 115W)	Intel Graphics
55 TOPS	49 TOPS	50 TOPS	49 TOPS	50 TOPS	49 TOPS
14in OLED (IPS tested)	14in OLED	13.8in IPS	13.3in OLED	16in OLED	16in IPS
2,880 x 1,800	2,880 x 1,800	2,304 x 1,536	2,880 x 1,800	2,560 x 1,600	1,920 x 1,200
246ppi	246ppi	208ppi	258ppi	188ppi	142ppi
48-120Hz	60Hz/120Hz	60Hz/120Hz	60Hz	240Hz	60Hz
✓	✗	✓	✗	✗	✗
SK hynix PC801	Samsung PM9C1b	Samsung (no model)	Phison ESR01TBYCCA4	Samsung PM9A1a	Samsung PM9C1b
PCIe Gen4 NVMe SSD	PCIe Gen4 NVMe SSD	PCIe Gen4 NVMe SSD	PCIe Gen4 NVMe SSD	PCIe Gen4 NVMe SSD	PCIe Gen4 NVMe SSD
1TB	512GB	512GB	1TB	2TB	1TB
✗	✗	✗	✗	✓	✗
74Wh	58Wh	54Wh	54Wh	90Wh	61Wh
100W	65W	39W	65W	240W	45W
USB-C	USB-C	Surface Connect, USB-C	USB-C	Proprietary, USB-C	USB-C
1440p	1440p	1080p	1080p	1080p	1080p
✓	✓	✓	✓	✓	✓
✓	✓	✗	✗	✓	✗
Wi-Fi 7	Wi-Fi 7	Wi-Fi 7	Wi-Fi 7	Wi-Fi 7	Wi-Fi 6E
Bluetooth 5.4	Bluetooth 5.4	Bluetooth 5.4	Bluetooth 6	Bluetooth 6	Bluetooth 5.4
✗	✗	✗	✗	✓ (2.5GbE)	✓ (1GbE)
✓ (2.1)	✓ (2.1)	✗	✓ (2.1)	✓ (2.1)	✓ (not stated)
3 x Thunderbolt 4	3 x Thunderbolt 4	2 x Thunderbolt 4	2 x Thunderbolt 4	2 x Thunderbolt 4	2 x USB 3.2 Gen2
1 x USB 3.2 Gen2	1 x USB 3.2 Gen1	1 x USB 3.2 Gen2	2 x USB 3.2 Gen1	2 x USB 3.2 Gen2	2 x USB 3.2 Gen2
✗	✗	✗	✓	✗	✓
✓	✓	✓	✓	✓	✓
Windows 11 Pro	Windows 11 Pro	Windows 11 Pro	Windows 11 Home	Windows 11 Home	Windows 11 Pro
HP AI Companion, HP Wolf Pro Security Edition (1yr), myHP	Lenovo Commercial Vantage	✗	MSI Center S	MSI Center	Samsung Settings, Samsung Knox Enterprise (1yr)
✓ (2)	✓ (2)	✓ (3)	✓ (3)	✓ (4 RGB)	✓ (3)
125 x 80mm	120 x 65mm	120 x 80mm	120 x 75mm	162 x 100mm	113 x 91mm
✓	✓	✗	✓	✓	✓
✗	✗	Surface Connect	✗	✗	✗

Buyer's guide: six things to look for

Alongside our feature comparison table, the performance graphs and our in-depth reviews, here are six handy things to consider when buying an executive laptop

Whether you're buying a single laptop or rolling out at larger scale, there are a few key things to look out for when buying a laptop built for business use – for executives and beyond.

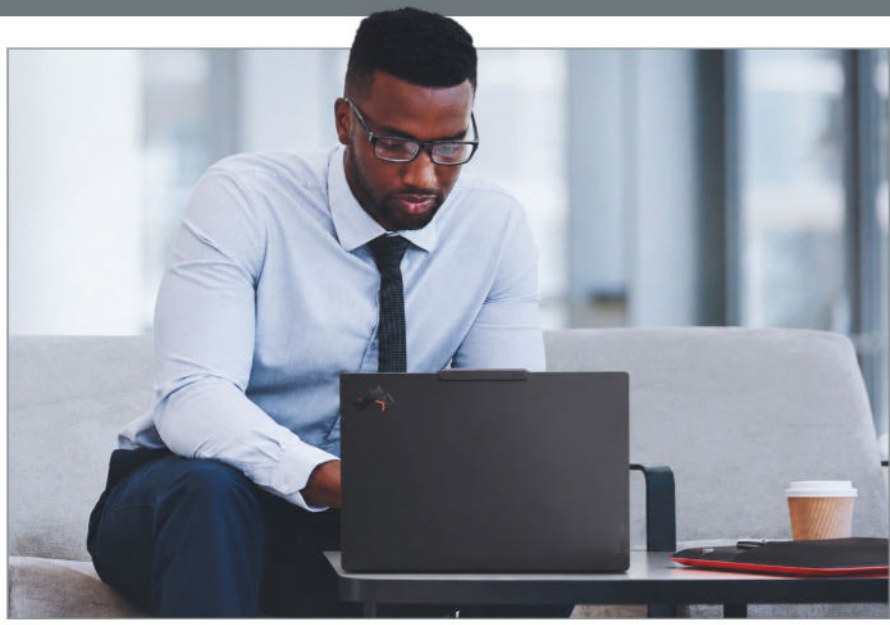
Local power... including AI

It's now more important than ever to know about the processor inside your laptop. Likewise how much RAM it comes with, as most of the time this is integrated onto the motherboard. Together, the CPU and memory will dictate how long your laptop lasts and what you can do with it.

That means you must do your research, otherwise it's easy to make a mistake. That includes wasting too much money on a CPU whose talents you never exploit. Intel hasn't helped with its naming system, as the Core Ultra 7 355 is a very different chip to the Core Ultra 7 358H: the latter has twice as many processing cores and a far superior graphics chip. And Intel isn't the only game in town, with AMD offering versatile Ryzen 300- and 400-series processors, while Qualcomm has just released its powerful Snapdragon X2 Elite family.

The best way to stay informed is via independent sources such as *PC Pro*, which offers well-informed reviews that don't skate over the details.

RIGHT If you're a regular traveller, consider one of the sub-1kg laptops on test



It's worth knowing whether your chosen laptop features a powerful GPU and neural processing unit (NPU), as this will dictate if your computer can handle local AI tasks. We suspect these will become increasingly commonplace over the lifetime of your laptop.

A poor keyboard with wobbly keys, a spongey feel or a cramped layout is always going to leave you regretting your choice

The ergonomics

While performance matters, the screen is critical for everyday use. This doesn't mean that you need the brightest display or perfect colour reproduction, but if it's dim and lacking in contrast, or if colours look washed out and dull, that's going to have an impact on everything you do. Generally speaking, you should avoid anything that can't exceed 300cd/m² at maximum brightness or is incapable of reproducing more than 65% of the colours in the standard sRGB colour space. For serious creative use, look for 100% coverage of the DCI-P3 space. That often means choosing OLED technology, but you may be surprised by the vividness of IPS panels so don't rule them out.

Keyboards are subjective to an extent, but we think it's always worth spending money on this area – it's one of the reasons a Lenovo ThinkPad wins this month's Labs. A poor keyboard with wobbly keys, a spongey feel or a cramped layout is always going to leave you regretting your choice of laptop.

Portability and battery life

If you're upgrading from a three-year-old laptop, you'll probably be amazed by your new machine's battery life. Every laptop here lasted for over ten hours in our light-use battery test, which means a full working day's life is possible – although you may need to dim the screen from maximum.

Reliability and reputation

Every year, we ask our readers to tell us how happy they are with their purchases. We then use this vital data to generate tables that show people's level of satisfaction with the reliability, customer support, value for money and battery life of their laptop – and whether they'd buy from the same manufacturer again. You can see the results in the table below.

Most laptops come with a minimal one-year warranty, so it's worth thinking about upgrading this at the time of purchase. A few manufacturers, such as Asus, HP, Dell and Lenovo, offer upgrades after you've bought the laptop too. Head into their provided app (such as MyAsus) to investigate extending your warranty.

	Customer support	Reliability	Value for money	Speed	Battery life	Buy again?	Overall
Apple	89%	96%	78%	94%	92%	98%	92%
PCSpecialist	89%	92%	94%	89%	81%	95%	90%
Lenovo	82%	88%	86%	85%	80%	94%	86%
Acer	79%	87%	87%	86%	79%	92%	85%
Dell	80%	87%	84%	85%	77%	94%	84%
Asus	77%	85%	84%	88%	79%	91%	84%
Microsoft	76%	87%	77%	84%	83%	96%	84%
HP	76%	87%	84%	83%	79%	93%	84%
Samsung	76%	85%	79%	85%	78%	90%	82%

Webcam comparison

We captured an image at each webcam's best video setting so you can see how their sensors compare



Acer TravelMate X4

You'll be visible in calls, but the X4's webcam produces washed-out images, and skin tones aren't the best



Asus ExpertBook Ultra

One of the best webcams around, with accurate skin tones despite challenging light conditions – and great detail



Asus Zenbook Duo

The Duo captures a similar level of detail to the ExpertBook, but skin tones aren't as well realised



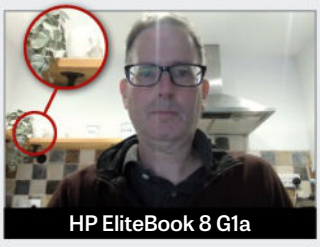
Dell Pro 7 Series 14

A strong performer with good skin tones and an exceptional level of detail: perfect for daily web calls



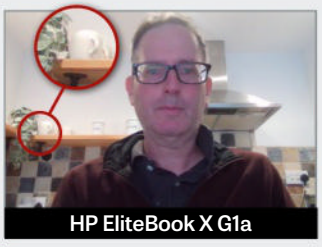
Dell XPS 14

Dell once again shows off its webcam abilities, although its colours are a fraction too strong



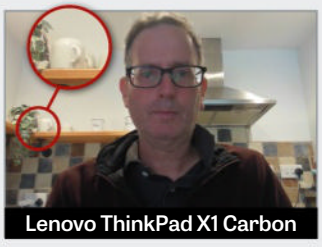
HP EliteBook 8 G1a

A surprisingly weak performance from a laptop aimed so squarely at business users, with grey-ish skin tones here



HP EliteBook X G1a

The EliteBook X steps things up with a higher-quality sensor, even if skin tones are a little off



Lenovo ThinkPad X1 Carbon

Good skin tones and detail, but the X1 Carbon struggled to expose correctly in our challenging light conditions



Microsoft Surface Laptop

One of the strongest webcams on show, with realistic skin tones and brilliant levels of detail



MSI Prestige 13 AI+

If our subject really was this grey he should be in hospital, but the Prestige proved better in kinder light conditions



MSI Stealth 16 AI+

Gone are the days when gaming laptops ignored webcams or threw in low-quality sensors: the Stealth is solid



Samsung Galaxy Book6

Considering the sensor IP Samsung owns, we expect its laptops to produce better images than this

Some of these laptops are also incredibly light, 1kg or under, and they're also slim; they barely make an impression in a backpack. The Asus ExpertBook Ultra and Lenovo X1 Carbon both fit this description yet still include a 14in screen. If you can't afford to pay such high prices, you may need to stretch to around 1.3kg. It's not a huge difference, but it is noticeable.

Finally, if you often travel then we recommend you buy a GaN (gallium nitride) charger. They're far more compact than typical laptop chargers, produce less heat and cost around £50. Many also include multiple USB ports so you can charge your phone, tablet or even both at the same time.

The little things

With so much focus on the screen, processors, battery life and size, it's easy to overlook the "extras" that can make using a laptop enjoyable – or a pain. Take ports. We're still thankful for HDMI and USB-A ports, simply because there are times when they become lifesavers. However, multiple USB-C ports – particularly fast ones, supporting USB 3.2 Gen2 (10Gbits/sec) and ideally USB4 or Thunderbolt 4 (from 40Gbits/sec) – are now a must-have as these connect to modern monitors and peripherals. On the topic of connectivity, we now recommend you buy a laptop with support for Wi-Fi 7, but it isn't vital: Wi-Fi 6 and Wi-Fi 6E are both fine, but Wi-Fi 5 is usually a bad sign.

Multiple USB-C ports – particularly fast ones – are now a must-have as these connect to modern monitors and peripherals

There are times when you'll be grateful for high-quality speakers, too. Specs won't tell you much (although it's a great sign if they include woofers), so look out for independent reviews instead. This is normally the point where we'd mention webcams as well, but we cover those above.



BELOW A GaN charger will make a world of difference when on the move

Ease of repair and management

Laptops will go wrong, and it's at this point where you'll suddenly wonder whether you can fix it. The good news is that it's gradually becoming easier to replace parts, particularly batteries, thanks to Right to Repair legislation and pressure from organisations such as iFixit; the bad news is that it's by no means ubiquitous. Before you buy any laptop, it's worth looking up its maintenance manual online. If it doesn't have one, that's an instant red flag.

We also mention in reviews where it's easy or tough to repair a laptop. We single out the Lenovo X1 Carbon for special praise because Lenovo has worked with iFixit to ensure this has replaceable parts, including the keyboard, but if you read Lee Grant's column (*see p113*), you'll know it isn't always easy to find the actual spares for its consumer laptops. This tends to be less of a problem for business machines.

If you want to remotely manage systems, then look out for Intel's vPro and AMD's Ryzen Pro technology. It's baked into the CPU's name: look out for vPro in Intel chip's names and Pro for AMD. This makes management and rollouts easier thanks to support for tools such as Microsoft Intune.

Acer TravelMate X4 14 AI

If you're looking for a cut-price business laptop, this mid-range model may just be the answer

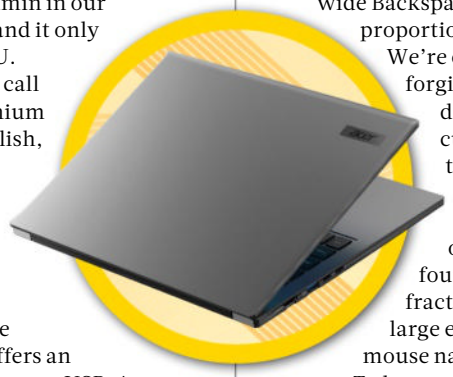
SCORE ★★★★☆

CHEAPEST MODEL £865 (£1,038 inc VAT)
MODEL TESTED £865 (£1,038 inc VAT)
from business.currys.co.uk



This is the only laptop here to use Intel chips from 2025, but don't let that put you off. The X4 may not be a powerhouse to match laptops with Core Ultra X7 or X9 chips inside, but its Core Ultra 5 226V stays within touching distance of the newer Core Ultra 7 355 found in the ThinkPad and MSI Prestige. More to the point, its eight cores are more than a match for most people's working lives, and while serious gaming is off limits it includes a 40 TOPS NPU so meets the key Copilot+ PC criterion.

And the Ultra 5 226V remains a highly efficient chip. This means Acer can get away with a 53Wh battery inside this slim and relatively light 14in laptop – 15.9mm and 1.3kg – yet remain confident it will work a full day away from mains power. It kept going for 13hrs 1min in our light-use tests, and it only needs a 65W PSU.



We wouldn't call the grey, aluminium alloy chassis stylish, but it ticks the professional box. Acer opts for function over form when it comes to connectivity: the left-hand side offers an HDMI 2.1 connector, a USB-A 3.2 Gen2 port and two Thunderbolt 4 ports. The right-hand provides a second USB-A port (this time lowly USB 2), 3.5mm jack, Kensington lock slot and a 1Gb Ethernet port. You also benefit from Wi-Fi 7 and Bluetooth 5.4. Acer squeezes two LED lights onto the right-hand side too: one shines blue if the laptop is switched on and working normally, the other whether the battery is charging or full (it's off if not plugged in).

Acer adds a couple of extra keys for shortcuts, too. The "a" key, as per Acer's logo, launches TravelMate Sense, which largely duplicates Windows settings but with the occasional Acer twist; it's a missed opportunity, with no way to keep drivers updated or fine-tune the display for example. There's also a configurable "My Key", which you can program to launch your favourite app.

As for the keyboard itself: we like it. There's enough travel and cushioning on the keys to make it comfortable for long periods, and we appreciate the double-height Enter, wide Backspace and well-proportioned spacebar. We're even willing to forgive the function doubling on the cursor keys. While the trackpoint isn't as smooth as glass-coated offerings, and we found the clicks a fraction too loud, it's large enough for easy mouse navigation.

To keep costs down, Acer uses a 1,920 x 1,200 IPS panel that sits firmly in mid-range territory. It's tuned for the sRGB colour space, and covers a lowly 75% of DCI-P3, so don't expect colours to whack you between the eyes. Colour accuracy is comparatively poor, too, with an average Delta E of 1.45. We also found ourselves pushing up the brightness levels to make the whites appear cleaner – and note this isn't a laptop that's particularly well suited to being used outside, with a peak of 320cd/m². Still, it's far better than the panel in the Samsung Galaxy Book6.

ABOVE The X4 is an attractively priced travel-friendly laptop

LEFT The aluminium alloy chassis is business-like rather than stylish

There's nothing special about the 1080p webcam, either. This sits in a relatively thick bezel above the screen and offers average image quality – decent colours in good lighting but too much grain – but we're pleased to see a physical shutter. The camera supports IR for Windows Hello logins, which is handy as there's no fingerprint reader here. The mics perform their job well, after we headed to Acer's Purified Voice app and played with the options, but we wish that Acer had invested a few dollars more in the quality of the speakers – tinny and sibilant are the words that spring to mind.

Sadly you can't replace the speakers yourself, but if you go beyond the one-year warranty then Acer provides clear instructions on how to replace the battery, SSD (the supplied 512GB unit isn't the fastest, but in general use we don't think this will be an issue), screen, WLAN, trackpad, USB ports and even the system board. All big plus points.

And there's one huge factor that also counts in Acer's favour: the price. While we've found lots to criticise about this laptop, it costs half of the price of its rivals aside from the MSI Prestige, which we also nitpicked at, and even this costs around £200 more. Which is why we still think there's an argument for choosing the TravelMate X4 if you only have so much budget and staff are begging for a travel-friendly laptop.



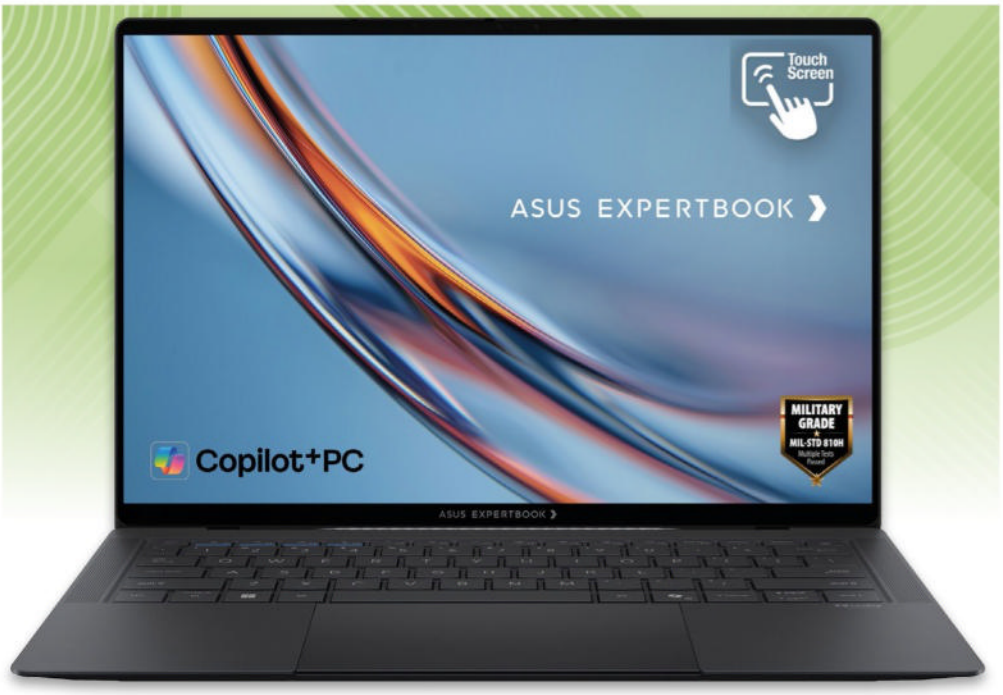
BELOW Connectivity options include HDMI and two USB-A ports

Asus ExpertBook Ultra

Asus does an astounding job of combining style, power and battery life – but it comes at a fiscal price

SCORE ★★★★½

CHEAPEST MODEL £2,000 (£2,400 inc VAT)
MODEL TESTED £2,000 (£2,400 inc VAT)
from uk.store.asus.com



They say you can't have everything, but Asus is desperate to prove that adage wrong with the ultra-slim, ultra-light and ultra-fast ExpertBook Ultra. Despite the tiny chassis, Asus goes all-in with a 16-core Intel Core Ultra 7 356H. This is much faster than the Core Ultra 7 355, as shown by the gulf between the ExpertBook Ultra and the MSI Prestige 13 AI+ in the multicore sections of Geekbench 6 and Cinebench 2024: 16,241 and 1,059 versus 11,243 and 579 respectively.

However, we should add a caveat: Asus sent us an ExpertBook with a Core Ultra X7 358H inside, and sadly it doesn't sell that spec in the UK. The Core Ultra 7 356H clocks slightly slower than the 358H at 4.7GHz rather than 4.8GHz, so we expect those multicore results to drop closer to 16,000 and 1,000, but we're still talking about exceptional multicore speeds.



The X7 family benefits from Intel's top-end Arc B390 GPU. This has 12 Xe-cores compared to four in the 356H, so we're sorry to say you won't enjoy the 70fps, 60fps and 66fps we saw from the ExpertBook at 1080p High settings in *Cyberpunk 2077*, *Dirt 5* and *Shadow of the Tomb Raider*. Expect closer to 40fps across those three titles with the 356H in place.

This means you may struggle to reach playable frame rates at the screen's native resolution of 2,880 x 1,800, and once again it's time for us to look up "superb" in the thesaurus. It's a wide-gamut OLED panel, and that means gorgeous colours: switch to Vivid mode and it covers 98% of the DCI-P3 space and 87% of Adobe RGB.

Colour accuracy is similarly top-notch, with an average Delta E of 0.5, and whites look spot-on too. This 14in panel also glows bright, hitting 626cd/m² at its peak.

That, together with an effective anti-glare coating, means you won't have any trouble using it outside. Which takes us to yet another of the ExpertBook Ultra's strengths, namely portability. Despite all that power it weighs precisely 1kg, with a slim magnesium-aluminium alloy chassis with a roughened "nano ceramic" coating that's designed to last for years. It looks great, although we wish that Asus had been braver and opted for the white version in the UK rather than the corporate grey. And that it had strengthened the hinges, as the lid drops backwards too easily.

Asus's next big achievement is to squeeze so much life out of the 70Wh battery. It lasted for over 18 hours in our light-use tests, and this longevity is one of the things you're paying for. For example, Asus invests in a Tandem OLED, which is more efficient than normal OLED panels. Although we'd consider buying a 90W GaN charger to replace the compact but two-part (charger unit plus cable) PSU that Asus supplies.

Asus makes no compromises when it comes to connectivity. The left edge holds one Thunderbolt 4 port next to an HDMI 2.1 connector, USB-A port and 3.5mm jack. Over on the right, you'll find a second Thunderbolt 4/USB4 port and USB-A port (both Type-A ports offer fast 10Gbits/sec transfers). You also benefit from Wi-Fi 7 and Bluetooth 6.

ABOVE Despite all its power, the ExpertBook Ultra weighs just 1kg

PC PRO RECOMMENDED

LEFT The aluminium chassis' nano ceramic coating provides plenty of protection

We also love the speakers, with sharp vocals and much more bass than we'd expect from a laptop this size. The mics are again excellent, while the 1080p webcam produces strong results under good lighting. Lenovo still leads the way for keyboard quality: there isn't the cushioning or sheer attention to detail you'll find on ThinkPads. We can't fault the giant touchpad, though. This is haptic – you can slide your fingers along the side of the touchpad to adjust brightness, for example – but also slick thanks to a glass coating. If you find it too sensitive, head into MyAsus and play around with the settings.

Asus needs to think more about its target IT audience when it comes to repair, with ten annoying Torx screws in the way. The generous 32GB of RAM is soldered on, as is the Wi-Fi chip, but you can replace the ports, battery and SSD. Note the latter is a Gen5 SSD, and our unit skewered Gen4 disks with sequential reads of over 14GB/sec and writes at almost 11GB/sec.

One final note on the ExpertBook Ultra versus its rivals here: most are available in different configurations, and some are user-configurable at the time of purchase. Not so the ExpertBook Ultra, which comes in this spec – Intel Core Ultra 7 356H, 32GB of RAM, 1TB SSD – and that's it. If that combination meets your needs, it's a gorgeous choice.



BELOW The enormous haptic touchpad is slick and adjustable

Asus ZenBook Duo (2026)

A dual-screen laptop that doubles as an all-in-one lifts the Zenbook Duo into a category all of its own

SCORE ★★★★★

CHEAPEST MODEL £2,083 (£2,500 inc VAT)
MODEL TESTED £2,500 (£3,000 inc VAT)
from uk.store.asus.com



Sometimes it isn't obvious what you're getting when you lavish money on a laptop. Not so with the Asus Zenbook Duo, which packs two glorious 144Hz OLED panels into something only a fraction larger than a normal 14in laptop – simply remove the magnetic Bluetooth keyboard when you have more space. It then effectively becomes an all-in-one PC: you can either prop the screens up as shown, one above the other, or side by side in landscape mode.

This year's model (UX8407) has a notably improved screen setup versus the previous iteration (UX8406), which is still available for £1,800 inc VAT, due to a far smaller gap between the panels. It's now less than a centimetre thick, bringing the experience closer to that of using a single 3,600 x 2,880 monitor when in landscape mode. It still works best when you treat it as two separate displays, but they work well as a combo if you're, say, editing a photo. Asus even provides a stylus to make this creative task more intuitive. Another less obvious but welcome improvement is the panels' much reduced glare, so if you work in environments with fluorescent overhead lighting or LEDs then you'll notice the difference.



It helps that both panels are in lockstep in terms of colour profile and quality, with an astonishing colour gamut – 63% beyond the sRGB colour space and 100% of DCI-P3 – and excellent colour accuracy. Asus also provides calibrated presets, so if you prefer to lock down to sRGB, Display P3 or DCI-P3 gamuts then you can. These options are all available in the MyAsus app, but we recommend you also fire up ScreenXpert at the earliest opportunity as this makes it easier to manage the dual panels.

Another big upgrade this year stems from the processor, Intel's top-of-the-range Core Ultra X9 388H. This packs in 16 cores with a peak 5.1GHz frequency, so it was no surprise to see the Duo topping both Geekbench CPU tests. The chip also features Intel's Arc B390 GPU, which is surprisingly potent for an integrated graphics solution: among the 12 laptops on test, the Duo only trailed the GeForce-toting MSI Stealth 16 AI+. It scored a superb 7,754 in 3DMark Time Spy, while an average of 64fps in Dirt 5 at 1200p and High settings show its potential. Admittedly it's still no gaming laptop, finding *Shadow of the Tomb Raider* more challenging with a 50fps average.

Despite the keyboard's detachable nature, we found it pleasant to type on. There's plenty of travel and just enough cushioning, while the only question mark we have over the layout is a single-height Enter key; the cursor keys avoid function doubling, thank goodness. You'll need to charge the keyboard separately – it has a USB-C connector – but Asus sensibly keeps the backlighting. The touchpad is one of the best here, being large, glass-coated and haptic – if you slide your finger along the right edge it adjusts brightness, along the left volume. You might want to disable the pad, though, as it's sometimes activated by accidental brushes.

You'll still probably want to add a mouse when using the Duo in all-in-one mode, and there's a USB-A port on the right next to a Thunderbolt 4 port and the power switch, with a second Thunderbolt 4 on the left alongside a 3.5mm jack and HDMI 2.1 output. Add Wi-Fi 7 and Bluetooth 5.4 and you have most bases covered. Talking of bass, the Asus is one of the better performers here thanks to six custom speakers that include both tweeters and woofers; we still want more bass, but it's far better than you might expect. This makes a big difference in films and games too, which is where you will notice the HDR support kick in – up to 1,000cd/m², incredibly.

ABOVE Two 144Hz OLED panels gives this laptop a versatility no rival can match

PC PRO RECOMMENDED

LEFT The dual displays can be used in portrait or landscape modes

The chassis is finished in Ceraluminium, Asus's own material that adds an extra layer of scratch resistance to the aluminium alloy frame. Asus claims it makes the Duo more durable, but it only comes with a year's warranty: with two panels to protect, it's worth exploring your options in MyAsus. We'd be tempted to pay £120 to extend this by two years and add on-site cover (UK mainland only) and accidental damage.

With excellent battery life – almost 20 hours with a single screen and 12hrs 53mins with both screens active – the Zenbook Duo adds up to a phenomenal and unique proposition. It's been yet another victim of price increases, jumping from £2,500 at launch to £3,000 now, but with 32GB of RAM and a fast 1TB SSD it remains a compelling option. And if that's too much, note that Curry's sells a version with a Core Ultra 9 386H processor and 16GB RAM for £2,500.

BELOW The detachable keyboard is a pleasure to type on



Dell Pro 7 Series 14

Arguably too expensive for what you get, but a sound choice if you're committed to the Dell ecosystem

SCORE ★★★★☆

CHEAPEST MODEL £2,056 (£2,467 inc VAT)
MODEL TESTED £4,388 (£5,266 inc VAT)
from dell.com



Unlike the Dell XPS 14 on the next page, this is an all-out business laptop. The Dell Pro range, previously known as Dell Latitude, shows this in its choice of vPro processors along with a multitude of security and management-friendly features.

For example, one of the many configuration options includes a smart card reader, NFC and Dell's Control Vault 3+ hardware: a secure space for passwords and biometric data. The webcam includes a privacy shutter and there's an optional fingerprint reader, while the default warranty includes three years of next-business-day on-site support.

While not as repair-friendly as the ThinkPad X1 Carbon, it's a simple process to whip off the base cover as only six crosshead screws stand in your way. Dell provides instructions for end users (or IT teams) to remove and replace the SSD, battery, fans, heatsink fan, Wi-Fi card and optional mobile broadband card (a 4G card costs £61 inc VAT, a 5G version £126).



The wide configuration options apply to the display, too. Dell sent us a unit with a super-low-power IPS panel with a 1,920 x 1,200 resolution and stated peak brightness of 500cd/m² (we measured 509cd/m²). This pushed battery life to a table-topping 21hrs 35mins in our light-use tests, although we also benefited from a 70Wh battery compared to the standard 56Wh – well worth £17.

We'd be tempted to switch to a different panel as colour coverage isn't great: 96% of the sRGB space is okay, but most people would appreciate seeing more than 67% of the DCI-P3 gamut. You actually save £13 by switching to the OLED panel with its claimed 100% coverage of DCI-P3, while if you want a higher resolution then there's a 2,560 x 1,600 option for £7 extra.

You can't switch keyboards, but that's not an issue. Unlike the Dell XPS 14, the keys are well separated, so we had no trouble with typos, and there's plenty of key travel. We could happily type on this laptop for hours, thanks in part to its quiet nature.

While the touchpad lacks haptic features such as sliding your finger up/down to adjust brightness, the target user is likely to appreciate its simplicity and effectiveness. There are also numerous ports, with USB-A, 3.5mm and a Kensington lock on the right, and an HDMI 2.1 port, USB-A and two Thunderbolt 4/USB-C slots on the left. There's no Ethernet port, but Wi-Fi 7 and Bluetooth 6 should keep connections smooth.

Your final set of options concern the core spec. You can save £23 by buying the non-vPro Core Ultra 5 325 versus the Core Ultra 5 355 that comes as standard, with the range topping out at the Core Ultra 7 366H. It's the only choice that includes 16 cores and four Xe graphics cores. That's the setup we tested, supported by the maximum 64GB of RAM and a 1TB Gen5 "Performance" SSD. And it's gloriously fast, as shown by 14GB/sec sequential reads and 12GB/sec writes. Dropping down to 16GB of RAM and a standard 512GB SSD saves you £1,495 and £498 respectively.

ABOVE The Pro 7 is unashamedly focused on business users

The extra RAM and faster storage made little difference in the rest of our tests, with the Dell Pro 7 shining in the multicore Geekbench and Cinebench tests thanks to all those cores. Having only four Xe graphics cores limited its chances in our 3D benchmarks, though.

Don't expect full immersion via the speakers, which offer some bass but not enough to delight music lovers. They're ideal for web calls, however, and here the 8MP webcam comes to the fore: it produces clear and detailed results at 1440p in good light, and the microphones capture voices clearly. It also supports presence detection.

Your one final choice is whether to spend £27 on a lighter magnesium alloy base rather than aluminium alloy, which the rest of the chassis uses. We'd be tempted to even for the minimal weight saving, as while this is a compact and extremely well built laptop it isn't the lightest at 1.3kg.

LEFT You can choose a lighter magnesium alloy base rather than aluminium alloy

While it's expensive even without the lavish options on our test unit, if you're rolling out laptops to users with different demands there's much to like about a single, compact design that can essentially do it all. And has stunning battery life to boot.



