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Editor Jim Martin jim_martin@idg.co.uk
Group Managing Editor Marie Brewis marie_brewis@idg.co.uk
Art Director Mandie Johnson mandie_johnson@idg.co.uk
Production Editor Rob Woodcock rob_grant@idg.co.uk
Multimedia Editor Dominik Tomaszewski dominik_tomaszewski@idg.co.uk
Consumer Tech Editor Chris Martin chris_martin@idg.co.uk
Senior Staff Writer Ashleigh Allsopp ashleigh_allsopp@idg.co.uk
Technical Editor Andrew Harrison reviews@idg.co.uk
Associate Online Editor David Price david_price@idg.co.uk
Associate Editor Karen Haslam karen_haslam@idg.co.uk
Associate Editor Neil Bennett neil_bennett@idg.co.uk
Forum Editor Peter Thomas moderator@idg.co.uk
Editor-In-Chief Matt Egan matt_egan@idg.co.uk

Contributors

Mike Bedford, Michael Burns, Alex Campbell, Martyn Casserly, Martyn Clayden, Stephen Dean, Cliff Joseph, Aryeh Klien, Tim McVeigh, Steve May, Alec Meer, Paul Monckton, Robin Morris, Jared Newman, Mikael Ricknäs, Agam Shah, Lisa Snider, John Taylor, Roland Waddilove, Iain White, Simon Williams

Advertising

Head Of Advertising Tom Drummond tom_drummond@idg.co.uk
Account Manager Edward Longmate edward_longmate@idg.co.uk
Account Manager Julian Tozer julian_tozer@idg.co.uk
Account Manager John Woolley john_woolley@idg.co.uk

Marketing

Marketing Manager Ash Patel ash_patel@idg.co.uk
Head of Marketing Design James Walker james_walker@idg.co.uk
Marketing Software Manager Letitia Austin letitia_austin@idg.co.uk
Subscriptions Customer Services pcadvisor@subscription.co.uk

Online

Online Development Manager Adrian Black webmaster@pcadvisor.co.uk
Web Developer Victor Chong **Junior Developer** John Copsey
Web Developer Dominik Koscielak

Accounts

Financial Director Chris Norman chris_norman@idg.co.uk
Credit Controller Dawnette Gordon dawnette_gordon@idg.co.uk
Management Accountant Parit Shah parit_shah@idg.co.uk

Publishing

Publishing Director Simon Jary sj@idg.co.uk
Managing Director Kit Gould kit_gould@idg.co.uk

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IDG UNITED KINGDOM

JIM MARTIN

Living with a phablet

Can a 6in phablet replace a smartphone and tablet?

There was a time when it was fashionable to have the smallest possible mobile phone. Back in 1999, Nokia released the iconic 8210. It was absolutely miniscule – you could almost fit two of them in the palm of your hand, and it weighed a feather-like 79g.

The five-line monochrome screen may have been tiny, but it was the keypad that caused the real problem as you had to press the buttons with your nail to avoid hitting more than one at a time.

Since then, phones have grown bigger and bigger: the original iPhone's 3.5in screen seemed huge at the time but compared with the raft of today's massive Android and Windows Phone handsets, it looks and feels like a toy.

I've been using a Nokia Lumia 1320 for the past couple of months and, as regular readers will know, it's been a dual-purpose test. One reason for ditching my usual iPhone was to try and live with the limited selection of Windows Phone apps and find out how they compared to the equivalents from Apple's App Store. The other was to discover whether a phablet offered the best of both worlds or not. With its 6in screen, the 1320 sits somewhat unevenly between my 4in iPhone 5 and 9.7in iPad Air and – in theory – could replace both.

Initially, the big screen felt enormous – just as you'd expect – and the extra screen real estate meant there was either more content on the screen (web pages, for example) or everything was just a lot bigger (Windows Phone's menus). Even though the screen's 1280x720 resolution is lower than the 1520's full-HD display, you don't really notice the lower pixel density in Windows Phone 8.

It's surprising how quickly you get used to making phone calls with such a big device – it doesn't take long to stop feeling self-conscious as there are so many other people carrying big phones now.

Comparing the 1320 with an iPhone 5 proved trickier than expected as Windows Phone is so different from iOS. Had the comparison been between the iPhone 5 and a theoretical 6in iPhone, I'm sure I'd have come to a different conclusion. As it was, I couldn't wait to put my SIM back in the iPhone and go back to having both an iPhone and iPad. Partly that was because I still preferred iOS to Windows Phone, and partly because I wanted to be able to use the apps that I couldn't get on the 1320.

The main reason, however, was because a 6in screen just wasn't big enough to replace the near-10in screen of the iPad Air. Those more used to using a 7- or 8in tablet might find the compromise acceptable, but I prefer to have the choice of a much larger screen for web browsing and a small screen for use on the move rather than being stuck with only a phablet.

For me, then, the trial has proved that a phablet can't replace my smartphone and tablet, but I miss the Nokia's large screen now I'm back to squinting at desktop-style web pages on the iPhone 5. By the time you read this, the iPhone 6 will have been announced: hopefully the rumours are true and I'll be able to upgrade to a big-screen iPhone before the year is out. ☒

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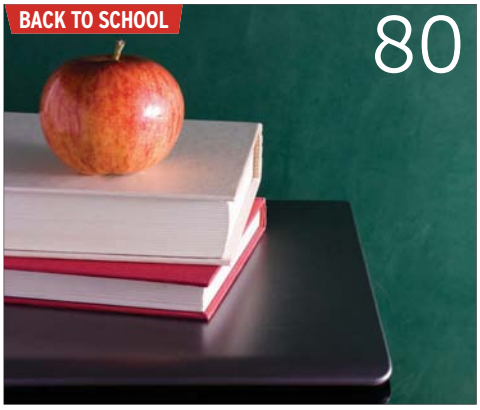

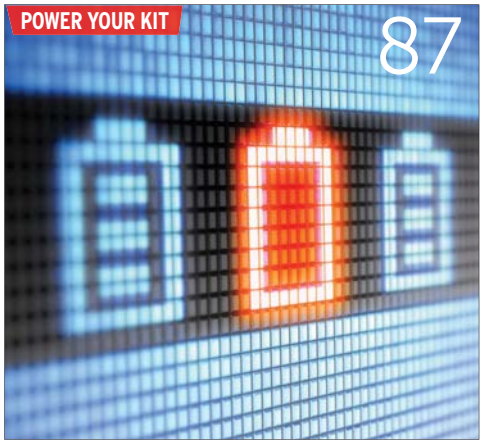

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TEST CENTRE

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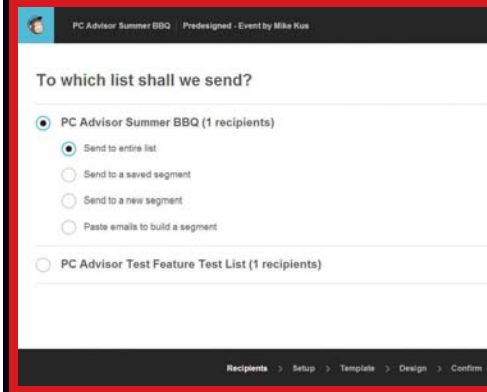
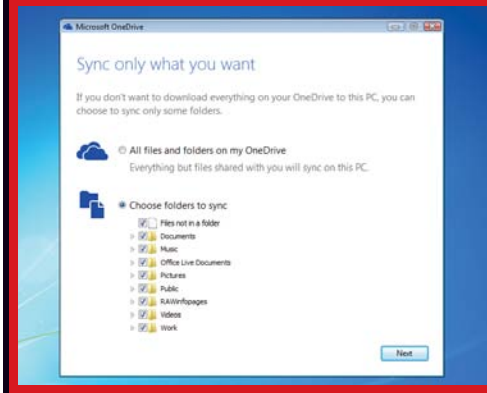




Intel aims 14nm 'Broadwell' technology at fanless tablets

Broadwell technology to power the 'Core M' for laptops and tablets, and the next-gen Core desktop chips

Intel recently unveiled its 14nm 'Broadwell' manufacturing technology, a capability the company believes will usher in a new generation of fanless Ultrabooks and tablets. It will underscore a new generation of products from tablets up through processors powering servers. Within the notebook and tablet market, those products will be known as the 'Core M'.

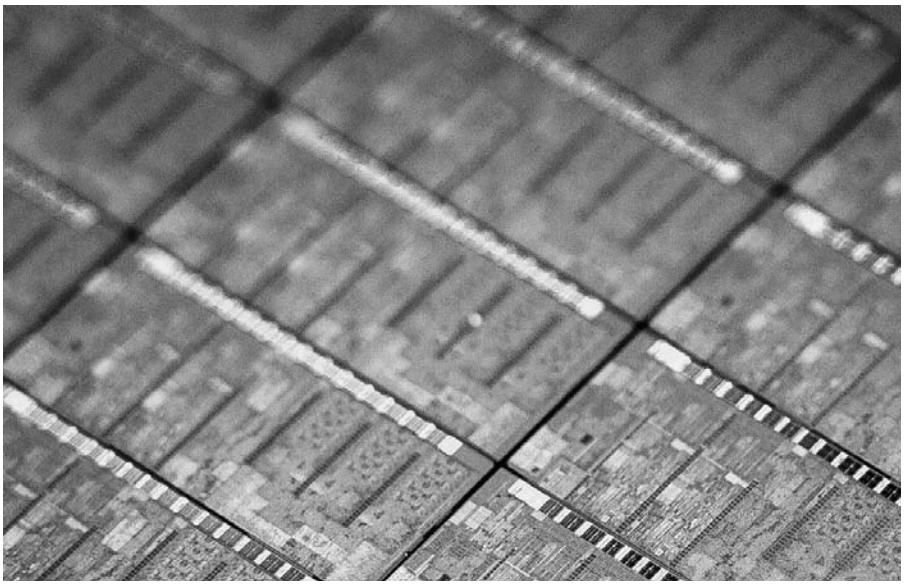
An Intel spokeswoman said the Core M will ship before the end of 2014, with systems on the shelves at the end of the year. Broadwell chips for the desktop, using the Core brand name, will follow shortly after.

Since the Broadwell generation represents manufacturing improvements and not a new chip design, the selling point is significantly reduced power. (Shrinking the process technology allows Intel the option to either increase performance, while holding power consumption constant, or cut power, while holding performance constant. In the notebook space, Intel has chosen the latter.)

This means laptops and tablets using the new Broadwell chips will offer the same performance as the current Haswell chips (which power today's Core chips), with the same battery life – but much lower power. In the real world, that will mean a "radically different" form factor: tablets 8mm thick or even thinner, revealed Stephan Jourdan, the chief architect of Broadwell and the director of Intel's system-on-a-chip architecture. Intel has already shown off one of those prototype tablets, known as Llama Mountain.

He said that tablets running Broadwell chips such as the Core M will consume 3- to 5W. The low power and thin design could mean eliminating one computing annoyance: the hissing fan.

That doesn't mean all Broadwell systems will eliminate fans, an Intel spokeswoman said. But OEMs will have the opportunity to design ultrathin tablets systems that could eliminate fans, a real first for the Core processor platform. "Putting the processor behind the glass is a lot more difficult than putting it in the base of an Ultrabook or notebook," argued Karen Regis, a mobile marketing manager at Intel.



Intel executives say it did achieve a modest five percent improvement over Haswell in the instructions per clock that Broadwell will achieve. In graphics, however, the new technology will significantly improve performance, with 20 percent more compute power and 50 percent higher sampling than Haswell, plus twice the performance of the video quality engine. Broadwell chips such as the Core M will support Direct X 11.2, and chips will support 4K and UHD resolutions.

Optimised for low power

On Broadwell, Intel's design team started with the goal of a Core processor operating within fanless tablets. "That was the starting point, that was the vision that the team started with," said Rani Borkar, vice president of the platform engineering group.

To reach that goal, Broadwell mixes in a number of improvements: from 14nm process optimisations and improvements in the chip packaging to more aggressive power management or quickly turning of parts of the chip that weren't being used. Finally, Intel attempted to reduce the power of those chips that are running at a given time as aggressively as possible.

The 14nm process cuts the power by 25 percent, compared with the 22nm technology used with Haswell. According to Mark Bohr, a senior fellow in Intel's manufacturing group, the 14nm process achieved a more than 2X improvement in performance per watt versus the 22nm technology used by Haswell. Intel has added a second generation Fully Integrated Voltage Regulator, delivering better efficiencies at lower voltages.

Intel has shrunk the processor package by more than 50 percent on the X and Y axis, and an additional 30 percent in height, Jourdan said, to 30x6.5x1.04mm thick.

The 'turbo boost' technology, which overclocks the chip in short bursts to quickly accomplish tasks and go into a low power mode, has also been improved. While Haswell's PL2 mode allows the system to run at a high-power draw for a few seconds, a new 'PL3' mode spikes performance even higher, though, just for a few milliseconds. Jourdan also said Intel did some major work rearchitecting I/O functions, such as memory and graphics, to help reduce power across the Core M processors themselves.

Broadwell systems will also do a better job in communicating information back and forth between system components, the processor, graphics, system fan, Wi-Fi chip, memory, battery charger, and more. The idea is to maximise the total battery life.

Windows Phone isn't dead, but it needs a reason to live

As Microsoft chases the low-end phone market, it could be neglecting one of its core strengths: productivity

After four years of uphill battles, Windows Phone appears to be reaching its peak. IDC recently estimated that shipments fell to 7.4 million units in the second quarter of 2014 – down from 8.2 million a year earlier – even as Android and iPhone shipments increased. As a result, Windows Phone's Q2 2014 market share dropped from 3.4- to 2.5 percent year-on-year.

The news has led some pundits to declare that Windows Phone is on life support, while others have expressed optimism that Microsoft can turn things around. But whether you're rooting for Windows Phone or not, it's hard to see its fortunes improving without a clearer turnaround plan.

The short-term strategy, as outlined by Devices group head Stephen Elop, is to try and sell lots of low-end Windows Phones in emerging markets, where the most growth is happening. In addition to producing more of its own low-cost handsets by converting future Nokia X devices into Windows Phones, Microsoft will allow cheaper handsets by dropping Windows Phone licensing fees.

But as IDC's numbers show, Windows Phone is no longer growing along with the low-end market. Android is likely winning because of its richer app ecosystem. And as Google rolls out its plan for sub-$100 'Android One' handsets, it's only going to get tougher for Microsoft to stay afloat. Simply producing more low-end phones won't be enough.

What about the high end? Again, we'll likely see more devices on the market, as Microsoft has made it easier for vendors to load Windows Phone on handsets originally designed for Android.

Still, there's no guarantee that wireless carriers in the lucrative US market are eager to sell these handsets. Reports have shown that customer service representatives steer people away from Windows Phone at every opportunity. That problem has plagued Microsoft for years, and it speaks to a larger problem: Android and the iPhone do such a good job of addressing most people's needs, it's not really clear who needs Windows Phone.

If there's any reason to be optimistic about Windows Phone, it's that Microsoft itself has a clearer vision for the kind of company it wants to be. When Elop says Microsoft hardware should showcase "the finest of Microsoft's digital work and digital life experiences," he's hinting at devices that are superior for productivity because of how they integrate Microsoft services. Perhaps someday, Windows Phones could appeal to that niche in the same way that Microsoft's Surface Pro 3 does.

But right now, all we have to go on are vague promises, and a strategy that seems to favour a low-end market that's suddenly slipping from Microsoft's grasp.

Microsoft pulls crippling patch from Windows Update

Tech giant is, however, still pushing a truncated version of the update that contained the flawed fix

Microsoft has withdrawn a patch for Windows Update. Identified as MS14-045 and one of nine released on 12 August, the patch addressed three vulnerabilities, including one related to a font bug.

Within hours of its release, however, users reported that MS14-045 had generated a Stop 0x50 error on some systems, notably on Windows 7 PCs running the 64-bit version of the OS. They were unable to start up their PCs and typical repair techniques, such as booting into Windows' Safe Mode, wouldn't work, some reported.

In response, Microsoft pulled the patch from its Download Center and revised the accompanying advisory. That was its only public message; the company's security centre didn't blog about the issue or tweet it had withdrawn the patch.

The company is, however, still offering part of MS14-045 to users via Windows Update. This was originally composed of two separate 'packages'; one pegged as 2982791 and the other as 2976897. The first of these – the fix for the font problem, and the one Microsoft told customers to uninstall – has been removed from Windows Update. The other is still being offered.

While Microsoft correctly identified the crippling package in a support document – actually, it tapped four, including two specific for Windows 8 and 8.1 – users who look at the list of available patches in Windows Update and take the time to examine each before installing may be confused, as 2976897 is also identified as associated with MS14-045. The 2976897 package, however, is safe to install, the tech giant said.

According to Microsoft, all versions of Windows, both client versions such as 7 and 8/8.1, and server editions such as Windows Server 2008 and 2012 R2, were fed the 2982791 patch package. It has not said when it would again offer the 2982791 part of MS14-045, saying only it was investigating the issues with that and the other three fixes it told customers to uninstall.

Sky tweaks Now TV pricing with Sky Sports Week Pass

Sky's Now TV streaming service has been popular since launch, but many users branded the pricing expensive, especially for Sky Sports. The firm has now changed its model with a new Sky Sports Week Pass. This allows viewers to watch a week's worth of sport for £10.99. The cost of a Day Pass has also been reduced to £6.99.
MORE: tinyurl.com/mjqbcrL

New BBC iPlayer coming to Xbox One

As a new version of iPlayer rolls out to devices, the BBC has confirmed that the Xbox One will be updated this year. The updated iPlayer has been rolling out since March, and although the BBC has announced its appearance on other devices, the big news is that Microsoft's Xbox One will get it by the end of 2014.
MORE: tinyurl.com/kst3oek

Mac vs PC returns in Microsoft's Surface Pro 3 vs MacBook Air advert

Microsoft has resurrected the age old Mac vs PC debate in its new advert for the Surface Pro 3. Just like it did at the launch event for the Windows 8 tablet, the tech giant has pitted the new Surface Pro 3 against Apple's MacBook Air laptop. With the tag line 'The tablet that can replace your laptop', the commercial shows off the benefits of the Surface.
MORE: tinyurl.com/Leu763p

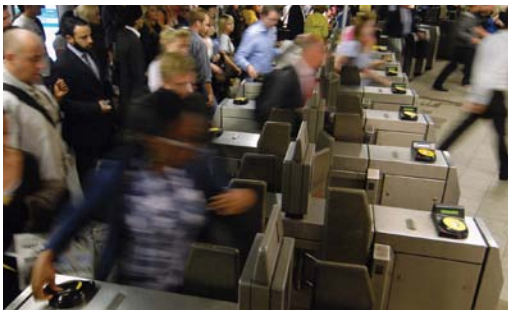
Contactless payments to launch on London public transport this year

Ditch your Oyster card for a range of contactless alternatives

Transport for London (TfL) has announced that all pay-as-you-go customers will be able to use contactless payments on the Underground, Docklands Light Railway, overground and trams. The new payment system, which came into service earlier this month, means that travellers can ditch their Oyster card for contactless credit, debit and pre-paid cards, as well as some smartphones.

EE confirmed that its customers will be able to travel on the underground, DLR and overground using their NFC-enabled smartphones. Users will be able to pay via the Cash on Tap app, which is free on the Google Play store and can already be used in shops such as Marks and Spencer and Caffè Nero.

"Offering the option of contactless payments will make it easier and more convenient for customers to pay for their travel, freeing them of the need to top up Oyster credit and helping them get on board without delay. The pilot has been a success, with participants giving us really useful feedback. This is the latest step in making life easier for our customers by using modern technology to offer the best service possible," said Shashi Verma, TfL's director of customer experience.



Transport for London

In addition to daily capping, a new Monday to Sunday cap will apply for customers using the contactless payment option. TfL's system will automatically calculate the best value fare for that week. The firm has also vowed to make it for customers to view their journey and payment history via and improved online account.

Gerry McQuade, chief marketing officer, EE said: "As more and more people benefit from the simplicity, convenience and security that mobile contactless payments offer, it's rapidly becoming clear that the days of the physical wallet are fast becoming numbered."

TfL trials free Wi-Fi on buses in London alongside other new technology

Two buses get free Wi-Fi but TfL needs a sponsor or two for further roll out

Public transport in London could about to be a whole lot more attractive with free internet access on buses – not just the underground. TfL is conducting a trial on two of its buses, so users can check their email, use social networks and browse the web on devices such as smartphones, tablets and laptops.

"It is hoped that if the trial is successful that sponsors would be found to enable it to be rolled out to further buses in the fleet allowing passengers to do more on our services, whether going to work, home or for a night out. A sponsorship would enable the technology to be delivered at no additional cost to taxpayers or passengers," said a TfL spokesman.

If you want to seek out these two Wi-Fi enabled buses then one is a route 12 between Dulwich and Oxford Circus and the other is a route RV1 between Covent Garden and Tower Hill.

The firm is also testing out a technology that analyses the CCTV system to tell travellers whether there are available seats on the upper deck. You'll

find it on a route 141 bus, which operates between Palmers Green and London Bridge.

Last but not least, new passenger information screens have been fitted to two route 12 buses. They provide real-time progress on a localised map, previous and next stops, anticipated time of arrival, and details of nearby transport interchanges.

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Cyberpolicing comes of age

The National Crime Agency is quickly becoming a major player in the fight against UK digital crime

The National Crime Agency (NCA) is soon to celebrate its first full year in operation, and the results, so far, show that this could become a key element in the fight against digital crime in the UK. A few months ago, we reported how the NCA, which includes the police's Cyber Crime unit, took part in an international, co-ordinated operation with the FBI and other agencies across Europe to bring down the creators of the Blackshades malware, which was being used to hijack computers and blackmail their owners. Now after a six month UK-wide operation, the NCA has announced the arrests of 660 suspected paedophiles.

In a statement the agency revealed that the operation targeted people accessing indecent images of children online. It has stayed covert until today in order to protect children, identify offenders and secure evidence. The NCA and its partners won't be revealing the methods they used to track down suspects so that they can use the same tactics again in the future.'

Since its inception, the NCA has used the collaborative power of regional and international police forces to accomplish its goals. The digital age has made this far easier, with the interchange of information and ability to analyse trends making law enforcement a truly modern affair, but, conversely, it has also given criminals more and more powerful weapons to use against their victims. The Cyber Crime unit is reported to have around four thousand specially trained intelligence officers who wage war on the variety of attacks that take place on a daily basis.

Tracking down the paedophile suspects isn't simply a case of monitoring Google searches results for keywords. Child pornography is heavily monitored by search engines due to its criminal nature, and after David Cameron pushed for even stricter filtering last year, both Google and Microsoft either delete images from searches or display warning messages at the top of any returns that may include the horrific scenes.

To find their evil fix, paedophiles are known to use encrypted private forums or head to the Dark Web, a sub-level of the internet akin to the dark alleyways where anything can be bought for a price. The Cyber Crime unit have be known to seek their prey in these shadowy corners of the web, infiltrating forums, and cracking the Tor browser – which afforded anonymity for its users – while also breaking up the Silk Road website that sold drugs, weapons, and various other illegal substances.

It's a battle that will only intensify while these arrests continue to threaten the profits of criminal activities. As encryption technologies change and the perpetrators, some of whom are essentially the digital arm of organised crime, adapt their methods to evade detection, the job of the Cyber Crime unit will increase in its complexity. This recent victory though has been hailed as a hugely significant operation, with the NCA confirming that its actions had safeguarded over 400 children.

"This is the first time the UK has had the capability to co-ordinate a single, targeted operation of this nature," said NCA Deputy Director General Phil Gormley. "Some of the people who start by accessing indecent images online go on to abuse children directly. So the operation is not only about catching people who have already offended – it's about influencing potential offenders before they cross that line.

"We want those particular offenders to know that the internet isn't a safe anonymous space for accessing indecent images, that they leave a digital footprint, and that law enforcement will find it." ☒

MARTYN CASSERLY

Government rushes through surveillance laws

The Data Retention and Investigatory Powers (DRIP) bill was made law in July, but it's raised questions about the government's motives and methods. We look at what the bill is – and why it's such an issue

The government was at the heart of a storm in July when it rushed a piece of new legislation through Parliament, leaving privacy advocates up in arms. The Data Retention and Investigatory Powers bill (DRIP), is designed to ensure that ISPs and telephone companies retain data about customers' calls and internet activities for twelve months, which the government and security services are then free to use as part of ongoing investigations.

The reason for the bill is to counteract a European Court of Justice ruling that was handed down in April, making it unlawful for this kind of data to be stored as it was a violation of users' basic human rights. The DRIP supporters, including the vast majority of both sides of the house and leaders of all the main political parties, argue that this kind of data is needed to capture paedophiles and prevent terrorist acts, with Conservative peer Lord Taylor of Holbeach stating: "If we don't take urgent action, lives could be lost." Home Secretary Theresa May was also unequivocal in the need for the legislation.

"If we delay [this bill's progress] we face the appalling prospect that police operations will go dark, trails will go cold, and terrorist plots will go undetected. If that happens, innocent lives may well be lost," she said.

While many would concede that intelligence agencies exist to utilise these sort of practices, and that no matter how uncomfortable this makes us feel, there's a solid argument for it, the main concern that was raised with DRIP was the way that the government pushed it through so quickly, giving MPs only one day to read, debate and vote on the bill. There was also the factor that, even though the government insisted DRIP wouldn't increase its surveillance powers and maintain the status quo, careful analysis of the bill suggested otherwise.

"Parliament has done a terrible thing," wrote Jim Killock, executive director of the Open Rights Group. "They've ignored a court judgment and shoved a complex law through a legislative mincer in three days. The Government was evasive and duplicitous, and they were in a hurry to cover their tracks."

Shami Chakrabarti, director at the human rights charity Liberty, also commented after the bill was passed. She said: "Far from 'maintaining the status quo', last week's political stitch-up, published after a behind-closed-doors agreement between Messrs Cameron, Clegg and Miliband, grants ministers astonishing new powers to pursue their thwarted 'Snoopers' Charter' – not just in this country, but across the globe. The Snoopers' Charter was torn apart by Parliamentary scrutiny. The Government's answer? Do away with democratic oversight."

It wasn't just advocacy groups who voiced concerns about the rapid nature of the bill, with several MPs commenting that more time was needed to review the possible implications of such powers being handed to security agencies. Labour MP Tom Watson launched a withering attack. "It represented democratic banditry, resonant of a rogue state," he said. "The people who put this shady deal together should be ashamed."

While around 50 MPs did rebel against DRIP, the bill was passed with an overwhelming majority. This might suggest a busy night in on the benches, but the sad truth was that only a handful of MPs even attended the House to discuss the controversial legislation.

Paul Bernal, a lecturer at University of East Anglia Law School, tweeted a picture of the scene, featuring vast empty benches in the commons, with the comment: "This is how seriously our MPs take privacy. Key, critical debate. Almost nobody here."

Balancing the need for security, law enforcement, and investigatory powers against a citizen's right to privacy is a huge political challenge. Edward Snowden has already shown how far intelligence agencies are willing to go, with both the NSA and GCHQ using questionable methods in their efforts to ensure the publics' safety.

With more people moving online, these debates are set to continue, which is why having time to discuss them thoroughly and maturely remains of the utmost importance. DRIP may have passed the vote, but the story hasn't ended yet, as part of a conciliatory measure the bill has a 'sunset clause' that means its power expires in 2016.

Then there's the more pressing issue that on 18 July the Open Rights Group announced its intentions to take the government to court over the DRIP legislation. Privacy might seem like a moot point in an age where so much happens on the web and can be easily found, but the landscape is changing, and laws that are made now could have many long-lasting repercussions. This is one case that's definitely worth watching. ☒

MARTYN CASSERLY

MICHAEL BURNS

Shooting stars

BBC used the Glasgow 2014 Commonwealth Games to trial 4K, augmented video and the Oculus Rift

The BBC has used the recently held Commonwealth Games as a testing ground for several new ways of delivering TV coverage of live events.

A special BBC R&D production was shown live in the Glasgow Science Centre for the duration of the Games (until 3 August), giving people a unique opportunity to see the very first live broadcast of a major sporting event in Ultra-High Definition (UHD) – aka 4K – which offers up to four times as much detail as standard HD broadcasts.

The video demonstrations formed part of the wider BBC at the Quay festivities. Central Londoners were able to view the action at the Media Cafe in New Broadcasting House.

Other technical innovations include a Venue Explorer, which allows you watch live video feeds on your tablet and then zoom into the images and pan around them. A fixed, wide-angle camera supplies UHD video, which means there's no resolution loss as you manipulate it. The audio is also remixed to correspond to the area being looked at, while graphical overlays provide local data.

Immersive viewing using virtual-reality technology is also being trailed. By combining the Oculus Rift headset as navigation toll with the department's ongoing research into 3D audio, viewers were able to experience being in the audience at The Hydro Stadium as events unfolded.

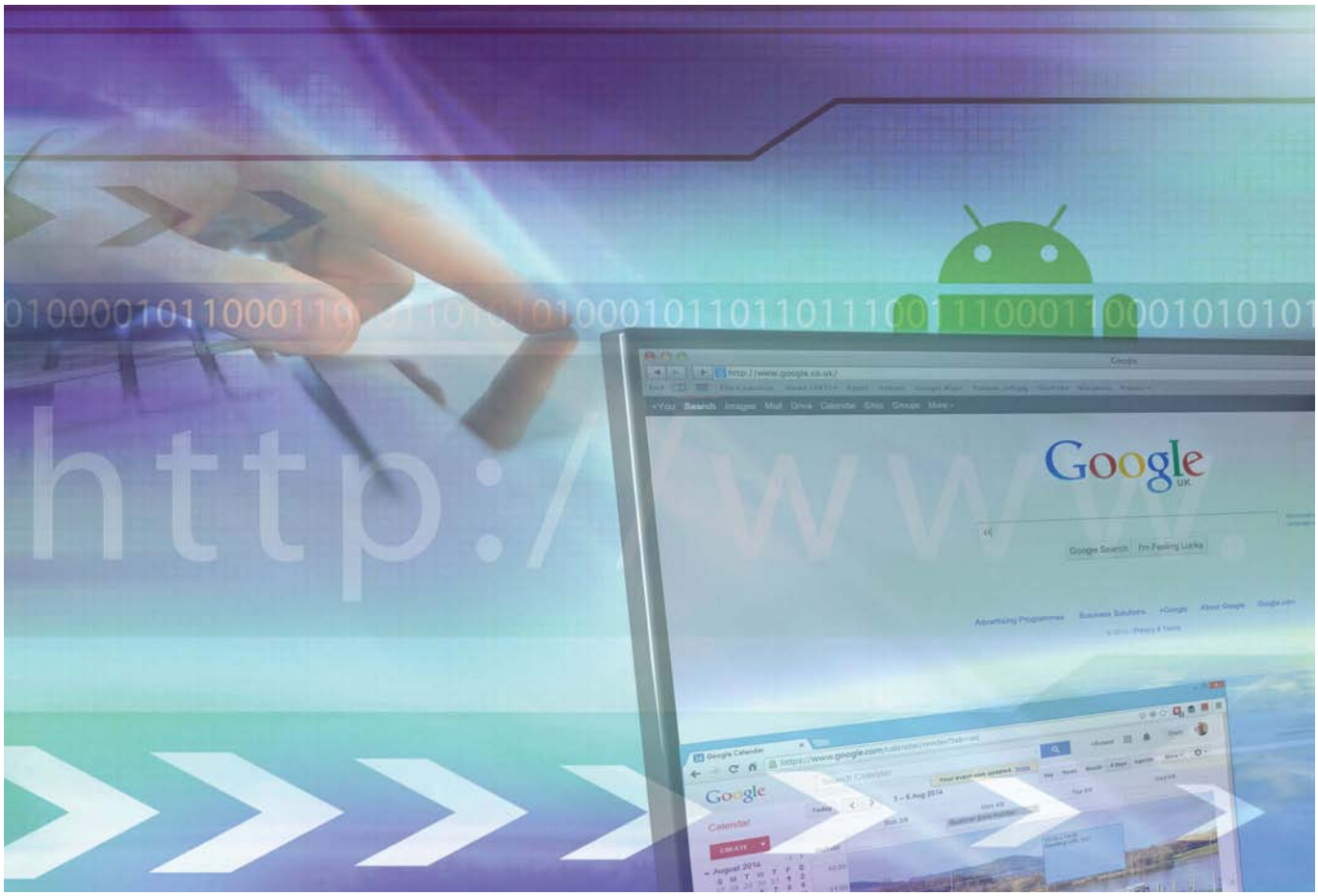
In another broadcasting first, that offers a lot of creative potential, the Commonwealth Games UHD broadcast from Glasgow was the first major live event to be produced and distributed entirely over IP networks. This was delivered using an initial version of BBC R&D's vision for a new broadcasting system, which aims to take advantage of the increasing speed and ubiquity of internet networks and IT technology.

One of the benefits of IP delivery will be to provide richer, more interactive and more personal ways of telling stories to audiences.

The BBC's Augmented Video Player is one example of this approach. It offered in-vision data during the coverage of The Games, overlaying gymnasts' performances with details of each movement they performed, thus providing an extra layer of information and understanding for the viewer.

"We may well look back at this trial as a watershed moment in the history of broadcasting," explained Matthew Postgate, controller of BBC R&D. "By proving, for the first time, that extremely complex events can be created and delivered completely over IP technology, we're opening up a whole new world of possibilities to programme makers and the wider industry as a whole." ☒

GLASGOW 2014
XX COMMONWEALTH GAMES



Concerned about privacy? Avoid Android (and the internet)

If you care about privacy don't use Android. But you should also avoid Google Search, and the web

A reader took me to task recently for saying in a Lumia vs Moto E comparison review that, unlike Windows Phone, Android harvests your personal data in order to sell it to advertisers (tinyurl.com/nptjdhc). In a sense the reader was correct: Google doesn't pass on your name and personal data to third parties. It doesn't sell data to anyone, and it collects only anonymous data on individuals. But when providing buying advice on Android devices I think it is valid to point out the implications of use of a Google device.

There was a time when iPhone and iPad ruled all, and Android was a poor relation. That's no longer the case. Recent versions of Android are just as intuitive, feature rich and good looking as is iOS. And because of the unique way that Android is open to manufacturers there's a broader range of Android phones and tablets than are available on any other platform. The app- and media support is incredible. Android is great.

Personally, I have used multiple Android devices and will continue to do so. But there's no escaping the fact that Android uses your data in a more aggressive way than does either Windows Phone or iOS. Or BlackBerry for that matter.

Personal profile

Google is an advertising business. It builds up an anonymised picture of users based on their use of Google tools from search to Gmail to calendar to Google+. Any time you use a Google service, that data is being put to use to increase ad sales. And with Android, it ties in all those things with personal data such as purchase history.

It doesn't sell that data to advertisers – that would be a bad business decision. If Google gave away its data, it would lose its competitive advantage. But it does rent this information, in the sense that advertisers can target Google ads at users based on all of this data.

Personally I have no problem with what Google does, and I expect it's inevitable that in time Apple and Microsoft will follow suit. We web users are all trained to expect something for nothing (up front), and in the longer term unless there's a significant backlash against data-driven advertising I don't see how rival companies can compete without getting involved. (Apple, for instance, does harvest the data, or at least reserve the right to do so. It just doesn't use it as Google does.)

However, right now this is a valid consideration for purchasers: if you are someone who cares deeply about privacy, you really shouldn't use Android. But then not should you use Google Search, any kind of web mail or – frankly – the internet. ☒

MATT EGAN

MATT EGAN

Introducing generation tech

We are witnessing the birth of a generation that's more tech-savvy than we are

Kids today, eh? They can watch whatever they want whenever they want, and they've never known life without always-on, connected, touchscreen devices. But where will that lead?

Recently, I had the pleasure of hosting my nephew and niece for a couple of days. A couple of days of swimming, petting farm animals and adults trying to stay awake until kids' bedtime.