BELOW Ports include HDMI 2.1, USB-A and two Thunderbolt 4/USB-C slots

Dell XPS 14 (2026)

Executives will love its slimline styling and top-end screen, but budget holders may not love the price

SCORE ★★★★☆

CHEAPEST MODEL £1,678 (£2,103 inc VAT)
MODEL TESTED £2,528 (£3,033 inc VAT)
from dell.com



The Dell XPS 14 makes a superb first impression. With its compact CNC-machined aluminium frame, minuscule bezels and dark grey finish it's as close as a Windows manufacturer has come to industrial chic. At 1.4kg it's by no means the lightest, but like every laptop here it can survive a full day on the road without a top-up – although this does depend on the configuration choices you make.

There are four key decisions. Top of the list is which processor. Dell offers a choice of four chips from Intel's Core Ultra Series 3 range, with the 8-core Core Ultra 5 325 and Core Ultra 7 355 for less demanding users and the 16-core Ultra X7 358H and Ultra X9 388H for those who need multiple cores and powerful graphics. The first two chips come with 16GB of RAM, while you can choose 32GB or 64GB for the latter two.



Next up, storage. This ranges from 512GB to 4TB, and it isn't easy to upgrade this if you change your mind. Accessing the XPS 14 involves removing the keyboard assembly, at which point you'll discover that the SSD, battery, fan, speakers and more are replaceable, if you're highly proficient. Which brings us to the third big decision of the warranty: you get a single year of on-site cover as standard, but you may want to upgrade that to three years for around £300.

And finally we come to the screen. Our test unit included the more expensive OLED touchscreen with a 2,880 x 1,800 resolution, and it's up there with the best. Colour coverage is exceptional, accuracy top of the table, and whites look fantastic. The downside is battery life. Despite Dell using tandem OLED technology, it lasted for a comparatively lowly 13hrs 9mins in our light-use tests.

That still fits comfortably into the "more than a working day" category, but if battery life is key for you then choose the 1,920 x 1,200 non-touch IPS panel. This only covered 71% of the DCI-P3 space compared to 100% for the OLED display, so isn't the best for watching films. Either way you should enjoy a thumping soundtrack thanks to four speakers. Dell needs to pump up the bass but it's exceptional for vocals. We listened to "Tom's Diner" and it was as if Suzanne Vega was right there.

You have no choice over the keyboard, which arguably sacrifices usability for style. There's no gap between the keys, and we made more typos than usual. However, it's a big improvement over last year's Dell 14 Premium range (essentially the predecessor to this year's XPS 14) as the top row of function keys are physical rather than capacitive. You also benefit from a double-height Enter key and big left/right cursors – although the up/down keys are half-height and share their duties with PgUp/PgDn.

Dell has also improved the usability of its touchpad compared to last year, as it's now actually visible. The effect is subtle, with faint ridges revealing where it starts and stops, but we can't fault the immense size of this touchpad – essentially the size of a phone. That's great for gestures but less good for accidental brushes: palm avoidance worked well most of the time, but on occasion the cursor flew up our page and we found ourselves typing in the wrong place.

ABOVE The stunning XPS 14 comes in a wide range of options

PC PRO RECOMMENDED

LEFT The dark grey finish lends the laptop an air of industrial chic

BELOW The enormous trackpad is just about visible and is great for Windows gestures



Another area where function loses out to form is the omission of USB-A and HDMI ports, with a trio of Thunderbolt 4/USB-C ports and a 3.5mm jack your only choices. Still, Wi-Fi 7 and Bluetooth 6 come as standard. If you intend to hook this laptop up to a screen via USB-C when at a desk, note that it needs 100W of power to perform at its peak.

Our unit included a Core Ultra X7 358H and, as our graphs on p92 show, there's plenty of power here. It's also a capable gaming system, with 54fps in *Shadow of the Tomb Raider* (1080p, High settings) and 50fps in *Dirt 5* (1200p, High).

Add one of the best webcams here, albeit with a tendency to over-saturate skin tones, and you have a laptop that most executives will fall in love with. But you will need a generous budget: if you include Windows 11 Pro, prices start at £2,083 inc VAT, while our configuration with a speedy 1TB Gen4 SSD costs £3,033. We'd lean towards the ThinkPad for its easy repair, lighter design, superior keyboard and greater customisability.

HP EliteBook 8 G1a 14 AI

An AMD-powered business laptop for an aggressive price, with an understated but still attractive design

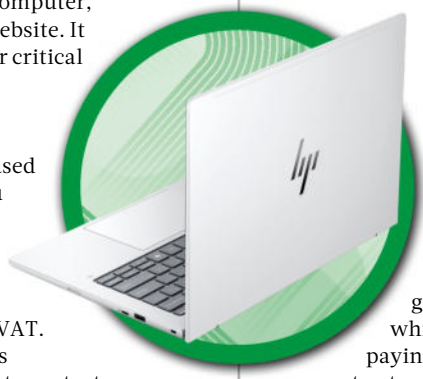
SCORE ★★★★☆

CHEAPEST MODEL £1,330 (£1,596 inc VAT)
MODEL TESTED £2,101 (£2,521 inc VAT)
from hp.com



If security is key, there are many excellent reasons why smaller businesses should consider the HP EliteBook 8 G1a (and the HP EliteBook X G1a overleaf). Top of the list is the option for an HP Sure View screen, which shifts into privacy mode at the press of the F2 button: someone sitting next to you will only see a black screen, although they may be curious as to what you're trying to hide.

Next up is HP Wolf Pro Security Edition, which acts as a cloud-based IT team to complement the skills within your organisation. This will open "websites and untrusted documents in micro-VMs (virtual machines). The micro-VM acts as a container that prevents malware from infecting your computer," explains HP's website. It can also monitor critical applications for vulnerabilities. Wolf Pro is a subscription-based service, and you get one year's cover, with annual renewals costing £36 inc VAT.



HP also offers numerous ways to protect individual PCs from physical attack. Along with the usual IR webcam and fingerprint recognition for Windows Hello logins, you can buy EliteBooks with Smart Card readers. All this on top of the usual professional security layers found with Windows 11 Pro.

Unlike Dell and Lenovo, you can't configure the EliteBook 8 G1a to your needs (unless you're an enterprise with a huge order to place). Instead, you select from its preconfigured options, with our test system having the part code B68RGEA#ABU. This includes a Sure View panel, and in many ways it's impressive: it peaks at over 500cd/m², colour accuracy is strong, and it covers the full sRGB gamut and a little beyond. However, it's extremely sensitive to viewing angles even when Sure View is deactivated: look at it head on and whites look superb, but contrast drops off noticeably if you shift around.

The other downside compared to many rivals here is its limited resolution. To be fair, 1,920 x 1,200 pixels (WUXGA) across a 14in diagonal still looks good, but it can't match the pin-sharp nature of a 2,880 x 1,800 panel.

We're starting to see G2a laptops appear on HP's site. These have the same design, but shift from AMD's Ryzen 300 Pro chips to Ryzen 400 Pro. The biggest difference is greater efficiency, which may be worth paying for: battery life is not a strength of this laptop, lasting 10hrs 41mins in our tests compared to the 15-20 hours of its best-performing rivals.

Our test unit included a mid-range AMD Ryzen AI 7 Pro 350 chip with eight cores (four Zen 5, four Zen 5c), and it proved a solid performer. Its highlight was 804 in Cinebench 2024's multicore section, but 13,847 in Geekbench 6 is noteworthy, too. It proved more middling elsewhere, including gaming, where we failed to get frame rates over 30fps even at this panel's modest native resolution.

ABOVE The EliteBook 8 G1a comes with a number of business-friendly features

LEFT Build quality is excellent, and the design is slim



BELOW Labelled ports make it easier to know what you're plugging into

If you buy the EliteBook 8 G2a 14 AI you can expect to see roughly 10% faster frame rates from a Ryzen AI 7 Pro 450 processor, but the NPU is rated at the same 50 TOPS as the 350. You might also want to consider the EliteBook 8 G2i 14 AI, as this features Intel's latest Panther Lake chips, such as the Core Ultra 7 355. Our testing suggests it has the upper hand for graphics and in Geekbench AI tests.

Either way, you'll benefit from a comfortable, quiet, well-cushioned keyboard, with a double-height Enter key, separated cursors and no function doubling (although the PgUp and PgDn keys sit right on top of the left/right arrow keys). We also like the smooth, glass-coated touchpad.

There are other nice touches. A bevel cut into the base below the palm rest to make it easier to lift the screen single-handed. Labelled ports, which is a good thing as only the two USB-C ports on the left support Thunderbolt 4; the right-hand USB-C is limited to USB 3.2 Gen2 (10Gbits/sec). There's also an HDMI port, USB-A port, 3.5mm combo jack and a Kensington lock. Connectivity is enhanced by Wi-Fi 7 and built-in mobile broadband; you only need to add a SIM.

With excellent build quality and a slim design (the EliteBook X is even slimmer), along with its security features, there's much to like about the HP EliteBook 8 G1a. However, at this price, which is admittedly boosted by the 64GB of RAM and 1TB SSD, we'd lean towards our award-winners.

HP EliteBook X G1a 14 AI

This feature-packed laptop certainly has executives in its sights, but the price is too high and competition tough

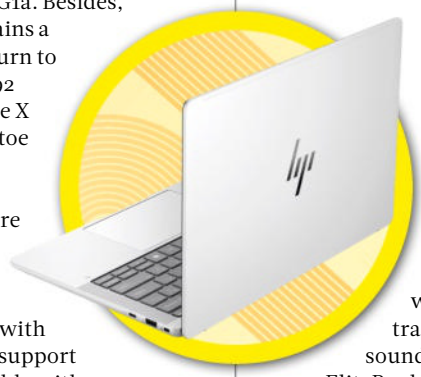
SCORE ★★★☆☆

CHEAPEST MODEL £1,630 (£1,956 inc VAT)
MODEL TESTED £2,367 (£2,840 inc VAT)
from hp.com



While the HP EliteBook 8 G1a 14 AI (*see p85*) is a solid all-rounder, the EliteBook X G1a 14 AI fits better into our idea of an executive laptop. It's more compact than its brother, but also 100g heavier at 1.5kg – most of this can be attributed to a larger battery. Perhaps it's also because the X G1a features heavyweight components.

That starts with our test unit's Ryzen AI 9 HX Pro 375 CPU, which sits at the pinnacle of AMD's Ryzen 300 series. HP is about to release the EliteBook X G2a 14 AI based around newer Ryzen 400 chips, but there isn't a huge leap in performance between them so this isn't a reason to avoid the EliteBook X G1a. Besides, the Pro 375 remains a strong choice. Turn to the graphs on p92 and you'll see the X G1a stood toe to toe with laptops powered by Intel's newer Core Ultra Series 3 processors in Geekbench and Cinebench, and with 64GB of RAM in support you can also dabble with running small language models locally. The only area of weakness is 3D acceleration, with the integrated Radeon 890M graphics no match for the Arc B390 found in Intel's Core Ultra X7 processors.



The EliteBook's results would have benefited if our test unit had 64GB of RAM: HP sent us a sample with 32GB. But that won't make as much day-to-day difference as the screen, with our sample including a 1,920 x 1,200 IPS panel rather than the luxurious 2,880 x 1,800 OLED screen you'll receive if you order from HP's website. (We've based our assessment on the EliteBook identified by part code B68RGEA#ABU, as this is the only model HP sells with a Ryzen AI 9 HX Pro 375 processor.)

This will have an effect on battery life, perhaps shaving off two hours, but there is leeway if you buy the EliteBook X G1a 14 AI. As specified, the laptop lasted a fine 14hrs 43mins under light use, and it charges up quickly thanks to the 100W power supply.

We love the audio system. Four speakers work their magic here to produce excellent music, with the best results if you place the laptop on a hard surface. There's even strong bass, to the point where drum-heavy trance music actually sounds good. The EliteBook X G1a will be a fine companion for streamed films and TV.

Back to the working day and those speakers can dedicate themselves to video calls, which is yet another great strength of the X1 G1a. Despite having a slimmer top bezel than the EliteBook 8 G1a, it produces clearer pictures at 1440p, and the microphone array is among the best here.

HP makes no mistake with the keyboard, either. The keystrokes have a solid yet cushioned feel, with plenty of travel. Rather than add function doubling to the cursors, it provides dedicated End, Ins and Del keys, and while the PgUp and PgDn are squeezed above the arrow keys (all of which are half-height) we think this is a better arrangement than most.

The touchpad is relatively compact but performs its job with smooth aplomb, helped by a glass coating. Another nice touch, one it shares with the EliteBook 8 G1a, is a cutout below the touchpad to make it easier to lift the lid single-handed.

While HP could learn from Lenovo in terms of ease of repair, with only the battery listed as a customer replaceable part, it's relatively easy to get inside. And, despite what HP's maintenance manual says, you won't need to be a trained technician to replace the SSD. Fans and speakers also look relatively easy to replace. Usefully, HP also provides part numbers while a dedicated site, **partsurfer.hp.com**, should help your IT team find an official replacement.

It's worth hunting out the official SSD if you need to replace it, with the 1TB drive in our sample topping the charts – along with the disk in the HP EliteBook 8 G1a – for PCIe Gen4 drives. And this reflects the quality of this laptop as a whole. While it's a shame that HP couldn't send us G2a versions yet, and that the screen in our unit isn't one you can actually buy in the UK, we can confidently say that this laptop won't disappoint – and who knows, it may be available for a fire-sale price when the G2a goes on sale more widely.

ABOVE Our X G1a was powered by AMD's Ryzen AI 9 HX Pro 375

LEFT An excellent keyboard and audio system are among the laptop's high points

BELOW The X G1a is more compact than the 8 G1a on p85



Lenovo ThinkPad X1 Carbon Gen14 Aura Edition

Emits quality from every gram of its slender body, and its customisability is unmatched, too

SCORE ★★★★★

CHEAPEST MODEL £1,741 (£2,089 inc VAT)
MODEL TESTED £2,083 (£2,499 inc VAT)
from lenovo.com



We have one criticism of the latest ThinkPad X1 Carbon: how difficult it is to find something to criticise. You'll struggle to find a laptop better suited to executives, and much of that stems from the flexibility offered by Intel's Core Ultra Series 3 CPUs. You can equip the laptop with anything from a Core Ultra 5 325 to a Core Ultra X7 368H, which means ranging from a medium-fast eight-core chip with modest 3D ambitions to a blazing 16-core monster replete with Intel's powerful Arc B390 GPU.

That flexibility extends to two flavours of Linux, up to 2TB of PCIe Gen5 storage, a maximum 64GB of RAM and a choice of screen. If battery life is important, go for the default low-power IPS option; select the version with an ePrivacy filter if you don't want snooping neighbours to see what's on screen; or upgrade to a 2,880 x 1,800 OLED panel, including a touchscreen option, if you want the most vivid colours. You can also upgrade to a 10MP webcam and add 4G or 5G mobile broadband.



Lenovo sent us a version with a Core Ultra 7 355 processor, 32GB of RAM and a 512GB NVMe SSD. That's enough to meet the needs of 90% of executives, we suspect, and with a pair of surprisingly large fans in place it powered to a fine set of results across our tests. The one weak area is 3D acceleration, with a modest 3,277 in 3DMark Time Spy and averages around the 25fps mark in our suite of games at 1080p and High settings.

We were pleased to see Lenovo supply an OLED panel, and it proved a fine example of its type. It covers around 80% of the DCI-P3 gamut; while other screens on test go higher still, colours look strong. Accuracy proved excellent, and you have the benefit of high levels of brightness: around 500cd/m² with SDR content and over 1,000cd/m² if you're watching HDR videos. We must also praise the exceptional pair of speakers on offer: they sound especially good if you're using the ThinkPad on a hard surface, as they're downward-firing and you then benefit from a true stereo soundstage.

Lenovo has long set the benchmark for laptop keyboards, and it's true again here. You may notice the lack of key travel if you're shifting from a much older ThinkPad, but we love the crisp, cushioned feel of the keys. The company also pays attention to the details, with grouped function keys to make them easier to hit, separated cursor keys, minimal function doubling and the option to choose auto backlighting.

The distinctive red TrackPoint is still there if you want it, but more forward-looking users may prefer to order the X1 Carbon with a haptic touchpad. This loses the TrackPoint, and the physical left/right mouse buttons that sit below the spacebar, but you gain more vertical space. Either way, the touchpad is coated with glass for smooth navigation.

ABOVE Lenovo's latest ThinkPad X1 Carbon is almost impossible to criticise

LEFT The laptop is highly customisable and easy to repair

BELOW Lenovo's keyboards continue to set the standard



Like the TrackPoint, the ThinkPad's design divides opinion. We think the carbon fibre frame, with recycled magnesium/aluminium, looks and feels superb, and it should continue to do so for years thanks to the rigid construction. Lenovo has made this laptop easier to repair than previous X1 Carbons, earning a 9/10 iFixit score: even the keyboard is removable, while the SSD and mobile broadband card are all user replaceable. Likewise the three Thunderbolt 4 ports, which are joined by an HDMI 2.1 output, USB-A port, audio jack and Kensington lock slot. We're pleased to see a three-year on-site warranty as standard, too.

You can also replace the battery, which kept the X1 Carbon going for over 13 hours in our light-use test. You can expect even more life if you opt for the IPS panel. If you expect to be travelling a lot, we recommend paying an extra £10 at the time of ordering for the compact GaN power supply.

As you can tell, our promise that we could find little to criticise for the ThinkPad X1 Carbon is true. Even its 1440p webcam leads the way for quality. We only wish that Lenovo was more predictable with its pricing, with our test configuration costing £2,499 inc VAT at time of testing but likely to change depending on the offers Lenovo chooses to apply. The official web price for this spec is £3,255, but it has never really been on sale for that. Still, even if the X1 Carbon were £300 more expensive, we wouldn't hesitate to recommend it.

Microsoft Surface Laptop for Business 13.8in (8th Edition, Intel)

An attractive and slim system, especially in black, but it's a shame more power isn't on offer

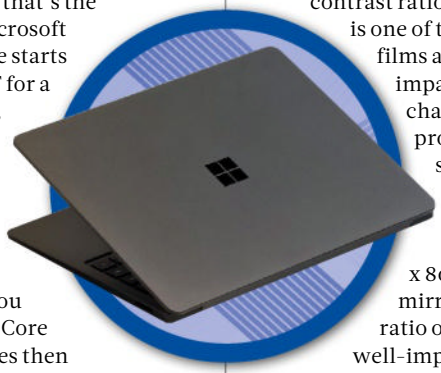
SCORE ★★★★☆

CHEAPEST MODEL £1,691 (£2,029 inc VAT)
MODEL TESTED £2,733 (£3,279 inc VAT)
from microsoft.com



Alongside its consumer laptops, Microsoft also sells its "for Business" range. That doesn't just mean shipping with Windows 11 Pro rather than Home: it offers business-friendly warranties and can be configured with Intel's Core Ultra Series 3 chips (the consumer offerings are solely based around Qualcomm's Snapdragon X2 chips).

You can choose Qualcomm with the Business range, but we suspect most commercial buyers stick with Intel inside – and that's the configuration Microsoft sent us. The range starts at £2,029 inc VAT for a Core Ultra 5 chip, 16GB of RAM and a 256GB SSD; realistically you'll want a 512GB SSD, which ups the price to £2,179. You can also choose a Core Ultra 7, with prices then starting at £2,429, but our test unit packs a Core Ultra X7 368H with 32GB of RAM and a 512GB SSD.



Aggravatingly, this configuration isn't currently available in the UK: if you want a Core Ultra X7 you'll need to choose a 15in version of the Surface Laptop for Business. That's a shame, as the Ultra X7 368H is far more powerful than the Core Ultra 7 355, having double the number of cores and offering much superior graphics. You can see this in the Surface Laptop's 3D results, with a storming result of 6,677 in 3DMark Time Spy and a 51fps average in *Dirt 5* (1,800 x 1,200, High).

It's a shame not to take advantage of the glorious panel, too. It relies on IPS technology rather than OLED, but colours look fantastic and it benefits from a 120Hz refresh rate. The screen has an unusual 2,304 x 1,536 resolution, which gives a 3:2 aspect ratio that's perfect for working – whether concentrating on a single window or splitting two. This being Microsoft, it supports touch too.

The panel is tuned to the DCI-P3 colour space, with 95% coverage out of a 98% volume. Colours are accurate, and our tests also revealed a high contrast ratio of 2,339:1, which is one of the reasons why films and games look so impactful. You can change the colour profile from Vivid to sRGB in settings, which gives cleaner whites.

The large 120 x 80mm trackpad mirrors the 3:2 aspect ratio of the panel, with well-implemented haptic feedback and a smooth glass coating. Microsoft uses a standard chiclet keyboard design, with plenty of space between the keys. There's plenty of cushioning and key travel, but it lacks the luxurious feel of a ThinkPad keyboard. Nevertheless, you should have no trouble hitting your top typing speeds, while the cursor keys are well separated.

Surprisingly, there's no fingerprint reader, so if you want to take advantage of Windows Hello for instant sign-ins the 1080p webcam is your only friend (there's no privacy cover). It produces clear and well-balanced results, while the mics do a fine job of picking up voices. Microsoft also packs a fine pair of speakers.

ABOVE The Surface Laptop for Business is a good-looking, superbly built laptop

LEFT The stylish black finish makes a genuine impact

BELOW A fine keyboard and large touchpad will help you get things done



Our unit came in black, which we far prefer over the corporate grey option, and it makes a genuine impact when you take it out of your bag. It's built to MacBook levels of quality, with a solid anodised aluminium casing that we're confident will look great for years. It lasts a good amount of time on battery too, with our sample – bear in mind it uses a more power-hungry Core Ultra X7 CPU – keeping going for 13hrs 51mins of light use.

There are minimal ports compared to rivals. Most of the action is on the left, where you'll find a pair of Thunderbolt 4 ports, a USB-A port and a 3.5mm jack. Microsoft's proprietary Surface Connect port sits to the right, which can be used to charge the laptop via the supplied 39W supply (it charges over USB-C as well).

You may want to upgrade the warranty, which only includes a year of basic cover, although Microsoft will cover courier costs. If you want three years of on-site cover then you'll need to upgrade to the Extended Service Plus plan for £149 inc VAT. At that point you're paying a very similar amount to the ThinkPad X1 Carbon, and this is the point where we start to wonder where the Surface Laptop offers compelling advantages over that model. It's certainly not ease of repair, with the Surface still using annoying Torx screws.

We love the Surface Laptop's looks, and the 15in version with its Core Ultra X7 options certainly has extra allure, but it's Lenovo that walks away with the award.

MSI Prestige 13 AI+ A3M

A feather-light laptop with lots of power and a superb screen, but we're less keen on its webcam quality

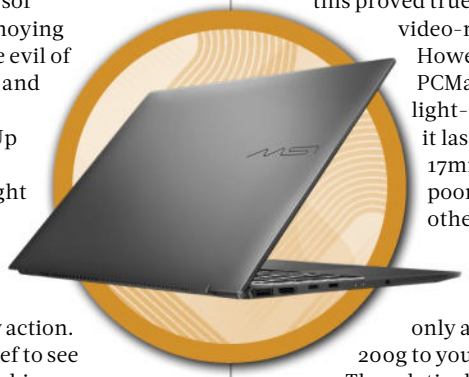
SCORE ★★★★½

CHEAPEST MODEL £1,042 (£1,249 inc VAT)
MODEL TESTED £1,042 (£1,249 inc VAT)
from ao.com



When it comes to laptops, most people will associate Taiwanese company MSI with systems geared for gamers rather than executives. However, its latest Prestige 13 AI+ lives up to its name despite its aggressive price, which drops to £1,186 inc VAT if you're an AO member (£40 per year).

Before we get on to the many aspects of this laptop that we love, we need to talk about the keyboard. We'll cut MSI some slack because this is a 13in laptop with a 299mm width, and that puts a premium on space. Still, we found the cursor arrangement annoying due to the double evil of half-height keys and the scrunching together of a PgUp and PgDn key above the left/right cursors. Even without this issue, we aren't fans of the uncushioned key action.



Still, it's a relief to see that MSI doesn't skimp on backlit keys despite the price, and we're also pleased to see a fingerprint reader built into the power key. And while the trackpad is relatively small at 120 x 75mm, it has a smooth coating and enough space to support gestures. We wish the palm rejection worked better, though, having been caught out on a number of occasions.

Not that the keyboard is the first thing you'll notice about this laptop: instead, you may well gawp in wonder at how light it is. Most sub-1kg laptops scrape their way into this weight category by a few grams, but courtesy of a magnesium-aluminium alloy chassis the Prestige 13 AI+ weighs 899g. The lid is super-skinny as a result, but overall it feels well built and MSI claims MIL-STD 810H certification, although its website is hazy on exactly which of the durability tests the laptop passed.

This is also one skinny laptop, with a dropped hinge to make it more compact and to give the keyboard a slight ergonomic lift. This aids airflow too, with a pair of small plastic bumpers at the front edge to ensure it doesn't slide when placed on a desk.

MSI promises up to 19 hours of battery life from the 54Wh unit, and this proved true in our video-rundown tests. However, in PCMark's tougher light-use benchmark it lasted for 12hrs 17mins, which is poor compared to others this month.

At least the compact, wall-plug PSU only adds around 200g to your carry weight.

The relatively small battery means you may find you need to drop the brightness of the panel for the laptop to last a full working day. Fortunately, it uses OLED technology, which is easier to read at low brightnesses compared to IPS panels. Its image quality is again excellent, covering 99% of the DCI-P3 space with sterling colour accuracy. We also love the 2,880 x 1,800 resolution, while support for VESA DisplayHDR True Black 600 revealed itself in our HDR video tests. Downsides? Only that a 60Hz refresh rate feels old-school.

It's worth delving into the MSI Center S app, as this allows you to switch between pre-calibrated colour profiles. Along with the default Display P3, there's Adobe RGB, DCI-P3, sRGB, anti-blue and an Office preset.

ABOVE At just 899g, this slim laptop is an ideal travel companion

LEFT The extremely thin lid feels robust enough to stand up to the rigours of life

BELOW The OLED screen offers excellent image quality



This is also the place to go if you want to squeeze more out of the Core Ultra 7 355 processor, one of Intel's latest chips. It's built for efficiency over speed, as reflected in the Prestige's mid-table results, and there isn't much scope for gaming as shown by its 1080p High scores hovering around 30fps (34fps in *Shadow of the Tomb Raider*, 28fps in *Dirt 5* and 26fps in *Cyberpunk 2077*). And boy did the chassis get hot, despite the sole fan whirring away at top speed.

Still, you have to make some sacrifices when building a laptop this small and light, and we think most people will be more than happy with the speed on offer. Plus that fan barely makes a whisper most of the time.

We discovered it was just one fan when we removed the base – a simple process with eight crosshead screws in the way. This also revealed a replaceable battery and slim SSD, but we suspect you'll struggle to make any other upgrades or replacements yourself. For example, the Wi-Fi 7/Bluetooth 6 chip is integrated rather than being a card. Nor is the single-year warranty a strong point, although you can extend this by three months by registering online.

Despite our concerns over the keyboard and battery life, we were on the cusp of giving this laptop a recommendation until we tested the webcam. Its grainy offerings made up our mind, although the strong pair of speakers were a welcome surprise. It may not be an award winner, but the MSI Prestige 13 AI+ won't disappoint if you're on a tight budget and want something supremely portable.

MSI Stealth 16 AI+ B3W

Compact and demure considering the GeForce GPU inside, but it stretches the definition of "executive"

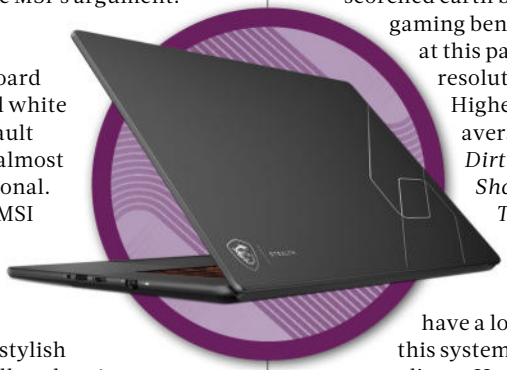
SCORE ★★★★☆

CHEAPEST MODEL £2,124 (£2,549 inc VAT)
MODEL TESTED £2,124 (£2,549 inc VAT)
from cyberpowersystem.co.uk



You have to admire chutzpah. When we invited MSI into this group test of executive laptops, its PR team suggested not only the MSI Prestige 13 AI+ but the Stealth 16 AI+ you see before you. Their argument: that the Stealth is so sleek and premium that it will appeal to executives, particularly ones who like to exploit GeForce graphics cards for work – or play. This model, identified by B3WH-032UK, packs an RTX 5070 Ti, but CyberPowerPC also sells one with an RTX 5080 for a less appetising £3,349 inc VAT.

We can see MSI's argument. Once we switched the backlit keyboard settings to all white from the default RGB, it does almost look professional. It helps that MSI eschews the plastic we often see on gaming laptops for a stylish aluminium alloy chassis. Despite the Nvidia GPU and the extra cooling this demands, the Stealth slides in at 2kg, while a battery life of around ten hours under light use means you won't necessarily need to carry the 240W charger with you – a good thing as this weighs 575g. It makes quite an impression in a bag too.



There are also obvious benefits to having a 16in panel when working, especially one as nice as this. It's an OLED screen with a 2,560 x 1,600 resolution, which is enough to ensure everything looks sharp. It's easy to work on two windows side by side, and while we've seen whiter whites the colours pack a real punch: it covers 94% of the DCI-P3 space, colour accuracy is beyond criticism, and it has DisplayHDR 600 certification. Streaming Netflix on this laptop is a genuine pleasure, helped by a powerful and detailed set of speakers: a pair of 2W woofers make their presence felt.

Then we come to the small matter of performance. MSI supports the Nvidia GPU with a 16-core Intel Core 9 386H processor and 32GB of memory via a pair of replaceable DDR5 SODIMMs. It was always jostling for top position in our CPU-based tests, while it left a trail of scorched earth behind it in our gaming benchmarks. Even at this panel's native resolution and Ultra/Highest settings, it averaged 100fps in *Dirt 5*, 91fps in *Shadow of the Tomb Raider* and 80fps in *Cyberpunk 2077*. You can have a lot of fun with this system, and note the panel's 240Hz refresh rate too. It would have been even better to see a 2TB SSD rather than 1TB, but a spare socket sits waiting inside.

MSI packs in plenty of connectivity, with a pair of Thunderbolt 4 ports on the left-hand side alongside a USB-A 3.2 Gen2 port, the proprietary power input (though you can charge more slowly via USB-C) and a Kensington lock. Head to the right and you'll find an always welcome 2.5Gb Ethernet input, HDMI 2.1 socket, another USB-A port and a 3.5mm jack. There are no ports at the back, as the lid drops down and covers the rear, but have no fear over the air cooling as a large ridge of plastic lifts this laptop off a surface. And you'll notice the fierce roar of the fans once this system is pushed, too.

ABOVE The Stealth packs a powerful GPU that helped it to shine in our benchmarks

LEFT The aluminium alloy chassis gives the laptop a stylish look

BELOW Switch the RGB keyboard to all white and the Stealth looks more executive



Spreadsheet crunchers may miss a dedicated number pad – there's certainly room – but overall this is a pleasant keyboard to work with. It's a long way from the cushioned engineering found on ThinkPads, but there's enough travel and conviction with each key press to make fast typing possible. You also benefit from a double-height Enter key and good sizing for most keys, with the only sacrifices being clustered around the cursors: the up/down keys are half-height and there's function doubling with Home, End, PgUp and PgDn.

There are no such compromises with the gigantic touchpad, which isn't haptic (not a problem from our point of view), but is smooth and responsive thanks to the glass coating.

There are weaknesses in the Stealth's armour for our target executive, and indeed anyone. First, the 1080p webcam is fine in good lighting but produced grainy images in low light (think Match of the Day highlights circa 1980), and the microphones aren't as sensitive as rivals. Another is a comparative lack of support, as it's unclear when you'll get a replacement if something goes wrong within the two-year warranty. This is an area where MSI must step up if it wants to challenge the Dells, HPs and Lenovos of this world.

But we're glad that we said yes to MSI submitting this laptop. It may not be an executive laptop in the truest sense, but it offers much that appeals – and is also almost a thousand pounds less than a Razer Blade 16 with a similar spec.

Samsung Galaxy Book6 Enterprise Edition 16in

There's much to admire, but this laptop needs a better screen to earn an award – especially at this price

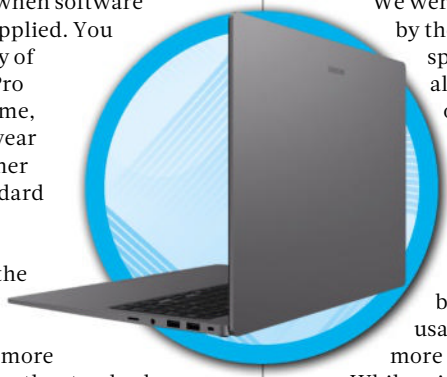
SCORE ★★★☆☆

CHEAPEST MODEL £1,536 (£1,843 inc VAT
MODEL TESTED £1,624 (£1,949 inc VAT)
from misco.co.uk



Along with its consumer models, Samsung sells a range of Enterprise Edition laptops designed for business rollouts. Buy direct from Samsung and you can create custom images, right down to bootup logos, so that the PCs arrive exactly as you need. They're also asset-tagged automatically. You have to contact Samsung for a price, but Misco sells individual units.

Wherever you buy from, you'll get a year's subscription to Samsung's Knox Suite Enterprise, which brings an extra layer of security and management via features such as Knox E-FOTA, which gives IT admins control over when software updates are applied. You also get a copy of Windows 11 Pro instead of Home, plus a three-year warranty rather than the standard single year.



This helps explain why the Enterprise Edition is considerably more expensive than the standard version: £1,949 inc VAT compared to £1,449. However, our spec includes 32GB of RAM and a 1TB SSD rather than 16GB and 512GB. Physically they're identical, which is fine for every area bar one: the screen.

We can live with the 1,920 x 1,200 resolution, but colour coverage is a mere 50% of the sRGB gamut. Accuracy is the worst here by a distance, too. Whites still look good and colours are by no means dreadful, but this level of quality is hard to defend when you're paying almost £2,000 for a laptop.

We don't have any complaints about the performance of the Galaxy Book6 Enterprise Edition in our other benchmarks. The Intel Core Ultra 7 355 produced results in line with our expectations, and so long as you don't intend to use this laptop for core-intensive tasks such as running VMs then your users will be happy.

The one area of weakness is 3D acceleration. The four Xe graphics cores meant it limped to 3,219 in 3DMark Time Spy, and it failed to break 30fps in any of our gaming tests. But there is a strong NPU here, so if future workloads take advantage the Galaxy Book6 will be ready.

We weren't overwhelmed by the quality of the speakers, with an almost comical lack of bass, but this aside it's fine for background music and web calls. Samsung has scrimped on the 1080p webcam too, but the results are usable and the mics more than up to the job.

While privacy-conscious users won't like the lack of a physical shutter, it's good to see that the IR webcam supports Windows Hello.

There's also a fingerprint reader, which you'll find at the top right of the separate number pad. Dedicated number keys always benefit workers who spend their days in spreadsheets, and it's good to see that Samsung keeps them a good size and easy to hit. We were also quite happy typing on the keyboard. There isn't much cushioning, but the keys have plenty of travel, are generally quiet (unless you really bash down), there's a double-height Enter key and the cursors are separated from the main area. They're half-height, and function doubled with Home/End and PgUp/PgDn, but we can live with this.

ABOVE The Galaxy Book6 is a decent laptop that's let down massively by its screen

We feel the same about the touchpad, which is a simple non-haptic affair with an odd aspect ratio: almost square, unlike the 16:10 screen. This limits the space for gestures, but it proved responsive and we didn't suffer any accidental brushes with palms as we sometimes do with wider touchpads.

Samsung comes up trumps with the port options, with the star inclusion being a physical Ethernet port. Other ports on the left include HDMI and two USB-C 3.2 Gen2 connectors, with the right-hand side home to a pair of USB-A ports, a 3.5mm jack, a Kensington lock slot and a microSD card reader.

LEFT Samsung provides a generous selection of ports

Surprisingly, there's an old Intel AX211 Wi-Fi card here, which means Wi-Fi 6E and Bluetooth 5.4 rather than more modern inclusions. This is embedded onto the board, but if you follow the detailed instructions in Samsung's repair guide then you'll be able to replace the SSD, battery and fans. It also explains how to replace the display and other parts, but this isn't for the faint-hearted.

All of which leaves us feeling ambivalent about the Galaxy Book6 Enterprise Edition. It's well built and arguably even stylish with its sleek, all-metal design and its industrial grey finish, while battery life is great at 15hrs 32mins in our light-use test. But there are so many choices out there that we can't see a compelling reason to opt for this Samsung laptop.



BELOW A separate number pad will please spreadsheet users

How we test

Each laptop was put through a punishing range of tests to find our award-winners

Our first set of tests concentrate on the CPU. We've used Geekbench 6 to give a base level of single-core and multicore performance, while Cinebench 2024 pushes things further with 3D rendering tests. We also ran CrystalDiskMark to test SSD speeds, focusing on sequential file transfers.

3DMark Time Spy gives us an idea of GPU performance, but we've also run tests in *Dirt 5* and *Shadow of the Tomb Raider* to gauge real-world gaming speed. We ran the former at 1200p High settings with no upscaling, the latter at 1080p High settings.

We used Geekbench AI to measure performance under machine-learning workloads, to provide an at-a-glance view of the strength of the laptops for local AI.

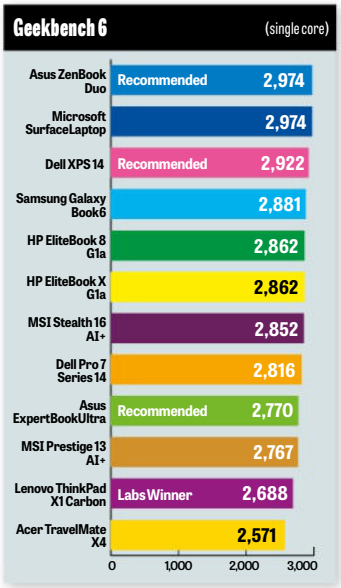
Alongside our more subjective tests for audio and image quality, we assessed each laptop's screen quality with a colorimeter. We measured the total gamut of the display, shown as the percentage coverage of the sRGB gamut. We also measured the coverage of the colourful DCI-P3 gamut. We then look for colour accuracy, as measured by Delta E. Ideally, the average should be under 1.

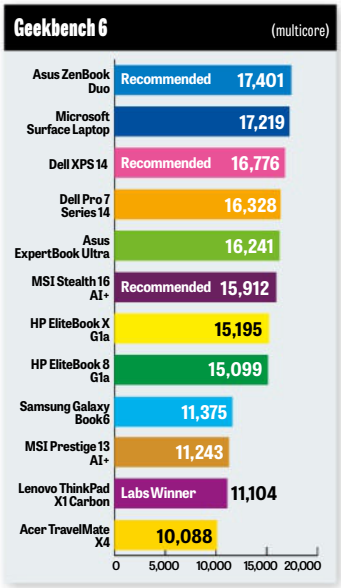
Finally, we tested the battery life by setting brightness levels to a uniform 150cd/m², then running PCMark's Modern Office test.

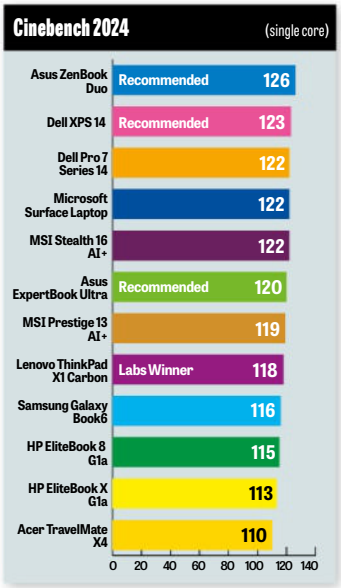


ABOVE An X-Rite i1 Display Pro HL colorimeter helps us determine a panel's image quality

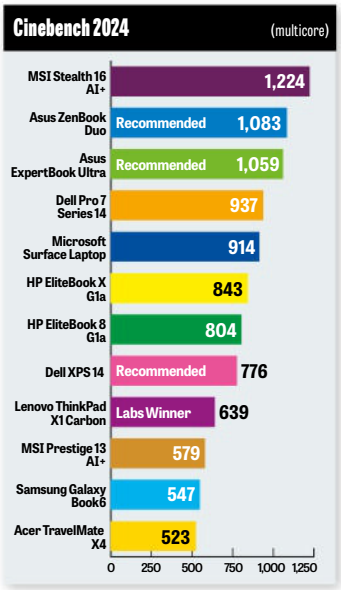
General performance

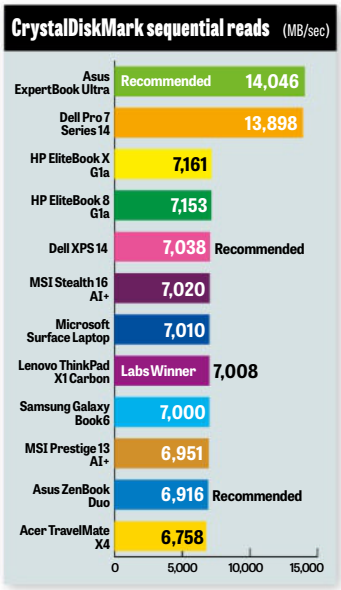


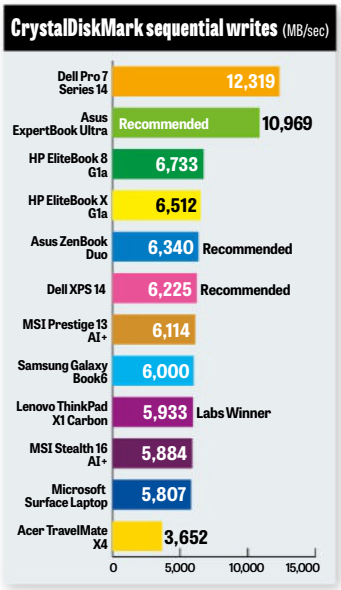




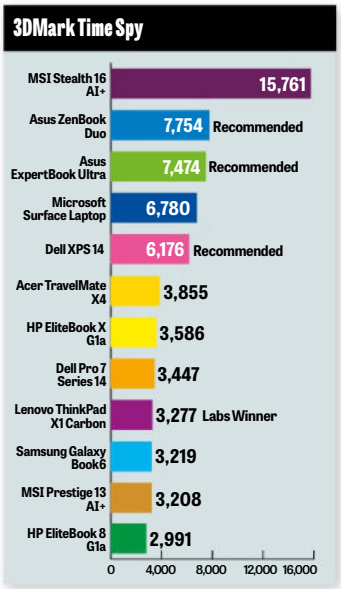
Storage performance

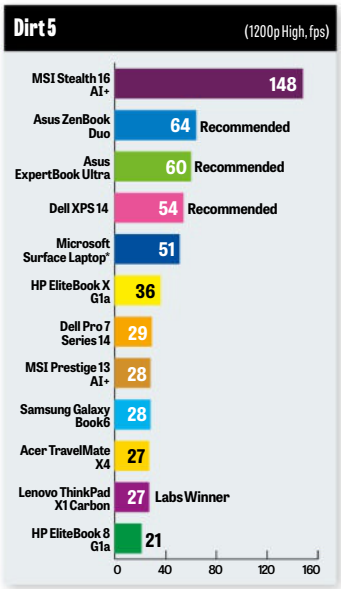


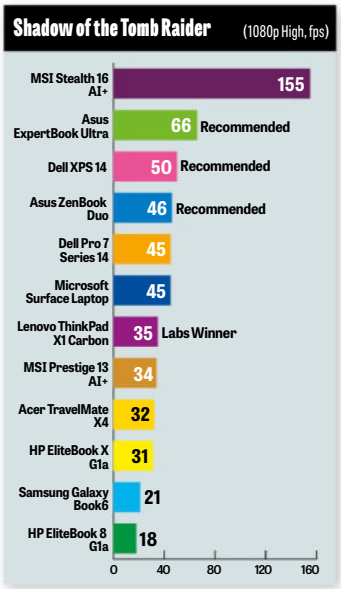




Gaming performance

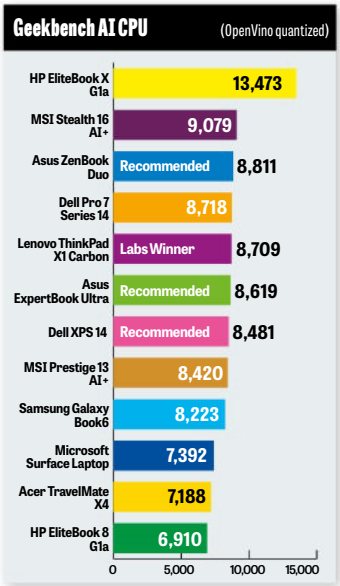


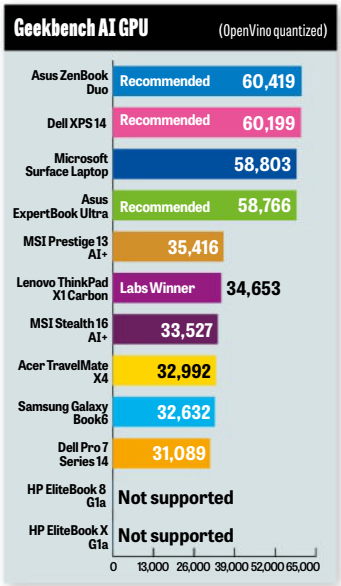


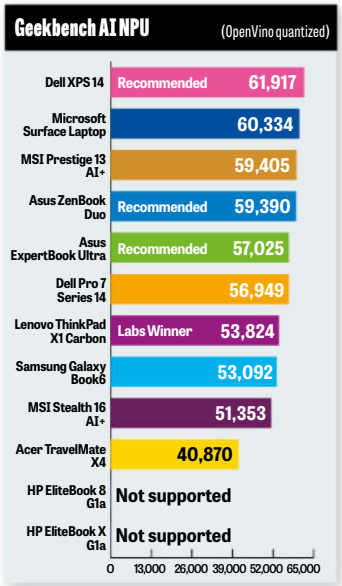


*At 1800 x 1200 rather than 1920 x 1200

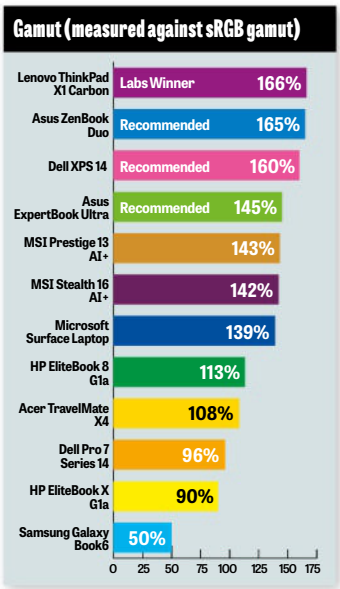
AI performance

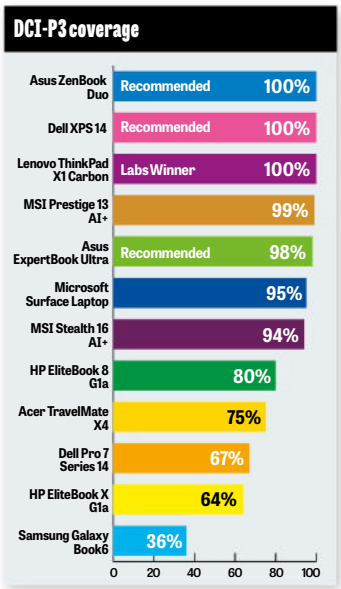


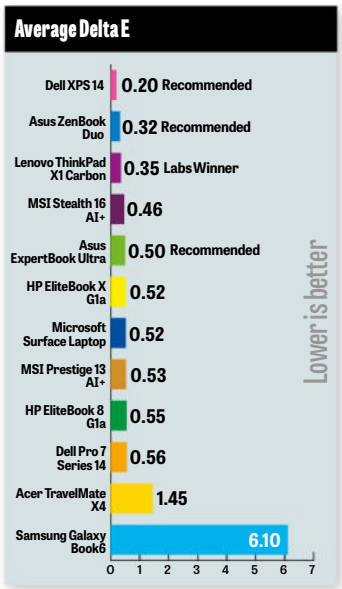




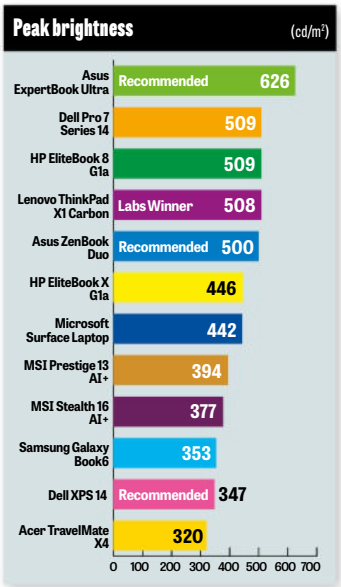
Display tests

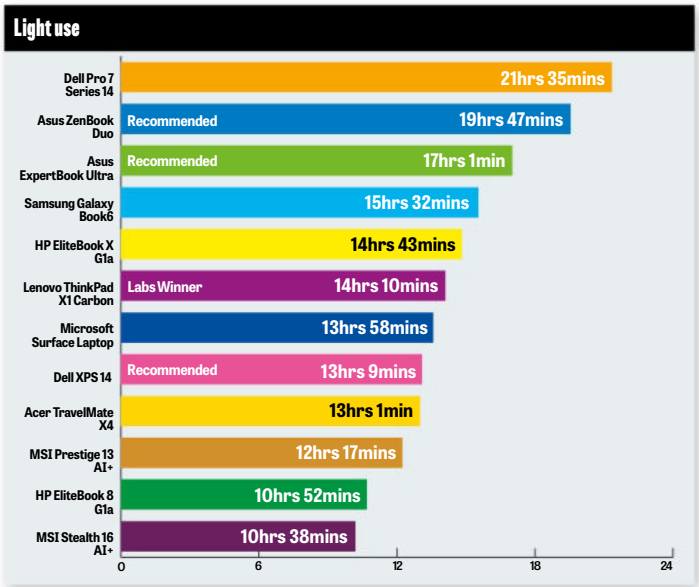






Battery life





View from the Labs

Battery life is now so good as standard that you shouldn't make sacrifices any more

I've just come back from a day working in London and for the first time ever I didn't even think about throwing in a power supply. I knew my laptop's battery would easily survive the day's demands, and it only occurred to as I walked down the hill to the station that I had achieved what might be called battery security.

It's a strange feeling. For years, a small part of my brain has whirred away with thoughts of battery capacity, and it's often been proved right. Those who know me will be well aware of utterances such as "oh, I've only got 20% left" and my fevered hunts for power sockets. No longer. I'm a new being, one who saunters through the day blatantly using my screen at full brightness.

While laptop manufacturers have talked about all-day battery life for years, that only felt true if you made sacrifices somewhere. And while it's certainly true that not all laptops will keep going at full blast, out of the dozen laptops on test here I would only have concerns if using the MSI Stealth and HP EliteBook 8. As you can see from the graph on the left, neither cross over the 11-hour mark in our light-use test where the screen is set to a modest 150cd/m².

There is another corollary to all this: that you don't always need to make sacrifices in your spec to eke out extra minutes. The Dell Pro 7 Series 14 tops our charts with a staggering 21hrs 35mins, but it does so at the expense of a relatively pallid screen. But how many people are going to be using a laptop for 20 hours without access to a plug at some point?

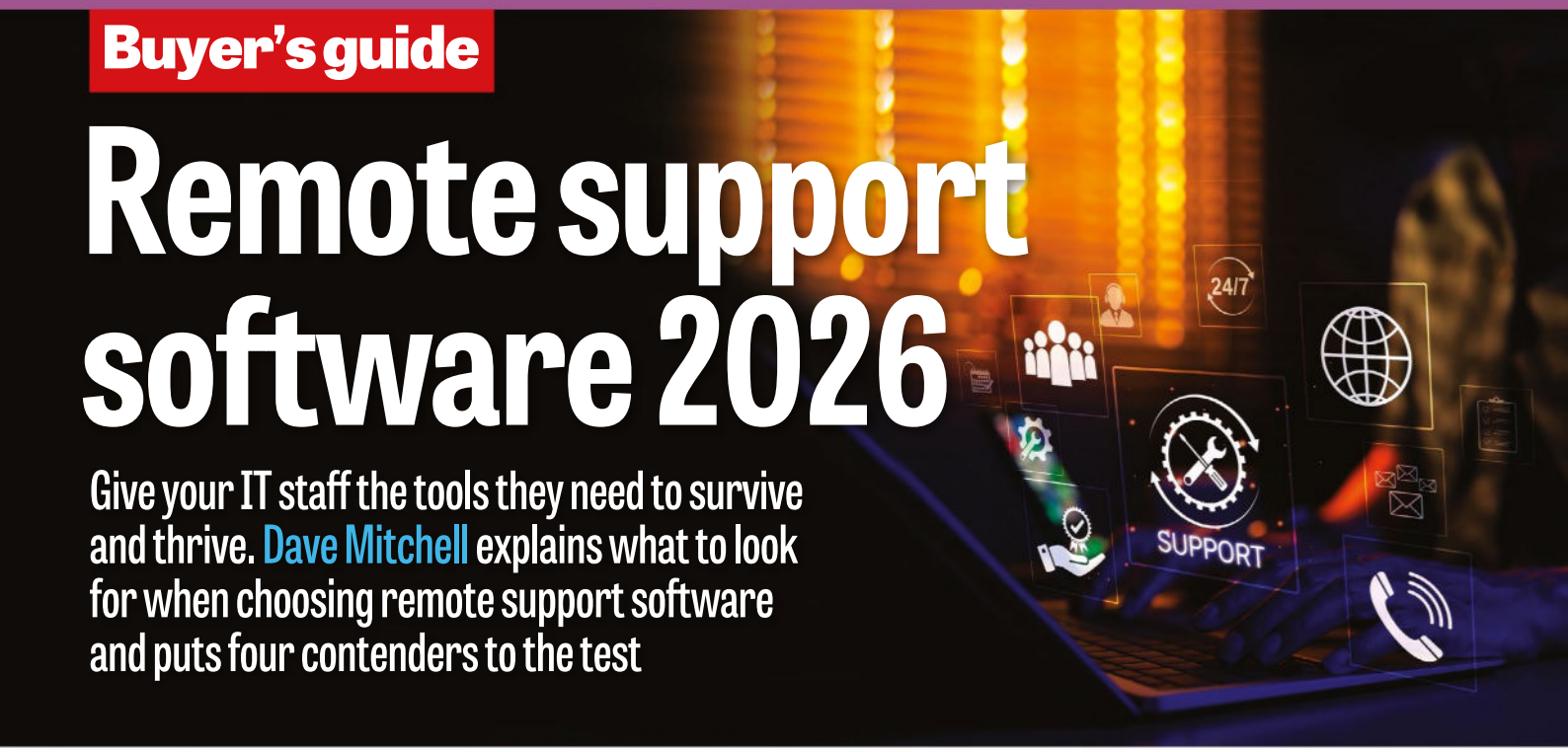
So, battery life is important, but it's now a tickbox feature. For me, the quality of the screen is much more vital.



Tim Danton is editor-in-chief of *PC Pro*, and has tested laptops for 27 years.
editor@pcpro.co.uk

Buyer's guide

Remote support software 2026



Give your IT staff the tools they need to survive and thrive. Dave Mitchell explains what to look for when choosing remote support software and puts four contenders to the test

Most companies wouldn't survive for long without their IT support teams: they invariably play a critical role in diagnosing and resolving technical issues that keep business operations running efficiently. The move to flexible and hybrid working shows no signs of slowing down, and this presents particular challenges as technicians must be able to support users regardless of where they are located.

In these new working environments it's impossible for technicians to personally visit users every time they have a hardware or software issue. They can't be expected to use telephone support either, as this is highly inefficient and can be incredibly frustrating without having access to the user's device.

Remote support software is the answer: it puts technicians in front of the user's troublesome computer without them having to be physically present. Cloud-hosted solutions take this to the next level, allowing technicians to reach out over the internet and fix problems no matter where the user is in the world.

The biggest decision facing SMBs is choosing the right one for their needs, as there's an overwhelming range of support solutions. In this month's guide, we look at affordable cloud-hosted support solutions from four of the big names – 247connect, LogMeIn, IDrive and WiseMo – and test them in the lab to help you choose the one that best fits your working practices.

Access all hours

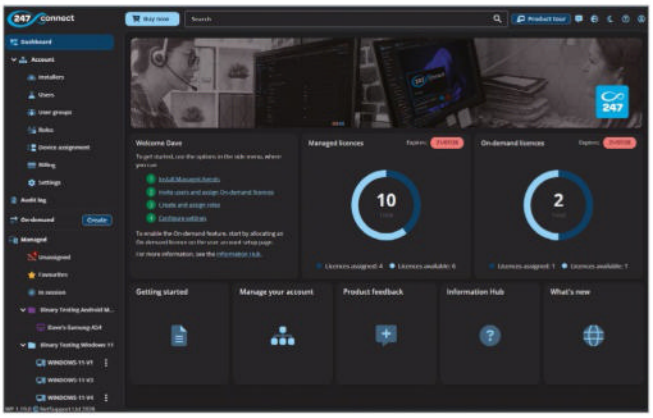
All remote support products require an agent loaded on client systems to allow technicians to access them, and there are two distinct methods of achieving this. For instant access in times of trouble, technicians can use on-demand, or attended, access where the user is present at their desk.

From their web portal account, the technician sends a request to the user with the message containing a unique session PIN and a download link for a temporary agent. A session only starts once both parties have agreed to join and, on completion, the agent software is automatically removed without trace from the remote system.

"Accept nothing less than AES 256-bit encryption for all communications between technicians and users to prevent eavesdropping"

However, there will undoubtedly be times when technicians need to access systems when the user isn't present. For this, a different agent is used, which is installed permanently. Called unattended or persistent access, the agent stays connected to the remote support service, allowing technicians to access the system as and when required.

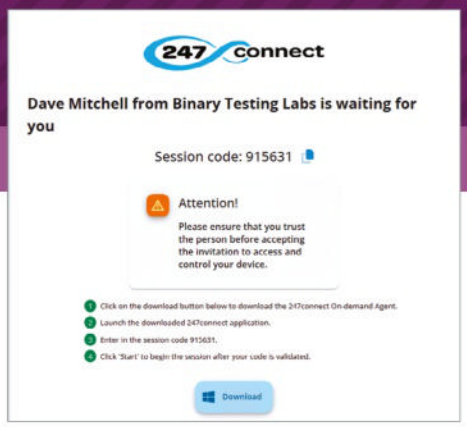
It's important to decide on the type of access you require as this can affect ongoing costs. Some support products include attended and unattended access in one simple subscription, whereas others require you to choose one type and add the other as an optional and chargeable feature.

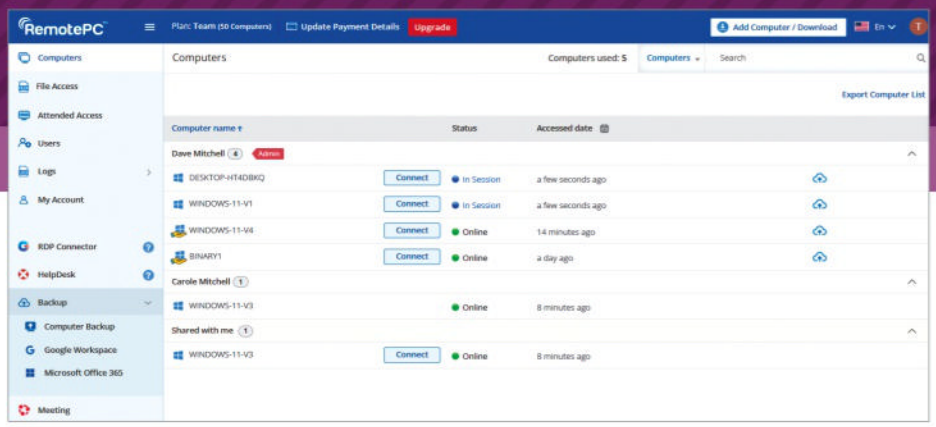


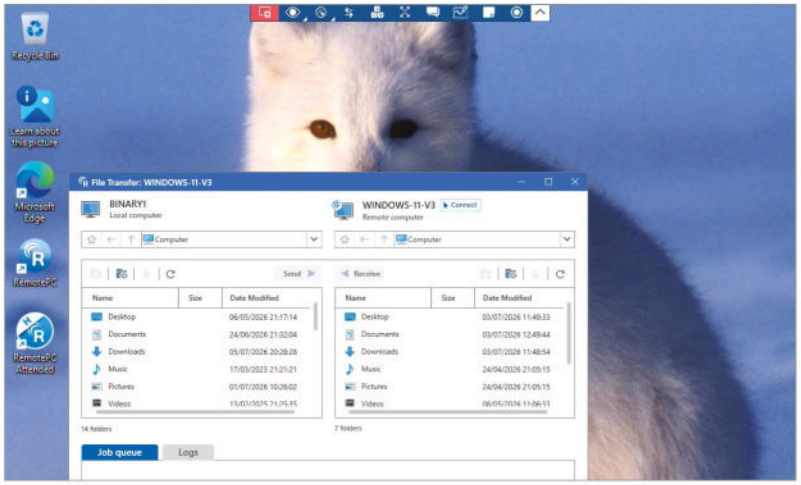
BELOW 247connect has an informative technician portal and supports computer grouping

Safety first

Security must be a top priority when choosing a remote support solution, as it can be extremely dangerous in the wrong hands. If it isn't configured correctly, it can punch a hole clean through your perimeter defences and allow cybercriminals to access







TOP LEFT 247connect offers advice to end users about remote access security

ABOVE RemotePC includes attended and unattended access in one subscription

LEFT RemotePC includes drag-and-drop transfer tools in the technician console

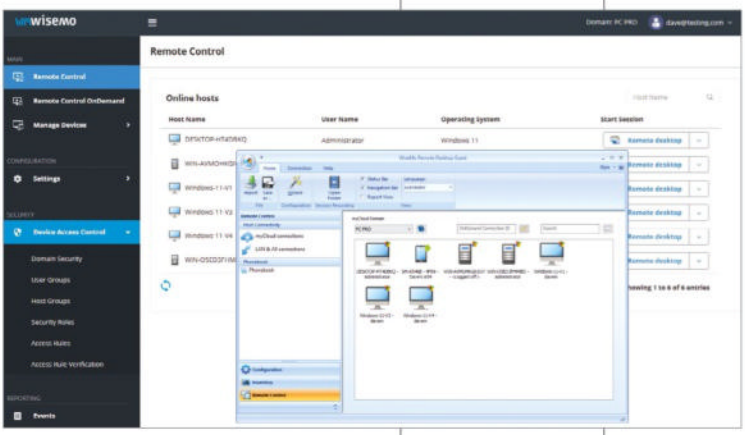
systems as though they were sitting directly in front of them.

Standardise on a single remote support product and ensure all your staff know which one you are using. Educate your employees about scareware and remote access scams, too, so they know how to recognise them and refuse unsolicited connection invitations.

Choose products that enforce multiple authentication methods for support sessions, including unique access codes and password protection. One product in this guide requires technicians to provide a personal signature code before it will allow them to initiate a support session.

For technician security, activate two-factor authentication (2FA) to further protect access to their personal cloud portal. And accept nothing less than AES 256-bit encryption for all communications between technicians and users to prevent eavesdropping.

Role-based administration is a valuable security feature that allows you to decide what levels of access new technicians are permitted to have when creating accounts. The best ones support device grouping so you can create groups, perhaps based on departments or remote offices, and allow only specific technicians to support them.



ABOVE The WiseMo Remote Control hybrid service offers both cloud-hosted and on-premises support

Free remote access tools such as Chrome Remote Desktop and the Windows 11 Quick Assist apps should be disabled or removed in business environments because they're often used by threat actors to impersonate IT support staff. Such tools are aimed primarily at personal use, have limited features and are virtually impossible to manage, secure and audit.

Power tools

Check what technician tools are included as these will improve the support experience. Remote control is a given, but other valuable features are view-only facilities, drag-and-drop file transfers, screen sharing, screen blanking, audio, video and chat services, note taking and remote Registry editors.

Workstation inventories can speed up troubleshooting as technicians are able to see what hardware and software is installed on the user's computer prior to a support call. Session recording is another useful feature as it can create a video audit trail of support sessions, which can also be used for training purposes.

AI is now making inroads into remote support and has the potential to streamline support desk operations. One product on review includes a virtual technician that can assist with troubleshooting, complete repetitive tasks, use session analysis to automatically create notes and generate company-specific knowledge-base articles for use by other technicians.

Most products focus on Windows endpoints, but if you have a mix of desktop devices check what other platforms they support; most also offer agents for macOS and Linux. Mobile support is an essential requirement too, and you should expect to see technician and client apps for Android devices. You can't remotely control iOS devices due to Apple's strict security model but, along with technician apps, some products offer facilities to broadcast their screen contents to a technician.

Cloud-hosted remote support can easily boost business productivity, and we chose the four products for this guide as they're all available as free time-limited trials so you can try them out first. Along with tight access security, they offer a wealth of valuable features that will allow your IT support department to resolve end user issues quickly before they become complaints.

247connect

Easily deployed cloud-hosted support with lots of features, strong access security and affordable licensing plans

SCORE ★★★★★

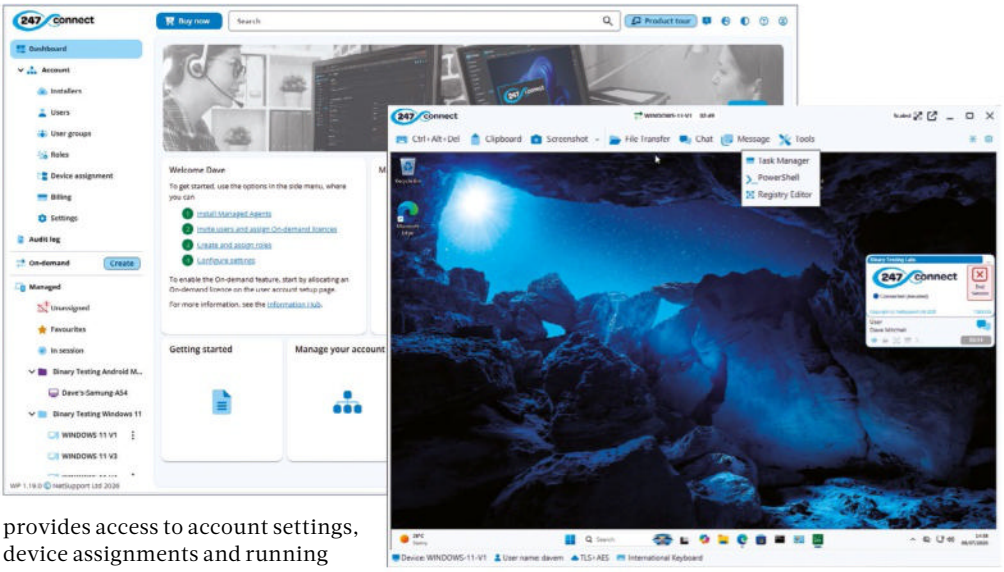
PRICE Starts from £180 exc VAT per operator/year from 247connect.cloud

NetSupport's Manager has always been one of our top choices for on-premises remote support and last year, the company moved into cloud-hosted support with its 247connect solution. Designed to be easy to manage and use, 247connect has seen significant updates since we last reviewed it in issue 373; the technician control app is now available for Windows, macOS and iOS devices, with an Android version on the way.