As ever when in the company of small children, I was fascinated by their interaction with technology. My niece will happily play for hours with an Innotech tablet, and both are keen for a bit of time with a grown-up smartphone or tablet. Apps and websites are as much standard parts of their lives as are teddy bears and bicycles. But the really interesting thing to watch is how they get to grips for the first time with new devices.

My seven-year-old nephew is an early riser, allowed to watch a bit of TV before the rest of the household wakes up. At home, he uses a Virgin V Box and a DVD player. And he uses them sufficiently well to require his parents to switch the PIN to prevent any surprises when the monthly bill comes in.

We have a Sky+ HD box, however. So I spent a little time showing him how to switch on the TV and use the EPG. Within minutes he was streaming on-demand movies using functions and features I didn't know we had.

I shouldn't have been surprised. His cousin used to 'borrow' his mum's phone and capture videos of her ankles as she went about her daily chores. This wouldn't have been so remarkable were it not for the fact that he also used to post the clips to YouTube. He'd watched his mother do so, and followed the intuitive process on her Android phone. He wasn't even two at the time.

None of this is in the way of humble bragging about the children in my life. This is now standard behaviour from digital-native kids. Kids grow up expecting to be able to access everything, everywhere and at any time. And they expect to do so with a touchscreen.

There are a couple of factors involved in this trend. For one thing consumer tech companies, with Apple in the vanguard, have pushed hard to make computing devices easy to use. You really shouldn't need a manual to use any modern personal computer, regardless of the form factor.

But the critical factor is expectations. We recently gifted an iPad to my mother-in-law. She is capable, committed to lifelong learning, and computer literate. But still her first instinct upon booting a device new to her was to ask for advice on how to use it. Those of us not brought up with connected computers expect to have to learn how to use them, the first digital native generation fiddles around until they work it out.

Those of us beyond the teenage years are scared that we might break things.

All of which makes the next generations of technological development fascinating to anticipate. What will generation tech develop, and how fast will that make the already searing pace of IT development?

And what does that mean for culture – it can't all be good? None of my nieces and nephews can understand the concept of not being able to watch a particular show or movie, in any device, at any time. On TV they don't, as we did, watch non-offensive programming primarily made for adults. They watch only content aimed at their specific age group. They're never bored.

These are almost all categorically good things. But they do mean that generation tech is growing up in a subtly but significantly different way to every preceding generation of children. And where that leads no-one knows. ☒

CHRIS MARTIN

Time up for Microsoft's tablets?

With Microsoft's series of Surface tablets continuing to lose money, it's likely the Pro 3 will be the last

Microsoft recently launched the Surface Pro 3 in the UK and other countries, but it might be the firm's last Surface tablet if it doesn't take off.

Since the Surface series of Windows tablets launched in 2012, Microsoft has been losing money, but it's continued to create new versions of the product, hoping to crack the magic formula for a single device that's able to replace both your tablet and laptop.

It's a big challenge and we've seen very few good attempts at a hybrid or convertible device, let alone one we'd want to buy.

In the most recent quarter, ending 30 June, Microsoft posted a revenue of $409 million for the Surface. However, it didn't specify the cost of revenue – meaning there was no way of working out the gross margin and therefore an estimate of profit.

However,, our colleagues at Computer World worked out that the cost of revenue for the quarter was $772m. That put the tablet in the red to the tune of $363m, the largest single-quarter loss since Microsoft began providing quarterly revenue figures.

Some of this was down to Microsoft's 'decision to not ship a new form factor', i.e. the Surface Mini. The firm reportedly pulled out of the launch fearing that it wouldn't sell well enough.

That's not good, to say the least – and Microsoft's total losses to date, since the original Surface, stand at $1.7 billion.

With Microsoft cutting its losses on the Surface Mini, it needs the Surface Pro 3 to be a success to avoid canning it entirely.

The Surface Pro 3 is getting some great reviews, and while that's a good sign, it doesn't mean anyone is actually going to buy one. I've always really liked the idea of a Surface, but haven't yet taken the plunge. I feel, like most consumers, I'd rather just have a tablet or laptop. Or both.

Then there's the price. It starts at £639 in the UK, which isn't bad, but that's for the most basic model – and you can spend up to a whopping £1,649 for the top-line version.

The Surface Pro 3 may well be the best Surface yet, but I still don't think Microsoft is going to sell enough of them to recover that loss, let alone launch even more. ☒

Gateway to your kingdom

Why everybody should check and update their broadband router

In a recent test of wireless routers for the home (see our group test on page 72), I followed the usual best practices and updated all the devices with the latest available firmware from the manufacturer before putting each one through its paces. But whether you've just bought a new router, or are about to, or are using a model that's already a few years old, you should be doing the same right now. In fact, and as boring as it may sound, it's definitely in your interest to check- and update any router you use.

For the sake of performance testing alone, it can be essential to literally get up to speed with the latest firmware build. Many router manufacturers release their product half-baked, it seems, with listed features missing, incomplete or unreliable.

In the case of a Linksys router on test, the WRT1900AC, it's listed as an 802.11ac device, but a visit to the admin interface might lead you to think otherwise – there are no settings to adjust core parameters of the new higher-speed 11ac protocol. Typical tweaks such as width of radio channel and which legacy protocols to support are strangely incomplete. All we saw was a choice of 20- or 40MHz channels (draft 11ac is founded on 80MHz channels) and a choice of 11a or 11n protocols; but no 11ac. A Linksys spokesman assured us the router does work with 11ac providing you don't touch any of these settings.

But whether you surf at home at 500Mb/s or just 50Mb/s seems academic when the bigger issue is the fundamental security of your router. You can run all the anti-virus software and firewalls you like, but if your home router leaves the back door wide open, anyone and everyone can walk in.

Cisco is one company known to have made routers that have included such problems, as documented by its advisory warning in January this year (advisory code cisco-sa-20140110-sbd), which explained how the firmware designers created what's been euphemistically termed an Undocumented Test Interface – a backdoor hidden only by obscurity on port 32764 that allows an attacker to gain unauthenticated root access. In other words, hackers can own the router and play god over all that it routes. Which is to say, every PC, laptop, tablet and phone in your home.

For someone with the necessary intent, a fiddle with your DNS settings is all that's required to divert your visit from natwest.online.banking.co.uk to a facsimile site that instead will happily accept your login credentials, for surreptitious use later.

Cisco is far from alone. In fact there's sometimes a theme of insecurity in numbers, especially when different router manufacturers rely on using the same kit or code from other vendors. In January, enthusiast security researcher Eloi Venderbeken published findings that Cisco, Linksys (then a sub-brand of Cisco), Netgear, TRENDnet, Belkin and other lesser-known brands all suffered the same backdoor vulnerability. Further research suggested the common thread was that all affected routers were made by another company entirely, Sercomm of Taiwan/China, which builds these devices for the better-known companies. Even if you trust a big brand name, be aware that they may not know what's being sold in their name.

In July 2013, Independent Security Evaluators (ISE) published a report that explored the issue of insecurity in SOHO (small office/home office) routers. In other words, just the kind of consumer and enthusiast routers that we test and review at *PC Advisor*. The researchers looked at 10 routers from familiar names such as Asus, Belkin, D-Link, Netgear and TP-Link.

In what the researchers describe as a less-than-exhaustive study, they found 55 new, previously undisclosed vulnerabilities. Many of the routers shared the same vulnerabilities since they were based on the same common design again, despite sporting different company badges.

More recently, the results of a hacker competition at Defcon 22 were revealed. In a challenge entitled SOHOpelessly Broken presented by ISE and the EFF, the first stage revealed another 15 zero-day vulnerabilities in popular modern routers from Asus, Belkin, D-Link, Linksys and Netgear.

Less frequently evaluated in penetration tests of domestic router is the security of unofficial firmware – the open-source alternatives to the commercial software already installed on every router. There are now several projects to port special builds of Linux to popular home and office routers, under names such as OpenWRT. These are enthusiast-led collaborative projects from router users, who are fed up with closed-source and leaky software on the gateway to their kingdoms. As open-source software, source code is available for any interested party (white hat or black) to scrutinise.

These are typically ongoing projects, with rolling updates that would paralyse a 'normal' home user with their frequency. We wouldn't necessarily recommend an open source-patched router in a group test of home routers, which is we tested only with the installed firmware.

The example of open-source firmware in that last challenge did in fact survive the hacking onslaught, the EFF's own Open Wireless Router firmware.

But good security advice remains to check your router's firmware and update with patches as soon as they become available. Who knows, maybe your router maker has closed some of the gaping holes revealed in the past few disclosures? ☒

ANDREW HARRISON

Illustration: Aryeh Klien

Open source

In the technology industry, everybody steals. And that's a good thing, says David Price

A few years ago, I was asked to appear (extremely briefly) on a Channel 5 news programme and talk about Apple's then patent dispute with Samsung. In those days, the case seemed to have been going on for longer than Jarndyce v Jarndyce, and patience was running thin; most observers felt that Judge Koh should knock the executives' heads together and tell them to stop wasting the court's time.

Having never 'done TV' before, I was unprepared for a classic presenters' trick: rehearsing the interview beforehand as a means to appropriate my carefully prepared remarks and use them as part of the filmed questions. (Keep your powder dry during rehearsals if you don't want to look like a mug – there's a bit of free advice for prospective TV interviewees.) But more than this, I remember being thrown by the suggestion that Apple v Samsung "is just a playground argument, isn't it?" We were talking about products that bring in billions upon billions in high-margin revenue. How much more serious could it get?

The more I think about patent litigation, however, the more I wonder if the presenter was right after all – and as an Apple fan, the more relieved I am that Tim Cook's attitude to the courts is so much more hands-off than his predecessor's. Defending your intellectual property is one thing, but most of the major showdowns in the great mobile patent wars, once you forget about the number of noughts on the claims for damages, have been just as 'he started it' petty as the average primary school dispute.

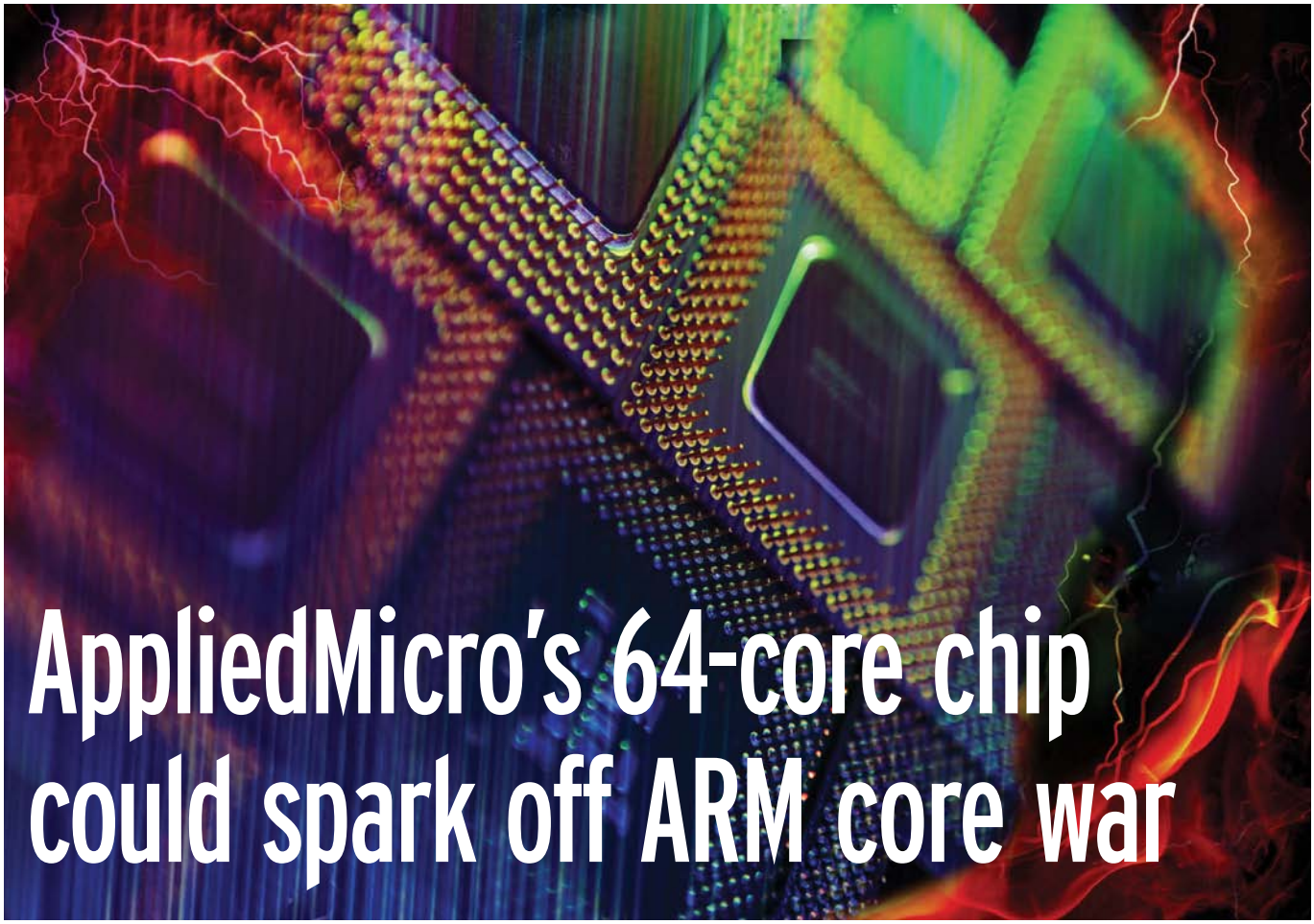
Because, when it comes down to it, all tech companies – indeed, all inventors – steal each other's ideas in some sense of the word. It's unavoidable. And it's a good thing. It's how the transport industry went from horse-drawn carriages to space shuttles within a lifetime. You couldn't double the number of transistors on a chip every 24 months if somebody had a patent on the transistor, and charged everyone else a licensing fee.

Steve Jobs once famously claimed – in characteristically melodramatic tones – that Android was a "stolen product", arguing that Google boss Eric Schmidt had used his time on the Apple board to gain an unfair advantage when launching Android a short while after the iPhone. (I'd take this with a grain of salt, but it's probably fair to say that Android was, at the very least, inspired by the iPhone, and that in its absence, it would have looked a bit more BlackBerry-esque.)

And yet, all these years later, it's Apple that's most often accused of technological larceny, with observers pointing out that the widgets, system-wide customisation options, whole-word predictive typing, app preview videos and other 'new' features in iOS 8 – even down to the "Hey Siri!" hotword voice activation – had appeared in some form in earlier editions of Android.

In the end, the truth is that each one of these great software platforms is utterly indebted to the other: that inspiration is a two-way street, and a vital part of the process of innovation. In 1979 Apple strolled into Xerox's research facilities and absorbed lessons that would manifest themselves in the Lisa graphical user interface; Microsoft took those ideas and carried them forward into Windows (at which point Apple did what it has since become famous for doing: rang up the lawyers). But the synthesis of those ideas, and the healthy competition between operating systems in the years that followed, forced each company to be more innovative.

iOS and Android couldn't possibly exist in their present incarnations without the other to spur them on, criticise and compete with them, and frequently inspire them. And, while it's entirely reasonable to defend the specific implementation of a concept, the ideas themselves need to be open to everyone for the good of the industry. ☒



AppliedMicro's 64-core chip could spark off ARM core war

AppliedMicro is to cram 64 cores in X-Gene 3 chip to crank up performance. Agam Shah reports

A decade-old race to crank up core counts in x86 chips may have lulled, but the competition has just started picking up in ARM processors.

AppliedMicro, which is makes 64-bit ARM processors, will put up to 64 cores in its upcoming X-Gene 3 server chip, revealed Gaurav Singh, vice president of engineering and product development at the company, during the recent Hot Chips conference in Cupertino, California.

The closest rival to the X-Gene 3 will be chip maker Cavium's ThunderX. The ThunderX is a 48-core ARM server processor and was announced in June.

The X-Gene 3 will be a big upgrade from another version, the X-Gene 2, which will have up to 16 cores. X-Gene 3 will ship to server makers for testing next year.

Adding CPU cores is a power-efficient way to increase processing power. ARM chips are typically used in smartphones and tablets, and AppliedMicro's goal is to put as many low-power cores as possible in a dense server so performance can be increased when customers need it.

"You can increase the performance density," Singh explained.

Chips based on the ARM architecture are also smaller, so it's possible to cram more CPU cores inside a dense server. By comparison, x86 server chips are bigger, generate more heat, and have to fit within the power limits of a system.

AppliedMicro's goal is to operate X-Gene 3 with up to 64 cores at speeds of up to 3GHz in servers that draw up to 160W of power, Singh said. The company is targeting its chips for use in web hosting, cloud applications and high-performance computing.

Chip makers started adding cores as an alternative to increasing CPU clock speed, which causes chips to draw more power. The 64 cores in X-Gene 3 tops the core count on any x86 or ARM server chip to date.

Intel has topped out at 15 cores on its x86 server chip, Advanced Micro Devices at 16 cores on its Opteron x86 chip and eight cores in its upcoming Opteron A1100 chip code-named Seattle, which is based on ARM.

The first multi-core chip, Power4, was introduced by IBM in 2001. The core war between Intel and AMD took off in 2004 and slowed down at the turn of the decade. ARM 64-bit servers have not yet shipped, but AppliedMicro has now fired the first salvo on the ARM front.

The first ARM 64-bit servers will come out in a few months, and "absolutely by the end of the year," Singh revealed.

The first servers will come with the eight-core X-Gene chip, which was introduced in 2011. AppliedMicro will bring performance improvements to X-Gene 2 and X-Gene 3, while shrinking the chip size, which will make it possible to keep adding more cores while keeping power draw in check.

Singh admitted the X-Gene has taken longer than expected, but the company's been putting in a lot of effort to develop the software and hardware ecosystem.

"We had to open a lot of doors to prove that we were a viable alternative," he explained. "We had to drive a lot of that ourselves, just to make sure the debuggers, operating systems and everything were up and running."