For unattended access, you have managed agents for Windows, macOS and Android. The 247connect web portal has seen a number of enhancements including integration with ServiceNow, support for Apple SSO and audit histories for individual technicians.

Pricing remains the same, with on-demand access based on the number of technicians, starting at £180 per year and enabling support for five concurrent connections. You can add unattended access services, which are priced per agent and start at £4 each per year for up to 99 agents, dropping to £2.50 each for 500 upwards.

The technician cloud portal is easy on the eye and its dashboard presents an overview of licence usage and expiry dates, along with quick links to deployment tasks and documentation. The left pane provides access to account settings, device assignments and running on-demand sessions, while the views of managed agents can be organised into custom groups.



New technicians are invited by sending them an email from the portal and choosing local, Apple, Google or Microsoft authentication. Access security is excellent, as you can assign default or custom roles to determine what support services each one can use.

The 247connect zero-trust policy means that when new users are issued an on-demand licence they don't have any access permissions until you decide which managed groups they can see. Their last task is to install the Control app, with deployment options including Microsoft InTune.

For unattended access, managed agents for Windows, macOS and Android are available from the portal, and more security is evident here as each device is initially placed in the portal's Unassigned group. They can't be accessed by technicians until an account admin moves them to a custom group or sub-group.

Unattended sessions are easily started by choosing a host and selecting the view, file transfer, chat, message or tools icons. The remote control interface toolbar provides quick links to tasks, and new features including PowerShell, a Registry editor, task manager and session-recording tools have now been added to the interface.

ABOVE Exemplary mobile features include support for iOS and Android devices

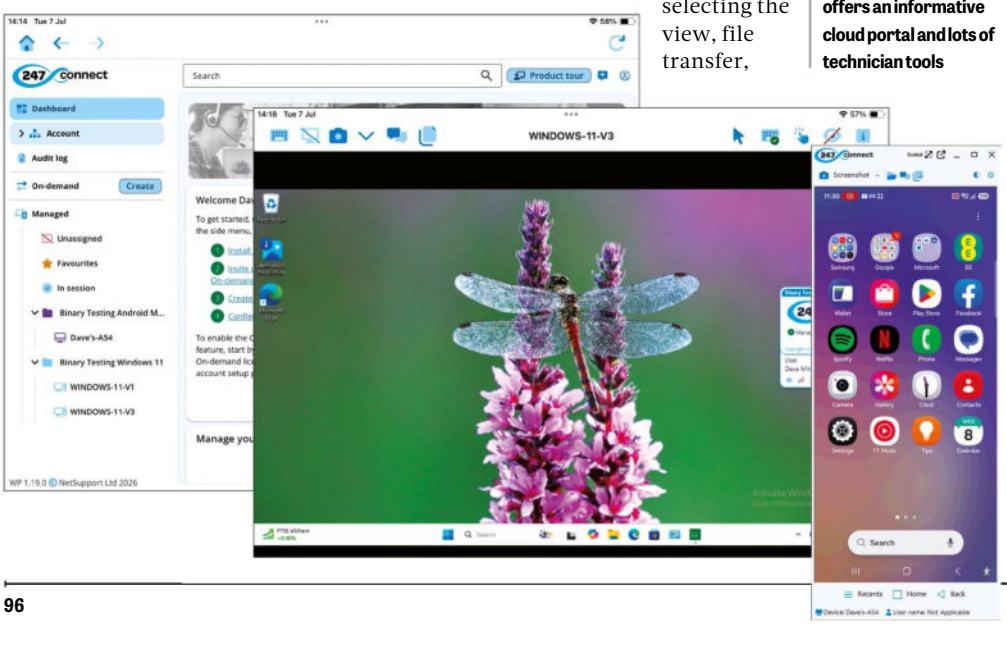
We loaded the Android-managed agent on our Samsung mobile from Google Play and scanned the QR code in the portal to register it with our account. After assigning it to a group, our technicians could remotely control the mobile, send messages and chat with the end user.

On-demand sessions are started with one click, which loads a new window with a unique 6-digit code and options to copy the web link and email it. When the end user clicks on the link, a web page opens with essential details of the technician and company name, a warning not to accept unsolicited requests and a link for the runtime app.

> **"This cloud-hosted solution is incredibly easy to use, offers great access security and is available in a range of affordable plans"**

Once the app is registered, the technician can choose from view, file transfer, chat or message options. Another window pops up on the host advising the user of the level of access being requested and, once approved, the session starts with the technician receiving the same remote control interface as with unattended sessions.

NetSupport has years of experience in the remote support market and it brings its expertise to bear with 247connect. This cloud-hosted solution is incredibly easy to use, offers great access security and is available in a range of affordable plans.



BELOW 247connect offers an informative cloud portal and lots of technician tools

REQUIREMENTS

Managed agent: Windows 10, Server 2016, macOS 11, Android 12 upwards ● **Control:** Windows 10, Server 2016, macOS 12, iOS 15 upwards

IDrive RemotePC Team

Secure cloud-hosted remote support that's rich in features and exceptional value for SMBs

SCORE ★★★★☆

PRICE First year, 50 computers, £168 exc VAT from remotepc.com

IDrive needs no introduction to *PC Pro* readers thanks to its excellent cloud backup services (*see issue 383, p100*), and it also offers a well-featured cloud-hosted remote support solution that's priced attractively for SMBs. Available in four versions – all with free seven-day trials – RemotePC is designed to keep things simple by being easy to deploy, use and manage.

The RemotePC Team plan on review takes all the goodness of the Solo and Pro versions, supports unlimited users and technicians, and adds Active Directory (AD) and syncing support, single-sign on (SSO) and access to helpdesk functions. Move up to the Enterprise version and you can schedule remote support sessions, manage remote client app deployments and use groups to assign user roles and access permissions.

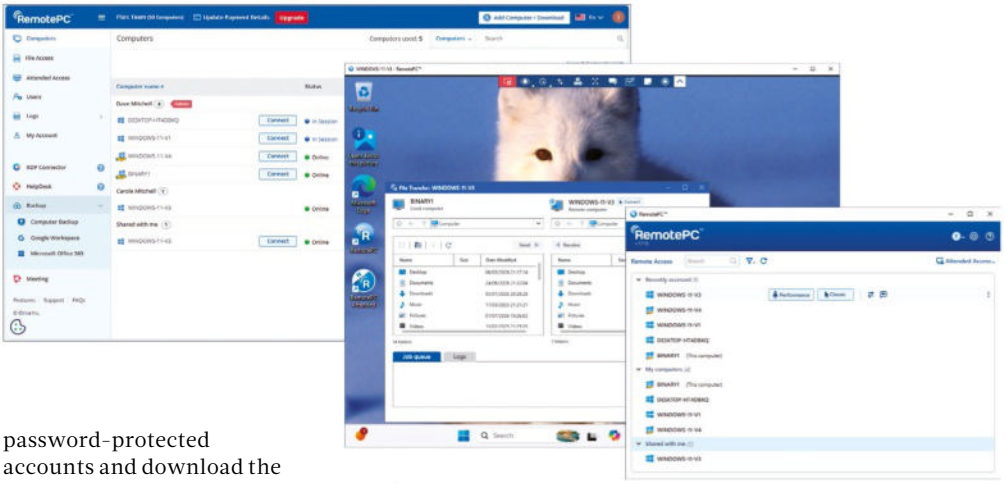
RemotePC Team starts with support for 50 Windows, macOS and Linux host computers, which should be plenty for most SMBs, but be mindful of IDrive's hosts overuse charge. If you exceed this count, you'll be charged a yearly fee of £15 per extra computer.

The admin web portal is a tidy affair. We added users by emailing invitations so they could create password-protected accounts and download the client desktop app. They can permit their own computer to be available for unattended remote access, which must be protected with a personal code.

Each user gets a cloud portal and a desktop app for viewing and connecting to other computers that have unattended access enabled. Initially, they can only see those they've personally invited, but the account admin can share other computers with them and revoke this at any time.

Unauthorised access can be blocked by enabling the trusted devices option on user accounts. Alternatively, admins can enable stronger two-factor authentication (2FA), which requires the account holder to log in using their password and a one-time verification code sent by email, SMS or a time-based OTP mobile app such as Google or Microsoft Authenticator.

On-demand attended sessions are started by emailing an invitation from the web portal or desktop app. Both user interfaces can be used to customise the email message for essential authenticity and, when the user clicks on the link, a temporary app is loaded and they share the unique nine-digit session code it generates with the technician.



ABOVE IDrive comes with free iOS and Android mobile technician apps

From the admin web portal, you can view active session details, disable them and start remote sessions on selected devices. The Viewer Lite browser app provides remote control, file browser, text and video chat and whiteboard services, as well as options to blank the host's screen and block local input. The desktop app, meanwhile, adds extra tools for drag-and-drop file copying, remote printing, audio and session recording.

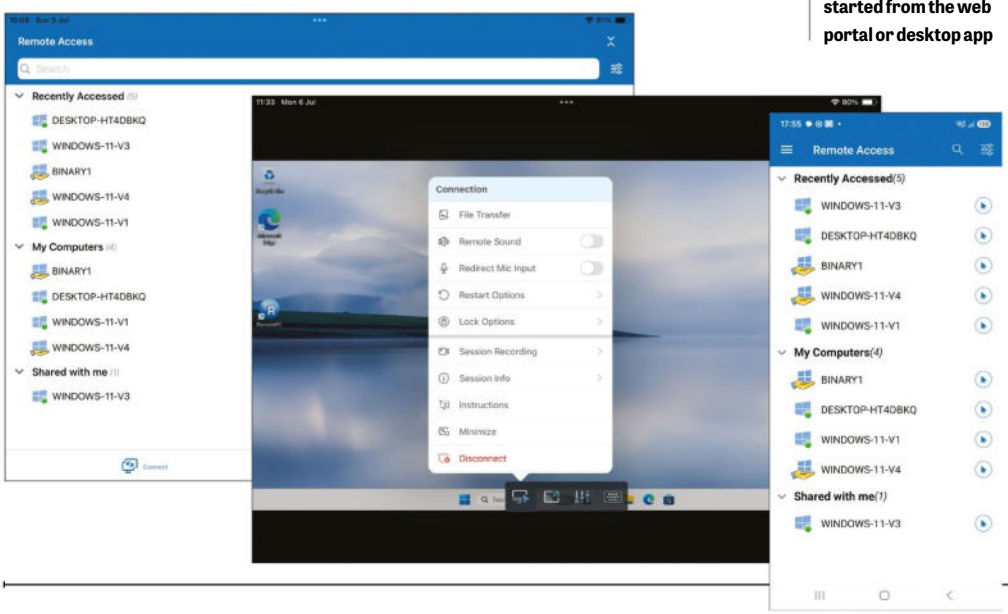
The desktop app Performance viewer connects to Windows and macOS hosts at up to 60fps and presents a similar interface to Viewer Lite, with additional support for multiple monitors. The slower Classic interface supports Windows, macOS and Linux hosts and provides the full set of support tools including microphone redirection.

"Available in four versions – all with free seven-day trials – RemotePC is designed to keep things simple by being easy to deploy, use and manage"

The portal provides a separate menu for quick access to a host's files. Select one from the File Access list and you can browse their storage and upload files and folders, or download them from the host.

Mobile apps are included. We used the iOS version to view a list of the unattended clients in our account for single tap access. We could remotely control them, load a virtual keyboard, use mouse or touch interaction and initiate attended access support sessions.

SMBs seeking simple cloud-hosted remote support for their office and home workers will like IDrive's RemotePC Team. It's easy to manage and use, provides strong access security and is available in a range of very affordable plans.



BELOW Support sessions can be easily started from the web portal or desktop app

REQUIREMENTS

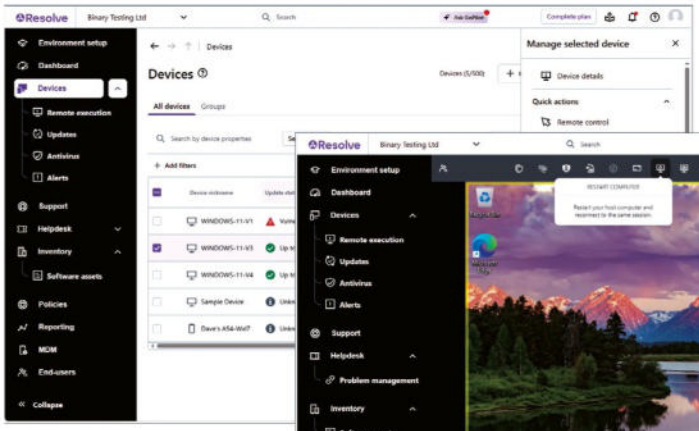
Windows 8.1, Server 2012, macOS 12, Android 7, iOS 13 upwards, Linux

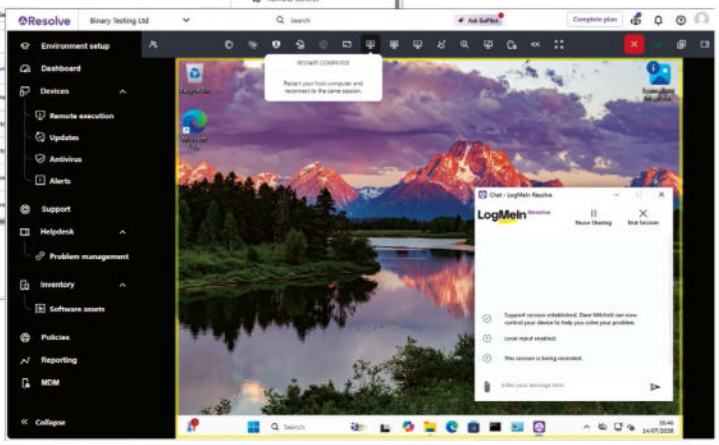
LogMeIn Resolve Advanced

Teams up slick cloud-hosted remote support with smart security keys and takes AI power to the next level

SCORE ★★★★★

PRICE From 25 devices, £48 exc VAT per month billed yearly from logmein.com





GoTo offers two distinct remote support solutions under the LogMeIn brand. Rescue is aimed at enterprises needing to support large numbers of users, while Resolve on test here targets SMBs and MSPs that want AI-powered support services plus features such as Windows patch management, endpoint antivirus and helpdesk functions.

LogMeIn offers four plans. We reviewed Resolve Advanced, which takes everything from the Starter and Growth plans and adds device monitoring, patch, antivirus, asset management and remote execution services. A valuable feature is that all plans support unlimited agents or technicians, and you're billed only on the number of endpoints required.

Deployment starts at the GoTo admin account portal, where you create new users, choose the features they can access, assign one of three admin roles and issue an invitation email. Resolve has a laser-sharp focus on security: when users first access their portal, they must create a personal signature key which has to be approved by another admin user.

The key must be entered whenever a user accesses a sensitive task such as remote control and, for extra security, LogMeIn can't recover it – so don't lose it. Resolve can request the key for every user action but, if this becomes tiresome, it can be changed to daily or weekly requests.

Resolve goes large on AI power. Along with the GoPilot assistant, you now have the Virtual Technician. This helps with troubleshooting and running custom tasks on endpoints, creating session recordings, notes and summaries and generating custom knowledge-base articles.

The technician portal opens with a dashboard view, and even this can be customised using AI insights. Just describe what you want visualised and Resolve will offer suggestions based on your criteria and create a new dashboard widget.

For unattended access, users can download the Windows and macOS installer, which loads a background service linked to the technician's key. You can deploy it using a shared web link, which is also used to retrieve the Android app.

Selecting an unattended device from the portal brings up a quick-access menu for remote control, device reboot, remote execution and loading a file manager, Registry editor and service manager. Unattended remote control presents the device's screen in a central window, and you can have active sessions to multiple devices and swap between them.

ABOVE Detailed device monitoring is included, along with the clever AI-powered virtual assistant

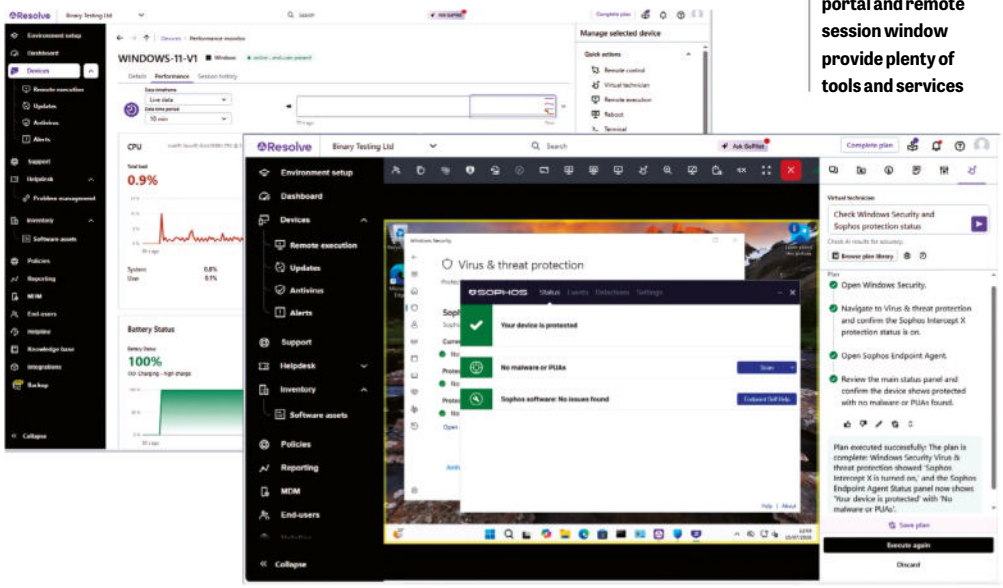
Load the virtual assistant from the session menu and prepare to be amazed – just tell it what you want to do and it will create a plan with an action list. We asked it to check on the Sophos Intercept X protection status on a Windows 11 endpoint and it drew up a plan for approval.

We executed the plan and watched Resolve load the Sophos agent, check that protection was enabled and confirm all was good. You can save plans for future use and, when the session is closed, Resolve creates detailed session notes.

"Load the virtual assistant from the session menu and prepare to be amazed – just tell it what you want to do and it will create a plan with an action list"

On-demand sessions are started from the portal's Support menu, which generates a unique nine-digit access code along with options to copy the web link and send the invitation via email. For essential authenticity, the end user is presented with the technician's details and, after they've downloaded the Resolve run-time app, the session starts and the technician sees the same screen and toolbar as used for unattended access.

The new plans makes LogMeIn Resolve much more affordable and, although you'll need to keep an eye on AI credit usage, the AI-powered virtual assistant is a star player that will make light work of mundane support tasks. This cloud-hosted solution is very easy to use, delivers the toughest access security and includes essential endpoint protection services.



BELOW The technician portal and remote session window provide plenty of tools and services

REQUIREMENTS

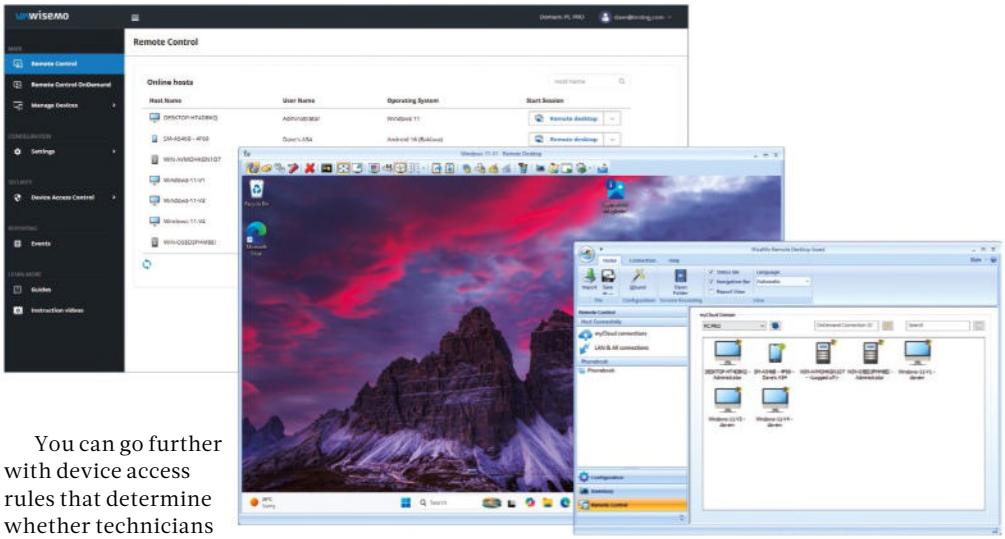
Windows 10, Server 2012, macOS 13, Android 9, iOS 17 upwards

WiseMo Remote Control

WiseMo offers a remote support connection for every occasion, backed up with stiff access security

SCORE ★★★★☆

PRICE Yearly subscription, ten hosts, £150 exc VAT from maitek.co.uk



Danish company WiseMo has been in the remote support market for over 16 years, and its Remote Control product stands out due to its extreme flexibility. Whereas the majority of solutions are deployed either in the cloud or on-premises, WiseMo gives you the best of both worlds.

This hybrid service offers a myCloud portal and an on-premises guest desktop app so technicians can choose the best connection for their needs. Remote hosts can be supported over the internet, while those on the same LAN can be accessed directly over a fast local connection.

WiseMo offers a range of flexible product licensing plans. We've shown the yearly subscription cost for ten unattended, or persistent, hosts, but you can opt for a perpetual licence instead if you prefer. The WiseMo OnDemand service is optional, snaps neatly into the web portal and has a yearly subscription cost of £195 per technician.

The web portal is easy to use and makes light work of deployment. From the Settings menu you create new users and use roles to determine whether each one is an administrator, an operator or is only allowed to run attended and unattended remote control sessions.

You can go further with device access rules that determine whether technicians are allowed full access, can view host inventories, have remote management permissions or only have viewing rights. Place your users in groups and you can apply one set of access rules to all members, and there are also myCloud domain policies that enforce guest 2FA.

Each user gets a personal cloud portal, and their first job is to download and install the guest app and log it into their myCloud account. For unattended access to hosts, you download and install the Windows, macOS or Android apps, which are customised to connect only to your cloud account.

The web portal offers a variety of options for support sessions; you can choose the remote desktop button or use the host's drop-down menu for running file transfer, chat and remote management. The guest app provides more features, with technicians able to see all registered hosts and, if these are on the same LAN, they can access them directly using their IP address or hostname.

The guest interface provides even more features, as detailed hardware and software inventories can be gathered from unattended hosts and the results stored for further investigation. The host drop-down menu also offers facilities for sending messages, remotely running programs and sending lock, logoff, restart and shutdown commands.

After starting an unattended session, the guest loads a new console with a wealth of support features. Along with full remote control, its ribbon menu offers file transfer, messaging, text and audio chat, remote application execution, Registry editing, screen blanking, and keyboard and mouse controls.

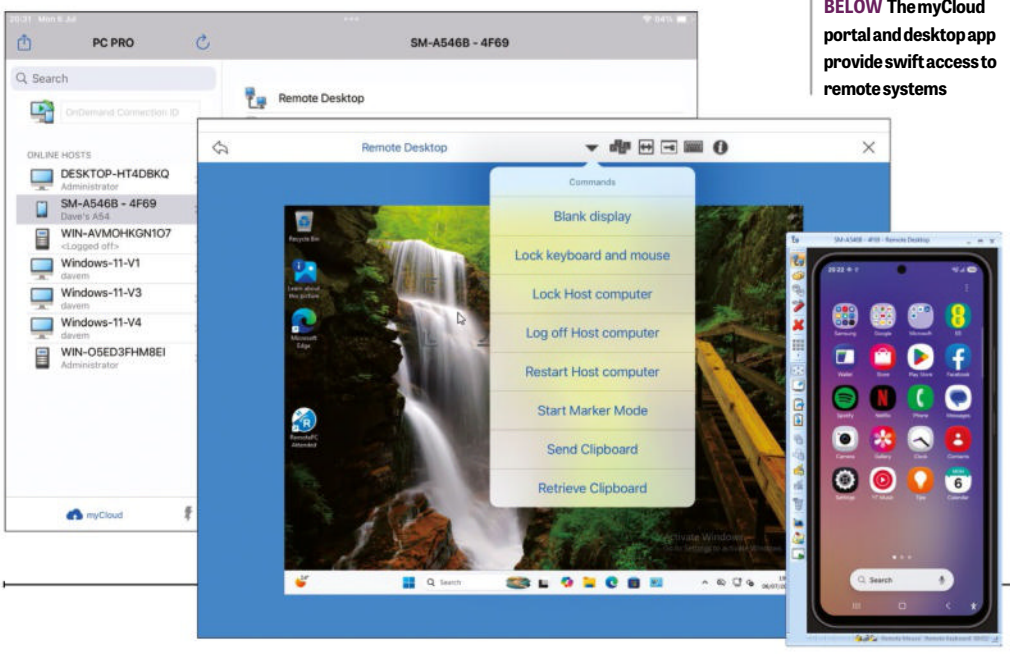
ABOVE The mobile apps provide easy access to hosts and lots of support tools

"Whereas the majority of solutions are deployed either in the cloud or on-premises, WiseMo gives you the best of both worlds"

OnDemand sessions are started by emailing a link to the user for the runtime app and, once installed, it generates a nine-digit PIN that's passed back to the technician. The remote user can decide which functions are permitted and, after authorising access, the technician is presented with the same desktop console as used for unattended sessions.

Mobile support is excellent, with WiseMo offering a guest iOS app and separate guest and host apps for Android. We tested both Android apps on a Samsung mobile and could take control of unattended hosts, start OnDemand sessions and allow it to be remotely controlled.

Businesses that want a versatile range of connection options will find WiseMo's hybrid support solution could be just the ticket. On-demand sessions are an optional feature, but access security is very good, it's easy to use and it offers a wealth of support features.



BELOW The myCloud portal and desktop app provide swift access to remote systems

REQUIREMENTS

Host/guest: Windows 7/Server 2012, macOS 10.15, Android 4 upwards ● **Guest only:** iOS 12 upwards, Linux

TP-Link Omada Fusion 2.5G

TP-Link brings plug-and-play cloud management and strong network security to SMBs at an appealing price



SCORE ★★★★★

PRICE £142 exc VAT
from broadbandbuyer.com

TP-Link offers a fine choice of OC hardware controllers for centralised site management from its Omada cloud platform, and the Fusion range takes this to the next level. Whereas the OC models are simple site controllers, Fusion appliances are all-in-one gateways that combine a controller and licence-free cloud management with multi-WAN routing, an SPI firewall, web content filtering, application controls, IDS/IPS and secure one-click VPNs with TP-Link's LightLink app.

The Fusion 2.5G sits on the third rung of this family of four new appliances, has five 2.5GbE ports for LAN or WAN duties and supports WAN failover and load balancing. It has a powerful 2GHz quad-core ARM CPU with 2GB of DDR4 RAM, and there's a colour touchscreen with five icons for status and network traffic views.

If you want PoE support, you'll need to step up to the larger Fusion 2.5G PoE model, which has a 110W power budget and offers nine 2.5GbE ports, eight of which provide PoE+. Neither appliance supports PoE-in so they must be powered by the included external PSU, which connects to the USB-C port.

Cloud deployment couldn't be any easier: we used the Omada Android mobile app to discover the appliance over Bluetooth and bind it to our account. You can do a lot from the mobile app but, for the best experience, we moved over to the Omada web portal which provides full access to advanced features and security services.

The portal's organisation level view now provides quick links to all your on-premises, cloud and Fusion controllers, and selecting the Fusion 2.5G took us to its remote management console. The Omada 6 interface is pleasing on the eye: it presents a smart multi-tab dashboard for quick access to a network overview, topology, Wi-Fi, client activity and network traffic views.

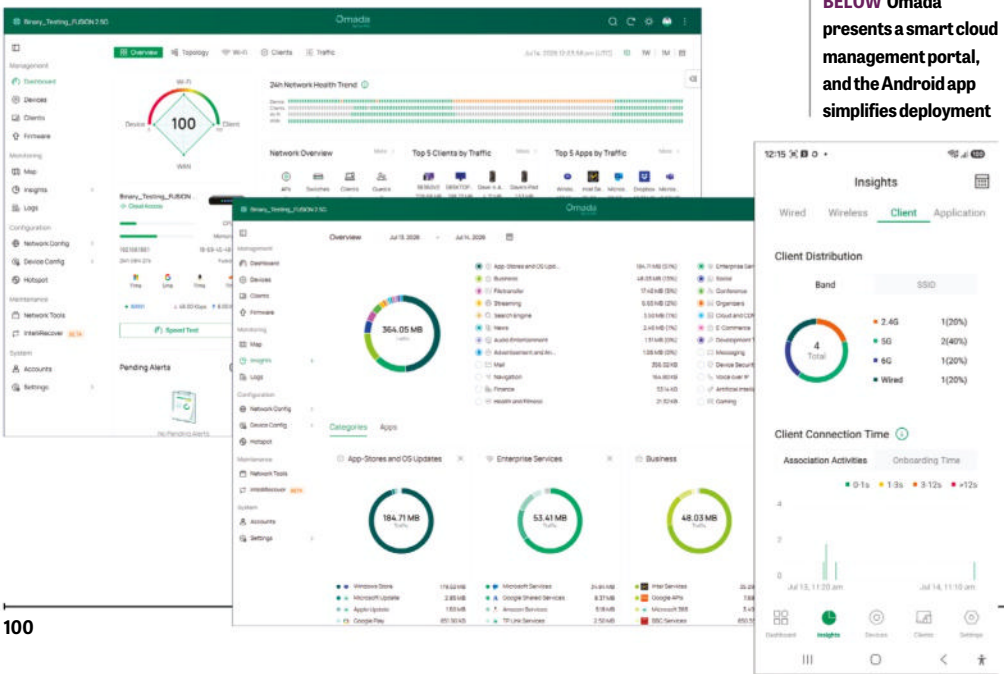
The main overview page provides a network health scoring system that evaluates all devices and clients to help locate potential issues. Alongside are views of the top five clients and detected applications, while below is an activity graph that can be swapped between internet and Wi-Fi traffic.

ABOVE **The Fusion 2.5G offers plenty of features for the price**

LEFT **There are five 2.5GbE ports for LAN and WAN duties**

"It's easy to deploy and manage, delivers an impressive range of security measures and is completely licence-free"

BELOW **Omada presents a smart cloud management portal, and the Android app simplifies deployment**



Being a standard Omada controller, the Fusion 2.5G can manage any compliant switch and wireless access point. We added a TP-Link SG3218XP-M2 PoE+ switch and connected an EAP787 Wi-Fi 7 AP to it, both of which appeared in the portal ready for adoption.

The appliance's deep packet inspection provides full visibility into all detected apps on the network, along with their bandwidth usage. Access control lists can be used to restrict app usage, and you can prioritise their traffic or limit their impact with gateway QoS rules.

Two default gateway content-filtering rules are provided, or you can create your own and choose what to block and allow. Ad blocking using a DNS database is available, while for general website filtering you have 81 categories to choose from.

The IDS/IPS section offers detect or detect and prevent options, with the highest security setting blocking 12 threat types including malware, worms, botnets and exploits. You can view a doughnut chart and list of detected threats from the Maps section, but to see the global threat map you'll need to acquire and import a Mapbox API access token.

Wireless networks are created from the portal's WLAN section, and you can enable multi-link operations on those set to 11be mode, extend coverage using AP meshing where supported, set SSIDs as guest networks with L2 isolation and assign custom captive portals. As the Fusion 2.5G is a fully licensed controller, you get the wireless RF scanning service, which provides charts of scan results for each radio along with spectrum analysis and interference graphs.

For the price, the Fusion 2.5G offers plenty of features and competes strongly with Ubiquiti's SMB-class Cloud Gateway appliances. It's easy to deploy and manage, delivers an impressive range of security measures and is completely licence-free. **DAVE MITCHELL**

SPECIFICATIONS

Desktop chassis ● 2GHz quad-core ARM Cortex-A53 CPU ● 2GB DDR4 RAM ● 16GB eMMC ● 2.5in colour touchscreen ● 5 x 2.5GbE WAN/LAN ports ● BLE antenna ● USB-C power input ● PSU included ● 160 x 130 x 32mm (WDH) ● limited lifetime warranty

Zyxel NWA30BE

The affordable NWA30BE puts Wi-Fi 7 in small spaces and delivers impressive performance for its size

SCORE ★★★★★

PRICE £83 exc VAT
from amazon.co.uk



ABOVE **The NWA30BE is very keenly priced for a Wi-Fi 7 AP**

Zyxel aims to put Wi-Fi 7 services right by your side, with its NWA30BE targeting a range of scenarios such as small cafes, retail counters, pop-up shops and wireless point-of-sale (POS) systems. No deployment planning is required as this desktop access point (AP) can be placed wherever you want to present your wireless services.

As you'd expect at this low price, it lacks a 6GHz radio and has a modest BE5100 rating, but it's powered by the same quad-core Qualcomm CPU found in Zyxel's higher-end Wi-Fi 7 APs. It isn't mandatory for Wi-Fi 7 APs to have a 6GHz radio and the NWA30BE delivers all the other key features such as 4K-QAM (quadrature amplitude modulation) and support for multi-link operations (MLO).