Intel, nVidia and AMD ship supercomputing chips with 60 cores and higher, but those are considered co-processors that work alongside main CPUs.

AppliedMicro shared details of its X-Gene 2 and 3 at the Hot Chips conference. ☒

Heartbleed exposes weaknesses in hardware design

Heartbleed highlights memory and cache architecture weaknesses, reveals Agam Shah

Data is vulnerable to hackers when in transit or in computer memory, argued Ruby Lee, professor of engineering at Princeton University's Department of Electrical Engineering, at a presentation to the Hot Chips conference.

The weakness is in the memory and cache, or secondary memory where data temporarily resides before being sent for processing or storage.

"This is correctly functioning hardware – with no bugs – but it is leaking out information," explained Lee, who was chief architect and one of the lead processor developers at HP before joining Princeton.

Securing memory was a hot discussion topic among chip experts at the forum, and Heartbleed sparked discussions on how hackers could access data from memory, storage and interconnects. Chip makers talked about hardware being the first line of defence against such attacks, and proposed techniques to scramble data and secure keys within a chip. A research project at Princeton funded by the US Department of Homeland Security recommended a new architecture that could secure memory and cache.

Heartbleed exposed a critical defect in affected versions of the OpenSSL software library, which enables secure communication over the Internet and networks. The bug affected servers, networking gear and appliances, and hardware makers have since issued patches to protect systems.

Heartbleed was a 'side-channel' attack that determined the availability of systems, and hackers could take advantage of defects in OpenSSL to read cache. It would be possible for attackers to steal important data such as passwords, private keys and other identify information from memory and cache, Lee told conference attendees.

"Lots of people have talked about the attacks, but very few people have talked about the solutions," she said. "The hardware is still leaking out your secret keys all the time. Every single piece of hardware that has a cache is vulnerable to cache-side channel leakage."

Weak link

The weak link is the fixed memory addresses of cache. Attackers can recreate the use of cache by a victim and map bits of keys to specific parts of memory used. Attackers can then extract data from the tracked memory addresses to reconstruct keys.

"Because there's a fixed memory address... the attacker can look backwards and figure out which memory addresses the victim used," Lee explained. "Then he can devise the whole key."

Attackers will be able to "read out the crown jewel of primary keys – the symmetric keys used for encryption and the private keys that are used for identity in the digital world that you should protect," she added.

It's difficult to launch software attacks on hardware, but side-channel attacks can be dangerous. An exposed system could be left vulnerable by other bugs like Heartbleed. "If the attacker can attack fixed systems, it's easier. Once he finds a path, he can attack 80 percent of the system and... when he comes back, he can find the same path in."

To mitigate such attacks, Lee and researchers at Princeton have reconstructed cache architecture so tracks left by the victim are effectively wiped out, making it difficult to carry out side-channel attacks. The cache architecture, called Newcache, could replace the exposed cache and memory in systems today.

"[DHS] would very much like the industry to adopt some of these techniques," Lee said.

Newcache is structured like regular cache, but has dynamic and randomised cache mapping that will make it harder for attackers to correlate memory usage to key bits. That will make it hard for hackers to map the cache and extract data.

"You want to be a moving target so that the attacker... can't get in the next hour or in an identically configured system," she added.

Newcache is ready to implement, and the additional security measures won't hurt performance. Memory typically slows down when new features – such as ECC for error correction – are added. But benchmarks of Newcache actually showed improvements in system performance.

"The secure caches are much bigger, they aren't any more power hungry, and with clever circuit design, aren't any slower than your conventional caches," Lee argued.

It could take years for chip and system makers to change memory features, but Lee said chip makers need to start thinking about securing data within systems.

Memory security should be a priority, Newcache or not. "Most of the security is done in a reactive mode. When an attack happens, people scramble to find a defence and close up a hole," Lee added. "You've got to think ahead." ☒

Motorola is back, back, back

Motorola has more than doubled its smartphone sales in the past year. Mikael Ricknäs explains how it did so

Motorola Mobility has made an unexpected comeback thanks to its popular Moto G and Moto E smartphones, but increased competition and its looming acquisition by Lenovo make its future far from certain.

What a difference a year makes. Motorola sold 8.6 million smartphones in the second quarter, up from 6.5 million in the first three months of the year, and more than double what it sold in the same quarter a year earlier, according to ABI Research.

The figures pale in comparison with those of Apple and Samsung, which sold 35.2 million and 75 million phones last quarter, respectively. But Motorola is in a position few thought it would reach just a year ago.

"The resurgence has slightly surprised me, to be honest. I didn't expect to see Motorola come back in a meaningful way, but it actually has," said Nick Spencer, senior practice director at ABI Research.

Ben Wood, director of research at CCS Insight, agreed. "If you'd asked me about Motorola a year ago, I would have said it was on a trajectory towards oblivion," he said.

Motorola's turnaround can be attributed only in part to Google, which announced it would buy the handset maker three years ago. The deal gave Motorola a new lease on life, but Google operated Motorola largely at arm's length, and it now plans to sell the division to Lenovo.

It took more than two years after the Google deal for Motorola to release a phone that resonated with consumers. Its first device was the high-end Moto X, but not using the latest components and relying on software features to attract buyers turned out to be a miscalculation.

But thanks to the Moto G, the LTE version of that phone and the Moto E, Motorola's sales have turned a corner. The company has hit on a winning formula, offering phones at lower prices but with features good enough to please many consumers.

"As the market for flagship smartphones has softened and a lot of people are looking at buying devices without a contract, Motorola's Moto E and G seem to have really captured the moment," Wood explained.

The strategy to pair decent specs with a low price isn't the only reason for Motorola's comeback. Avoiding the cluttered interface found on many other Android products also helped, according to Roberta Cozza, research director at Gartner. And while the US remains an important market for Motorola, traction in India and a return to Europe have also lifted its sales.

Motorola is expected to release successors soon to both the Moto G and the Moto X. But with interest growing in low-end smartphones, the Moto G will face more competition this time around.

"Motorola is doing well right now, but other vendors are observing its success with great interest. You can expect to see a slew of affordable Android devices from the major brands during the rest of the year," argued Wood.

Samsung has signalled it will increase its efforts in the low end of the market. The company is still the world's biggest smartphone maker, though, it had a difficult second quarter. Local stars like China's Xiaomi and India's Micromax have, like Motorola, benefitted from the growing popularity of affordable phones.

Analysts say the Moto G stands a good chance of becoming another hit, even if it faces more competitors. But success at the high end with the Moto X may be more difficult to come by.

"That segment of the market is very saturated, and it's just tough to stand out," Cozza said. But he added that there may be more openness to trying Android devices from brands other than Samsung.

How the future will play out under Lenovo remains to be seen. The acquisition is still going through regulatory approvals, but it's expected to close by the end of the year.

"Lenovo arguably made a very astute move to acquire Motorola at the time it did," argued Wood.

Since Microsoft bought Nokia, it has had to lay off workers and cut costs to get the company back in profit, he said. "Google has been through a lot of that pain," Wood explained. Motorola may be losing money, but it's now a leaner company focused on a vibrant part of the market, Wood said.

The challenge for Lenovo will be to find the right branding strategy. When it bought IBM's PC business 10 years ago, it had only the Think brand to deal with, which had a solid reputation. This time, Lenovo has to square its own Vibe brand with the Moto brand, and decide how to use the Motorola name.

One thing is for sure: Lenovo can't waste time on a long integration process if it wants to build on Motorola's comeback. It needs to keep the company's supply chain working smoothly, and it should follow through on Motorola's road map rather than waste time rethinking it, according to Wood.

Lenovo should also be careful not to take too much cost out of Motorola's products, because "the colour, material and finish on Motorola's devices is exceptional for the price point," Wood said. "When I've compared it to some of Lenovo's own Android products, they don't necessarily reach such a high bar." ☒

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Microsoft to speed up Bing with FPGAs next year

Agam Shah says Microsoft's experiment of using FPGAs to deliver faster search results is bearing fruit

It started off as an experiment, but Microsoft now wants to speed up and return more accurate Bing search results with the help of reconfigurable chips called FPGAs (field-programmable gate arrays) in data centres.

Next year, the company will start installing FPGAs in its data centres, hoping to speed up and increase the accuracy and relevancy of search results.

"Increasing capabilities and reducing the cost of Microsoft cloud services relies on increasingly efficient hardware," explained Andrew Putnam, a researcher at Microsoft, during the Hot Chips conference in Cupertino, California, on Wednesday.

The FPGAs are intended to help the tech giant deliver text and image search results much faster. Their use will also reduce the number of servers for processing search requests in Microsoft's data centres. They will be used in specially designed servers and will be connected through a specialised cable called Catapult.

"Hardware specialisation is... possibly the way to gain efficiency and performance we need to improve data centre services. The Catapult reconfigurable fabric offers a flexible, elastic pool of resources where we can build these kind of accelerators," Putnam said.

Catapult started off as the name of an experiment in 2011 to put FPGAs in servers, and as a way to circumvent traditional data centre designs. Microsoft was playing with the idea of specialised hardware to tackle processing for Bing, which would be faster on FPGAs than through traditional CPUs.

"Technology has not been a friend... in the last handful of years. It becomes more and more difficult to get those kind of efficiency gains and cost reductions by just waiting for technology to get better," Putnam argued.

An experimental deployment of FPGAs in 1,632 servers in Microsoft's data centre yielded promising results.

"The FPGAs provided two times improvement in throughput and 29 percent reduction in network latency. Half the servers were required to do all the processing," Putnam revealed. "If we need to improve the efficiency of the architecture, we can do it via hardware specialisation."

But the decision to deploy FPGAs took a while. Microsoft initially looked at FPGAs and ASICs (application-specific integrated circuits). ASICs would be better on the power-efficiency scale than FPGAs, but they would be less flexible regarding software. But FPGAs, with their ability to be quickly reprogrammed, can be repurposed much more easily.

"As soon as the software changes, that FPGA accelerator can be updated along with the application change. But the ASIC is going to be a waste of power, or going to hold software development back," Putnam said.

The FPGAs run code to determine query results, which are then sent back to the CPU for delivery to the web. The faster computing through FPGAs allows for more services to be separated, differentiated and applied.

One service could allow filtering and ranking of results. A separate service within the FPGAs could provide scores and measure relevancy of queries to results. The scores are then sorted and returned as results. It also allows more maths and image recognition services to be applied to the results.

But as the number of FPGAs grows, it could be a challenge reprogramming all of them. Microsoft's data centre administrators hated the idea of FPGAs in servers. There were many reasons for the FPGA model not to fit well in data centres.

"First of all, it's a single point of failure and it complicates the rack design, the thermals and maintainability. You have an FPGA box that's spitting out a ton of heat, all the other servers are at a different level and it becomes really hard to control," explained Putnam.

It's also a security nightmare, as the FPGAs run different operating system images and software than conventional servers. FPGAs on the main network would also create latency problems, limiting the elasticity of a data centre, Putnam said.

In 2011, Microsoft designed prototype boards with six Virtex-6 FPGAs and Intel Xeon CPUs. The plan was to put these boards into 1U, 2U and 4U rack-mount servers and slip them into racks across data centres. But that didn't work out well.

So when reconsidering implementing FPGAs in data centres, Microsoft set up two design requirements. The FPGAs would go into dedicated servers that could be used for tasks outside processing Bing search. Also, the server couldn't increase the hardware failure rates or require network modifications.

Limitations were also set for Microsoft's server design team: the FPGAs had to be less than 30 percent of the cost of a server, and couldn't draw more than 10 percent of the overall power drawn by the system.

And that led to the birth of the Microsoft Open Compute Server, a 1U-tall server with a PCI-Express slot that could squeeze in a single FPGA. The compact server had two eight-core Xeon CPUs, 64GB of DRAM, two solid-state drives, four hard drives total and a 10Gbit Ethernet slot. The servers were used in the experiment earlier this year. Your only slot for adding accelerators was tiny, about 10cmx10cm," Putnam said.

The FPGA accelerator board was an Altera Stratix V G5 D5 card, which had an 8GB DDR3, 32MB flash and eight-lane Mini-SAS connectors. It was plugged into a PCI-Express slot. The FPGA on each server had a heatsink of its own. The CPUs and other components generated a lot of heat, and the FPGA were getting baked in a 68ºC inlet. "That's the air we're supposed to cool the [FPGA] with," Putnam remarked.

The FPGAs were built on a specialised network connected through cables. Search requests were bounced from the CPU to a local FPGA, with the request then rerouted across a separate network of PGAs covering computer vision, math acceleration and other search services. The FPGA network was scalable, and didn't rely on the network connecting the computers.

"From the perspective of a CPU, its local FPGA can handle what actually took a lot of FPGAs," revealed Putnam. "You can add a bunch of services to this kind of FPGA network. Every CPU thinks it's attached to all of these services."

As the number of FPGAs in a data centre piles up, programming them could become a nightmare. Microsoft has ported over filtering, ranking, relevancy and sorting tools so FPGAs remain relevant and are easier to reprogram. "They are actually going to push [FPGAs] into their data centres, but of course, in order to keep them there, we're going to have to really improve the future of programmability," Putnam explained.

Galaxy Note 4 won't turn around Samsung's ailing fortunes

Samsung needs better high-end smartphones and a better portfolio of low-end devices, argues Mikael Ricknäs

By the time you read this Samsung will have launched the Galaxy Note 4, in a bid to help improve its ailing fortunes in the high-end segment of the smartphone market. But the company's problems run deeper, with local vendors eating its lunch with cheaper devices in countries like China and India.

The launch took place simultaneously in Berlin, Beijing and New York on 3 September. The company usually launches a new version of its Galaxy Note line at the IFA trade show in Berlin, and this year was no different with the invite telling people to "note the date".

The launch comes after a second quarter that was catastrophic for Samsung. The company may still be the largest smartphone vendor in the world, but its market share dropped from 32.6- to 25.2 percent. And while overall sales grew by almost 27 percent, Samsung's shipments dropped by 1.5 million units to 74.5 million smartphones, according to Strategy Analytics. The Note family has become very important to the tech giant, but something more is needed to give the company a real boost.

"I think Samsung is in a holding pattern at the moment. Any new device launch at this stage is really focused on stabilising rather than regrowing its device business. For Samsung to revitalise its sales, the company needs a revolutionary design, something like a foldable or bendable screen to shake up the market," argued Neil Mawston, executive director at Strategy Analytics.

The Galaxy Note 4 is more of an evolution of the existing Note 3 model. Its specifications include a 5.7in screen with a 2560x1440-pixel resolution and Qualcomm's new Snapdragon 805 processor.

Even if the Galaxy Note 4 is an incremental update under the hood, Samsung has to show it has learned from the "Galaxy S5 debacle," according to Neil Shah, research director at Counterpoint Technology Market Research.

The Galaxy S5 has been seen by many as a disappointment, largely because it doesn't have a more luxurious design like the HTC One M8 to help set it apart from previous models and cheaper smartphones.

Speaking before the launch, Shah said that: "I hope the Note 4 will have all those factors missing from the S5. For example, a premium design with a new design language that includes some metal instead of the plastic design of its existing products. If you look at the Note 2 and 3, and the Galaxy S4 and S5 from the front they all look the same."

At the time of writing, Apple was expected to launch new iPhones with bigger screens just a couple of days after the Unpacked event, so it was thought that Samsung would have something special in store to avoid further market share losses.

To turn around its fortunes, Samsung also has to woo consumers in countries such as China and India with an improved portfolio of low-cost smartphones. As sales in Western countries have stalled, emerging markets have taken over as growth engines.

For example, in India just six percent of the population are expected to own a mobile phone in the first half of the year, according to Strategy Analytics. India also added 28 million mobile subscribers during the first quarter, the largest increase of any country in the world.

In both China and India, Samsung's smartphone sales are suffering at the hands of local companies.

"Consumers buying smartphones from local brands have been a trend from the last four or five years, and is snowballing at the moment," explained Mawston.

In China, Xiaomi was either neck and neck with Samsung or on top during the second quarter depending upon whom you believe. In India, Micromax has already surpassed Samsung's overall phone sales and is catching up on smartphones.

The sheer number of products Samsung is offering has become confusing to consumers and its low-end smartphones are also too expensive.

"The prices are almost 30- to 40 percent higher than what Chinese and Indian brands would charge for smartphones with similar specifications," Shah said.

There are several reasons for the progress companies such as Xiaomi and Micromax have made. One is the growing availability of so-called reference platforms or designs. Even Google is getting involved with Android One, a program designed to help vendors build high-quality smartphones priced under $100. The first products will come from Micromax and other Indian smartphone manufacturers such as Karbonn Mobiles and Spice this fall.

What the reference platforms have done is lower the bar for developing smartphones by providing the components and resources that manufacturers need to quickly and cheaply put out devices. So even vendors that lack the huge research and development departments found at Apple or Samsung can still offer competitive products.

To better compete in this segment, Samsung has to make some big changes, like consolidating its portfolio and accelerating the refresh cycle, according to Shah. It also has to cut prices and offer more high-end features on its cheaper models, according to Mawston.

Regardless of what happens next, the big winners will be consumers who, thanks to increased competition, get access to more advanced smartphones at better prices.

LTE in Wi-Fi spectrum shows great potential, says DoCoMo

The growing popularity of Wi-Fi means LTE isn't necessarily needed, according to analysts. Mikael Ricknäs and Tim Hornyak investigate

In the hunt for new ways to handle growing data volumes, NTT DoCoMo and Huawei Technologies have demonstrated that LTE can be deployed over 5GHz, which today is used for Wi-Fi networks.

One of the ways mobile operators can boost capacity in their networks is to increase the amount of spectrum, which could be compared to adding more lanes to a highway. The 5GHz band is one alternative they and other vendors have started to look closer at.

The indoor test found that LTE can work in the 5GHz band at speeds of up to 100Mbit/s, DoCoMo said via email. The test showed so-called LAA (Licensed-Assisted Access) can be used to enhance current LTE networks, and also networks based on LTE-Advanced. The plan is to use LTE at 5GHz alongside Wi-Fi networks to improve capacity using small base stations or cells, a scenario where it shows "great potential," according to DoCoMo.

Today's mobile networks use licensed spectrum, which operators are granted access to by local telecom authorities for a fee. Unlicensed spectrum is free for anyone to use as long as they stay within rules for operating in the band. The lower cost is the upside, while unpredictable performance is the drawback.

DoCoMo, Huawei and other companies such as Alcatel-Lucent, Nokia and Qualcomm are looking at using unlicensed spectrum for just download traffic or for download and upload traffic. Another alternative is to combine the two spectrum types using carrier aggregation, which is the most important LTE-Advanced feature. It allows networks to devote more resources to some users by treating two or more channels in the same or different frequency bands as if they were one.

The work on using LTE in unlicensed spectrum such as the 5GHz band is still in its infancy, and even though DoCoMo thinks the technology looks promising it doesn't have a solid plan to commercialise it at the moment.

"Currently, we are aiming to finish the joint experiment by fiscal 2015. The next step will be to develop a technology that will enable LAA and WLAN to efficiently coexist in the same spectrum. We hope LAA will be standardized with the Release 13 LTE which should come out in fiscal 2016," a DoCoMo spokesman said.

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Samsung Galaxy Alpha

Smartphone

Samsung has finally introduced some cold, hard metal into a smartphone design in the form of the Galaxy Alpha. Like the Galaxy S5, it has a fingerprint scanner and heart rate monitor, though, the Alpha has a smaller 4.7in 720p screen, a 12Mp camera and no microSD card slot.

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Bang & Olufsen has launched three new limited edition models of its BeoPlay H6 headphones in Blue Stone, Bronzed Hazel and Graphite Blush. They all come with a daisy chain functionality for sharing your tunes and an in-line control with a microphone.

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Microsoft Xbox One Call of Duty bundle «

Games console

The Xbox One is not a new product but this bundle may tempt a few gamers out there. The special edition Call of Duty Advanced Warfare console comes with a customised exterior with a 1TB hard drive and a new controller design. It also includes the Day 0 edition of the game.

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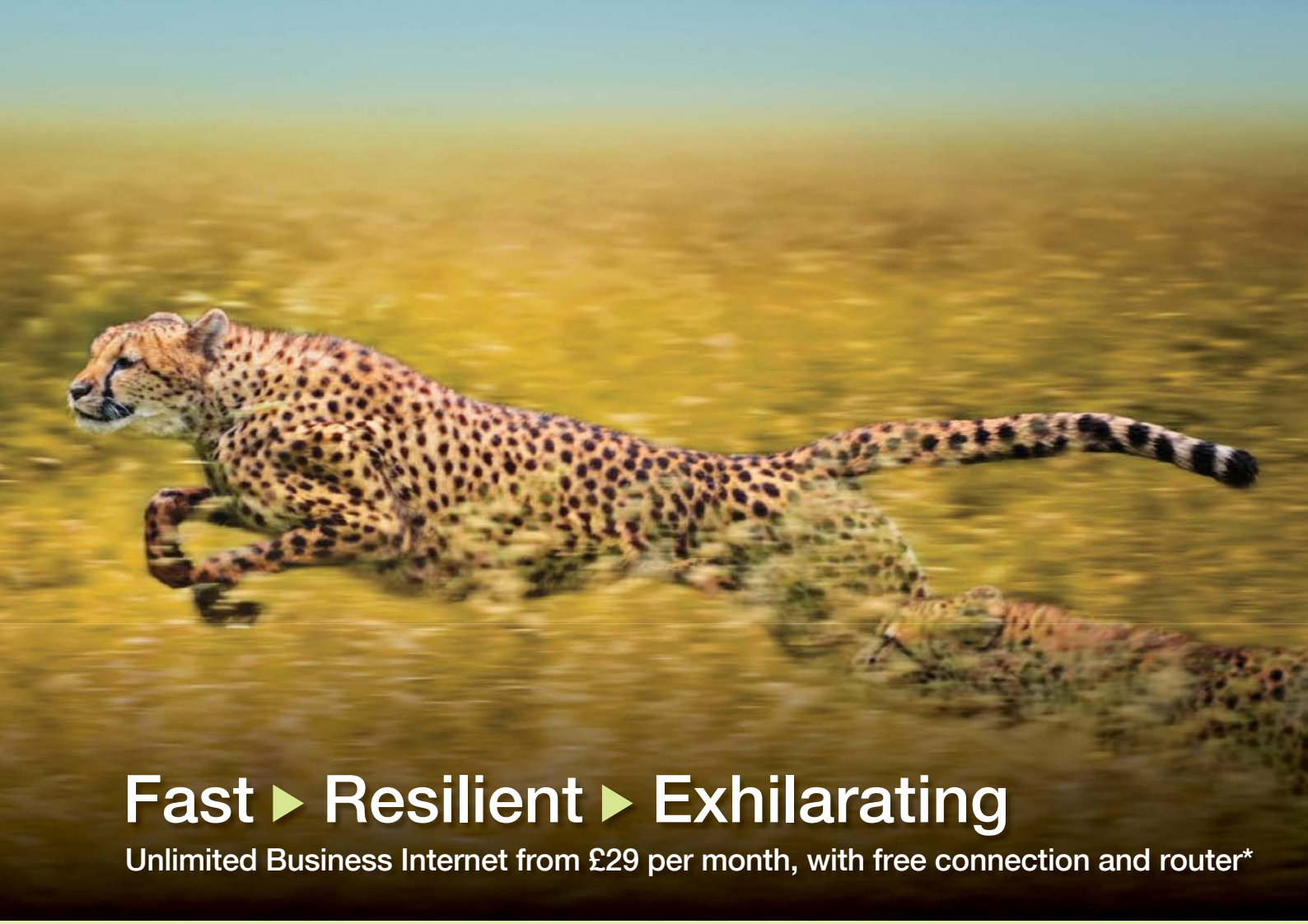

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Acer Chromebook 13 »

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Acer's new Chromebook 13 is the first to feature an nVidia Tegra K1 quad-core processor, clocked at 2.1GHz. The firm claims it's one of the thinnest Chrome operating system laptops around at 18mm, and will provide an impressive battery life of up to 13 hours.

$279 (£167)

acer.co.uk

« Nokia Lumia 530

Smartphone

Microsoft's latest entry to the budget smartphone market is the Lumia 530, which will come with Windows Phone 8.1. It has a 4in LCD screen, a 1.2GHz quad-core Qualcomm Snapdragon 200 processor and 512MB of RAM. There's no front camera or 4G support, though.

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Not all smartwatches have a huge touchscreen and the Cogito Classic is one of them. Instead, it looks like a regular wrist watch, while providing notifications in the background when connected to an iOS or Android device. It's available in different colours and is waterproof up to 100m.

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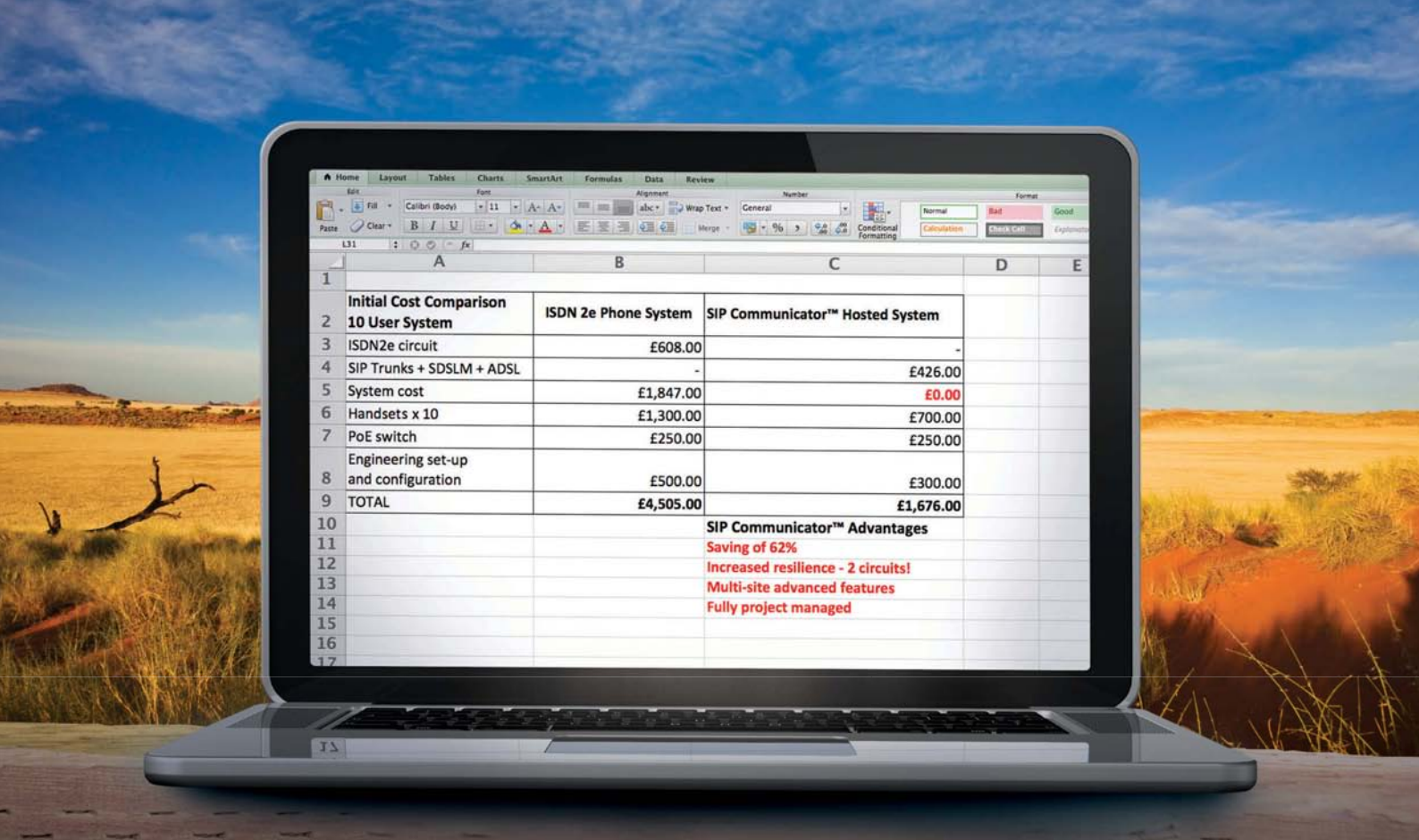

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LAPTOP

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System requirements
17.3in (1920x1080) glossy TN display; 2.4GHz Intel Core i7-4700HQ (3.4GHz Turboboost); AMD Radeon HD8800M (2GB VRAM) + Intel HD 4600; Windows 8.1 (64-bit); 16GB DDR3L RAM; 1TB hard drive (5400rpm) + 8GB SSD; 802.11b/g/n/ac; Bluetooth 4.0; 1x HDMI 1.4, 1x VGA, 2x USB 3.0, 2x USB 2.0, SDXC card slot; gigabit ethernet; 720p webcam/microphone; 1x headphone, 1x microphone socket; 48Wh lithium-ion battery; 413x268x33mm; 2.7kg

Build: ★★★½☆
Features: ★★★★☆
Performance: ★★★★☆
Value: ★★½☆☆

If you're looking for a 17in desktop replacement that provides stronger all-round performance and a wide range of features, then Toshiba's Satellite S70-B-10N is worth a look.

It makes a good first impression with its smart black-and-silver trim. It's a little chunky at 33mm thick, and with its 17.3in screen and built-in Blu-ray drive, it weighs 2.7kg, which is only slightly heavier than many 15in Windows laptops. It's certainly no Ultrabook, but you can move it around at home or in the office without any trouble.

The plastic casing doesn't scream 'premium quality', but it's sturdy and the firm keyboard panel feels comfortable when typing at speed.

The aspect ratio of the widescreen means there's room for a numeric keypad, and good size trackpad (105x70mm) is included, too. A large Harmon Kardon-branded speaker panel runs across the top of the keyboard, and speakers within provide plenty of volume and a more solid bass sound than most laptops.

Connectivity options include gigabit ethernet for wired networks, and both HDMI and VGA ports for connecting to external displays. Now running Windows 8.1, you can also try Miracast for streaming video wirelessly from the Toshiba to a compatible display.

Unfortunately, the built-in screen didn't live up to expectation. As you'd expect, the 17.3in display provides full 1920x1080 resolution for high-definition video. It's bright and colourful, and provides good horizontal viewing angles, but vertical viewing angles are more limited. The image darkens noticeably when you tilt the screen panel backward or forwards by just a couple of inches, and we often found ourselves nudging the screen in order to improve visibility.

It's not a fatal flaw, and the S70 is still a choice for watching streaming video and Blu-ray films, but a laptop of this price needs to include a decent quality display with better all-round viewing angles.

Speed performance is impressive, though. The S70 is equipped with a quad-core Haswell-generation Intel Core i7 running at 2.4GHz, 16GB of memory, a hybrid 1TB hard drive that includes an 8GB solid-state module. Graphics comprise an AMD Radeon HD8800M processor alongside Intel's integrated HD 4600 option.

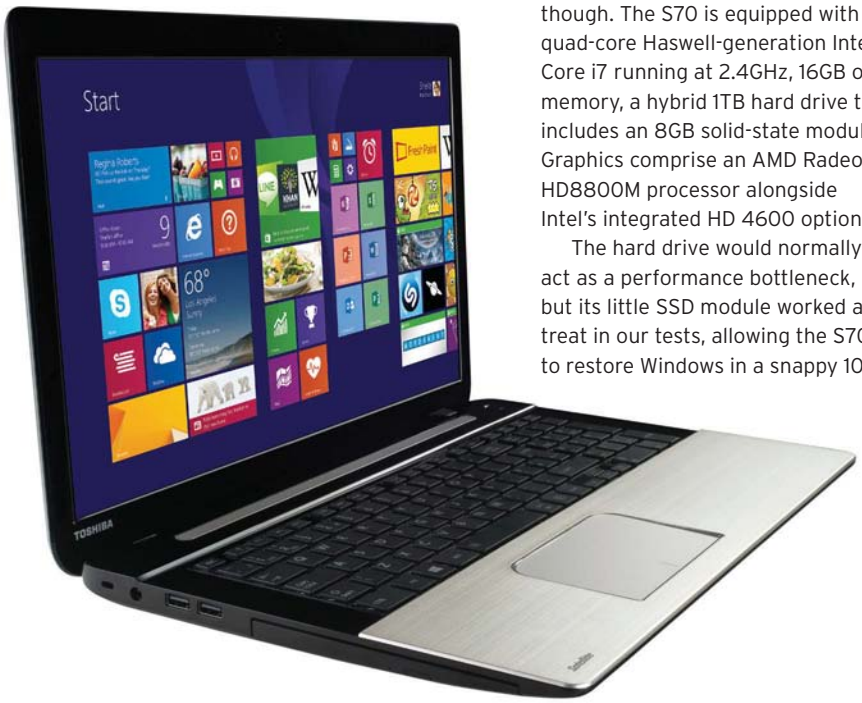
The hard drive would normally act as a performance bottleneck, but its little SSD module worked a treat in our tests, allowing the S70 to restore Windows in a snappy 10 seconds when using the Windows 8 fast-start option.

The laptops managed a strong score of 5288 points when running the general-purpose PCMark 7 tests, which is good going for a laptop that doesn't include a proper SSD.

It also does well in the Home and Work test suites in PCMark 8, with scores of 3429 and 3238.

It can even handle some solid gaming action as well. The S70 isn't designed as an all-out gaming rig, but its Radeon HD8800 turned in good performance with demanding games such as Batman: Arkham City. At screen-native 1920x1080 resolution with DirectX 11 and High graphics settings, the S70 still managed a perfectly playable 38fps. We only had to step down to 1600x900 to average 50fps.

Switching to the less power-hungry integrated graphics still only allowed us to get three-and-a-half hours (210 minutes) of streaming video, so battery life isn't poor. However, a laptop like this isn't going to go outdoors so often, and that should still allow you to give a presentation or watch a film without having to worry about the battery.



Verdict

The Toshiba Satellite S70 provides strong all-round performance and will make a good desktop-replacement system for both home and office use. However, the screen is below par for a laptop in this price range, and that's an obvious weakness in a laptop that's designed for entertainment. ☒ **Cliff Joseph**

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System requirements
17.3in (1920x1080) matt anti-glare TN display; 2.5GHz Intel Core i7-4710HQ (3.5GHz Turbo); Intel HD Graphics 4600 + nVidia GeForce GTX 870M (2GB); Windows 8.1 (64-bit); 8GB DDR3L RAM; 120GB Samsung 840 EVO mSATA SSD + 1TB hard drive; 802.11b/g/n/ac with 2x2 MIMO (Intel Centrino 7260); Bluetooth 4.0; 1x HDMI 1.4, 2x DisplayPort; gigabit ethernet; 4x USB 3.0; SDXC card slot; 720p webcam/ microphone; 1x headphone, 1x microphone socket, 1x line-out; 60Wh lithium-ion battery; 419x287x21.8mm; 2.66kg

Build: ★★★★☆
Features: ★★★★☆
Performance: ★★★½☆
Value: ★★★★☆

★★★★☆

Gaming laptops are often built like tanks, but when nVidia unveiled its GTX 800M series of graphics processors earlier this year, it promised that the power-efficient chips would make it possible to develop a new generation of slimmer, lighter gaming laptops.

It's taken a while for these new laptops to surface, but following our review of Gigabyte's impressive P35W v2 (tinyurl.com/o9wuf8s), we now have another relatively sleek gaming laptop in the form of the 17in Chillblast Helix.

The 2.66kg laptop is a little heavier than its Gigabyte rival (2.5kg), and you certainly won't want to carry it around in a backpack all day. Even so, it's only slightly heavier than many 15in Windows laptops, and its 21.8mm chassis makes it easy to pick up and carry.

The slimline design does mean that Chillblast has jettisoned the DVD drive, so you'll need to find a USB drive if you're installing games from optical disc.