This palm-sized package has two rear fixed aerials and can be placed on a countertop or wall-mounted. It has a 2.5GbE port, but PoE isn't supported as the AP is designed for environments that are unlikely to have a suitable source. The box includes an external PSU.



LEFT **There's a 2.5GbE port, but no support for PoE**

Management options are undiminished, with the NWA30BE supporting standalone mode or Zyxel's Nebula Control Center (NCC) cloud platform. Zyxel's NWA models are designed to offer SMBs a more affordable solution with a reduced feature set and don't include a one-year NCC Pro Pack licence in the price.

Installation is aided by the AP's web console wizard, which offers the choice of standalone or cloud management. After selecting the former, it guided us through changing the default admin password, setting the country of operation and creating our first SSID.

The AP supports up to eight SSIDs, which employ a combination of profiles and objects. Those new to Zyxel will find it takes a while to get the hang of their relationships, but AP management objects use radio and SSID profiles to define the active radios, operating mode, channel width and encryption method.

You won't find any toggle buttons for MLO as this is fully automated in standalone and NCC modes. Setting the operating mode for both radios to 11be enables Zyxel's auto-MLO, which enforces the mandatory Enhanced Open, WPA3 Personal or WPA3 Enterprise encryption.

Swapping to cloud management was a breeze. We used the Nebula iOS app on an iPad to scan the QR code on the AP's base and choose the site from which it should take its settings. The portal presents an informative dashboard with customisable widgets showing the status of all Zyxel cloud-managed devices, total wireless traffic, APs by usage and all connected wireless clients, along with their detected OS.

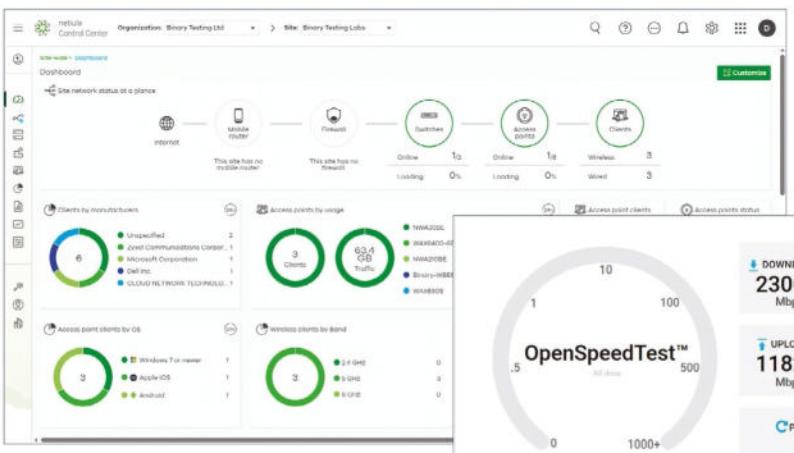
It supports the same number of SSIDs as standalone mode, and tags can be applied so they're only broadcast by APs that have a matching tag. For guest wireless networks, you can present custom captive portals with your own logos and messages, use a variety of authentication methods and enforce L2 isolation so your customers only get internet access.

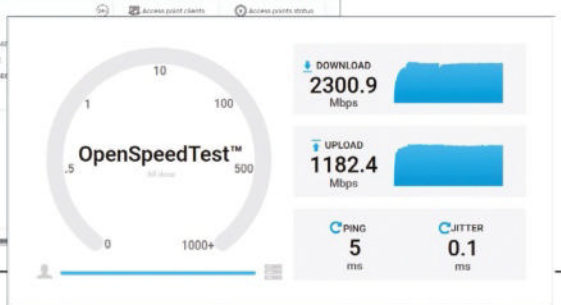
For performance testing, we connected the NWA30BE to the lab's Zyxel XMG1930-30HP multi-gig switch, which confirmed a 2.5GbE connection. Our test hosts were a Windows 11 Pro Lenovo desktop client equipped with a TP-Link Archer TBE550E Wi-Fi 7 PCIe adapter and a Dell Windows Server 2022 system connected over 10GbE.

"The NWA30BE is ideal for small businesses that want on-demand Wi-Fi 7 services. It's a cinch to deploy and is perfectly priced"

We used the OpenSpeedTest HTML5-based tool to test maximum raw speeds and ran the server component on our Windows Server host. With a 2.4/5GHz MLO link on the Windows 11 client showing a link speed of 3,226Mbits/sec, we pointed its browser at the OpenSpeedTest server address and port and watched it report back with respectable close-range upload and download rates of 148MB/sec and 287MB/sec. Moving the AP ten metres away and into an adjoining room saw upload and download rates drop to 125MB/sec and 223MB/sec.

The NWA30BE is ideal for small businesses and offices that want on-demand Wi-Fi 7 services. It's a cinch to deploy, delivers an impressive performance and is perfectly priced for the target market. **DAVE MITCHELL**





LEFT **The NWA30BE supports remote management from Zyxel's NCC portal**

SPECIFICATIONS

BE5100 dual-band 2.4GHz/5GHz 802.11be • quad-core Qualcomm CPU • 2 x external fixed aerials, 2.5GbE LAN • desktop/wall-mount chassis • 155 x 140 x 35mm (WDH) • 307g • external PSU included • limited lifetime warranty

Brother MFC-L8970CDW

Plenty of business-friendly features and great all-round quality make this a solid choice for busy offices

SCORE ★★★★½

PRICE £737 (£885 inc VAT) from printerland.co.uk



The Brother MFC-L8970CDW sits at the top of the Japanese manufacturer's updated range of colour laser devices for workgroups and small businesses. And it has an enviable specification. On the top, you'll find an automatic document feeder (ADF) that can handle 80 sheets. It can duplex (double-side) scan each sheet in a single pass. Just in front of this sits a colour touchscreen so huge it looks like someone's left their tablet behind.

The scanner and display unit sit atop a colour laser printer rated at 31 pages per minute (ppm), or 20 images per minute (ipm) when printing in duplex – 20 sides printed onto ten sheets of paper each minute. This printer combines a 50-sheet multipurpose feed and 250-sheet cassette. That's the only slightly off-note in an otherwise comprehensively well-specced device – at this price we'd expect to be able to load in an entire ream.

Alongside its duplex print, scan, copy and fax party tricks, this MFP supports 2.4GHz and 5GHz wireless networks and a gigabit Ethernet connection. Its vast screen has plenty of room for mundane setup and operational features, along with space for up to 64 configurable shortcuts – useful if, say, people frequently need to make a double-sided copy of a double-sided original, and want to avoid having to dig around in the copy menu.

While it's a shame the MFC-L8970CDW doesn't have a bigger standard cassette, you can upgrade it to a maximum 1,340 pages with a combination of additional 250- and 520-sheet trays. There's no stapler unit or sorting bin, however, which rules it out of true departmental roles – it doesn't really have the speed for it anyway.

Brother says the MFC-L8970CDW is designed for a recommended 7,500 monthly pages or an 80,000-page maximum. It certainly feels well put together, with sturdy trays and impressively robust-feeling paper stops in the printer and ADF outputs. The usability is good, too, from the large display down to details such as the clearly displayed paper orientation icon in the main tray – helpful if you're reloading paper and need to know which will be the print side.

ABOVE Brother's MFC-L8970CDW is a sturdy colour MFP that's built for heavy workloads

Cost of running

Things start to get more complicated when you look at consumables. The MFC-L8970CDW supports a dizzying range of 16 different toners rated from 1,800 to 10,000 pages, on top of which there are drums and waste toner containers each good for 50,000 pages. Heavily used examples might find themselves needing a new fuser or transfer belt unit, too.

That's a lot to manage, particularly if you're used to competing devices that just take four combined toner/drum consumables. Nobody would blame you for signing up to a managed print service – Brother's start at around £7 per month – but if you're buying consumables and you stick with the biggest 10,000-page toners, you can get running costs down to less than a penny per page of black text, or 6.8p (exc VAT) for colour. Factor in all the lifetime consumables, and these still only rise by fractions of a penny.

This isn't a cheap MFP, but it does arrive with XXL toners rated for 7,500 black and 6,000 colour pages – these alone are worth a few hundred pounds.

This isn't the ugliest laser MFP you'll see, but it has the misfortune to combine a comparatively deep and narrow laser printer with a wide and deep scanner unit. The result is some mushroomy overtones, plus the more practical need for more depth and width on a counter than you might expect. This is compounded slightly by vents on the right side and a USB slot on the left – the latter bizarrely under, and inset from, the overhanging touchscreen in such a way that the casual user is unlikely ever to find it.

This device is bulky and heavy enough that it's a two-person lift over any significant height or distance. There's the usual amount of tape to extract, along with some orange plastic spacers for the toner/drum tray. While these were easy to remove on the HL-L8570CDW printer we tested (*see issue 383, p72*), here the left-hand spacers were reluctant to part company with a pin at the front.

"Usability is good, from the large display down to details such as the clearly displayed paper orientation icon"



LEFT The huge colour touchscreen makes it look like someone's left their tablet behind

Security questions

With such a large display, it's no surprise that this MFP is easy to join to a wireless network. It's easy to use and configure, too: adding a shortcut is as simple as tapping one of the plus icons and navigating through the menu to the feature you want to access. Overall the menu system feels more like a consumer device than a business-class one, and that's a good thing: too many enterprise printers bamboozle non-technical users with complex control panels.

As you'd expect, the MFC-L8970CDW includes various security features and protocols, including IP filtering, SSL/TLS encryption, secure boot, and user authentication. There's also an NFC reader, configurable for authentication and workflow personalisation.

At this price, we're a little surprised Brother hasn't given the MFC-L8970CDW faster print speeds. It's always the case that a range-topping device can seem slow when it shares a print engine with more basic models, but we'd expect more than a modest 31ppm for this money. This is especially the case given this MFP didn't get all that close to Brother's

figures, managing only 23.8ppm across 25 pages in our standard black text test. It was slower still on our colour graphics test, although here its 21.5ppm is fair – our test document is graphics-heavy, and few printers sail through it at top speed.

We often get faster results over long documents, as these minimise the relative impact of the time it takes a PC to prepare and send the job. Sure enough, tested over a 50-page text document, the printer hit 30.3ppm – laudably close to Brother's claim. Using the first ten pages of the same document we timed duplex printing at 10.9ipm.



LEFT **The large screen makes it easy to take control of the printer**

Fine quality

This MFP defaults to 2,400 x 600dpi Fine print quality. Normal (600 x 600dpi) is no faster, so we completed our tests with the Fine setting. It printed six 6x4in photos on three A4 sheets in 32 seconds, and needed 35 seconds to complete two 10x8in images on two pages. From standby it could print a first black or colour page in 18 seconds, needing only another three seconds if we'd left it unused for an hour first.

This MFP is unusual among office-focused devices in that its scanner goes up to a very detailed 1,200 dots per inch (dpi) – 600dpi is a more common maximum. It's very quick: we were able to preview an A4 page in just five seconds, and needed only six seconds to scan it at 150dpi. At 300dpi this job still completed in ten seconds. Even when scanning photos at higher resolution, this MFP didn't hang about. It captured a 6x4in print at 600dpi in 13 seconds. At 1,200dpi the same job needed 52 seconds – that's much more competitive than it sounds.

The Brother MFC-L8970CDW isn't that quick off the mark when copying, returning a single black page in 13 seconds and a colour one in 15 seconds. It's much more impressive when using the ADF, completing a ten-page simplex copy in 32 seconds whether in black or colour.

The ADF's ability to capture both sides at once ought to make for rapid duplex copying, but the reality wasn't quite so impressive. While our original ten-page, 20-sided document rapidly fed through, the printer didn't kick into action until it had almost finished. There's not much wrong with a speed of 15.4ipm on this test, but it seemed like this MFP should be capable of more.

With so many features to get right, it's not unusual for a multifunction to slip up in at least one area. The happy news here is that the MFC-L8970CDW doesn't, and in several ways it's extremely good.

This MFP's main weakness across our tests was murky black photocopies in which darker shades bled together, leading to the loss of detail. We're not sure why, given that colour copies were perfectly exposed and quite faithful to the originals.

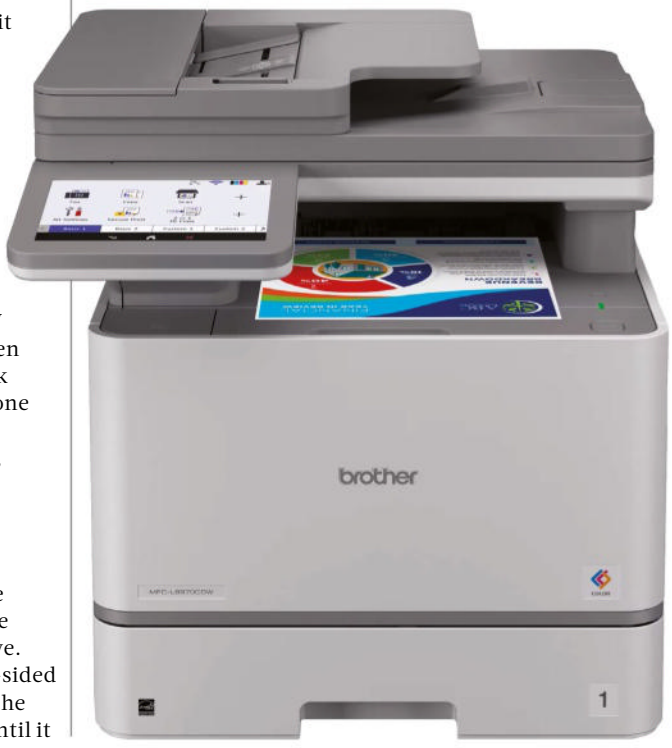
Elsewhere, text quality was as good as you'd expect from a laser printer, with crisp characters that stood up to close scrutiny – only under magnification could we spot a tiny bit of stepping on some curved outlines. Colour graphics were generally very impressive, particularly when it came to shade control: while many lasers struggle to differentiate shades and colours without bands of half-toning patterns, here the content shone through without obvious artefacts.

It's worth noting that this printer has something of a cool colour bias, leading to less perky photos than you might get from some rivals. Skin tones could fall victim to this, particularly in illustrations where lighter skin tended to be rendered a little pale. Overall, however, all of our print results were strong.

If a colour laser MFP is likely to fall short anywhere, it's in the scanner. But while the MFC-L8970CDW was in a hurry to get the job done, you'd be hard-pressed to tell from the results. It captured among the best images we've seen from a business-oriented scanner, with well-judged exposure and sharp focus more than up to the task of archiving office documents.

More unusually, it was comfortable scanning photos at higher resolutions, displaying a wide dynamic range that allowed it to capture detail from among the lightest and darkest shades. This scanner managed to distinguish all but the darkest couple of shades on our Kodak Q60 test target – far better than the average for a business device.

"Text quality was as good as you'd expect from a laser printer, with crisp characters that stood up to close scrutiny"



BELOW **This bulky MFP will take up a considerable amount of space on a desk**

Worth the price?

This multifunction offers a huge range of features, and while it might not have the fastest printer, it's generally quick enough to dispatch all the jobs it will encounter in busy workgroup use. The payoff for your patience is that it will complete almost anything you want to a very high standard – it offers one of the best scan and print quality combinations we've seen.

On the flip side, a heavily used MFC-L8970CDW fleet might need stock of up to eight different consumables. Even if each is reasonably priced and comes with a long service life, that makes management more of a headache, and suggests this device might be best viewed through the lens of a managed print contract.

It's hard to shake the impression that this MFP is overpriced. While sharing its print specifications with the HL-L8570CDW, it's twice as expensive; its scanner and display are both good, but we're not sure they're worth that premium. And while it's good to see the MFC-L8970CDW arrive with such generous inbox toners, remember the HL-L8570CDW gets those too. Overall, this is a strong MFP, but it might be worth waiting to see if its price drops before buying. **SIMON HANDBY**

SPECIFICATIONS

Four-colour 2,400 x 600dpi A4 laser • 1,200 x 1,200dpi scanner • 7in colour LCD touchscreen • dual-band Wi-Fi 5 • USB-A 2 • 1Gb Ethernet • 33.6K fax modem • automatic duplex printing • 250-sheet A4 cassette • 50-sheet rear tray • 80-sheet automatic document feeder • 454 x 505 x 460mm (WDH) • 27kg • 1yr RTB warranty

FIVE FIVE-MINUTE FIXES

that could save your business from cyber disaster

Security projects don't need to be big to be effective. Adam Shepherd highlights five quick exercises that every business could benefit from

For SMB IT teams tasked with maintaining day-to-day operational capabilities, keeping on top of security best practice at the same time can seem like a herculean task. But not all cybersecurity measures have to be complex, weeks-long projects that suck up time and resources. Here are some measures you can tackle over a cup of coffee to help keep your network and your business protected.

1 Sign up for the NCSC Early Warning Service

The UK government's National Cyber Security Centre has been helping businesses prevent and respond to cyber-attacks for almost a decade. As part of its work, the centre collates and monitors threat intelligence feeds from a variety of sources, and offers a fantastic (and free) early warning service to help UK organisations keep up with data breaches and potential malicious activity.

If you're signed up to the service, the NCSC will actively notify you any time your organisation is mentioned in any of the feeds it monitors; even if you're already tracking threats yourself, it's well worth signing up as, in addition to shared feeds from public groups, security vendors and commercial organisations, the NCSC says it refers to "privileged feeds which are not available elsewhere".

As well as flagging mentions of your business in external feeds, the NCSC offers alerts for potential risks such as vulnerable applications and open ports on your network, evidence that your infrastructure may be being used for malicious purposes and potential malware compromise indicators. If you've registered for a MyNCSC account, all you need to sign up is your company name and a list of the public IP addresses and domain names you want to monitor, as well as all the contacts that you want to receive the alerts. Naturally these should include key security and IT operations personnel, but you might also want to set up specific alerts for business owners or finance controllers, to put threats in a real-world context and help ensure they don't accidentally fall prey to fraudulent wire transfer requests or similar.



BELOW Take advantage of free alerts to get early warning of potential attacks

The NCSC stresses that its service should be considered only as one part of a layered defence strategy, not least because the service doesn't carry out active network scanning. However, an early warning helps you to rapidly take responsive measures such as air-gapping critical systems, tightening firewall restrictions or enforcing an immediate password reset for privileged accounts.

Other helpful resources from the NCSC include its Cyber Essentials and Cyber Essentials Plus certification schemes, which organisations can use to sharpen up their awareness and confirm their security credentials to customers and partners. For further training, its "Exercise in a Box" tabletop role-playing packs help IT teams game out realistic attack scenarios, while the Cyber Security Toolkit for Boards supports senior leadership in understanding and implementing recommended codes of practice.



2 Review your patch management strategy

Even in a small business, keeping on top of updates for employee devices, back-end software and infrastructure can be a mammoth job. But there's always room to make it a little more efficient, and if you haven't revisited your patch management plan recently, this can be a quick and easy way to improve your security posture.

In particular, the traditional "Patch Tuesday" release pattern is being increasingly replaced by a phased, ring-based approach that allows businesses to balance a rapid threat response with stable, predictable processes. If you're not already using this model, it's worth spending a few minutes plotting how your systems might be divided into tiered update rings – typically consisting of a small pilot ring to catch major issues with new patches, a broader general-user ring, and finally mission-critical hardware and senior leadership devices.

Usually, the first test ring is set to receive patches almost instantly, with a few days' delay before each subsequent ring. However, it also makes sense to set up a fast-track process, so that when a severe vulnerability is discovered (keep an eye on the CISA Known Exploited Vulnerabilities list at **tinyurl.com/385cisalist**), you can cascade the appropriate patches through the rings in a significantly shorter timescale.

Similarly, fast-tracking patches for commonly exploited apps can be a wise decision. Popular apps such as Adobe Acrobat and Google Chrome are common targets for hackers, who routinely look for businesses running older, exploitable versions of the software to gain a backdoor into corporate environments.

On the flipside, there are some scenarios where it's better to pause all non-essential patches. If your business has predictable busy periods, mapping out these peak seasons with department heads and instituting patch freezes can help you avoid headaches from poorly timed outages. You can consider giving individual users the ability to postpone patch installation too, but this shouldn't be an indefinite option: make sure that you've set limits on how many times users can put off installing a security update.

Remember that patch management is a key part of compliance procedure, and many cyber-insurance policies mandate that policyholders ensure their systems are kept updated. Whatever your update strategy, it's worth maintaining a centralised log of all patches applied and outstanding. As well as helping with compliance obligations, this helps to identify any assets that are being left unpatched for long periods. For instance, if an accounting app is receiving security updates every six months or so, you may wish to investigate alternative options that are supported with more frequent updates. Cross-referencing your ring structure with your asset management platform will help ensure that no critical systems are accidentally slipping through the net.

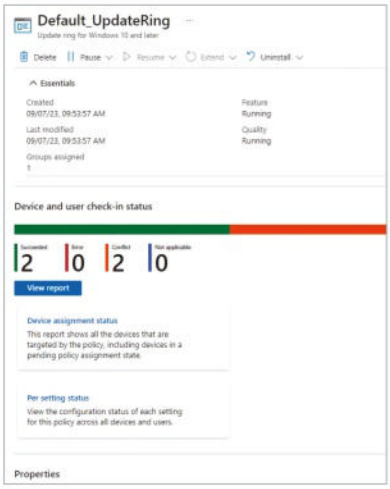
3 Check your network permissions

One of the great benefits of cloud architectures is how flexible and extensible they are. However, working across multiple interconnected environments results in a very broad security perimeter, with lots of potential opportunities for compromise. It's easy to authorise a small plugin to do a specific job, or to give a temporary contractor access to your systems, and then forget about it once the job is complete. Cloud storage buckets or network shares can be made public for a specific purpose, then never locked back down again. Such slips create opportunities for hackers, who scan the internet regularly for unsecured public storage and mine data breaches for leaked access credentials.

There's also a risk of potential vulnerabilities arising from shadow IT. Unwary employees may install a seemingly innocuous app without realising that they're granting it deep access to your network and systems.

If you haven't revisited your patch management plan recently, this can be a quick way to improve your security

ABOVE Some major security enhancements can be made in minutes, from the comfort of your desk



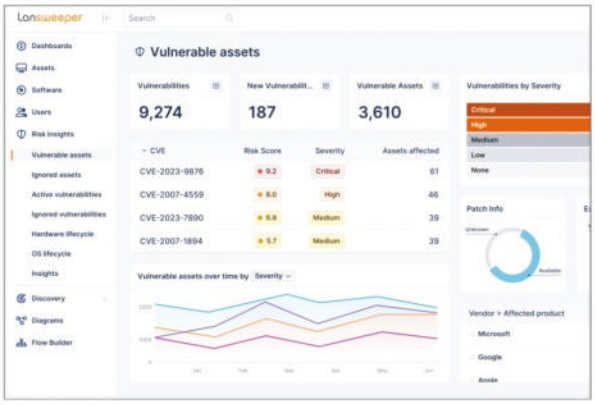
RIGHT Staged updating gives you a chance to trial new patches ahead of a full rollout

Create an emergency comms backchannel

In the event of an active cyber-attack, internal communication channels such as Teams, email and Slack could be shut down or compromised. It's imperative for IT, security and senior leadership teams to have a reliable way of communicating in such situations, and it's a good idea to plan this in advance, as a matter of minutes can mean the difference between a successful response and a catastrophe.

The simplest approach is to set up a group chat on a secure, non-corporate platform such as Signal, Telegram or WhatsApp. Ensure that this group isn't linked to any company-owned hardware or accounts, to prevent attackers from also being able to remotely access it or lock users out.

With any luck, you'll never have to use your backchannel, but as an insurance policy it's good to know that you've got a way to quickly confer with major stakeholders should the need ever arise. Just be sure that it's only used in the event of a major attack or lockout, as using external channels for everyday management creates challenges for transparency and governance.



Worse, malicious actors have been known to set up imitation apps mimicking popular existing tools or hijacking legitimate plugins, hoping to trick unsuspecting users into giving them a foothold from which to steal data or install further malware.

The best response is to regularly audit your network environment and apply the principle of least privilege – that is, ensuring that users, software and processes have only the minimum level of access they need to perform their function. There are numerous tools that can help with this, working across local file systems, multi-cloud environments and user endpoints; many are either open-source or free community editions of commercial security products, such as Semperis' free Purple Knight tool (**semperis.com**), which scans Active Directory, Entra ID and Okta environments to identify areas where misconfigured permissions may present a risk of cyber-attack. Other free utilities are built into the platforms of major hyperscalers including Microsoft, Google and AWS.

A quick scan of the output from these tools can help you identify any users or applications that have greater access than needed, as well as flagging unfamiliar apps with access privileges. To prevent issues recurring, you can mandate administrative approval for third-party tools, and implement stricter permissioning rules for new user accounts. If your audit reveals previously unknown areas of shadow IT, consider rolling out an approved solution so that users have no reason to resort to unofficial, unmanaged alternatives.

4 Document backup dependencies

No doubt your business already has a robust backup strategy in place, but the restoration side of things is easy to overlook. In an ideal world, restoring from backups isn't something you should ever have to do, but if you find yourself in a position where it's necessary, you really want the process to be smooth and successful.

ABOVE There are plenty of tools that can help expose vulnerabilities on your network

To help with this, it's worth creating a visual map of dependencies while the going is good, and plotting out the process of booting up your restored systems in a recovery scenario. Having a simplified visualisation of how data moves through your environment allows you to plan which services need to be brought online in what order, when you need to get back up and running. For example, your first priority is likely to be getting Active Directory and DNS restored, as without these services business apps and databases can't be authenticated.

You can also use your dependency map in conjunction with tools such as Lansweeper or Domotz to create a more comprehensive map of your entire estate. This may take longer, but it's invaluable for identifying any bottlenecks or single points of failure within your backup architecture. For example, if your servers and backup systems are both running through the same primary switch, consider using switch stacking to add redundancy and failover capacity. It's also good practice to ensure that cloud data is mapped and backed up independently of local server infrastructure, to prevent cross-contamination in the event of a ransomware infection and to avoid bandwidth bottlenecks. And a map can highlight any gaps in your backup routines, such as a new cloud environment that was recently added but hasn't yet been integrated into backup plans.

Of course, if your servers go down you may not have access to your digital assets, so make sure you have a physical copy of the map printed out and stored somewhere accessible. Other ways to strengthen the resiliency of your backups include applying WORM policies to enforce data immutability, setting a regular schedule for testing restore times from backups and documenting explicit recovery time objectives to provide a baseline timeframe for getting systems back up.

5 Plant a trap file

Cyber-attacks often seem to happen suddenly and without warning, but in reality attackers often spend extended periods lurking on networks after they initially gain access, quietly collecting information and mapping out storage configurations, before making their move. The sooner you can catch them, the less time they have to exfiltrate data and damage your business.

One way to trick attackers into revealing themselves is through the use of "canary files" that are designed to look particularly enticing, such as spreadsheets purporting to show financial information or PDFs of supposedly confidential business plans. These files are deliberately placed in relatively easy-to-access locations on your network – not obvious enough to be suspicious, but visible enough to attract the attention of unauthorised snoopers. When the file is accessed, an embedded token silently triggers an alert notifying security teams of a potential compromise, allowing them to investigate and take action.

There are a number of options for deploying canary files: security specialist Thinkst offers a supported commercial service at **canary.tools** and an open-source version hosted at **tinyurl.com/385thinkst**. The latter is free to set up and use, and can be configured to mimic multiple file types and environments. As well as documents and databases, it's also possible to hide canary tokens in fake AWS API keys, dummy network directories and more – helping you to catch not only external intruders but rogue employees, too.

If you want to take your security response a step further, you can even build an automated process on top of a canary token to instantly lock down access as soon as the alarm is triggered. Automated orchestration tools such as Zapier or cloud-based webhooks can be set to listen for the alert, and instantly strip access and permissions from the account that set it off, providing an immediate response without requiring a manual intervention by security teams.

Attackers often spend long periods lurking on networks after they initially gain access before making their move

Block lateral movement across subnets

Lateral movement is a core component of almost any cyber-attack; once a hacker has a foot in your digital door, they'll usually look for ways to leapfrog across to other systems. Most businesses have basic network segmentation in place to prevent (for example) users on a guest Wi-Fi network from accessing the corporate LAN. However, individual subnets are often left open internally – so if a hacker or piece of malware compromises a single machine, they can freely scan and sweep every other device on the network.

If you want to maximise security and lock down lateral movement risks on your most vulnerable subnets, there are several steps worth taking, including enabling client isolation on Wi-Fi, configuring private VLANs on wired switches and changing internal firewall rules to a strict "default deny" policy. These measures can ensure that any compromised device is trapped on a digital island, limiting an attacker's runway to expand the breach.



Observability debt

Are you overlooking important operational information? Darien Graham-Smith weighs up the potential cost

Observability debt? What do we owe now, and to whom?
Well, you've probably heard of "technical debt" – the notional liability a company incurs when it makes short-term choices that are easy and cheap today, but make future operations harder or more costly. Observability debt is a similar sort of idea – it's where you have operations, system logs and so forth that can and should be monitored, but you haven't invested in the resources to do so in a useful and actionable way.

Just being able to access the information is good, surely?
Observability debt isn't just about accumulating log files that no-one's monitoring; it can also involve a lack of clarity about the information you're seeing. For example, if you have multiple dashboard views on your servers, you could end up with a muddled, inconsistent picture of your IT estate. If you have alerts continually firing for a dozen different events, the important ones may not cut through. The "debt" accrues interest in the form of IT staff having to work harder to get at the information they need.

What sort of bad decisions might lead to observability debt?
The tricky thing about observability debt is that it can arise from decisions that are, individually, perfectly good ones for the business. Big upgrades such as deploying new systems or migrating services to the cloud tend to introduce new data sources and monitoring platforms to add to your ongoing management requirements. This ought to be factored into the project cost, but rarely is.

How do we know whether we're incurring observability debt?
A simple map of what information you're collecting and where it comes from can help expose information gaps, and also highlight any areas of potentially troublesome overlap. For example, if two dashboards tell similar stories, IT staff may focus on one and overlook important information from the other. Even if someone spots a discrepancy, there's rarely any standard procedure for dealing with divergent signals – so they may well use their own discretion, resolving the immediate situation but perpetuating long-term ambiguity and inconsistency.

Can't we just feed all this data into an AI and let it figure things out?
It's true that system logs, analytics and telemetry data can be used for AI-powered optimisation, anomaly detection and other worthwhile purposes. But the data needs to be actually useful – telling the AI that your PoE switch processed 20 billion data packets in the past month won't yield much useful insight.

It also needs to be coherent enough that the AI can make meaningful connections; if you're working with dozens of reports from different systems, the work involved in collecting and preparing the data may not be justified by the value of the insights you get back.

How can we ensure we don't accrue observability debt?
Realistically, you can't – a modern business will almost inevitably operate across different platforms and locations, and there's always going to be more information on hand than you can sensibly process. But you can try to avoid accruing debt unnecessarily: when a new data source becomes available, make a point of figuring out what information you actually need from it, and how it fits into your existing monitoring and management workflows.

Paying down the debt

Observability debt may not be entirely avoidable, but there are practical steps you can take to minimise its impact. As we've mentioned, a good start is to make a list of the dashboards, logs and reporting platforms available to you, so you can at least get a sense of what you're working with.

With this done, you can start to think about "sources of truth" – that is, deciding what information, from which sources, you will consider authoritative and actionable. As part of this, you should also decide which outputs you're going to intentionally ignore – this can be a big help when dealing with an overload of notifications.

As a next step, consider responsibility. A common observability debt scenario is when a new data source comes online and no-one is directly assigned to monitor it. Nominating an accountable individual or department for each type of log or alert, rather than for each individual feed, helps provide clarity.

Once you've worked out these basic principles you can try wargaming some scenarios, such as conflicting reports from different security platforms, or alerts popping up on a feed that has no assigned owner. If this exposes an accountability gap, or a conflict of responsibilities within your organisation, that's not a failure – it's a valuable discovery.

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Real world computing

Expert advice from our panel of professionals

JON HONEYBALL

"The problem isn't parents' lack of knowledge but poor implementation by hardware vendors"

Parents need a way to keep their children safe online, and Jon thinks he has it – but we need a company to step up and deliver an easy-to-understand solution

I have been thinking a lot about NAS recently, spurred on by my visit to Synology in Taipei a month or so ago. I have eight Synology NAS devices in active deployment, with a couple that have been retired due to old age. It isn't the standard SMB file storage: we run quite a few services on these boxes, taking advantage of Synology's file replication, archiving and off-site cloud storage platforms, plus tools such as its Calendar server. And some virtual machines hosting Docker containers. Oh, and the security camera platforms on two physical sites. It isn't a high-end installation by any means, but it surely can't be typical for an SMB installation.

My visit to Synology's HQ showed a vibrant company working on a lot of technology. All of that is very good. On the flip side, there's a serious push towards the enterprise end of the market, and I've discussed its lock-in to its own branded hard disks before in depth.

Ultimately, it's Synology's toys and Synology's toy shop, so it can do what it wants to do. But I have been becoming increasingly frustrated with the platform as an SMB user. It's not the lack of capability: given a decent CPU, 10Gb Ethernet and enough system RAM, a well-stocked and cached Synology NAS can do big workloads appropriate to its platform.

No, it's the lack of genuine progress for the home and SMB user base. Synology said that home users represent only around 5% of its sales, and no-one would disagree that supporting home users can be a whole different level of support cost compared to a corporate or enterprise customer. But the volumes are obviously much higher, so although there is a potentially tighter margin, you sell more of them.