The chassis is nice and sturdy, and provides good support for the 17.3in screen. We also like the feel of the keyboard, which has a nice, firm action on the keys – although moving the Windows key over to the right of the Space bar – while common to gaming laptops – still feels odd to us and took a little while to get used to.

Connectivity is good, with four USB 3.0 ports, and two Mini DisplayPort interfaces along with HDMI for connecting to a larger display. There are also separate ports for headphone, microphone and external speakers, although the internal speakers provide plenty of volume and even a respectable bass sound, so you can play games or listen to a few songs without needing to plug in another set of speakers.

We weren't particularly impressed by the screen, though. As we've come to expect for this size, the 17.3in screen provides 1920x1080-pixel resolution, but it's not as bright as we liked and viewing angles taper off noticeably at around 120 degrees.

It's adequate for streaming video and web browsing, and you can lurch from side-to-side a bit during hectic gaming sessions without losing sight of your target, but we'd hope for greater brightness and contrast from a laptop costing over £1,000.

Battery life was relatively short, too, giving us just three hours, 45 minutes of streaming video – even when we switched to the less power-hungry integrated HD 4600 graphics. But, of course, a laptop of this size and weight isn't going to stray too far from a mains socket, but that's about long enough to crash on the couch and watch three episodes of *Game Of Thrones* between charges.

Crucially, though, the Helix delivers the goods better it comes to speed performance. Our review unit came hot off the production line with a quad-core Intel Core i7 running at 2.5GHz, 8GB memory, nVidia GeForce GTX 870M graphics, and both a 120GB Samsung 840 EVO solid-state drive (SSD) and 1TB hard disk.

Ordinarily, that conventional hard drive would be something of a performance bottleneck, but the SSD restores performance considerably, allowing the Helix to restore from suspend in nine seconds when using the Windows 8 fast-start option, and to hit a decent score of 5710 points in the PCMark 7 system benchmark test. We've seen higher scores – many gaming laptops exceed 6000 points with that particular benchmark – but only from more expensive laptops using larger, dedicated solid-state drives.

Its scores of 3014 and 3400 points in the Home and Work suites of PCMark 8 also suggest that the Chillblast Helix is more than capable of handling a wide range of demanding tasks.

But of course, it's gaming performance that really counts here. And while the GTX 870M used by the Helix isn't top-of-the-range, it still provides speeds that will satisfy all but the most hard-core gamers.

It breezed to 142fps when running our Stalker: Call of Pripyat casual gaming test at native 1920x1080 resolution.

We then tried the more demanding Batman: Arkham City. That game defaults to 1600x900 resolution with DirectX 11 turned off, which produced a smooth 55fps, but turning DX11 on and stepping up to 1920x1080 with all graphics settings on High only caused that score to dip slightly to 50fps.

Verdict

The Helix isn't perfect, and its screen and battery life are adequate rather than impressive. However, it manages to provide high-end performance at a competitive mid-range price, and will appeal to gamers who want a laptop that won't break the bank – or their back. ☒ **Cliff Joseph**

DESKTOP COMPUTER

Apple 21.5in iMac with Fusion Drive

£1,099 inc VAT

Contact
- apple.com/uk

Read more
- tinyurl.com/mLzjwpy

System requirements
21.5in (1920x1080) IPS display; OS X Mavericks; 1.4GHz dual-core Intel Core i5 processor (Turbo Boost up to 2.7GHz) with 3MB shared L3 cache; 500GB hard drive; Intel HD Graphics 5000; 8GB LPDDR3 RAM; Bluetooth 4.0; 802.11a/b/g/n; 2x Thunderbolt 2, 4x USB 3.0, 1x headphone socket, 1x SDXC card slot, 10/100/1000BASE-T gigabit ethernet (RJ-45 connector); 45x52.8x17.5cm; 5.68kg

Build: ★★★★★
Features: ★★★★½
Performance: ★★★★½
Value: ★★★★½

The latest 21.5in iMac is the second revision of the new-style all-in-one desktop PC with the vanishingly thin screen edge.

First launched in late 2012 with an Intel Core i5 running at 2.7GHz (from the series codenamed Ivy Bridge), the slim-screen 21.5in iMac then received an internal upgrade to a Haswell-generation 2.9GHz Intel Core i3 in autumn of 2013.

This new entry-level model for 2014 has a Haswell processor like the rest of the range, but with the much lower clock speed of just 1.4GHz, compared to 2.9GHz in the next model up. It also features a slow laptop hard disk rather than an SSD drive as found in Apple's laptops, all enabling a price drop that sees a starting point of £899.

You don't have to settle for a slow hard drive, though. In this review, we're looking at the entry-level option with a build-to order 1TB Fusion Drive – this will cost an extra £200. This should side-step the main performance issue with the new model – not the reduction in processor power, but the loss of the best storage drive in the business, now that Apple fits PCIe-attached flash drives across most of its Mac range.

Processor

The new 1.4GHz iMac represents something of a departure in its choice of processor. Since the eye-catching redesign of late-2012 all iMacs came with quad-core CPUs running at closer to 3GHz. The 1.4GHz processor used here is the same chip that powers Apple's current MacBook Air, enabling very low power consumption and minimal heat output.

In our test of raw processor performance using Geekbench 3, the new iMac unsurprisingly returned similar results to those mid-2014 MacBook Air models. It's fractionally faster, though, with 2838 points for a single-core and 5464 points for multi-core operation. The 11in MacBook Air scored 2762 and 5392 points respectively, giving the iMac an insignificant advantage of around two percent.

In the Cinebench R11.5 test of single- and multi-core performance, the 2014 iMac scored the same as the MacBook Air, returning 1.13 and 2.58 points respectively. Turning to the more recent Cinebench R15 benchmark, we saw 98 and 240 points for the two sub tests, against 97 and 236 points for the 11in Air. So a tiny increment difference in the benchmark results, perhaps reflecting more optimal conditions for the processor in a desktop machine, where power is more plentiful and cooling is easier.

Graphics

When Apple last revised its iMac range in September 2013, the upgrade to Haswell chips also saw the removal of a separate nVidia graphics processor, to rely on the increasingly capable Intel integrated graphics built into the main CPU. Also known as Iris Pro, the Intel HD Graphics 5200 graphics processor was the same as that found in the entry-level 15in MacBook Pro with Retina display. For gameplay, this was a step up from the discrete nVidia GeForce 650M used before.

However, with the new low-price iMac we find graphics performance has been reduced. It's now powered by the same Intel HD Graphics 5000 processor you'll find in all current MacBook Air models.

While the OpenGL section of Cinebench R11.5 showed the same 22fps graphics capability for both laptop and desktop machines, the entry-level iMac pulled ahead slightly in Cinebench R15's graphics test – 21.7fps against the MacBook Air's 18.5fps.

When we attempted to play Tomb Raider, it displayed a warning the iMac didn't meet the game's minimum requirements. And sure enough, even running at reduced 1280x960-pixel resolution and Low detail, we saw a just-playable average framerate of 29fps. Raising the detail level from Low to Normal made framerates tumble to 19fps.

Batman: Arkham City also played with similarly borderline framerates. Set to the proffered 1280x960 resolution and the game's Medium detail setting, it ran at an average framerate of 29fps.

Display

Apart from the slow hard disk, the new budget iMac can be seen as a MacBook Air that's taken root to the desk, and one fitted with a

much larger display. And what a screen it is. It may lack the Retina level of ultra-sharp pixel density that we enjoy from iPhone, iPad and the MacBook Pro, settling instead at 102ppi on its 1920x1080 full-HD panel. But thanks to a similar single-glazed construction process as the latest Retina MacBooks, it's mercifully low in annoying screen reflections.

As an IPS panel, once only the preserve of deep-pocketed graphics professionals, it also impressed with vivid life-like colour and superb all-round viewability from any angle.

We put it through its paces with a Datacolor Spyder4Elite to put numbers to the great image quality we were seeing. Crucially, it hit the required 100 percent coverage figure of the industry-standard sRGB colour gamut. The more demanding Adobe RGB gamut was also covered well, up to 80 percent.

Colour calibration out of the box was superb, with pre- and post-calibration screen images looking very close when judged by eye. And colour accuracy was another forté, showing an average Delta-E deviation figure from 48 swatches of just 1.79. Remarkably, the highest single-colour deviation (1F, teal) was itself at a relatively low value of 4.83.

Storage

Our review unit included two drives, combined together in software by OS X's Core Storage technology to create what Apple calls a Fusion Drive. Here this comprised a 128GB SanDisk SSD attached by PCIe, and a 1TB Hitachi Travelstar 5K1000 SATA disk.

To get an idea of how the new budget iMac performs with both its Fusion Drive and with a standard hard drive only, we partitioned the internal drive and cloned the entire operating system to the second partition. The first original partition benefited from the flash-drive acceleration, while the second partition worked like a typical hard disk-only system.

In the Windows world especially, boot times are bandied around as sign of computer performance. For Windows PCs that need frequent rebooting, we can see why needless waiting here is frustrating, even if it's almost a non-issue for Apple Mac computers: they recover from sleep mode perfectly every time, and system updates are fewer and less likely to require a complete restart.

Nonetheless, we compared the boot time between standard and Fusion Drive setups. With just the hard disk, OS X took one minute, 13 seconds to start up; with the Fusion Drive, only 11 seconds.

Using a compressed test directory of around 3GB and comprising of 40,000 files inside, we unzipped the package in both configurations. The regular hard disk took three minutes, 43 seconds, while the Fusion Drive setup needed one minute, 38 seconds to run the same job.

A typical daily task may be to duplicate a large file on the computer. We found a large .app application and compressed it to .zip to create a single homogeneous file, final size around 12GB. With a standard disk this duplicate-in-place process took five minutes, 20 seconds, while with the Fusion Drive setup it took 57 seconds.

These three simple tests showed that a Fusion Drive-based iMac has native SSD-like performance, with tasks taking 44 percent of the time in the case of our unzipping test, and only 15- to 18 percent the time in the case of booting and file duplication.

Conversely, you could look at the increased time you would be left waiting on a hard disk-based iMac to carry out your chosen daily chores, compared to one with a flash/disk hybrid setup: 228 percent longer to unzip a large directory of files; 561 percent longer to duplicate a large file; and 660 percent longer to wait for the system to boot.

These latencies in purely disk-based computing also reflect the tardiness we felt in the core user experience, in tasks such as launching applications.

Other features

The Wi-Fi system in the new budget iMac appears to be the same as used in 2013's iMac upgrade, and is therefore capable of connecting to the latest 802.11ac routers. Unlike that found in the MacBook Air, though, this wireless configuration is the superior three-stream MIMO (in other words, with three antennas) rather than just two, so is capable of better wireless range and throughput than the Air.

Power consumption is very low for a complete all-in-one desktop PC. At its peak – with screen brightness set to 100 percent, and graphics and CPU under full load – the iMac drew up to 70W of power. At its lowest idle level though – with screen set to a more comfortable 120cd/m^2 and no user processes active – it consumed just 19W.

At no time during testing did the iMac get warm, and we didn't hear a cooling fan. Nor in fact did we hear the sound of the spinning hard disk within. In effect, it's silent, one of the positive attributes of most Macs that make them so easy to live with.

As noted already, the 2014 budget iMac has much in common with this year's revised MacBook Air range in internal specification, although we noted one other subtle difference, in the audio sub-system.

While the latter 13in MacBook Air can play up to 16-bit 96kHz digital audio, the new iMac has 24-bit 48kHz capability. That still leaves both types of computer short of true high-resolution 24/96 playback, but both are also specified slightly higher than the old 16/44.1 standard used by CD.

An external audio input is available using the 3.5mm headphone port, which allows an in-line microphone to be used from headset earphones and headphones.

Verdict

We recommend specifying a Fusion Drive when purchasing the new iMac. If you have the £1,099 budget for this model, do not be tempted to plump instead for the cheaper 21.5in iMac with faster 2.7GHz Intel Core i5 quad-core processor – that system will be similarly hamstrung by the slow hard disk that comes as standard.

Andrew Harrison

LAPTOP

Toshiba Satellite P50T-B-10K

£1,200 inc VAT

Contact
■ toshiba.co.uk
Read more
■ tinyurl.com/Ln2euoo

System requirements
15.6in (3840x2160) TFT display, glossy, touch-sensitive; 2.4GHz Intel Core i7-4700HQ (3.4GHz Turbo); Intel HD 4600 integrated + AMD Radeon HD8800M (2GB memory); Windows 8.1 (64-bit); 8GB DDR3L RAM; 1TB hard drive (5400rpm); BDXL optical drive; 802.11b/g/n/ac; Bluetooth 4.0; 1x HDMI 1.4; 4x USB 3.0; SDXC card slot; 720p webcam/microphone; 1x headphone, 1x microphone socket; 43Wh lithium-ion battery; 377.5x244x28mm; 2.3kg

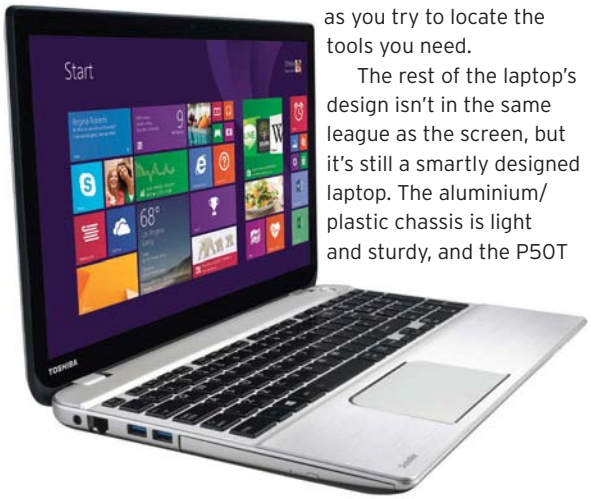
Build:
Features:
Performance:
Value:

It's tempting to dismiss the 4K display of Toshiba's new P50T-B laptops as simply being a bit of a gimmick – especially given the graphical limitations of Windows itself. But there's no denying that the 4K display is a treat for the eyes, and we can imagine that it might appeal to professional photographers or video editors who need to play back 4K video.

The 15.6in screen boasts a 3840x2160 resolution and pixel density of 282ppi. That's four times the resolution of a conventional 1920x1080 high-definition display, easily surpassing the 3200x1800 resolution of other Windows rivals such as the Dell XPS 15, as well as the ultra-resolution 2880x1800 Retina display of Apple's 15in MacBook Pro (see page 40).

And, not surprisingly, it looks terrific, with its pin-point clarity, strong contrast and rich, warm colours. Viewing angles are good and our only minor complaint is that the mirror-like glossy finish on the screen is annoyingly reflective. Even so, the sheer clarity and rich colours of the 4K display are outstanding and the P50T will be hard to beat if you need to look at ultra-high definition video or at photography

The main problem lies with Windows itself. As we found in our review of the Dell XPS 15 (tinyurl.com/n9grt4u), the Windows 8 desktop can scale text and graphics elements, so that they are clearly visible at such high resolution. However, that's not true of many third-party Windows programs, which will leave you squinting at tiny toolbars and miniature menus as you try to locate the tools you need.



The rest of the laptop's design isn't in the same league as the screen, but it's still a smartly designed laptop. The aluminium/plastic chassis is light and sturdy, and the P50T weighs only 2.3kg. That's below average weight for a 15in laptop that includes a built-in Blu-ray drive, although it's a shame that Toshiba couldn't slim its fat 28mm profile down a little. The drive is specified as BDXL, able to write discs up to 100GB capacity.

Connectivity is good, too, with the latest 802.11ac W-Fi and gigabit ethernet along with an HDMI 1.4 interface that supports both 4K and 3D output to an external display. There are four USB 3.0 ports, and the SDXC card slot supports the latest UHS II (ultra-high speed) memory cards, which will be useful for importing HD photos and videos.

Performance is something of a mixed bag, though. We reviewed the 'entry-level' P50T-B-10K model, which costs £1,200 with a quad-core Intel Core i7 running at 2.4GHz, 8GB memory, 1TB hard drive and AMD Radeon HD8800M graphics. That's a good specification for the price – especially when you include the touch-sensitive 4K display as well, but the 5400rpm hard drive did slow things down considerably.

The P50T managed a score of just 3610 points when running the PCMark 7 benchtest – a score that's bettered by numerous less-expensive laptops equipped with faster solid-state drives.

Meanwhile the Home and Work suites in PCMark 8 produced similarly mediocre scores of 2877 and 2528 points.

We also noticed the sluggish hard drive whenever the P50T started up. The Windows 8 'fast-start' option allowed it to recover from hibernation into the Windows Start screen in 15 seconds, but that was followed by about 30 seconds of cursor-spinning before the laptop could actually start to launch programs and get down to work.

Fortunately, once it's up and running, the P50T did feel fast and responsive, and the Core i7 processor provided enough raw horsepower to handle high-definition photos and video.

We would, however, suggest it's worth spending another £100 to get the '10T' model that uses a 1TB hybrid drive with 8GB solid-state module to enhance performance.

Another weakness is battery life. We managed to get just two-and-a-half hours (150 minutes) of streaming video even when switching to integrated graphics. That's disappointing, and it means the P50T is only suitable for use as a desktop replacement system and will be of little use for anyone that needs to work on the move.

Verdict

The dazzling 4K display of the P50T-B-10K is genuinely in a class of its own, and will certainly appeal to professional photographers and video-editors. It may look good value when compared to rivals such as Apple's Retina MacBook Pro, but its poor battery life means it will rarely leave the office, while professional users will likely be frustrated by Windows programs that don't work correctly with the 3840x2160 resolution display. ☒ **Stephen Dean**

PHABLET

Asus Fonepad 7 LTE

£199 inc VAT

Contact
- asus.com/uk

Read more
- tinyurl.com/ojvq4mc

System requirements
Android 4.4 KitKat OS; 7in IPS LED Backlight WXGA (1280x800) screen; 2X2 1.6GHz Intel Atom multi-core Z2520; 1GB RAM; 8GB/16GB built-in storage; 2G/3G/4G LTE; Wi-Fi; Bluetooth 4.0; 1.2Mp front-facing camera; 5Mp rear camera; 1080p video recording; stereo front-facing speakers; Micro-USB; audio jack; microSD card reader up to 64GB; micro-SIM card tray; 15Wh battery, 197.7x120x10.5mm, 333g

Build: ★★★☆☆
Features: ★★★☆☆
Performance: ★★½☆☆
Value: ★★½☆☆

★★★☆☆

The Asus Fonepad 7 LTE certainly qualifies as a 'phablet'. It's a 7in tablet that also acts as a phone. It might not be to everyone's taste but it does its job well.