What do I mean by genuine progress? The user interface is adequate in a nerdy "you need to learn this" way. Far too many dialog boxes are unclear or can't be expanded to show the necessary data. Some are just user-hostile. The log system is Byzantine and opaque, and too many things are awkward and clumsy.

There's no likely fix. This UI has been around for years, and the new 7.4 version doesn't solve any of the issues. It's clear that Synology views its 5% of turnover via home users as being an annoyance.

So this is what I want to see. First, we have to accept that a lot of home and SME internet connections come through an ISP-provided router, especially in the home market. Companies such as Virgin like to lock you into their hardware by supplying the service on coax, and then running key management services only in the cloud. Others, including Sky, like to use wire standards that veer away from the default norm, and make it somewhat more awkward to work around.

Getting a clean, non-NAT IP feed from one of these boxes is somewhere between difficult and impossible. What we need is a clean, preferably non-NAT IP address on Ethernet, delivered by either raw DHCP address or via a PPPOE connection.



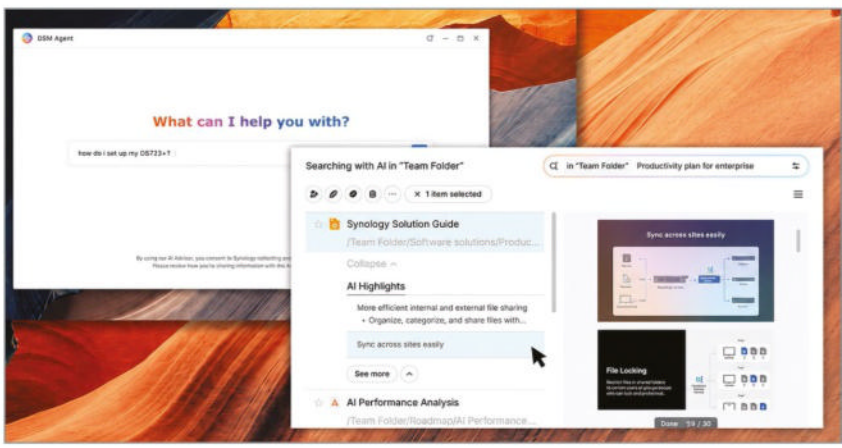
Jon is the MD of an IT consultancy that specialises in testing and deploying kit
@jonhoneyball

"We need a boundary security box. And we need to lay down some rules"

Let's assume that we have that. What do we need then? We need a boundary security box. And then we need to lay down some rules. Your home is your secure place, so your internet connection should follow the same rules of security. That means that any device taken outside of the home must be bound by its security policies. And that means all devices that are portable (laptops, phones, tablets) should have a hard-wired VPN client installed that automatically connects straight back to the VPN server in your boundary router box. All traffic is routed through it from the remote client, not just traffic that needs to reach services in the home.

Once we have a method of securing all devices, whether they're local to the LAN or remote via VPN, we can now set up policy rules that are simple to operate. If you want a laugh, look at the firewall rules that are in place on most domestic and SMB-sized firewall routers. They're just pitiful.

We need standardised approaches. A default "easy security" mode that



BELOW The Synology interface is adequate when it's not actively user-hostile

allows for any outbound traffic originating from within the LAN. Or a stricter "no traffic in either direction unless explicitly allowed" mode for those who are rightly more paranoid.

Asking users to set up port mappings and filter rules is an exercise in wasted effort. So the system needs to learn patterns and then dynamically adjust itself, driven by clear conversations with the network owner. "Did you want this site to be visited by Little Johnny at 1am this morning?" is the sort of question that can be answered. "This IP address x.x.x.x connected to server y.y.y.y on port 1521 at 1am" is meaningless garbage.

Then we need to enforce far better and more usable Wi-Fi security. Some systems will warn you about a new MAC address appearing on your network, but this is usually way too obfuscated to be useful. Take a time-based view of the network, categorise everything automatically, and then have the discussion with the user. Then, with their guidance, place obvious IoT items onto a separate SSID and VLAN, with no access to the local LAN. A smart dishwasher shouldn't need access to other devices. And if for some odd reason it does, it should be easy to allow this.

It's actually scandalous that home and SMB Wi-Fi installations are so bad at this. Often there will be a guest network facility, but I've encountered some that don't lock things down to prevent LAN access, which mostly makes it rather pointless.

Access should be managed via an app. I really like the way UniFi is going with its Identity system and the Endpoint tool for access LAN storage. Again, all of this should be tied together into a super-simple platform that manages access both to the LAN and the internet, to local storage services and also to the enforced VPN tunnel home.

At this point, it becomes possible to put in place a parental control and monitoring system that actually means something. It's very easy for us nerds to roll our eyes when a parent bleats that "oh, it's all too complicated and Little Johnny would work around it anyway". But doing so ignores the key point. Ultimately, the problem isn't parents' lack of knowledge (why should they know?) but poor implementation by the hardware vendors.



ABOVE **All portable devices should have a hard-wired VPN client**

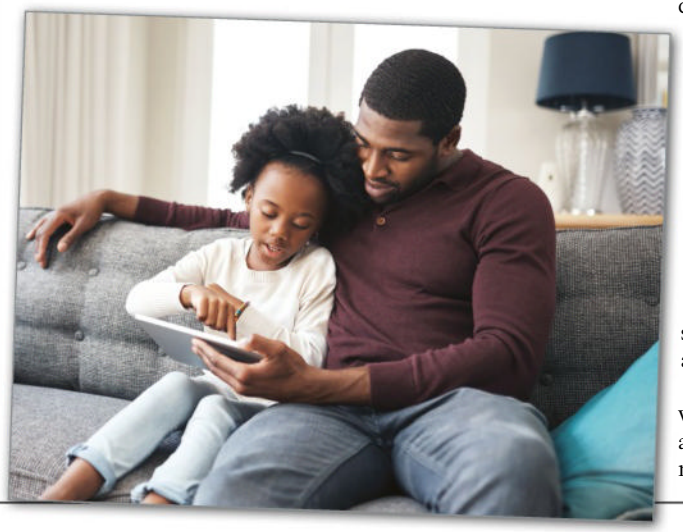
The beauty of tunnelling everything through your home network is that you can apply policy in a meaningful way. There's no point having rules for the home network if they're simply ignored when the device is taken out of the house and onto someone else's Wi-Fi network. Or if the device connects to a 4G/5G network. The tunnel-all-traffic-to-home is the killer feature that enables home security policies to work. But it only works if the user is capable and confident in the setup, configuration and ongoing operation.

This time dimension is badly missing from all current implementations. A parent needs to monitor what is happening, to be able to unlock features and sites on a time-based service, and to be able to engage with the child about what's happened.

"It's scandalous that home and SMB Wi-Fi installations are so bad at this"

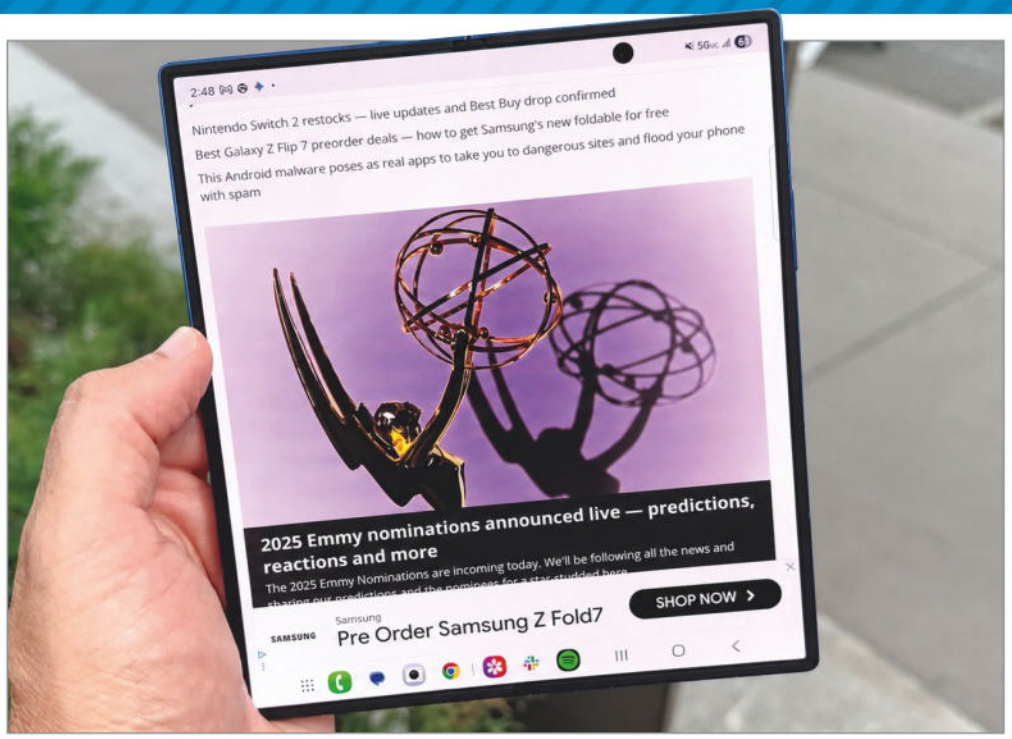
Of course, this doesn't allow for any sort of fine-grained control within a platform. This either allows for Facebook or not, and has no control within such a platform itself. It can't enforce YouTube to be in child-mode, either. But it does allow for all the items that a parent wants: time-based access, confidence that the system can't be bypassed, and reassurance that they know what's happening on the home network.

Now I'm certain that many of you dear readers are jumping up and down on your sofas, shouting at the dog, that Jon is truly an idiot and that this will never work. Here is the problem. Whether we like this or not, such a mandated solution is almost certainly in our future. The government has got its teeth into this topic and isn't going to let go any time soon. We also know that the endless "make the American companies pay for the management of all of their content" approach isn't going to work. That's not because of the ongoing nonsense between the UK regulator and 4Chan, but simply because it's unworkable at a content level.



BELOW **Parents need help from tech firms to keep their kids safe**

So let's be realistic. If we want parents to take appropriate control and responsibility for the data



actions of their children, we must be able to provide them with the tools that actually work for them. No-one is doing so, as far as I can see.

It would be an extraordinarily powerful platform for Synology to move into. However, it appears to be moving away from consumers entirely, which is somewhat of a pity given it has the building blocks to create something extraordinary if it was to put its mind to it.

That's the problem with pushing up into the enterprise space, pulling up the drawbridge behind you. Higher profit margin on smaller sales is fine, but leaves you exposed if the wind changes direction. Maybe UniFi will walk into this space: it has most of the components ready to go, and understands the software and VPN tunnelling space well with its one-button Teleport solution and the endpoint access tools. Maybe I'm just looking in the wrong direction with Synology for this home and SOHO space.

Samsung renewal costs

About a year ago, I bought the then new Samsung Z Fold7 phone. This is the larger unit that unfolds sideways, rather than the small one that unfolds upwards. It's been an interesting device, albeit one plagued by various implementation problems. But that's Samsung phones and Android.

My concern was more around the longevity of the hardware itself. I haven't used it as my daily driver, but it's had a reasonable amount of wear and tear around the lab. I am happy to report that the hinge is still fine, and the screen hasn't fallen apart. Although I could be convinced that the trough in the screen along the hinge is bigger than it was when it was new.

However, when I bought the phone, I took out the official Samsung insurance policy, just in case it decided to fall apart in my hands. It costs £9.49 a month, which seemed a reasonable short-term insurance for a device costing nearly £1,500. A year on, it was time to terminate the contract.

It turns out this isn't quite as simple as you might expect. Samsung itself doesn't handle this warranty, which is essentially an insurance policy. It's subcontracted to Assurant.

Getting through to the right person wasn't easy, nor helped by the fact that it seems that Assurant stopped being the backend earlier in the year when it moved to someone else. However, I finally got through to someone who assurant-ed me that they would cancel the policy. Shortly after, an email arrived confirming the cancellation on 22 June.

Imagine my surprise to receive a monthly payment email on 1 July telling me that my Samsung Care+ policy was active and about to be billed. Except the "Monthly accident damage" line item was £0.00. The Delivery and installation cost was £0.00. The total excluding VAT was £0.00. And the VAT was £0.00. However, the total amount was £9.49.

ABOVE My Samsung Z Fold7 is still going strong, despite a fair bit of wear and tear

"Maybe I'm just looking in the wrong direction with Synology for this home and SOHO space"

I'm at a loss to understand how a billing system can generate an invoice where all the line items are zero, and yet charge over nine quid for the total. I forwarded this back to the billing email address and heard nothing.

Would you be surprised to hear that I have just received another payment email stating it would take the £9.49? Another phone call to Assurant's support line, and now I have to send proof that payment was taken, and that they will, if necessary, get a refund from Samsung.

All I can say is that this is far too complicated, opaque and riddled with annoyance. And any billing system that appears, in writing, to be so broken, is one to be avoided under all circumstances. I really expected better from Samsung.

MacBook Neo update

I thought I'd give an update on my MacBook Neo. I bought the larger storage version, which has the fingerprint reader. And I chose the Citrus finish, which is somewhere between lemon and lime in colour.

Let's start with the positives. It's beautifully made and feels like a three grand MacBook Pro. In fact, it *is* a three grand MacBook Pro in everything except for raw performance, ports and storage. Functionally, it's otherwise just the same thing.

The A series processor is more than quick enough for day-to-day tasks, but it's no pro workstation for pro tasks. For a giggle, I installed the powerful media-editing tools Final Cut Pro and Logic Pro and the experience was... well, somewhat disappointing. But what did I expect with 8GB of system RAM? To be blunt, if you want pro level tools, you buy a powerful workstation. Otherwise the huge amounts of time you invest into

BELOW Satechi's OntheGo hub is a great addition to any laptop



learning these tools is wasted by the throttling of the machine you choose to run them on.

For more normal workloads, the Neo is just fine. By that I mean I really can't tell if I'm on my Neo or on an M3 Max Mac mini.

The ports are a limitation only if you make it so. The power port is slow USB, but that's okay. The faster port works fine. If I want more ports, there are excellent add-ons from companies such as Satechi. I adore the look of its OntheGo dongle, which would give me USB-C, a 100W charging port, HDMI at 4K/60Hz, 1GbE, two USB-A ports and SD/microSD readers. All in a cute round hub that can fit into my bag. I would buy one immediately (£55 from **tinyurl.com/385satechi**) but Satechi doesn't import the matching Citrus-coloured version that you can buy in the USA.

I know that the black one would work fine, as indeed would any decent USB-C port expander. But dammit, it needs to be matching Citrus. Because Steve Jobs would have wanted it to be so. Maybe I'll have to order from Satechi in USA and have it shipped. I've done madder things before now.

Talking of bolt-on additional hardware, I've just ordered a new unit from Ugreen called the Magnetic M.2 NVMe SSD Enclosure with MagSafe (**tinyurl.com/385ugreen**).

This is a battery-pack-sized unit with MagSafe that will clip onto the back of my iPhone 17 Pro Max. Inside you can fit a USB 3.2 Gen2 10Gbits/sec NVMe stick, so naturally I've ordered a Samsung 990 Pro 2TB unit.

It snaps onto the MagSafe mounting and comes with a very short USB-C-to-USB-C jumper cable to plug into the phone. There's a USB-C power socket on the side of the unit, allowing for it to be mounted as well as charging the phone.

Why buy it? For the 4K, 120 frames per second ProRES format that the 17 Pro Max can do. It's too fast for the built-in storage of the phone so you need to use external storage. And it generates huge files, as I discussed a few months ago. Having a storage unit snap onto the back of the phone is much more convenient than an external USB-C drive dangling on a cable. I look forward to trying it out.

jon@jonhoneyball.com

LEE GRANT

"Indie repairers have the freedom and flexibility to spend days working on ridiculous repairs"

As our intrepid repairer attempts to outperform a private detective, he's distracted by a dazzling new award with HP's name on it

There is, understandably, a certain amount of trepidation when I tell you stories of repair mayhem and computer shop catastrophes. This increases somewhat when dealing with subjects from yesteryear, so let me flag straight away that if one of you lovely readers recognises yourself in what I'm about to say, I wouldn't be surprised at all. Also, it would be nice to connect as one of my clients has gone to considerable effort (and cost) to hunt you down.

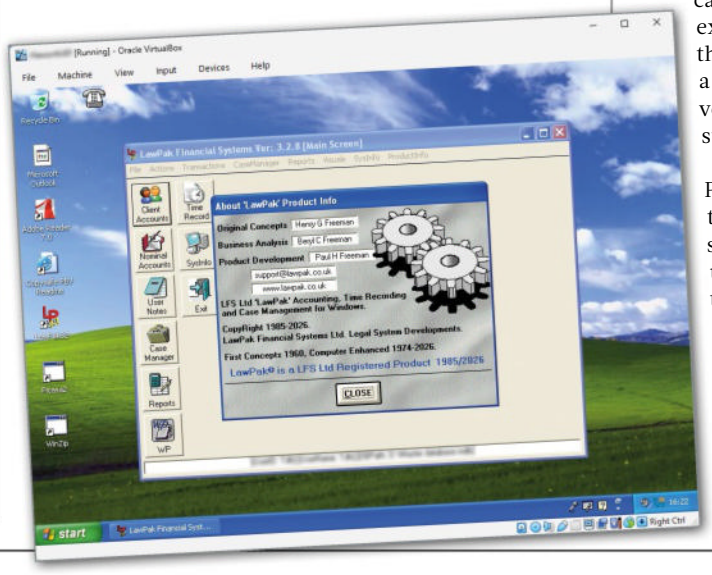
This repair began in 2003, the same year that Alison and I opened our repair shop. It was a different time when broadband was slow, software came on discs and the *PC Pro* Podcast wasn't a thing. However, Bowie was still on tour, so it wasn't all bad.

At this time, a man called Paul worked for a small solicitor's firm located somewhere in Yorkshire. Much of the management of this busy practice was entrusted to a piece of software called LawPak Accounting, happily churning away on a small Windows XP laptop atop Paul's desk. I'm told that, at the time, LawPak was extraordinarily popular and was effortlessly adept at handling case management, time recording, tax compliance and client records.



Lee Grant and his wife have run a repair shop in West Yorkshire for over 20 years
@tnargeel.com

"If one of you lovely readers recognises yourself in what I say, I wouldn't be surprised at all"



BELOW It's back to 2003 with LawPack

With LawPak running the show, all was well with Paul's business.

Meanwhile, in 2026

If I can introduce a little timey-wimey chronology shuffle into this (surely) Costa Book Award long-list narrative, I knew nothing about LawPak when Paul arrived in the shop nearly two decades later. What I did spot was that the uncomfortable look on his face was the one used exclusively by my most anxious clients. Over the next 45 minutes, he explained precisely why he looked like a man on the edge. I should also mention that he was clutching an ageing desktop PC, but we'll get to that later.

Understandably, the XP laptop running LawPak was now well past its sell-by date. As the machine wasn't connected to the web, any incentive to replace it had been ignored, mainly because it was working, but also because of a quirk in how Paul's version of LawPak was installed.

During the initial 2003 setup, LawPak requested a code to validate the installation process. According to Paul, this wasn't given to the user in the media bundle and we're still several years before internet authentication was widespread. The method in play was to make a phone call to LawPak's team, exchange a few details, and then someone would read out a code for the user to input. All very quaint by modern standards, but it worked.

If you listen to the *PC Pro* Podcast, we often speak about the problem of connected services ending, leaving the user with a lump of hardware that no longer functions as the manufacturer has turned the servers off. This issue isn't exclusive to the modern age, as LawPak users now experience the same issue. The person at the end of the registration hotline is no longer there. It is

suspected that the people behind LawPak have long since retired.

Paul had spotted this about a decade previously when he'd attempted to install LawPak on a PC and couldn't obtain a new code. Now, what would you have done at this point? As a valued reader of the galaxy's finest technology magazine, I imagine that you'd have taken this as the moment to perform the long-delayed migration to another piece of software and bid LawPak a fond farewell. From what I've already explained, you'll have inferred that Paul didn't take this path, but what may surprise you is that in order to get a new activation code, his firm employed a private investigator who utterly failed to locate LawPak's team.

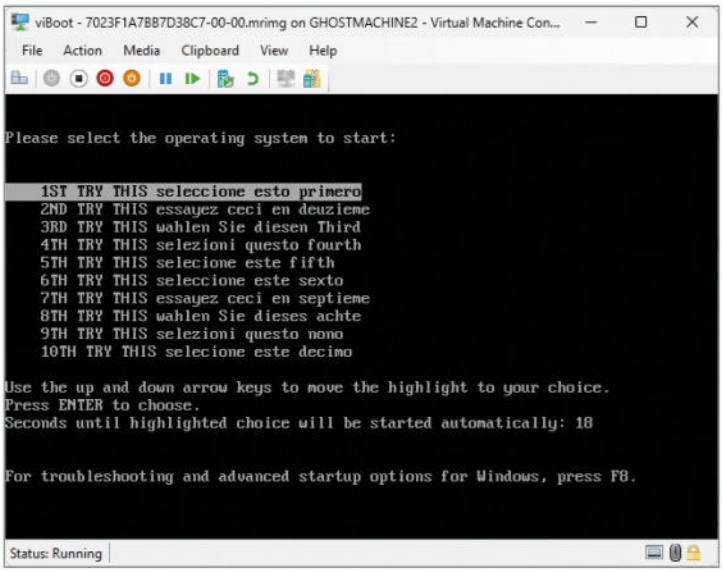
One day somewhere in the 2010s, Paul's LawPak laptop coughed and a local IT company was called in to clone the drive onto a spare desktop PC. Why the decision wasn't made to retire the laptop at this point isn't clear, but now Paul had a backup. If the laptop hiccupped again, he could dash to the roof with a kite and wait for the lightning to breathe new life into the LawPak backup machine.

This was the desktop that Paul was clutching to his chest on the morning he arrived. Earlier that day, the 20-something-year-old laptop had coughed again and a panicking Paul had dragged the backup desktop machine from the back of the cupboard, plugged it in, and watched as nothing happened.

Always test the backup

In the meantime, the laptop had crawled itself back into a semi-working state, but even Paul had to admit that the time had come to act. The laptop was now permanently switched on and a 24-hour security cordon put into place as if it were a priceless antique in the Louvre. I know that you've spotted that a power cut would bring this plan to its knees, but he hadn't.

Paul handed over the backup desktop and asked me to get it running. Naturally, I enquired when it had last been used, and to be told that it never had was rather revealing. Seemingly, the IT company had completed the cloning work, delivered it back to Paul, who'd shoved it in a cupboard. The moment I spotted the AMD Athlon 2 sticker, I realised that this machine may have been new to Paul, but certainly hadn't been "new" for some time.



ABOVE Some of you may recognise this old XP menu...

I sent Paul away and pulled the side off the desktop and swiftly deduced that the reason the desktop was dead was because all the CPU's power capacitors were leaking. This was a common ailment of PCs until around 2010. Manufacturers used aluminium capacitors in the design of their products, and these were filled with an electrolyte (hence, electrolytic capacitors) to conduct electricity. To give the capacitors greater performance and longevity, high-quality manufacturers developed high-quality electrolytes. Others seemingly topped up the components with salt mixed with water and the contents of the vacuum bag.

Replacing these capacitors would have been a reasonably simple task, but it was impossible to tell what other components were reaching, or had already passed, the end of their service life. Digging deeper, I was surprised (as was Paul) that the machine had two SATA drives. One was connected but goosed by a severe motor error, but the mysterious disconnected drive was damaged but alive. Although Paul had asked me to get this machine running, resurrecting an Athlon 2 PC wasn't the solution to this problem and although "the customer is always right", there are times when they need a solution-focused nudge into avoiding the wrong decision.

As I'm sure you've already realised, the fix was to virtualise the XP environment. Paul should have migrated off LawPak over a decade previously but, by his own admission, retirement was looming and the desire to scope, source and learn new software had long gone. As this antique software on life support was still being used in a business setting, I told Paul he needed a new laptop to run it on. Paul accepted my suggestions and all I had to do was get it to work.

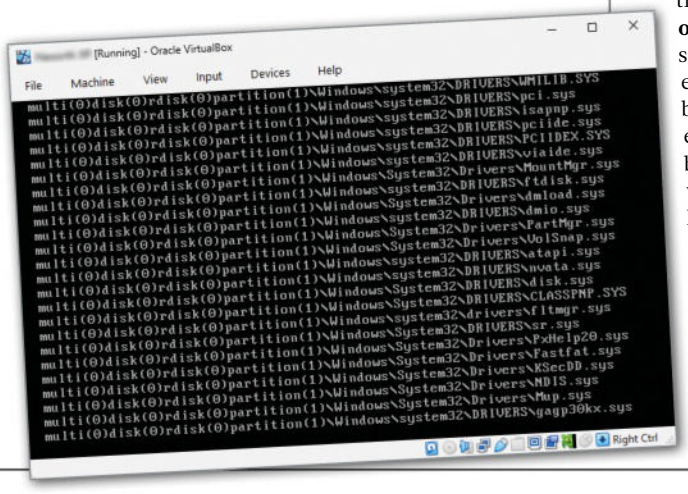
"A 24-hour security cordon was put into place as if it were a priceless antique in the Louvre"

XP to VM

The next stage was a multi-day voyage back in time. Twenty years ago, I was match-fit in terms of getting petulant XP installations to behave, but most of that knowledge has been archived by my brain.

To make this part of the story a little more palatable, I'm going to recall it at 2x speed. To begin, I needed a functional drive image, so I took the faulty (but alive) hard drive and used Clonezilla (**clonezilla.org**) to generate what I needed. From that, I re-imaged a workbench SATA drive to give a functional XP disk, which is much easier to manipulate than a Clonezilla image.

Next, I used Microsoft's own Disk2vhd (**tinyurl.com/385disk2vhd**) to turn the newly imaged drive into a Virtual Hard Disk (VHD) and piped this into VirtualBox (**virtualbox.org**). After tweaking the settings of the VirtualBox XP environment, I attempted to boot from the VHD and encountered the first of several booting showstoppers. These were caused by the XP VHD loading drivers for hardware that existed within the Athlon 2 system but weren't present within the VM environment. So old favourites such as gagp30kx.sys and intelppm.sys had to be renamed in order for XP to move through the boot process.



BELOW VirtualBox threw up several booting showstoppers



Although progress was slow, I eventually got the machine to move to a point where it showed me a menu which I'm sure many *PC Pro* readers will have seen. If I said, "1ST TRY THIS seleccione esto primero" to you, some of you will recognise this as the first option of an old tool that modified XP's boot.ini file to get it to launch. Although it was nice to see an old friend, it made me wonder if Paul's backup desktop had ever been capable of a clean boot. Seeing this menu certainly suggests that the boot system had been under the microscope at some point, so I repaired the boot.ini file using Linux (to avoid fighting with NTFS permissions), and finally the XP VM fired into life and LawPak loaded.

Sadly, I wasn't out of the woods. I fixed the drivers for the display and also tweaked the hard-drive modes. All looked well, but there was no escaping that the performance of the XP VM was diabolical. For those familiar with VirtualBox, I was being shown the turtle icon, which indicates that performance is lacking.

Eventually, I spotted that VirtualBox couldn't utilise the Nested VT-x/AMD-V feature as it was being hogged by Windows' own built-in hypervisor, Hyper-V. Despite removing Hyper-V as an installed feature, the VirtualBox turtle kept appearing. The desperate fix was to modify the Windows 11 boot record so Hyper-V did not load (the command was: bcdedit /set hypervisorlaunchtype off) and, one reboot later, the turtle had gone and XP was flying. I installed an XP PDF printer, which dropped files into a folder that VirtualBox makes accessible to XP and Windows 11. Once I was happy, the customer was called.

There are many things I could say to wrap up this tale. We could muse on the dangers of running unsupported software, but businesses and consumers are creatures of habit and it's hard to let go of something that works. We should also raise a glass to the mysterious people behind LawPak, whose software is still powering at least one busy business.

I suppose we must also blow the trumpet for independent computer repairers. If Paul had arrived on the doorstep of one of our large high-street multiples asking for this repair, I'm certain he'd have been laughed back into his car. Indie repairers have the freedom and flexibility to spend days working on ridiculous repairs that won't get us into the FTSE 100, but will put a smile on the face of a solicitor addicted to antique software.

PC Price Wars (episode #4833)

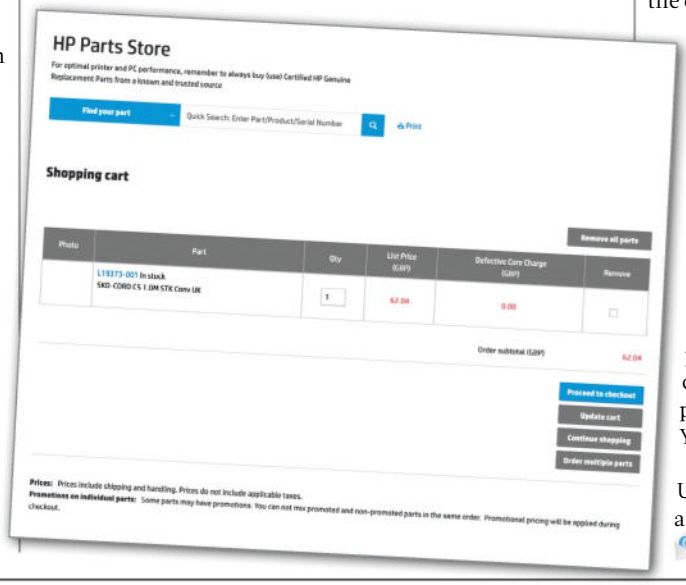
It goes without saying that the tech business is an ultra-competitive sharks' nest surrounded by viper-infested waters and, although I've dislocated my idioms, I'm sure you get the idea. If you flick through your *PC Pro* back issues (*see issue 381, p114*), you'll see the pricing horlicks that Dell was making of its power cords. Aside from the confusion about which of the five variants was the correct one, there was the unfathomable pricing of £19.40 for what is essentially a 1m kettle lead.

Clearly the executives at HP are huge fans of my column, with the exact same intensity with which I loathe their printers. That said, something in my report about Dell clearly stirred HP's marketing department into action and they've released their 2026 contender for *PC Pro*'s coveted "F*** me! Look at the f****** price of that!" award.

HP has been selling the same 1m C5 (cloverleaf) mains cable, which slots into a billion PSUs, for the record-beating price of £62.04. Let us all stand to applaud this audacious bout of price gouging. I can't wait to see what pricing gems other firms will launch to wrestle the prized silverware out of HP's hands.

ABOVE All USB-Cs are equal, but some are more equal than others

"Clearly the executives at HP are huge fans of my column"



BELOW A contender for 2026's "F* me! Look at the f****** price of that!" award**

The universality of USB-C

Hindsight is an attribute that can generate moments of elation and surprise, especially when it reveals the obvious that has always been sitting in plain sight. Over the years, I've enthused about the benefits of USB-C as a standard for charging laptops, believing the universality of the connector will make life for consumers much simpler.

I recently worked on a "dead" laptop owned by a frantic customer who needed to host an online seminar. Apparently, every member of the family and half the street had attempted to bring life to the machine, and they'd all missed the obvious. So, was the USB-C plugged in? Yes. Was the mains switch turned to "on"? Also, yes. Is the USB-C cable part of the laptop charger or is it a cable that looks identical but is plugged into a 5V phone charger? Yes, well, that explains it.

If I may misquote Orwell: "All USB-Cs are equal, but some USB-Cs are more equal than others."

lee@inspirationcomputers.com

OLIVIA WHITCROFT

"Don't mention Brexit. I've mentioned it once, but I think I got it away with it all right"

If you'll forgive us for the stating the bleedin' obvious, sometimes it's useful to state the bleedin' obvious – especially when it comes to Fawlty contracts

I'm imagining readers quoting Basil Fawlty as they read this article: "Can't we get you on *Mastermind*, Olivia? Next contestant, Olivia Whitcroft from Surrey, special subject: the bleedin' obvious." I've tended to focus my articles on tricky or evolving areas of law, but have recently been reminded that, in the frenzy of tackling complexities, it's important not to overlook the more basic foundations of a matter.

So this article looks at the following bleedin' obvious points (BOPs) which sometimes appear to be forgotten.

1. The UK is not in the EU.
2. If you want a business to do something for you, you should do something for it in return.
3. If you want someone to follow your terms, you should let them know what those terms are.
4. Not all personal data is an identifier.

1. The UK is not in the EU

A popular BOP to start with. The UK left the EU in January 2020 – almost seven years ago now. As a corollary to this, UK companies have operations outside the EU. The UK is also no longer in the European Economic Area (EEA).

Nevertheless, the number of UK-based documents that I still come across that appear to assume the UK is part of the EU is phenomenal. Each week, as sure as Mr O'Reilly is going to muck up the building work at Fawlty Towers, I'm going to read a UK agreement, privacy notice or risk assessment with a reference to EU law or transfers of data outside the EEA*. It may be excusable if these were very old documents, but they've usually been drafted or reviewed recently. Did I miss the memo, "Don't mention Brexit"? (I've mentioned it once, but I think I got away with it all right.) Or maybe it's all wishful thinking that we're rejoining the EU imminently.



Olivia is principal of the law firm OBEP, which specialises in technology contracts, IP and data protection
@ObepOlivia

"Maybe it's wishful thinking that we'll be rejoining the EU imminently"

Here are some examples relating to the provision of services in the UK.

- "The provider shall not transfer data outside the EEA." It uses data in the UK, so will almost certainly be in breach of this.
- "The provider shall perform its services from its office in the European Union." Oh dear, it doesn't have one.
- "The company shall keep data confidential unless it is required to be disclosed by a law of the European Union." It will have to ignore any UK disclosure requirements, then.

How can you address this? I would suggest doing "Find 'EU' or 'EEA' and replace with 'UK'" in all your documents. You'll probably also need to check the provisions still work with these substitutions, but you can worry about that when you come to it.



BELOW The UK left the EU seven years ago, but you'd never know it looking at some legal contracts

2. If you want a business to do something for you, you should do something for it in return

To form a binding contract, both parties need to provide something of value, known as "consideration". For example, I provide you with a service, and you pay me. Or Mr Fawlty agrees to provide a hotel room with a bath and a view, and Mrs Richards promises to pay £7.20 plus VAT.

If you try to require someone to do something for you but offer nothing in return, then there's consideration passing from them to you, but no consideration passing from you to them, and so no contract is formed.

The consideration passing one way doesn't need to be of comparable value to the consideration passing the other way. So if one party pays £1 for something that's worth a lot more, that's still sufficient.

A couple of other rules: "past consideration is no consideration", meaning that, for example, if a service has already been performed, it's too late to require a payment in return (if this didn't form part of the original terms) and a subsequent promise of payment may be unenforceable. Also, it's not sufficient to use something that a party is already required to do as consideration.

I have an example of a recent situation with questionable consideration. The parties entered into an agreement under which one party would provide the other with access to a system in return for payment. At a later stage, some "acceptable use" terms were presented to the customer to agree to. But where was the fresh consideration for agreeing to these new terms? The provider was already obliged to provide access to the system under the original agreement, so this wasn't sufficient.

I did, however, say that consideration was "questionable" rather than definitively absent. If the original contract for services had envisaged these future acceptable use terms, then it's possible that they were an element of the original bargain (where the consideration from the provider was access to the system). But this leads me on nicely to BOP 3.

Acknowledgement
Fawlty Towers quotes and references are from *Fawlty Towers* by John Cleese and Connie Booth; © John Cleese, Connie Booth, Waterfall Productions Limited.



3. If you want someone to follow your terms, you should let them know what those terms are

I was recently signing up for an online account to book an event. To register, I had to agree to some terms and conditions. There was purportedly a link to these, which I clicked on. This resulted in a pop-up saying that I needed to register to view the terms and conditions. So I needed to agree to the terms in order to view the terms that I'd just agreed to. I've kept a copy of this with the filename "Terrible Booking Process".

Just as when Mr Hamilton wants a Waldorf salad at Fawlty Towers he needs to spell out the ingredients at the time of ordering (celery, apples, walnuts, grapes, or so I've heard), if you want particular terms to be incorporated into a contract, you need to make them clear at the time the contract is formed. Terms can be incorporated by reference to another document, as long as the other party is given sufficient notice of them. If the core terms of the contract aren't available to look at until after the agreement has been entered into, this is unlikely to be sufficient notice.

In addition, any unusual or onerous terms may not be effectively incorporated if you haven't drawn sufficient attention to them. So if you are trying to "hide" provisions you don't think the other party will like deep within your standard terms, they may not form part of the contract. Even if they are incorporated, they may risk unenforceability if they aren't reasonable in context.

The solution: at the time a contract is being made, give people a copy of the terms you want to apply, specifically point out any terms that may surprise them, and try to be fair.

4. Not all personal data is an identifier

To finish off, I have another common BOP. Personal data, as has been similarly defined in UK data protection law since the Data Protection Act 1984, means information relating to an identified or identifiable individual. This is not equivalent to "data that identifies an individual" or "personally identifiable information", as I commonly see referenced.

Data that identifies an individual may include direct identifiers such as name, facial image (used for facial recognition), online ID, customer or staff number. Someone may also be identified indirectly from particular pieces of data, if combining them with other information allows that person to be identified or singled out. For example, reference numbers within pseudonymised data sets enable organisations to link information back to identified individuals, and physical characteristics may enable someone to be singled out within specific CCTV footage. These are all subsets of personal data.

The concept of personal data is wider, however, and includes any other information which relates to that individual who can be identified. The potential scope of what "relates to" an individual is broad and includes your opinion of them, inaccurate data about them, information that forms the basis of a decision concerning them, or data that otherwise impacts them.

To give an example, the information "there are bricks in Lord Melbury's briefcase" contains the name of Lord Melbury as an identifier (and even if it's fake it still singles him out). The fact that there are bricks in his briefcase is additional personal data about him. Mr Fawlty's opinion of him (changing from high esteem to contempt following the brick discovery) is also his personal data.

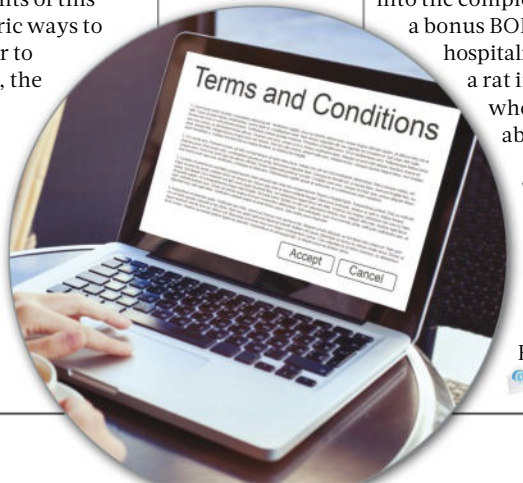
All data protection rules rely on the meaning of personal data: you must process personal data for specified and lawful purposes and with a lawful basis, individuals have a right of access to their personal data and so on. You may craft an otherwise fabulous data protection policy, but if the meaning of personal data has not been understood, the policy may not be implemented correctly.

"Personally identifiable information", and variants of this term, are more US-centric ways to refer to a concept similar to personal data. However, the term has different meanings under different laws and in different contexts, and may be more limited in scope than personal data. Use of this terminology in UK documents can therefore lead to uncertainties.

ABOVE Handling personal data such as credit card details needs to be treated with caution

"The moral of the story is to get the basics right before delving into the complexities"

BELOW T&Cs should be clear from the outset, and shouldn't "hide" any surprises



The ICO also picks up on this point on the "Tackling misconceptions" page of its Gen AI guidance. It says: "'Personally identifiable information' (PII) is different to the legal definition of 'personal data'... Organisations must not undertake compliance based on a fundamental misunderstanding or miscommunicate their processing operations."

I was recently reviewing a risk assessment looking at complex uses of data for data analytics. It had some clever analysis and mitigations. But "personal data" had been equated with "personally identifiable information" and went on to describe it as "data which identifies an individual". This meant the assessment may have been insufficient or incomplete, as it may not have considered the wider (or differing) scope of personal data.

What does all this mean? If you're looking at risks and compliance under UK data protection law, it's best to stick with the term "personal data" and its legally defined meaning, to avoid misapplication in practice.

The moral

The moral of the story is to remember to get the basics right before delving into the complexities of a matter. And a bonus BOP, well known in the hospitality sector: you can't keep a rat in a hotel, particularly when a health inspector is about to pay a visit.

*Postscript: I finished writing this article and turned my attention to a contract for review. Second page, third line down: mention of the EEA – bingo!

olivia.whitcroft@obep.uk

DAVEY WINDER

“Drum banging I am, but if it takes noise to get attention, then so be it”

What is OSINT, and why aren’t you already using it? Plus the not-so-hidden dangers of AI tools revealing record levels of security vulnerabilities

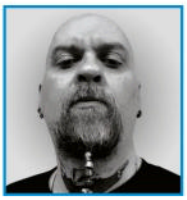
If you spend sufficient time engaging with cybersecurity professionals in any capacity, the term “OSINT” will inevitably pop up at some point. But what precisely is OSINT, and why should you not only care about this dark art but also seek to educate yourself in it? Wonder no more.

The first thing to know is that the acronym expands to Open-Source Intelligence. The second thing is that just because you can use Google doesn’t mean you’re already an OSINT practitioner. Well, it does to a degree, I guess, but not one that’s worth shouting about except to yourself, in the mirror, followed by “are you talking to me?”

Real cybersecurity people know that OSINT demands much more attention than a single search engine, not least because so much information isn’t indexed by such “surface web” tools. Which brings me nicely to a third point: information is not the same as intelligence.

Indeed, the SANS Institute defines OSINT as “intelligence produced by collecting, evaluating and analysing publicly available information with the purpose of answering a specific intelligence question”. In other words, the information you find is just the starting point, the raw data if you will. It demands analysis and the addition of context to become actionable intelligence. If you don’t possess critical thinking skills, then you shouldn’t be anywhere near the cybersecurity field, in my never humble opinion, and you certainly shouldn’t turn to OSINT as some kind of magic security tool.

Those of you with that kind of thought process will already be wondering what the heck you can use OSINT for in a defensive capacity.



Davey is a journalist and consultant specialising in privacy and security issues
@happygeek

“You certainly shouldn’t turn to OSINT as some kind of magic security tool”

Surely this kind of publicly available information-gathering is the very thing threat actors use to build attack profiles? You’d be right; they do. OSINT and social engineering/phishing are joined at the hip. It’s one of the reasons cybersecurity people are always warning about being careful what you post online, across social media platforms in particular, as these very postings can be used to build personalised attacks.

The rise of AI tooling to create convincing phishing bait using data from OSINT operations is one of the reasons targeted attacks have become so prevalent and so successful. But there are two sides to the OSINT coin, and the defensive side is just as useful, if not more so. By using exactly the same information-gathering reconnaissance methodology, defenders can pre-empt attacks and look to erect stronger barricades, be that in terms of warning likely targets or ensuring layered authentication protections are in place.

Here’s another way to think of OSINT: as another weapon in the penetration-testing arsenal. One that can help assess your attack surface and expose the more obvious weaknesses. Such as, he says nonchalantly, all that highly sensitive corporate data, including the aforementioned employee and director details, that are being exposed online.

If criminal forums on the dark web have new posts that include the name of an executive working at your organisation, that’s the kind of information that can be turned into actionable intelligence. If public sources are mentioning attacks against businesses that are in the same industry/sector as you, that’s information that can be used as actionable intelligence. If you find evidence of brand impersonation, domains registered that are manipulated to look like yours, then that’s... yes, you get the picture by now, I hope. I know, drum banging I am, but if it takes noise to get attention, then so be it.

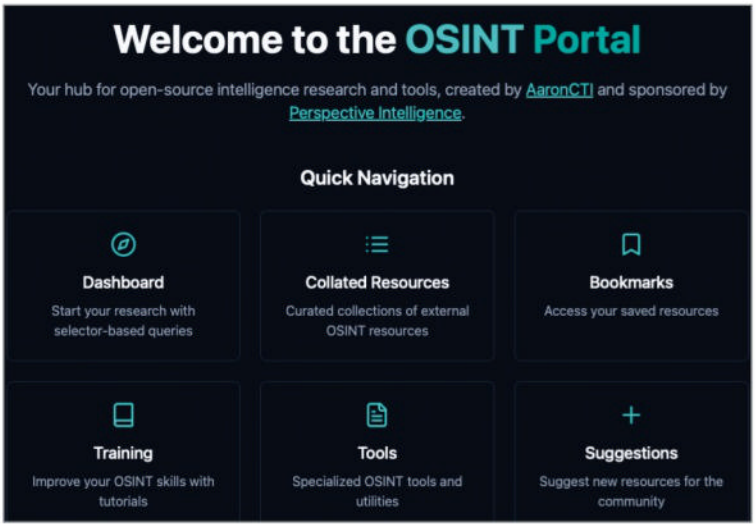
Where to find OSINT

By now you should have an idea of the stuff you’re looking for, bearing in mind that it always has to be specific and properly aligned with your business security needs (general OSINT trawling is, frankly, a waste of everyone’s time and resources). So to the next question: where do you look for it?

The answer will largely depend on the intelligence you require, but sources such as WHOIS databases, the dark web, GitHub repositories, paste sites, LinkedIn profiles, breach disclosures and social media postings are all in the frame.

Which brings me to the most important question: how do you search them effectively? The problem here is there are lots of tools for OSINT purposes, and you can easily get lost in finding and testing them.

Aaron Roberts, the co-founder of Webamon, the self-proclaimed “Google of threat intelligence,” has one of the best resources out there. It’s free to use, although you’ll have to register to do so. It’s called the OSINT Portal (**osintportal.com**) and does just what it says on the, er, URL. It’s a hub for OSINT research and tools, sorting them by category such as CVs, data breaches, paste sites, search engines (including the dark web), social media and so on.



BELOW The OSINT Portal is a useful hub for OSINT research and tools

But it's much more than that. I love the collated resources section, for example, where you can find highly curated collections of OSINT resources organised by category, whether you're looking for cybercriminal campaign intelligence, UK-specific OSINT or a starting point for cyber-threat intelligence.

Using AI to jog your code security memory is a double-edged sword

I must put my hands up and admit to writing as much about the double-edged sword that is AI in the cybersecurity field as the next journalist looking for clicks. Nonetheless, the topic is an important one given that the number of newly disclosed vulnerabilities is continuing to go through the roof, month after month after month.

The facts speak for themselves. Microsoft's July Patch Tuesday announcement saw the company confirm an absolutely staggering 570 security vulnerabilities, in what was a record-breaking rollout at the time. Although I wouldn't be at all surprised if that has been beaten by the time you read this.

Google has been making similar discoveries, with the biggest ever Chrome security update addressing 429 vulnerabilities in June. Literally as I'm about to submit my copy, news has broken that 432 Linux kernel CVEs were confirmed across just two days at the end of July. And if all that has left your mouth agape, better get the gob vice out as Oracle managed to top the lot with, wait for it, the release of 1,449 security patches.

Looking more closely at only one of these platforms, Google Chrome, it becomes obvious that one type of vulnerability is front and centre more than any other: memory issues. More specifically, we're talking about use-after-free, heap buffer overflow vulnerabilities, and uninitialised memory usage.

The Open Worldwide Application Security Project (**owasp.org**) defines a use-after-free condition as something that happens when a program references heap-allocated memory after it has already been freed or deleted, which can result in data corruption and even arbitrary code execution, but all three are critical memory security issues. They simply differ when it comes to location.

While use-after-free issues occur when a program accesses memory after it has been discarded, uninitialised use is when that program accesses memory before data has been written to it. A heap buffer overflow, meanwhile, occurs when a program writes more data into memory than the allocated, fixed space can hold.

An exploited uninitialised use vulnerability can lead to remote code execution, privilege escalation, information leaks and crashes. Heap buffer overflows can allow a program to read and/or write data controlled by an attacker, and a use-after-free exploit can create the conditions required for data corruption and arbitrary code execution.

Bear in mind that Chrome is primarily a huge C++ codebase. The discovery of dangling memory pointers in C++ code is hardly unusual, especially when the code is extremely complex and dynamic. But then AI enters the equation.

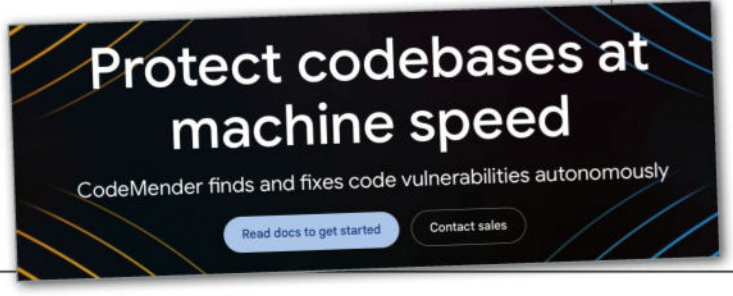
The common denominator among all this vulnerability discovery activity is AI. The latest LLMs can find vulnerabilities in code at a rate we have simply never experienced before. And that's a problem.

Automated, aggressive AI vulnerability scanning isn't inherently bad, as it uncovers vulnerabilities that need fixing. However, it becomes inherently bad when threat actors use it to do the same. That's one obvious example; less obvious, but perhaps even more concerning, is that the sheer volume of vulnerability discovery, and most importantly disclosure, is overwhelming bug bounty platform triage systems and developer remediation processes alike.



ABOVE **Cybersecurity people are always warning about being careful what you post on social media**

"One type of vulnerability is front and centre more than any other: memory issues"



BELOW **CodeMender uses AI to fix code vulnerabilities before it's released**

Which is where my plea comes in. If these tools can be used to discover vulnerabilities in code that's being used, why can't they be used to discover them before they get released? The answer, of course, is that they can, and they are.

Tools such as the CodeMender agent on Gemini Enterprise Agent Platform, for example, exist to find and fix code vulnerabilities with developer tool integrations built in. There are real-time IDE scanning tools, AI-powered contextual data flow analysis models, advanced agentic methods for automated proof-of-concept exploit execution and, of course, automated patch-generating options that, once checked by the developer, can fix what has been found. All of which comes at a cost, both in terms of licensing and trust.

But that's not all, as Jeff Burt writing at DevOps.com (**tinyurl.com/385devops**) has sagely warned. Burt pointed out that AI coding assistants, which are fast becoming a developer essential, represent a significant security risk. "Cybersecurity researchers have reported on such threats as 'HalluSquatting' and

Continued from previous page

'GhostApproval', which target developers and their AI tools.

"That's in part because the adoption of AI coding agents is outpacing the development of security tools to protect them," Burt wrote.

This means that developers using such tools are now a target. Or more of a target than they were previously, I should say. Of course, I'm aware of the irony of AI agents designed to find vulnerabilities in code having vulnerabilities of their own that attackers exploit. In fact, I think I'll go and have a lay down. Is it too early for a large bourbon on the rocks?

And finally...

Printers: hate them or hate them, we can't quite yet live without them. Nor, it would seem, can cybercriminals. The latest threat – and it would be laughable were it not so serious – to emerge via the printer is the ransomware note.

Yep, researchers at Kaspersky have been analysing what they called a bizarre ransomware campaign whereby hackers have hijacked victims' printers and caused them to print physical copies of the ransomware notes.

Over to Eduardo Chavarro Ovalle, Kaspersky digital forensic and incident response group manager, for his words on the matter: "These incidents highlight a pragmatic approach to ransomware. Instead of relying on sophisticated malware, attackers are taking advantage of exposed services, weak configurations and legitimate administrative tools already present in the environment to encrypt data and pressure victims into paying. In some cases, they also use channels such as printed ransom notes to exert psychological pressure on victims and reinforce the urgency of their demands."

I guess this proves, up to a point, that at least some of the target infrastructure had been compromised, but I'm not really sure why a printed demand should be any more compelling than the ones taking the usual route of system notifications, emails and telephone calls.

davey@happygeek.com

STEVE CASSIDY

"Today, we have it easy. Too easy, to the point where the art of programming could soon be lost"

Understanding how to code remains crucial for people who work in IT, especially when today's tools make it so easy to grasp

When was the last time you wrote a program? While working on a revised CV in a vain attempt to take my mind off the maxed-out fans in my server room, I was quite surprised to realise just how many languages I've worked in, and also how many of my customers have combined the roles of chief executive and principal developer. Yet, in 2026, the number of workers and owners I know who would use a traditional compiled language to address a business problem is countable on the fingers of one hand.

I'd go even further: I know more people who have no idea what a "compiler" might be, yet are working all day, every day with a mouse, keyboard and some things they loosely describe as programs, or apps in modern parlance. Most of this generation of knowledge workers would be horrified to discover that they might be expected to roll their own tools and technologies. Yet this is how computing was started, and many aspects of those early years still deliver practical, everyday business lessons if only you know where to look.

Little of this folklore is found online, because it pertains to the early days of code and compiler and hardware vs software. You have to hunt out actual paper books to get to the bottom of the importance of the compiler, and why you should at least understand its governing principles.

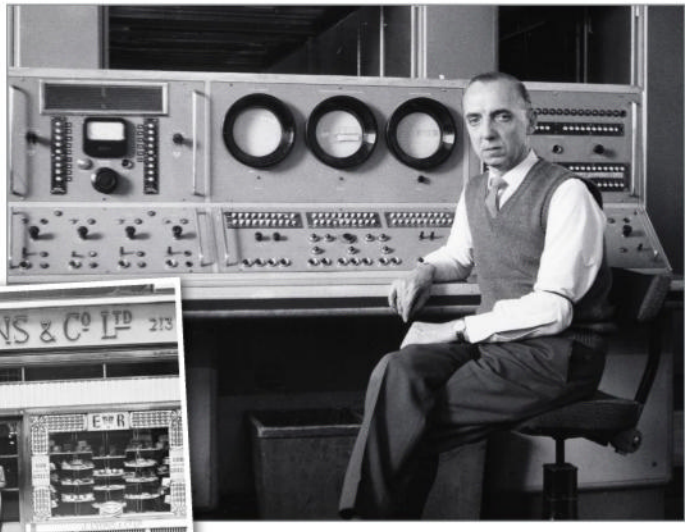
When I find someone interested in this matter I recommend two books: *A Computer Called LEO* by Georgina Ferry, and *Programming Pearls* by Jon Bentley. The LEO book is about the world's first commercial computer, used to process daily receipts from an entire nation of Lyons tea houses – the Starbucks of its era, selling tea and cake for minute amounts of money. LEO was based on the University of Cambridge's EDSAC, itself an adapted version of the American EDSAC concept.



Steve is a consultant who specialises in networks, cloud, HR and upsetting the corporate apple cart
@stardotpro

LEO was then reprogrammed for the British way of life, not least the British currency at that time, which was still counting in pounds, shillings and pence. So that starts out being in base 10, shifts to base 12 for the shilling, and then just spirals off into lunacy with a coin that was worth almost nothing and yet had 12 sides: the threepenny bit. You won't be surprised to hear that no applications for early computing platforms came with packaged solutions to include the existence of a 12-sided coin worth less than a packet of crisps. That early programmers working for LEO, entirely self-taught of course, managed to create useful software from scratch is worthy of adulation and respect.

Today, we have it easy. Too easy, to the point where the art of programming could soon be lost, particularly for newcomers to IT. But being unable to put together a program – however simple – on a computer you own is a near total disaster, in my book. I started out coding in COBOL, branching rapidly





BELOW One of the first commercial computers processed receipts from Lyons tea houses

off into BASIC, PASCAL, Modula-2 and -3. Of those, by far the most productive in the longer term was BASIC. Despite a certain level of snobbery in developer communities, BASIC was included with almost every computer sold in the dawn of the PC era.

Crucially, it also got tweaked a lot, becoming a macro-writing toolbox within Microsoft Excel and other Microsoft Office applications. No fooling: I probably spent 15 years writing business applications in one dialect of BASIC or another. Ten years of that was customising Lotus Notes, which had embedded a near-unrecognisable version of BASIC inside the cores (server and workstation) of its corporate email platform. When I left that particular marketplace, the best way to write yourself an intelligent email agent on an IBM mainframe the size of a minibus was to use BASIC.

One of the greatest puzzles in figuring out the advantages of compiled versus interpreted code is whether the platform you're working on is telling the absolute truth about its status as a compiled language. Quite a lot of BASICs reduce the entered code into "tokens" – short data fields in which a single value maps to a multi-lettered language keyword. This trick became widespread in the humble Spectrum, but could still be found in some of the bigger mainframe platforms nearly 20 years later.

Beyond the BASICs

It would be foolish to ignore the competitors for compiled languages, in trying to suggest that business computing users familiarise themselves with the technologies they could be using with a bit of education and encouragement. In particular, it pays to understand the use cases and differences between Apple's HyperCard and the 800lb gorilla in the world of coding these days – that suite of utilities ending in "ML" – so, HTML, XML and all their derivatives.

The distinction in my mind is clear: real languages take the computers they're installed on through processes of change. The various markup languages are much more passive, not so much being modified by the attention of the CPU, as illuminated as the device presents them to the human driving the process.

HyperCard is now a lesson from the history books. In particular the decline of HyperCard, which proceeded at some speed during 2004 until Apple withdrew the product entirely. On the one hand this was bad news for businesses and academics who had gone 100% boots-in on Apple's solution; on the other, the lesson about writing code in the most portable tool you can find was not lost on a whole generation of pioneers in computing, from Professor Richard Dawkins right down to poor old Cassidy, trying to make sense of the differences between BASIC and Psion OPL, both of which were considered way out of the limelight until that moment.



ABOVE **This excellent mini-documentary about the rise and fall of the HyperCard can be seen at tinyurl.com/385hypercard**

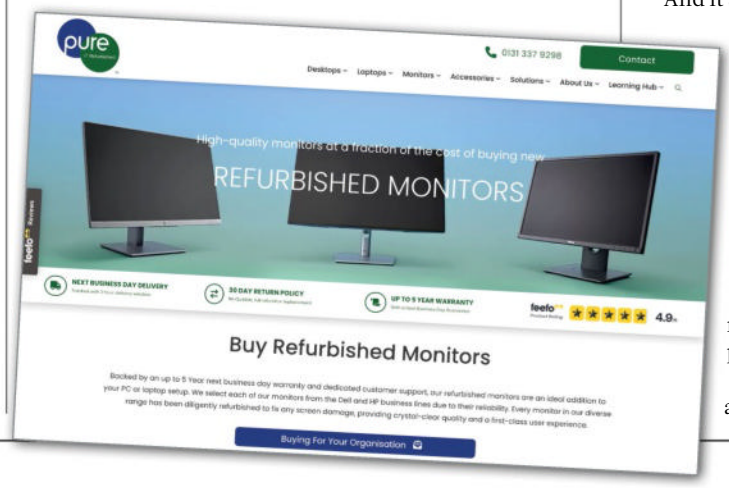
Let's be crystal clear about the business takeaway here. If you don't even know how your business computing product has been developed, and you have no way to examine the source code that's alleged to be doing all the work for you, then you're critically exposed to your supplier. And that's not restricted to the IT department; it's the whole business. Taking an interest in the variety of languages used to build your business software suite is sensible insurance; even the best of businesses fall out with suppliers now and then.

Heart of glass

One of the best ways to buy yourself a high-quality monitor is to go hunting in the corporate refurbished marketplace. I've been hanging out in the online shops of my trusted traders for rather too long, so long that a definite pattern of buying has emerged. Nasty shock from the taxman? Time for a new laptop. Glum visit with the dentist or optician? Nice high-quality screen, here I come.

"Glum visit with the dentist or optician? Nice high-quality screen, here I come"

Only a few weeks ago, I spotted a beautiful 4K screen, all in order except that the desk stand wasn't included.



BELOW **A high-quality refurbished monitor can make even a trip to the dentist bearable**

But the stars aligned. I like both the seller and the brand (Lenovo), but mostly what I liked was the price: £80 on my doorstep, tested, bubble wrapped and with leads included. Don't mind if I do.

After a week or so of ludicrous courier-delivery shenanigans (of which more below), I finally received my new-to-me Lenovo ThinkVision Pro 2840m, in good order and fully functional – just short of the desk stand. No biggie, I thought. I have screen arm mounts clamped on my desk, ending in the four-limbed claw of the standard VESA mount.

I eagerly grabbed my electronic screwdriver and set about demounting the old screen whose place would soon be occupied by the Lenovo display. Or at least, I started to unscrew the bolts, until the whole mount gave off a deep, grating moaning noise, and both screens slumped forward, flapping out and down as the elbow-style carrier arms unfolded to their maximum extension. This made matters even worse, because the leverage of the monitor's dead weight became amplified by the extension of the arms.

And it suddenly sunk in. All this action and groaning and what-have-you was taking place around a heavy steel clamp, grasping the top of my working desk. My *glass* working desk.

On this occasion, the groaning and damage was the cut edge of the glass desktop grating across the closing clamp of the screen mount, for which I shall give profuse and eternal thanks.

The VESA standard covers a lot of ground when it comes

to screen mounting. There are three different sizes of bolt you might have to use, a variety of bolt-hole spacing suggestions, and no actual penalty should you get the loading wrong: kind of disappointing to say the least, especially now, because the world has moved on quite a lot since VESA was originally proposed. 15in and 17in TFT displays were the kings of the hill back then, and even though some of them might have been heavier than a modern screen, their smaller size helped to offset the imbalance created by two odd-sized screens attached to a dual-arm mount.

But! Let's not lose track of my particular incident. The point of damage and impending failure wasn't the screen end of the arm: it was the clamp. A pair of metal plates and a screw-down connector, designed to be strong enough to allow you to pick up the desk by the screen-mount. This is fine so long as you're working with a chipboard desk surface, where over-tightening of the humble steel clamp just digs into the soft amalgam of glue and woodchips making up the desk. In the case of my nice modernist glass-topped, trestle-mounted working desk, the only material available for the clamp to grab was the actual glass surface itself.

(Don't tell anyone, but I don't like glass desks. My partner decided I needed a bit of a cheer-up and waited until I was away from home to bring in not one but two slightly oversized dining tables as my work surfaces. I had to keep them, and ended up adorning them with stick-down mouse mats, because optical mice don't actually work on glass. Let's move on rapidly: this is one of those relationship subjects.)

So here is my serious business guidance. While computing hardware has been getting faster and smaller and less power-hungry all the time, there has been a marked lack of innovation in the systems that form your workspace. My new 4K screen presents a heavier load, offset further from the mount's centre of gravity, increasing the drag on the desk clamp mechanism and the surface it's mounted on. The very last thing I want is for a careless bump to a heavier screen to make the glass desk shatter like a car windscreen, dumping not just the screen mount but also everything else on the desk down into a glittery pile of toughened glass adorned with sharp edges.



ABOVE **This Lenovo screen was an £80 bargain, but at the cost of my glass desk**

I regret to inform you that there's no widely agreed written standard for load-bearing glass sheets. It's just not possible to Google for weight-bearing in table-top transparent materials: if you stray into architectural resources then there are some studies and suggestions, and there's a standout piece of work done on cars with moon or panoramic sunroofs (apparently they're not a lot of help should you roll your pride and joy into a ditch). But outside of this specialist area, what we mostly work on is a few rules of thumb and stand-out examples, and there are precious few of those when it comes to monitors. And remember, each screen weighs about as much as a nine-month-old baby.

"The last thing I want is for a careless bump to make the glass desk shatter like a windscreen"



BELOW **Glass desks are not ideal for clamping monitors to**

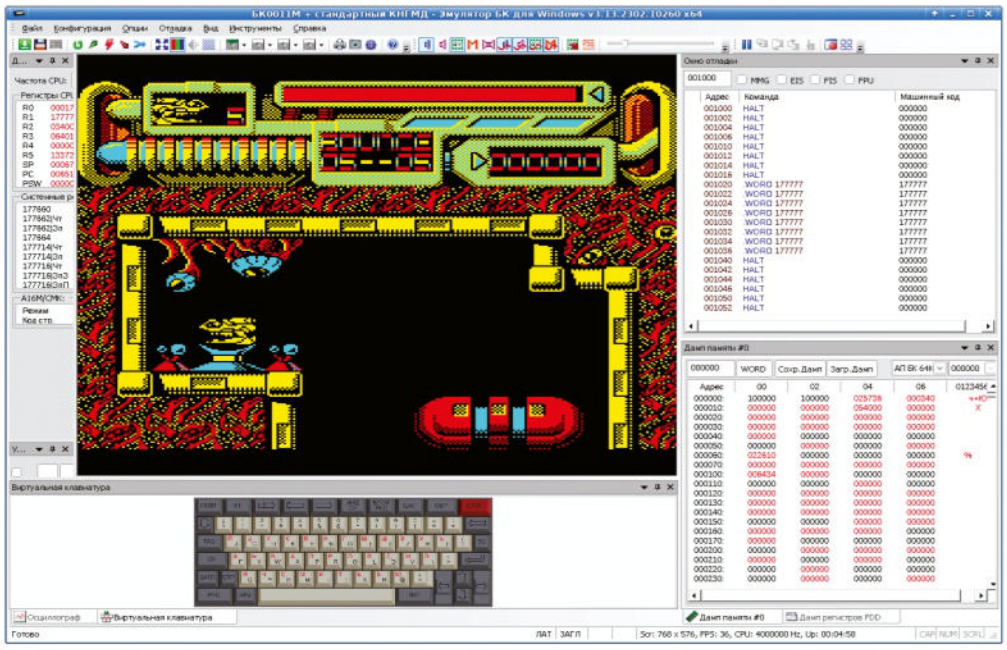
So what's to be done here? My solution was to layer the clamp area, mainly using a couple of old, horribly scratched polyurethane kitchen chopping boards as cushions between the glass and the clamp. The scratches and knife cuts are relevant, because they provide more grip on both the glass and the clamp, and the larger size of the board reduces the forces around the edges. I can foresee a moment when there will be lots of sploshing about and cursing while the kitchen board pad is permanently epoxied to the jaws of the clamp, but only when heavy 5K screens or a strong-enough mount to take a complete iMac become more commonplace.

This is where the boundary between amateur DIY and professional, safe workplace lies, and the distinction is in the matter of insurance. You're unlikely to be able to insure a bodge-up solution, no matter how strong it is. Insurers want to see the Kitemark logo and a specification sheet with handy measures such as maximum loading and anticipated breaking points. As IT people, we must acknowledge that premises and furniture are fields where the supported equipment has changed radically over the last quarter of a century, but the supports themselves have not.

This train of thought came up after a casual survey in the *PC Pro* readers Facebook group, in which we were asked what our desktop rig looked like. Mine is not quite the most leading-edge selection of devices, but it was pretty close to the heaviest: in particular, my IBM T210 screen and Barco x-ray monitor are at the upper limit of what I'd consider as a one-man lift. They're definitely beyond the limits I'd be happy to test a desk-mounted arm with.