At £199, it seems a little overpriced, particularly compared with Asus's own impressive £120 Memo Pad 7 (tinyurl.com/odLvok5). However, that model doesn't have a SIM-card slot, so there's no 3G/4G connectivity and you can't make phone calls and send texts.

The FonePad 7 comes in black or white, unlike the Memo Pad 7, which is available in several bright colours. We tested the black unit, which has a slightly sparkly, textured finish on its plastic back (see below). Unfortunately, rather than adding a bit of glamour, this looks tacky.

Aside from this, we found the overall design and build of the Fonepad 7 to be solid and attractive, though, the bezels around the display are a little thick for our liking. Dust and dirt tended to get stuck in the uncovered microSD slot and Micro-USB port, too.

Then there's the matter of weight and thickness. It's a great size overall, measuring 198x120mm, but it's thicker than many rival tablets at 10.5mm, such as the Memo Pad 7's 9.6mm and the Google Nexus 7's 8.7mm (tinyurl.com/qyudy5c).

It also feels heavy, at 333g compared with the 295g of the Memo Pad 7, though, it's only 2g heavier than the larger 7.9in Retina iPad mini (tinyurl.com/mzdxbgq).

We found the Fonepad 7 easy to hold in both portrait and landscape orientations, though, it did begin to feel heavy after prolonged periods of time – watching a film on the train home or browsing the web for several minutes, for example.

Additionally, if you're planning on using the Fonepad 7 to make phone calls without using the speakerphone functionality or plugging in headphones, you've got to hold it up to your ear. Not only does it look silly, it's also extremely uncomfortable – a Bluetooth headset or headphones with a built-in mic will be a good investment.

The Fonepad 7 has a 7in HD display with a 1280x800 resolution IPS panel, which is disappointing when compared with the Nexus 7's 323ppi display. However, the screen is bright and crisp enough to enjoy watching movies, browsing the web and viewing photos.

Inside is a 2x2 Intel Atom Multi-core Z2560 processor clocked at 1.6GHz, and paired with 1GB of RAM. That's not as impressive as the MemoPad 7's quad-core 1.86GHz 64-bit processor, but it's still pretty good for a tablet at this price.

We still found that the Fonepad 7 LTE coped with most tasks we threw at it, launching apps quickly on most occasions, even the Camera app.

You'll get the option of either 8GB or 16GB internal memory, but it's not a decision you'll need to take too seriously, as there's a microSD slot for adding up to an extra 64GB storage if you need it. Plus, you'll get 5GB lifetime Asus Web Storage space for storing photos, videos and other files in the cloud, with an additional 11GB for the first year.

The Fonepad 7 LTE has 802.11a/b/g/n Wi-Fi and Bluetooth 4.0, as well as 3G and 4G LTE connectivity if your contract supports it. There's no NFC, though, or other premium features like an IR blaster.

The Fonepad 7 has rear- (5Mp) and front-facing (1.2Mp) cameras. We particularly like Asus's camera app, which offers filters and effects as well as features such as Smart Remove for getting rid of unwanted objects from a photo.

Asus has given the Fonepad an Android 4.4 KitKat update complete with the new Asus ZenUI. This offers a flat, simple and colourful interface with easy-to-understand icons and nicely designed apps.

We were impressed by the battery life, too. Asus claims that it'll last for 11-and-a-half hours of constant use, or 735 hours in standby. Our test unit managed four days between charges, and in that time we used it to take photographs, record video, browse the web, make phone calls and run apps. It's got a 15Wh, non-removable battery.

Verdict

For anyone looking for a 7in tablet that can make phone calls, the Asus Fonepad 7 LTE is worth a look, though, we're not convinced anyone would want to. ☒ **Ashleigh Allsopp**

LAPTOP

Apple 13in MacBook Pro with Retina display

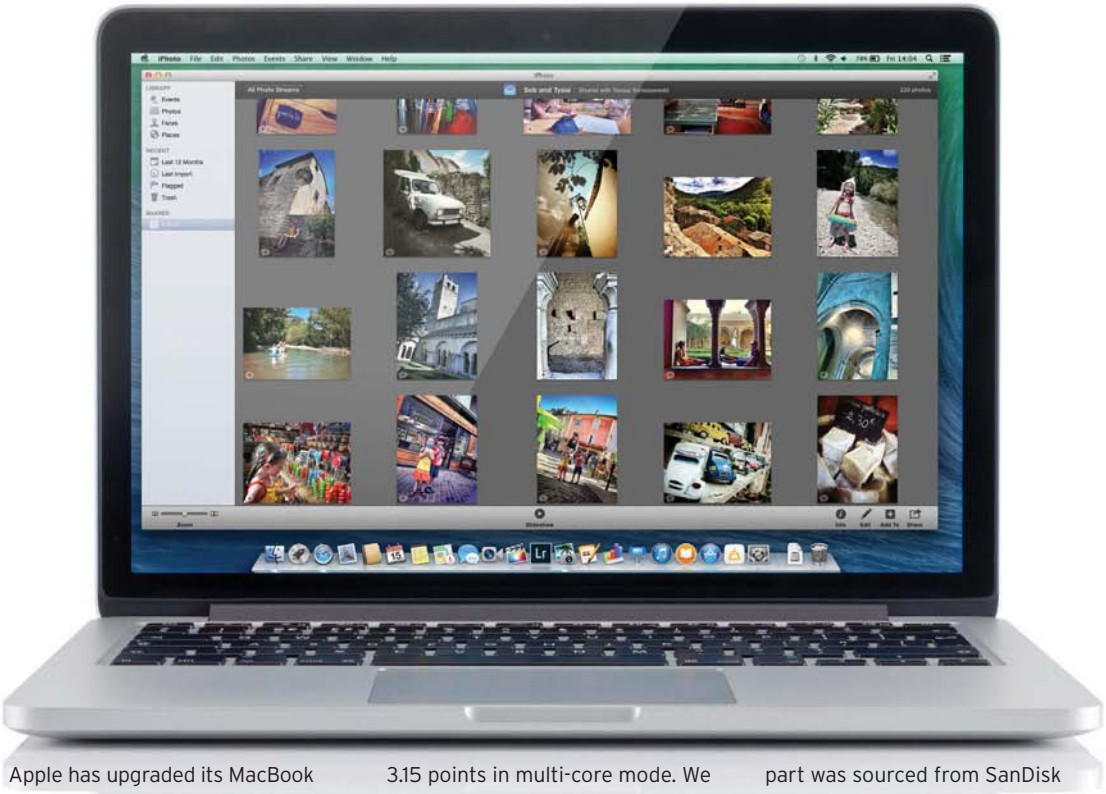
£999 inc VAT

Contact
- apple.com/uk

Read more
- tinyurl.com/ngcccqe3

System requirements
13.3in (2560x1600) IPS display; OS X Mavericks; 2.6GHz dual-core Intel Core i5 processor (Turbo Boost up to 3.1GHz) with 3MB shared L3 cache; Intel Iris Graphics; 128GB flash storage; 8GB DDR3L RAM; Bluetooth 4.0; 802.11a/b/g/n; 1x MagSafe 2 power port, 2x Thunderbolt 2, 2x USB 3.0, 1x HDMI, 1x headphone socket, 1x SDXC card slot; 71.8Wh lithium-polymer battery; 1.8x31.4x21.9cm; 1.57kg

Build: ★★★★½
Features: ★★★★☆
Performance: ★★★★☆
Value: ★★★★☆



Apple has upgraded its MacBook Pro with Retina display line-up. Both the 13- and 15in (see page 40) models have been given a small speed bump along with price drops for all the UK models.

The best news is that prices have dropped across the range. The entry-level 13in model we look at here will set you back £999, which is £100 less than the equivalent 2013 option. The other 13in MacBooks in the range are priced £1,199 – reduced from £1,249 – and £1,399 – down £100 from £1,499 – for the top model.

When Apple revised the 13in MacBook Pro in the autumn of 2013 with a Haswell-generation Intel CPU, it offered a choice of 2.4- or 2.6GHz dual-core Intel Core i5 processors. In the mid-2014 update, we find the same choice of chips, but bumped up to 2.5- and 2.8GHz respectively for the 'good' and 'best' models. There's also a configure to order (CTO) version with an Intel Core i7 processor, still with dual rather than quad cores, but running at a baseline clock frequency of 3GHz.

Our review unit was the entry-level model, now with a 2.6GHz Core i5 processor, a 128GB solid-state flash drive and 8GB of RAM.

In the Cinebench 11.5 benchmark test, our test unit scored 1.31 points with a single processor core, and 3.15 points in multi-core mode. We don't have figures for 2013's 2.3GHz model, but these numbers compare well with the 'best' model of that generation, also with a 2.6GHz Intel Core i5, the earlier i5-4288U parts.

The laptop recorded 1.30 and 3.13 points respectively, so this year's 2.6GHz model has virtually the same performance in this test, slightly faster in fact by a little under one percent, although that could be accounted for by experimental variables or even the change in the operating system's software between the original version of Mavericks and the current 10.9.4.

In the Cinebench 15 benchmark test, we saw the same story. 2013's 'best' 2.6GHz model performance is now found in this year's 'good' 2.6GHz MacBook Pro, with both scoring 113 points in single-core mode, and 280 and 281 respectively with all four virtual cores in this Hyper Threading Technology chip in operation.

Storage

As the entry-level 13in Retina MacBook Pro, our review laptop has the smallest storage capacity of 128GB from its PCIe-attached internal flash drive. (The other models in the line-up offer 256- and 512GB.) In our test sample this part was sourced from SanDisk (SD0128F), although its lower recorded performance is likely due to its smaller size – solid-state drives usually benefit from increased parallelism in the larger storage capacities.

In our tests, it still scored SATA-busting read speeds, peaking at 755MB/s in the QuickBench test, and averaged 732MB/s for data sized between 20- and 100MB. Unfortunately, write speeds were only half as fast, reaching a maximum sequential figure of 322MB/s, and averaging 319MB/s for the same data set.

Small-file transfers remained speedy, though, and averaged 176- and 141MB/s for random reads and writes (4- to 1024kB data). So even without the two-times speed up of write performance available with larger capacity drives, this notebook still benefits greatly from very rapid small file delivery to keep it feeling slick in operation.

It's important if you're considering buying a new MacBook you note that you can't upgrade the RAM at a later date as it's soldered on to the motherboard. If you think you might need more memory than the standard 8GB, then this can be boosted to 16GB as a CTO option for an extra £160. On the plus side,

the entry-level 13in model now has 8GB of RAM – previously it had 4GB. This brings it into line with the other laptops in Apple's 13in line-up.

The graphics chip in Apple's 13in Retina MacBook Pros are the same as those used in last year's range – Intel's Iris Graphics.

The OpenGL section of Maxon's Cinebench test showed that graphics performance between 2013's 2.6GHz model has been matched by this year's entry-level model. There was just a one frame per second advantage to the newer model (25.68- to 26.53fps) in the v11 test, while the v15 test recorded a similar result (22.03- to 22.08fps).

Turning to some action games, when we fired up Batman: Arkham City, we found the same just-playable framerate when set to 1280x800 pixels and High detail, 31fps for 2013's 2.6GHz MacBook Pro and 32fps for the latest model.

Next, we played the graphically testing Tomb Raider (2013) game, which proved a match for the Intel Iris Graphics 5100 in this laptop. Set to a relatively low 1280x800-pixel resolution, and with Normal detail settings, it averaged just 15fps. Turning down the detail level to Low bumped up the framerate to 18fps, which is still too low to enjoy playing the game smoothly.

Following the chunkier pre-Retina 13in MacBook Pro, this laptop is set to a 1280x800-pixel resolution, rendered from its double-sized 2560x1800-pixel native resolution. If you require more space on your screen, or you're upgrading from a recent 13in MacBook Air, you may be more comfortable selecting a higher virtual resolution from the Displays option in System Preferences. Here you'll find 1440x900 to match the Air, as well as 1680x1050 modes.

The panel on our review sample was measured with the Spyder4Elite colorimeter, which indicated 95 percent coverage of the sRGB gamut and 70 percent of Adobe RGB. These are good results, just a trace behind the 96- and 72 percent we recorded with this year's 15in model. Contrast ratio was superb, just nudging out its big brother with 800:1 contrast ratio at it's nominal 75 percent brightness setting (corresponding to 150cd/m^2) and 870:1 when set to full brightness of 322cd/m^2.

Colour uniformity was around 1 Delta E at most brightness settings, rising to 2.1 in the lower-right corner at full brightness. Luminance uniformity was more consistent than the 15in option, perhaps assisted by the smaller area of panel that required lighting. The greatest deviation was around 10 percent, rising to 14 percent in one corner at the 50 percent level setting.

Overall colour accuracy fell a little behind that measured on the 15in display, averaging 4.69 Delta E from 48 colour swatches, with a peak error of 9.41 Delta E with the 1F tone.

Battery life

Apple claims that its 13in Retina MacBook Pros should last for nine hours between charges. This is more than the eight hours offered by the 15in version, and the seven hours of the non-Retina model.

When we tested 2013's 'best' 13in model with 2.6GHz processor, we recorded a battery life of nine hours, 55 minutes in our standard looped-video wireless test. This year, it lasted 10 hours, seven minutes result, using the calibrated 120cd/m^2 display setting.

According to our colleagues at *Macworld* Labs, the 2.6GHz 13in model managed 10 hours, two minutes, while the 13in 2.8GHz model achieved nine hours, 24 minutes. For the entry-level model this is a better score than last year, when the equivalent system managed nine hours, 48 minutes.

Battery life was tested by looping a playlist of shows downloaded from the iTunes Store. Wi-Fi was turned off and brightness set to 200cd/m^2.

We found similar performance in 2013's 2.6GHz model and this year's 2.6GHz MacBook Pro, with both scoring 113 points in single-core mode, and 280 and 281 in multi-core mode.

However, according to the results of the speed tests performed by *Macworld* Lab in the US, the 13in 2.6GHz Retina MacBook Pro speedmark score was 158.

In 2013, the 2.4GHz Retina MacBook Pro score was slightly lower at 155, as you'd expect from a slower processor. However, the 2013 2.6GHz Retina MacBook Pro scored 177, meaning the 2013 option with the same chip performed better.

In the tests performed by Macworld Labs, the new models all performed better in application tests run in Photoshop, Aperture, iTunes, iPhoto, iMovie and Handbrake. It seems the new models were slower, in some cases, in Finder elements, such as copy, zip and unzip.

Verdict

Looking at this 2014 revision of the 13in Retina MacBook Pro, it's difficult to find any fault. The last upgrade in October 2013 introduced the world to the best all-round compact laptop we've tested and enjoyed using, with its 11ac wireless, extended battery life and flawless build quality. With this model, you're getting the performance of last year's best off-the-shelf model, for an entry-level price that's also £100 less than its predecessor. ☒ **Karen Haslam and Andrew Harrison**

LAPTOP

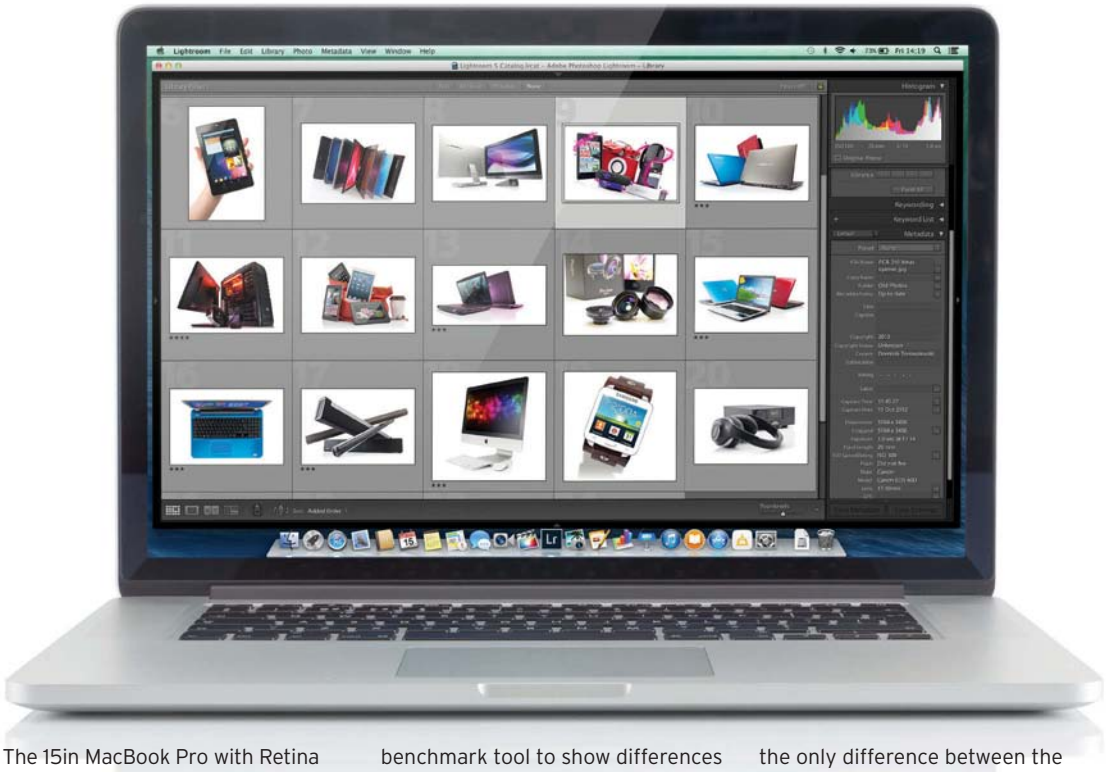
Apple 15in MacBook Pro with Retina display

£1,999 inc VAT

Contact
■ apple.com/uk
Read more
■ tinyurl.com/o8k7843

System requirements
15.4in (2560x1600) IPS display; OS X Mavericks; 2.5GHz quad-core Intel Core i7 processor (Turbo Boost up to 3.7GHz) with 6MB shared L3 cache; 512GB flash storage; Intel Iris Pro Graphics and nVidia GeForce GT 750M with 2GB of GDDR5 memory and automatic graphics switching; 16GB DDR3L RAM; Bluetooth 4.0; 802.11a/b/g/n; 1x MagSafe 2 power port, 2x Thunderbolt 2, 2x USB 3.0, 1x HDMI, 1x headphone socket, 1x SDXC card slot; 95Wh lithium-polymer battery; 1.8x35.89x24.71cm; 2.02kg

Build: ★★★★½
Features: ★★★★½
Performance: ★★★★½
Value: ★★★★½



The 15in MacBook Pro with Retina display is Apple's best ever notebook computer, a portable workstation squeezed into an 18mm-thick slab of aluminium. This summer, its price was reduced, the processors in its range refreshed and the amount of RAM boosted. Here we'll be looking at the top-of-the range option.