So the next time you knock back a buying request for an enormous formed-alloy multi-screen mount, priced within an inch of the value of the screens and laptop that will present as its burden, just run through the logic for a minute. It might actually be money well spent.

cassidy@well.com



Operation reboot

Welcome to the Virtual OS Museum

David Crookes looks at a tool that allows hundreds of old operating systems to run on modern computers

Operating systems come and go. Some are fondly remembered (think AmigaOS, famous for its pre-emptive multitasking), while others are best consigned to history (looking at you, Windows Me). We've had many mobile operating systems, distributed operating systems, network operating systems, embedded operating systems and even one designed to be the Third Temple from the Hebrew Bible (TempleOS). They've come to define how we use our computers.

Given their importance, it's no surprise that enthusiasts enjoy looking back and exploring what operating systems had to offer. Among them is a Canadian software enthusiast called Andrew Warkentin, who's so passionate about such foundational software he's created a digital museum packed with examples. His Virtual OS Museum is a vast, impressive collection of more than 570 operating systems across 250 platforms, and it's a joy to explore.

Warkentin's museum – available via the website **virtualosmuseum.org** – covers a wide range of goodies, from early computing milestones such as the Manchester Baby (the world's first stored-program computer, built in 1948) to the earliest versions of Unix. It includes machines released in the golden age of home computing, from the Apple II and Commodore 64 to the ZX Spectrum and BBC Micro, as well as once popular mobile platforms such as PalmOS and EPOC/Symbian. There are more obscure systems such as Oberon and Bell Labs' Plan 9, and you'll also find later mainframes and minicomputers.

Such is the size and complexity of Warkentin's archive that "visitors" must put in some legwork before they start exploring. Although each operating system has been set up to work without configuration, they all run under emulation inside a Linux virtual machine, using software such as VirtualBox, QEMU and UTM. This means the museum must be downloaded and launched on a computer that has a *lot* of free storage space. The amount required is not for the faint of heart.

As a minimum, the Lite version of the Virtual OS Museum needs 22GB of storage, and that only provides access to the collection. Each individual operating system must then be downloaded separately. If that sounds like a faff and you'd rather have everything available from the outset, you'd need a whopping 179GB of free space. For anyone seriously interested in computing history, however, such requirements are a small price to pay.

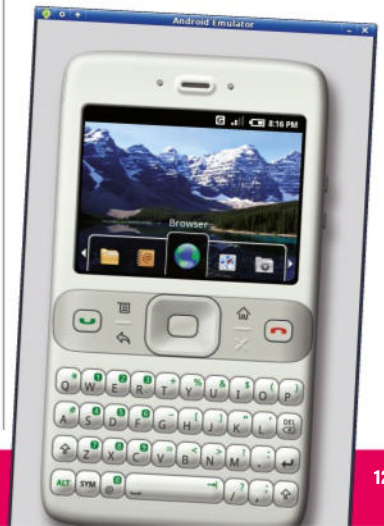
ABOVE AO-DOS, seen here running the game Cybernoid, was a disk OS for the Soviet computers BK-0011 and BK-0011M

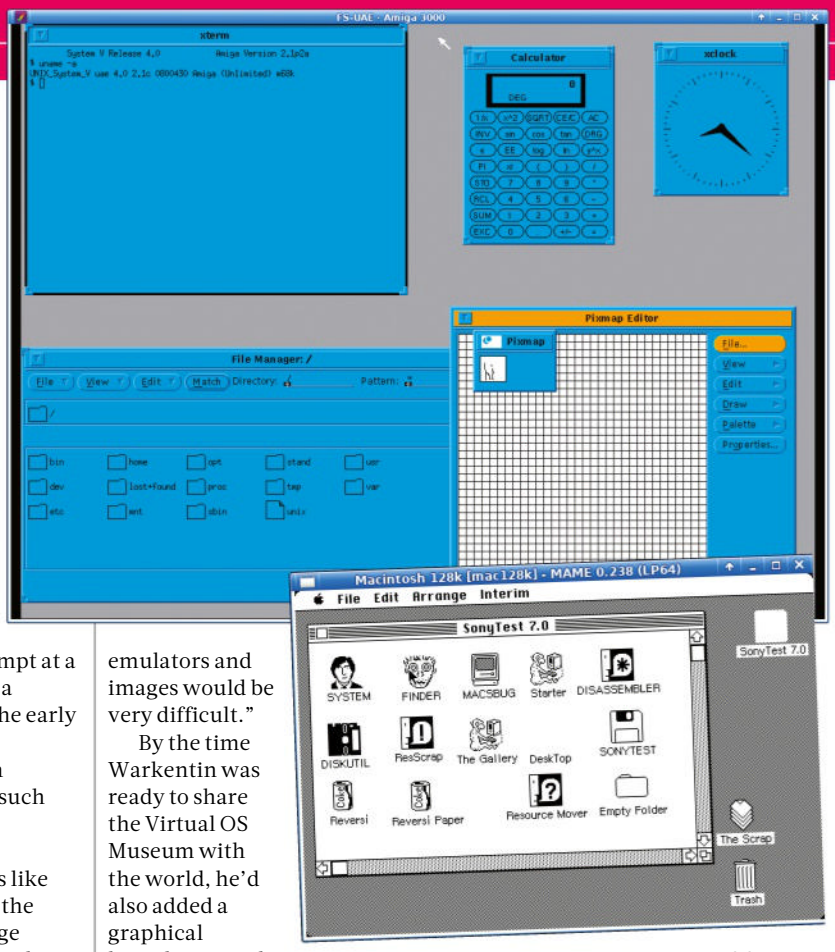
RIGHT The pre-launch test version of Android – Milestone 5, released in 2008

It's hard not to admire how much effort has gone into bringing this free collection to life

Operating history

It's hard not to admire how much effort has gone into bringing this free collection to life. Warkentin, who has been collecting emulators and virtual machine images for over 20 years, has spent a significant amount of time looking for operating systems and emulators to install.





He's also made a few contributions of his own, asking people to send him DVDs containing multiple operating system images that he could then dump (dumping being the act of copying its internal memory or file system to create a snapshot of what the computer is doing at that moment). Some of these have been used to install images in the Virtual OS Museum.

"I've also dumped some operating systems from original media that weren't previously available online," he told *PC Pro*. "These were MaxOS Linux (an obscure attempt at a commercial Linux distro from a company semi-local to me in the early 2000s) and LynxOS 4.0."

But just how did Warkentin become interested in creating such a collection?

"I read about old non-Unix timesharing operating systems like ITS and TOPS-10 in places like the Jargon File [a glossary and usage dictionary of slang that dates back to the 1970s]," he said. "I wondered what they were like and eventually found a site with ITS tape images and instructions on how to install them."

Those instructions related to SIMH, an open-source emulator written in 1993 that recreates many classic computers such as the PDP-10 and VAX. "I immediately downloaded and installed the images," Warkentin said. "I then downloaded a bunch of images from the SIMH site and installed those as well. Soon enough I was hooked."

As time went on, Warkentin realised his growing collection would be of interest to others. "The thought of sharing it crossed my mind a few times over the years, but it wasn't until a few years ago that I got serious about getting it up to a release-worthy standard," he said.

The work involved cleaning up the collection so that it had a consistent structure. He also added proper metadata. Warkentin wanted users to get stuck in with minimum fuss, so he handled the complicated process of getting the operating systems running on a modern computer. Packaging all the operating systems into a Linux virtual machine was an obvious step.

"There's really no other good way to package something like this," Warkentin said. "Packaging all the dependencies of more than 150 emulators would be very difficult to do any other way. No mainstream OS has a container manager that would be up to this, and distributing this as a loose collection of independent emulators and images would be very difficult."

By the time Warkentin was ready to share the Virtual OS Museum with the world, he'd also added a graphical launcher to make it simple to find and select an operating system. "Before that, I was just running the scripts for each installation from the command line," he said. "Sometimes I still do."

TOP Amiga Unix – an alternative to AmigaOS – was bundled with the Amiga 3000UX

ABOVE Check out the 1983 alpha version of Mac System Software 1.0 (Sony Test 7.0)

Challenging times

Warkentin isn't alone in his desire to preserve old computer systems and software. Preservation, whether digitally or physically, is widely considered to be of vital importance. Experts and enthusiasts fear that vast amounts of history would otherwise be lost – more so as physical media begins to degrade over time.

As such, there are many preservation efforts, most of them driven by enthusiasts who have created emulators along with disk and tape images of software. This has ensured the survival of a lot of software, especially given the potential for physical media to degrade.

But while many websites such as the Internet Archive have proven invaluable in ensuring software and operating systems remain available to use, there's a general feeling that even more needs to be done. The non-profit Video Game History Foundation in the US, for example, recently launched the latest version of its digital archive (**archive.gamehistory.org**), which is packed with magazine scans, press materials and documents.

> "I was running the scripts for each installation from the command line. Sometimes I still do"

In 2020, the National Videogame Museum in the UK set up a Specialist Subject Network called the Videogame Heritage Society. Its members include the BFI, Science Museum Group, Museum of London, Centre for Computing History, Bath Spa University, the British Library, C64 Audio and The RetroHour Podcast. Their mutual aim: to collaborate on the challenges of digital game preservation.

There certainly are challenges. In March, the fan-run Myrient archive, containing more than 390TB of game ROMs and ISOs covering systems, was forced to close, citing unsustainable monthly costs. In July, Germany's largest video game archive, the Internationale Computerspielesammlung, announced it was closing due to the expiration of public funding, despite having more than 60,000 catalogued games.

This is rather worrying. If game preservation is proving difficult to sustain, what hope is there for "serious" software? "It does seem like platforms with a gaming focus tend to be the best preserved," Warkentin said. "Nearly every home computer, no matter how obscure, has an emulator, same with later consumer platforms, but the same can't be said for other categories.

"A decent number of workstations, minicomputers and mainframes are emulated these days, but there definitely still are some gaps. The worst preserved category would definitely be midrange/office computers such as the IBM System/3x machines and the like. There was an entire cottage industry of small manufacturers of such machines in some places, but software and documentation for nearly all of them seems to be lost. Even most such machines from major manufacturers like IBM are still unemulated."

Exploring the classics

It's why the Virtual OS Museum is important and why having it as a downloadable local archive is sure to work well in the long term.

Warkentin's only regret is that he didn't release the Virtual OS Museum sooner, something he puts down to a "severely crippling tendency to stay quiet". But, with a concerted effort to be more active ("it's only recently that I've realised how much it's held me back"), Warkentin is throwing himself into his hobby.

"I'm getting back into emulator development," he said. "Quite a while ago I patched a few emulators to run OSes that were previously broken, but I hadn't done anything like that for quite a while."

So far, he has begun developing one emulator and he will be making a video about it soon. But his ambitions aren't stopping there. "I would also like to buy obscure hardware that's currently unemulated, image the disks, and write emulators for it, but I don't really have the money to do that kind of thing at the moment." Suffice to say, there's a Patreon link on the Virtual OS Museum web page and it's a good way of financially supporting his work.

In the meantime, Warkentin is happy discovering past operating systems with all their innovations and quirks. He said he particularly likes the general architecture of QNX, a commercial, Unix-like real-time operating system developed by BlackBerry. He also admires older versions of Mac OS X, as well as the desktops of Business TRON (BTRON), which was originally released in 1984 as a next-gen computing environment and packed innovations such as built-in hypertext and object-oriented interface elements.

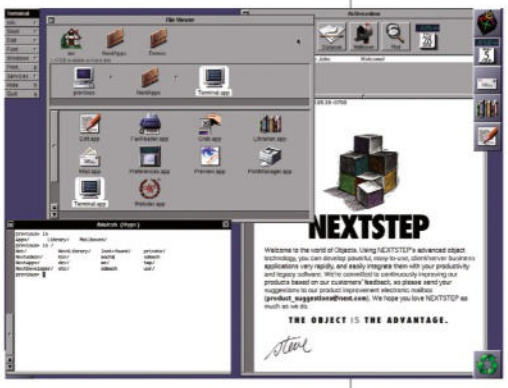
Another favourite is Scheme A. This was devised in 1951 by Alan Turing, with the help of Cecily Popplewell, for the Ferranti Mark 1 – the world's first commercially available stored-program computer.

"Scheme A is the first system software that could be described as an OS or resident monitor, and it's a lot simpler than the somewhat later sequential batch monitors that could load a series of jobs from cards or magtape," he said. "Basically all it does is load software from punch tape using a very primitive command interpreter and handle calling routines from the drum memory through a directory; each program has to be manually loaded from punch tape."

> "I want to add an 'exhibit' feature with lists of OS installations relevant to particular topics"

Back to the future

Warkentin's experience of operating systems has had another positive effect: he's created his own operating system, which he gives the working title UX/RT. You can find out more about it by going to his GitLab page (**tinyurl.com/385retro**) and, if you download the Virtual OS Museum, you'll also find a demo image ready to try. UX/RT is so impressive that a major conglomerate paid for him to fly to its headquarters to discuss using it as a replacement for QNX. It also uses some once-used but now forgotten ideas that he believes modern operating systems ought to revisit.



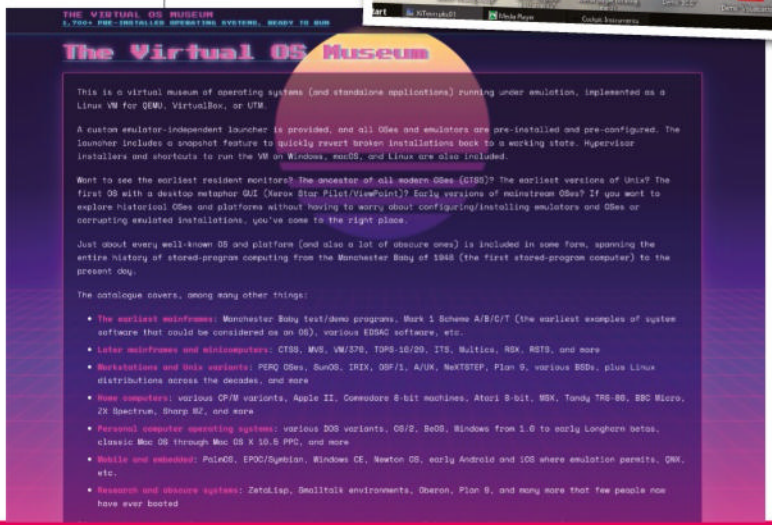
TOP NeXTStep 3.3, the final release of the OS developed by Steve Jobs' NeXT

BELOW OS-9, a real-time, process-based OS developed in the 1980s

BOTTOM The Virtual OS Museum looks gloriously retro



"My own OS is similar to QNX in its general architecture, but I've come across a few things that I think modern OSes should have and it will incorporate features from various other OSes. These will include scoped file system namespace tables like VMS (to allow more control over how files are shared between processes), a data type switch library like the AmigaOS family (to provide extensible cross-application support for different file formats rather than each application having a fixed list of supported formats), and a desktop with a compound document model and application embedding similar to BTRON (to allow more flexibility on how applications can work together)."



As you can imagine, work on UX/RT and the Virtual OS Museum are keeping Warkentin busy, but he's keen to continue working on both for some time. Indeed, he has a list of operating systems he would like to add to the museum, ensuring it remains far and away the world's largest collection of pre-installed emulated operating systems.

"There's still definitely some stuff missing," he said. "There are a few Amstrad CPC OSes in there, specifically a couple of early versions of SymbOS and a port of MSX-DOS to a Russian clone, but that's definitely one of the platforms that's underrepresented at the moment. This is true of a few other major home computer platforms, and Linux is also somewhat underrepresented. While I do have a decent number of Linux images, it's still not enough to be truly representative."

Warkentin is also keen to expand people's knowledge of past operating systems and allow users of the Virtual OS Museum to better appreciate the features that were included. "I want to add an 'exhibit' feature with lists of OS installations relevant to particular topics and explanations as to how each is relevant," he said. "I'd also like to add some kind of integration with a wiki."

For now, though, he's more than happy to see what people make of his collection and to hear stories from those who have begun to explore it. Indeed, half the fun is in clicking randomly and checking out the likes of the IBM Big Iron or a Texas Instrument graphing calculator.

If you'd like to give it a try, visit **virtualosmuseum.org**, select Downloads and seek help with installation in the ReadMe/Help section. You won't be disappointed.

Futures

The long history of the future – and what's already here



Nicole Kobie assesses her own predictions about future tech. Was she right more often than wrong?

The problem with predicting the future is this: one day it may catch up on you. Two years ago, my book about the history of the future came out; my publishers, with little regard for my mental health, chose to wait more than *two whole years* for the paperback to be released (in stores now!). So every headline about driverless rollouts, humanoid robot advances and the looming arrival of AGI have sparked panic: how wrong was I? And how foolish will the passage of time make me look?

Thankfully, the future still moves slowly. For every new city that gets Waymo cars, there's an equally embarrassing incident about driverless cars sparking a traffic jam, taking a rider around in circles outside an airport or heading down the wrong side of the road. The same follows for most of the technologies I explored, including AI and robotics.

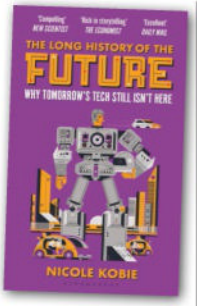
But it's clear that some of these future technologies have inched closer. Here, I'll smugly note where I was correct (so far, anyway), humbly highlight where I've missed the boat, and along the way offer an update on the state of everything from humanoid robotics to flying cars.

Driverless cars

Waymo is in London. Teslas are in limited use as robotaxis in Texas and Florida. Baidu has robotaxis via Apollo Go in Wuhan, Shanghai and parts of Shenzhen, among others. Progress is slowly marching along when it comes to driverless cars. But I'm still not convinced this technology is changing our streets any time soon, if ever.

On the one hand, these machines continue to be remarkable: they can actually navigate cities without a person at the wheel. Most of the time, at least. And the problem is cities are full of edge cases. Consider San Francisco. The lovely tech-filled city by the bay has been the de facto test lab for Google-owned Waymo since 2009, so you'd think they'd have the streets down by now.

But alas, no. Waymo One is now offering a commercial taxi service in the city, and though the cars are certainly capable, they keep getting tripped up by what technically minded people would call "edge cases". Just in the past few months, the following has happened: Waymos ran out of power and shut down amid 4 July traffic, sparking an investigation by city officials. On the



ABOVE Nicole's book is available now in paperback

A trio of the robotaxis blocked a street in a 'standoff' following a minor collision



ABOVE **Waymo's robotaxis are on the streets of London – but don't give up the bus pass just yet**

same day, Waymo robotaxis drove over fireworks that had been set off in the middle of the street (apparently a common form of celebration there, though admittedly bonkers). And in June, a Waymo got lost in a construction area and required police intervention; that same month, a trio of the robotaxis blocked a street in a "standoff" following a minor collision.

Waymo's only rival in the city, Cruise, was put on pause in 2023 after a wild accident in which a person was thrown under the car; the driverless system didn't spot them and *kept driving*. The victim thankfully survived, but owner GM shut it down shortly thereafter.

That's in a city – an admittedly complicated one, what with the street fireworks – that has been Waymo's test lab for 17 years. And now they're coming to London.

Waymo is already testing on the capital's streets, as is local startup Wayve as part of an Uber partnership – both with safety drivers. Baidu and Uber also have a partnership planned to join them later this year. That these cars can navigate London's complicated streets – bizarre roundabouts, stolen Lime bikes, unpredictable human pedestrians – at all is a sign that the systems aren't total failures.

But as ever, it's not the day-to-day traffic that's the problem, it's the once-in-a-lifetime events that continue to confuse these cars. Despite that, Waymo's execs said at a press event in London earlier this year that they were spending a lot of time trying to understand how zebra crossings work. On one hand, as a pedestrian, *good please continue*, but on the other hand, similar crossing styles exist in San Francisco, so this shouldn't be a newsworthy engineering challenge but a doddle.

In short, driverless is here. But, as I predicted, it's just not a way most people are getting around, so keep your licence, bus pass or Lime app, because you're going to need it for a good long time.

AGI

It's almost impossible to unpick the hype around artificial intelligence right now, and that's true of artificial general intelligence (AGI) and superintelligent AI in particular. In the book, I noted: "At the time of writing, AGI, or super-intelligent AI or strong AI – whatever you want to call it – doesn't exist. It might never exist, or it might have been created before this book is published." How's that for a dodgy prediction?

But I don't think AGI is looming. That's because I've used the generative AI chatbots and the like that we have now, and they are so frustratingly dumb I may actually chuck my laptop into our neighbouring canal in frustration. Earlier today, I asked how much rain we had last night, only for AI Overviews – admittedly the dumbest of all AI bots – to tell me it didn't rain. But I looked out of the window at 4am, and it was raining; I told it so, and it corrected itself. Why does anyone trust these machines with anything?

Plenty do, of course. And AI is unquestionably more a part of our daily lives than I would have thought possible two years ago. But are we close to AGI? Some tech leaders believe it's imminent. Others, myself included, don't think LLMs, even when combined with reasoning models, are the right route. Either way, we don't have anything we could call AGI, no matter how much the AI hype machine likes to pretend. That's fine by me; let's figure out how to make good use of what we've got before rolling out the death machines.

Another consideration is the arrival of another AI winter, in which failure to progress in the technology sparks a pullback in funding. This seems unlikely given the heavy investment flowing towards the sector, but if the bubble bursts and all those data centres prove unnecessary, the ensuing economic fallout won't be pretty. Personally, I think it will spark riots.

At this point, AI is probably too big to fail; if the bottom falls out of this market, expect governments to swoop in with cash to keep development happening – not so you can avoid writing emails yourself, but for military might. AI is here to stay, in other words. And it got here much faster than I predicted.

AI is unquestionably more a part of our daily lives than I would have thought possible two years ago

Humanoid robots

Two years ago, there were a few startups starting to edge into this area: Figure, 1X Technologies, Sanctuary, Agility Robotics. And they're all still kicking around. But a question remained: why use humanoid robots when they're so difficult to build?

In some ways, this particular technology has come on faster than I would have thought possible, but remains largely in the trial phase. Hyundai Motor Group has plans to roll out Boston Dynamics' Atlas more widely – though, of course,

BELOW **AI chatbots are frustratingly dumb, yet still trusted by many**



that company is now the owner of the famed robotics firm, so no wonder.

Challenges remain. The idea of a robot butler *á la The Jetsons* remains unlikely. In the book, I mention Prosper Robotics, a company that uses humanoid robots controlled remotely by overseas workers to clean homes. The company hasn't updated its social media for three years, so perhaps that project may no longer be happening, but American company Shift is paying people to let them clean their homes as part of a training data-gathering exercise. We truly live in weird times.

Either way, Tesla's Optimus still isn't here. In March, CEO Elon Musk admitted plans to reveal the latest version of the humanoid robot were being pushed back, saying it was "walking round, but needs finishing touches before it's ready to be shown".

In short, we remain largely at the same point: these robots exist, they're being trialled, but they aren't a major force. Given worker shortages in key areas such as logistics, it seems likely robots will be used, but why we keep making them human-shaped is a question I still can't answer. Amazon's warehouse robots continue to largely be functional, though it recently bought humanoid robot developer Fauna, but for home use, rather than industrial. Robotics continue to pick up pace, but humanoid shapes are still trundling along – just as I predicted.

Flying cars

This is perhaps the technology I was most bullish about, though I don't expect any of us – beyond Tony Stark-wannabes with the cash for serious cosplay – will ever have personal flying cars. Where would we park them? How would they take off without individual traffic control? And do we want airborne traffic jams?

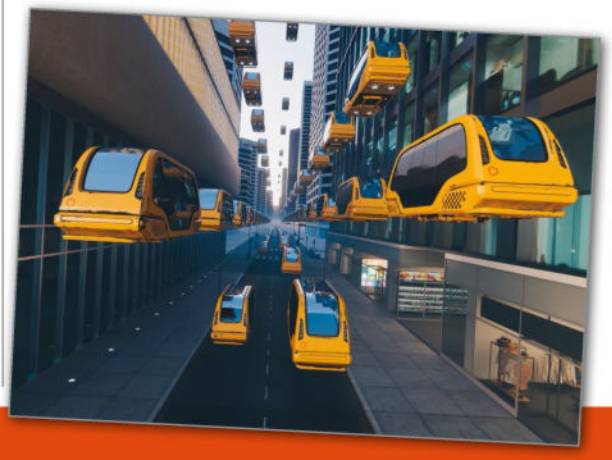
However, the idea of flying taxis or short-haul electric planes has real merit, in particular to bring public transport to areas without solid links. Unquestionably, these should disrupt helicopters, but hopefully they will be more than a way for the wealthy to rise above traffic.

So far, we remain solidly in the trial phase. Flight tests abound, and a few are even ready to head into limited production – helped by solid support from the US, which has a military that is surely interested in quiet flying machines. An Alef Aeronautics model is now moving towards production.

That said, it's been a turbulent start for many companies. Germany's Lilium went out of business, while British Vertical Aerospace has pushed back certification of one of its eVTOLs to 2029. In the US, Archer Aviation continues to chase certification. Coming up with a new form of air transport isn't easy, nor is appeasing regulators (thankfully).

In the short term, if you want to take to the air now, you'll need to head to China, where EHang is running tourist flights around a park, though Dubai and Abu Dhabi want to launch operations with Joby Aviation and Archer Aviation respectively this year. So just head to the Middle East and install an Uber app to take to the air, easy-peasy. In the US, the 2028 Summer Olympics in LA are planning – well, hoping – to offer air taxis via Archer Aviation to help link up the city and dodge its terrible traffic.

Flying cars are really air taxis, and they are slowly arriving in some cities. Expect rollouts to follow the pattern of driverless cars, with plenty of trials followed by a long wait for actual commercial services, starting in big cities in other countries. I had hoped we'd be further along by now, but aviation certification is a long road, so no surprises there. It's still a long wait to the future, I'm afraid.

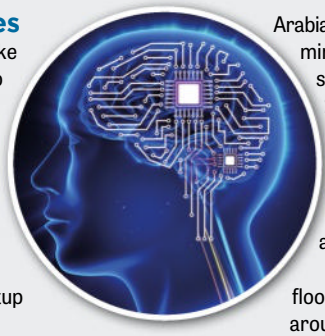


BELOW Flying cars are coming to Dubai and Abu Dhabi later this year

The rest of future tech

Brain computer interfaces

This is the future tech that I'd most like to see happen – so long as it's used to help people with brain disorders, paralysis and other health issues. Progress is happening, slowly, though that's probably the right way to develop a technology that gets surgically implanted into people's brains.



ABOVE Brain implants are progressing slowly

Neuralink, the brain implant startup backed by Elon Musk, had its first human patient in 2024 and has since announced a total of 26 other participants, including a Brit named Paul. That's serious progress – especially for the patients who have regained physical capabilities – but it's a long way from becoming brain-reading technology that would let us ditch our keyboards. The slow road is what I predicted, and it's necessary to move slowly where brain health is at risk.

Hyperloop

This is perhaps the least controversial opinion in the book: hyperloops are a silly idea and aren't going to happen. Virgin Hyperloop is no more as of 2023, and Hardt Hyperloop followed suit earlier this year, as did Zeleros. A few companies remain in operation, slowly toiling away at the vacuum-sealed magnetic trains, and trial tracks are still in place, so the dream isn't completely dead.

One in particular is TransPod, which until the end of last year was pushing a line between the Canadian cities of Edmonton and Calgary, saying it was ready to build and merely awaiting a transport report from the local government; that arrived and doesn't mention hyperloop at all. There is a plan to link those two cities, using high-speed rail at 320km/h... some time within the next 30 years. This prediction was an easy win.

Smart cities

This idea seems to be on the wane. Toyota's Woven City has pivoted to a "living laboratory", while Saudi Arabia's NEOM and The Line – a 170km-long mirrored city in the desert – have been scaled back, to put it mildly, with just a 2.4km section built. Instead, the project is now focusing on AI data centres. This was another easy prediction: building a city from scratch rarely makes sense and always exceeds budgets.

Of course, smart tech is still flooding cities – and raising issues around privacy and surveillance. Controversial CCTV/ANPR surveillance firm Flock has been dropped by policing agencies in LA and Mountain View in California, as well as elsewhere.

Augmented reality

Smartglasses that can overlay digital information onto the real world are here, but does anyone want them? Meta cleverly worked with actual glasses makers for its Smart Glasses lineup, ensuring they dodged the weird sci-fi vibes of Google Glass back in the day, selling seven million units last year. That's seven million more than I thought would ever sell, but means the devices remain relatively niche – for now. Google has its own smartglasses set to arrive this autumn.



ABOVE Does anyone really want a computer on their face?

No matter how good these are, surely no-one wants their social media notifications popping up in their eyeline or to ask Gemini a question without pulling out their phones. I expect to be proven wrong on this, and I find that disappointing and worry about the privacy implications. I just can't wrap my head around why anyone would want a computer on their face, so that likely means they'll become massively successful in the next two years. Sigh.

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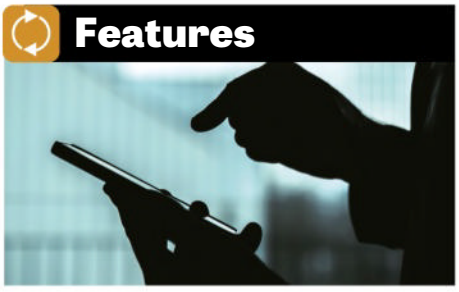
Features



Robots: a golden age at last?

We discover how close we are to humanoid robots in the workspace and at home. Could CPUs, language models and mechanical robots push us closer to a breakthrough?

Features



Screen time isn't the problem

From dopamine-driven scrolling to more intentional use, the real question isn't how long you're on your device, but what you're up to.

Labs

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We challenge the UK's leading workstation builders, along with their big-name international rivals, to build powerful systems around the latest chips from AMD, Intel and Nvidia – and without price limits.



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The Network



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Please note: Labs and features are subject to change



Jon Honeyball pokes one in the eye at current smartglasses, but may just have the solution

In mid-August, courts in England and Wales declared a ban on smartglasses, specifically the new Meta glasses. As *PC Pro* Podcast listeners will know, I'm not surprised. His Majesty's buildings already have strict rules about the use of cameras; simply hiding them within your Ray-Bans was never going to impress a judge.

The courts aren't alone. Numerous well-known places like Wetherspoons are coming round to the idea that video recording within their environments isn't conducive to happy customers. A pub doesn't have the same legal restrictions as a court – you're unlikely to be jailed for contempt at the Dog and Whistle – but it's a private space so house rules apply.

It reminds me of the ill-fated Google Glasses, launched with huge fanfare in April 2013. That product rolled forward till about January 2015 when sales stopped. The reason – well, one reason among many – was that people weren't happy at being filmed in public places. I don't need to remind you what the common name for Google Glass wearers was, either.

This all opens up the question of why you would want to wear glasses with cameras built in. Or, to twist that question slightly, what benefits could they possibly bring? Well, there are many reasons why head-mounted cameras are useful, starting with those who need to document work. A car technician is a good example, or engineers working on aircraft engines. There are any number of tasks where video recording is entirely appropriate and useful to the business.

Let's not forget the transformative capabilities of a camera wirelessly connected to a smartphone, allowing someone with visual impairment to have the scene around them described aurally. "There is a door to your left, five feet away. It's closed with the door knob on the right. You are now two feet away." This is the sort of assistive technology that should be applauded, especially when combined with Lidar to create a 3D map of the space around you.

But that scenario is a long way away from taking some camera-enabled Ray-Bans into the gym changing room. And there lies the core of the problem. The current solutions are trying to hide away the capabilities, rather than celebrate them and make it open and obvious what is happening. A tiny red LED doesn't count. What we need is an entirely new form factor.

We also know that Apple is working on smartglasses, based on the ecosystem developed with the Apple Vision Pro hardware and, most importantly, the visionOS software platform.

So here's what I would do if I was Apple. Design smartglasses without a lens component. No, I haven't lost my mind. People with perfect vision don't want lenses in front of their eyes, nor do those who wear contact lenses. So make a pair of glasses that have no lenses, just a horizontal unit with a standard nose bridge. Make the video recording LED super bright. Give feedback to the user via speech from the glasses' ear wings and via other supported devices – their Apple Watch, an iPhone, via CarPlay.

But this means there wouldn't be a floating screen in front of the eyes, I hear you mutter. Good. They're rubbish. The technology simply isn't there to provide a high-resolution solution for both eyes coupled to a decent battery life. Trying to jam low-resolution optical wave guides into the glasses results in a miserable experience, especially if it's for one eye only. Let's do away with it until the technology catches up.

With an entirely different style of device, there's no pretending that people are just wearing Ray-Bans with a barely visible flashing LED. They'd be obvious for what they were and would be immediately recognisable.

For those who need prescription lenses, offer that too in the new design. But keep to the core principle of public visibility. That way, we can have the conversation about what's happening. Most importantly, the industry isn't attempting to hoodwink the general public by hiding this invasive technology away within something familiar. That just makes everyone feel uncomfortable.

> "Here's what I would do if I was Apple. Design smartglasses without a lens component. No, I haven't lost my mind"

Now let's come back to the benefits question. Such iWear (I'll take my usual 5%, thanks) adds to my personal, portable computing fabric. I use them when appropriate. I put them in my pocket when not. I can benefit from voice assistance in the helmet of my motorbike, or when taking phone calls, or when doing any of the myriad tasks where the new Siri AI comes into play. It's just another item in my day-to-day technological life, not something to be feared.

This is a classic example of "don't come up with a better idea, redefine the question". The current solutions are too creepy, because they hide the capability rather than celebrate it. And those efforts at displays within glasses are too miserable to be serious.

Jon is a contributing editor to *PC Pro*. He's still smiling at the term "iWear" and cursing Apple for moving away from the "i" naming strategy. Join him at pcpro.link/discord

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