There are two models in Apple's 15in Retina MacBook Pro line-up. The top-of-the-range option comes with a Core i7 2.5GHz processor, bumped up from 2.3GHz. In the case of the entry-level 15in, the processor is now a 2.2GHz Core i7, up from 2GHz.

Because these laptops use a quad-core, Core i7 setup, it's far faster than the dual-core setup of the 13in models, there are four processor cores. This is one of the key differences between the 13- and 15in options. The quad-core processors mean than the speedmark score of the 15in models is around 60 percent higher Speedmark 9 scores than their 13in counterparts.

Surprisingly, despite the small increase in chip speed this wasn't reflected in our benchmark scores. Indeed, where our colleagues at *Macworld US* Labs found that the results were slightly better than last year, we found this year's model was slower.

For our processor tests we used Cinebench, this is the standard benchmark tool to show differences between computers. We're used to seeing small incremental increases in the benchmark point score as newer systems with faster processors are released. What we're not so familiar with is faster-clocked processors of the same family returning lower numbered results. But that's what we saw in both the Cinebench 11.5 single-core and Cinebench 15 multi-core processor tests.

In the 11.5 tests, we found that this year's best model scored 1.55 points, compared to 1.46 for 2013's best model. A six percent increase.

However, things became interesting when we ran the multi-core tests. 2013's top-of-the-range model scored 6.82 points, but this year's premier 15in option scored 6.48 points in the same test. That's around a five percent decrease in its point score compared to the late-2013, 2.3GHz model.

Things didn't get any better when we ran the Cinebench 15 tests. Here the 2013 model scored 126 and 623 points, respectively, for single- and multi-core modes. This year's 15in Retina MacBook Pro scored 134 and 599 points, again we saw a decline when all eight virtual cores were engaged in the multi-core test.

Based on the fact that the hardware components are identical, the only difference between the models that could explain the results is the installed operating system. When we tested the late 2013-generation option, its OS was the then new OS X Mavericks. The latest 2014 model also ships with Mavericks, but a later iteration – 10.9.4 versus the 10.9.0 This theory was confirmed when we ran the Cinebench tests again on the 2013 MacBook Pro with the latest 10.9.4 operating system.

In those tests, the late-2013 model scored 1.46 and 6.82 for single- and multi-core modes. With 10.9.4 the same machine scored 1.46 again; but 5.96 points in the multi-core test. That's a 14 percent decrease. When both models were compared, running the same version of the operating system, our tests showed a 6.3 percent increase in point score in single-core mode; and 13.7 percent increase in multi-core. In Cinebench 15, there was a similar 6.2 percent increase in single-core mode; and 8.7 percent in multi-core operation.

Both 15in options come with 16GB RAM as standard. Although this can't be boosted as a build-to-order option, 16GB should stand you in good stead.

The graphics chips used in 2014's models are exactly the same as those used in last year's 15in options – an Intel iris Pro Graphics.

The top-of-the-range 15in model, tested here, retains its dual graphics card setup with the same nVidia GeForce GT 750M discrete graphics processor in conjunction with Intel Iris Pro Graphics. Only one graphics card is used at a time, rather than both being used at the same time as is the case with the Mac Pro.

Game players should find the 15in MacBook Pro just as capable as before. In Batman: Arkham City our review unit averaged a framerate of 61fps when set to 1280x800-pixel resolution, for both Medium and High detail settings.

In Tomb Raider (2013) both generations could play with the same average framerate when set to 1440x900, and Normal and High detail – 33- and 31fps respectively.

Incidentally, while these framerates are good enough for most players, we found the game could play almost 50 percent faster when 'Use Legacy OpenGL' was selected in the game's settings. With the same resolution and settings, it recorded up to a 46fps average, and crucially with a minimum framerate that never dropped below 34fps.

We don't have quantitative measurements of the display quality of the late-2013 15in MacBook Pro, but it would seem that the same panel is in use. In our example, it was a Samsung LCD (LSN154YL01-A01), although we've also seen LG/Philips in some models.

In our tests with a Datacolor Spyder4Elite colorimeter, we found this panel to have 96 percent coverage of the sRGB colour gamut, and 80 percent of the more challenging Adobe RGB gamut.

Its contrast ratio in a test was 680:1 when set to 50 percent brightness (corresponding to 62cd/m^2), 720:1 at 75 percent brightness (152cd/m^2) and 810:1 at full brightness (330cd/m^2). Colour fidelity of the calibrated display was excellent, averaging just 1.34 Delta E from a 48-swatch test, with largest deviation found with the usual '1F' cyan/teal colour tone.

Colour uniformity at various brightnesses was good, around one percent deviation from 50- to 100 percent brightness, but luminance uniformity was much less consistent. The top (and specifically, top-right) of the screen was brighter than the bottom, with the bottom third as much as 30 percent darker than the top.

Battery life

Apple says that the battery life is eight hours – less than the nine hours offered by the 13in option.

We ran our usual battery rundown test, looping an MPEG-4 film (1920x1080, 30fps) played wirelessly from a NAS drive. Consistent screen brightness is paramount since the display luminance level can greatly alter overall runtime. We've recently updated our screen calibration technique and can now match screen brightness to within around one percent of the target reference level of 120cd/m^2. Our test unit last for seven hours, 57 minutes before going into its sleep state.

When we ran the same test on a late-2013 model, with nVidia graphics automatically switched to Intel Iris Pro under battery test conditions, it lasted seven hours, 46 minutes, although we can't be confident of screen reference brightness being so exactly matched.

When our colleagues at *Macworld* Labs ran their battery tests the results were less positive. They tested the battery life by looping a playlist of shows downloaded from the iTunes Store. Wi-Fi was turned off and brightness set to 200cd/m^2. The new 2.2GHz 15in managed seven hours, 13 minutes, while the new 2.5GHz model managed six hours, 48 minutes. The numbers compare favourably with the 2013 models. The 15in 2GHz option managed seven hours, 18 minutes, while the 2.3GHz model lasted for seven hours, 32 minutes.

Storage

As far as we are aware, Apple is the only designer of laptops to specify the highly specified PCIe-attached flash solid-state drive, or SSD. With three different companies supplying these parts to Apple (Samsung, SanDisk and Toshiba) there's some variability in performance between different samples of ostensibly the same computer, depending on drive manufacturer.

In a recent lab test, we had two MacBook Air samples (11- and 13in, mid-2014) with examples of Toshiba and SanDisk parts. In our review 15in model, we found a Samsung PCIe-attached flash drive (SM0512F) with 512GB storage capacity. In our tests this had the same performance as that found in October 2013's 15in MacBook Pro, also fitted with the same SM0512F storage drive. And this is one extremely quick flash drive – its headline sequential speed averaged 784MB/s reads and 737MB/s for writes (20- to 100MB data). That's nearly 50 percent faster than the very fastest SSDs you'll find in any other brand of personal computer, which are all restricted by the bottleneck of the SATA Revision 3 interface with which they connect to the PC.

Looking at random small-file performance as measured by QuickBench, when averaged with files sized between 4- and 1024kB, we saw read speeds of 199MB/s and write speeds of 351MB/s. These are impressive figures, and help explain the entirely lag-free 'snappiness' you feel when launching applications and opening and saving files.

Verdict

The price drops are welcome, especially at the top-of-the-range where the 15in MacBook Pro with Retina display is now £200 cheaper. At £1,999, it's still pricy, though. ☒

Karen Haslam and Andrew Harrison

SMARTPHONE

ZTE Blade L2

£89 inc VAT

Contact
- zte.com.cn/en

Read more
- tinyurl.com/ku4o74h

System requirements
1.3GHz ARM MediaTek MT6582M (ARM Cortex-A7) quad-core processor; Android 4.2.2 Jelly Bean; 1GB RAM; 4GB storage (microSDXC slot for expansion); 5in (854x480, 196ppi) display; 416MHz ARM Mali-400 graphics; 802.11b/g/n Wi-Fi; Bluetooth 3.0; GPS; 5Mp rear camera with autofocus and LED flash; 720p video recording at 30fps; 0.3Mp front camera; 2000mAh lithium-ion; battery; 72.2x142.5x8.95mm; 130g

Build: ★★★☆☆
Features: ★★★½☆
Performance: ★★★½☆
Value: ★★★★½

The Blade L2 is the latest super-budget smartphone from Chinese phone maker ZTE. At £89, its closest rival is the same-price Motorola Moto E (tinyurl.com/moj7L7e), a 4.3in qHD-screen Android KitKat phone with a dual-core processor. This phone's faster than Motorola's cheapest handset, but speed isn't everything in the highly competitive smartphone market.

Neither, of course, are looks, although they do help. Whereas the Moto E is incredibly well built, just a slightly chunkier version of its best-selling pebble-design Moto G (tinyurl.com/q5Ln5xq), the Blade L2 caused us problems even before we turned it on.

The rear cover is removable, allowing you to access the SIM and microSDXC slots – we say removable, it felt like it had been superglued on. Once you've prised off the cover once, it's much easier to remove, but this isn't necessarily a good thing. With the 2000mAh battery inside a non-removable model there's no need to get under the cover, yet you're left with a phone whose chassis now creaks under pressure.

It's not all bad. The all-white ZTE doesn't suffer the usual tell-tale budget belly, measuring just 8.95x142.5x72.2mm. It's not too heavy either, at just 130g. And despite the now-creaky chassis, the Blade L2 is fairly sturdy, with nothing rattling inside.

It's plastic, sure, and with a silver plastic trim that is rather obviously painted plastic rather than chrome bling. But this is a ridiculously cheap smartphone, which feels good in the hand – despite its large 5in screen – and its ports and buttons lie about the chassis exactly as you'd expect. The speaker might have been better-positioned, of course, not only on the rear but falling directly under the palm of your hand.

Turning our attention to what's on the inside things start to look up for the Blade L2. A quad-core processor and 1GB of RAM at £89 is very good, even if this MediaTek chip is clocked at only 1.3GHz. We found it faster than the Moto E's 1.2GHz dual-core Qualcomm Snapdragon 200 and 1GB of RAM combo. Significantly faster, in fact: in GeekBench 3's multi-core test, the ZTE scored almost twice as high as that of the Moto E, with 1191 points versus its 608. We also recorded 356 points in the single-core test for the Blade L2.

The Moto E's 400MHz Adreno 302 graphics took the upper hand over ZTE's 416MHz ARM Mali-400 in GFXBench, though. In the T-Rex graphics test, we recorded just 9fps for the ZTE, but 11fps for the Motorola. Even ZTE's £39 Kis 3 (tinyurl.com/mqzw34y) scored 12fps.

That's not to say graphics are unusable on the Blade L2. Although we found frames a little sluggish, we were able to stream video from the preinstalled YouTube app and play casual games such as Temple Run 2 and Jetpack Joyride without issue.

The 5in screen is also welcome, if only for its size: viewing angles are poor and the display is dull at all but its maximum brightness setting. With a 480x854 resolution and 196ppi pixel density, the Blade falls short of the Moto E's qHD (540x960) 256ppi display in terms of clarity. In fact, the L2's screen even falls short of that of the Kis 3, which has a 233ppi density.

Amazingly at this price, you get support for microSDXC removable storage, which goes some way to help us forgive the paltry 4GB inside.

The ZTE gives away its low pricing on the connectivity front. Not only does it lack NFC, 4G and the latest 802.11ac Wi-Fi, but it features old Bluetooth 3.0.

The 2000mAh battery should get you through a full working day, but with the screen brightness ramped up don't expect any more.

The Blade L2 has a 5Mp rear camera with an LED flash. A device that can take photos whenever the moment happens is a useful thing to have in your pocket, but this isn't going to replace your dedicated camera. It's slow to focus, was lost and colours looked washed out.

On the front is a 0.3Mp webcam that will do the job for Skype, but this isn't a phone for taking selfies.

With more than half (56.5 percent) the Android phones in use today running Android Jelly Bean, the Blade L2 is in good company. But a device that ships brand-new running Jelly Bean at a time when KitKat is about to be superseded with Android L isn't a good sign. After all, this isn't even the latest version of Jelly Bean (4.3), this is 4.2.2. The Motorola Moto E, which ships with KitKat, certainly beats it in this regard. As does ZTE's own Kis 3, also running KitKat.

ZTE has tweaked the standard Android OS slightly. To access the phone from the lock screen, for example, you have to press and hold the lock icon rather than swiping across the screen. Also unfamiliar to regular Android users will be the need to long-press the menu button to bring up the recent apps, and long-press the Home button to get to Google Now.

Verdict

The Blade L2 has a lot to offer at just £89, with a quad-core processor, a large screen and support for microSDXC. But while it may be faster than the Motorola Moto E, in many respects the ZTE is the inferior phone and even gets shown up by the significantly cheaper ZTE Kis 3. ☒ **Marie Brewis**

£799 inc VAT

Contact
■ samsung.com/uk
Read more
■ tinyurl.com/mrnyotc

System requirements
40in (1920x1080) LCD TV; Freeview HD; stereo speakers with 2x 10W amplifier; 4x HDMI, 1x SCART, component (YPbPr)/composite; stereo phono audio input; digital optical audio output, 3.5mm headphone jack; 10/100 Ethernet, CI card slot; 2.4/5GHz 802.11n Wi-Fi built-in/Wi-Fi Direct; Active Shutter 3D; 52W quoted average power consumption; 115W quoted maximum power consumption; 918x535x49mm; 8.2kg

Build: ★★★★☆
Features: ★★★★½
Performance: ★★★★☆
Value: ★★★★☆

★★★★☆

LCD TV

Samsung UE40H640

When you consider the specs of this attractively priced 40in flatscreen TV, you might struggle to think of reasons to spend more. This mid-range model packs a mighty punch with scads of network functionality, above-average image quality and a fair smattering of gimmicky nonsense.

Also available in 32-, 48-, 55- and 65in screen sizes (as the UE32H6400, UE48H6400, UE55H6400 and UE65H6400 respectively), this 6-Series set boasts a fashionable design with traditional Samsung translucent edging and swivelling X-style pedestal.

There's no shortage of connection ports either, with a quartet of HDMI (one of which is ARC compliant), SCART, component/composite inputs, ethernet and a trio of USB ports. There's an optical digital audio output for use with soundbars. Wi-Fi is integrated.

Remotes

The screen comes with two remotes: a standard infrared zapper and an increasingly common Bluetooth Smart Touch Control. The latter has a touch-sensitive pad and integrated microphone for voice interaction, although the set is without Samsung's finger-wagging gesture control technology. In addition, there's an onbody, rear-placed joystick control to navigate the set manually.

The out-of-the-box setup routine is neatly executed, while the Freeview programme guide has both a PIP channel window and overlaid audio.

Image quality is more than satisfactory. The set combines terrific levels of detail and texture, with vibrant colour reproduction, courtesy of the brand's Wide

Colour Enhancer Plus processor. Pictures are pleasingly dynamic too, thanks to bright peak whites. While the UE40H6400 doesn't deliver absolute black (no criticism, it is a mid-range offering after all), Black Tone and Dynamic Contrast adjustments help considerably.

The latter, using either the Low or Medium setting, manages to emphasise shadow detail; picture depth can be further enhanced by applying the Dark Tone (we liked the Chris Nolan-friendly 'Dark' setting). Gradated levels of darkness are handled well, with no overt pixel noise. The panel's LED edge-lighting appears uniform, a practical benefit of this particular screen size.

Motion handling is fine, making this screen suitable for all kinds of high-octane action fare. Despite only warranting a lowly CMR400 Motion Plus rating, the Motion Plus Clear setting delivers a crisp 1080 lines of moving resolution with nothing much in the way of picture artefacts to spoil the fun.

For a cinematic presentation, we'd advise you turn Motion Plus off all together. There's only a moderate drop in moving resolution.

The UE40H640's Active Shutter 3D performance is more difficult to enthuse over. The TV suffers from overt double imaging, which isn't particularly comfortable to watch, meaning the dimensional illusion doesn't quite gel. That said, a 40in screen isn't big enough to provide an immersive 3D experience anyway. Two pairs of 3D glasses are supplied in the box.

Samsung's Smart Hub platform has had a subtle revamp in 2014. In addition to copious catch-up, there's a Timeline thumbnail TV guide, a Trending page for hit shows and second-generation Soccer mode, although this seems to have been developed mainly for those who like to watch the big match in hyper-real dynamic shop window mode – it succeeds only in making the beautiful game look decidedly ugly. The inclusion of top streaming apps, including Netflix and YouTube, are obviously welcome. Samsung has also stepped up it's casual games offerings. Overall navigation is sprightly, thanks to a quad-core processor.

Multimedia playback support from networked devices and local USB is pleasingly comprehensive, with a wide selection of file types supported. We unwrapped AVI, MOV, MKV and WMV files from a networked DLNA server; audio compatibility covers WAV, FLAC, MP3 and WMA.

Sound quality is generally better than you might imagine for such a slim set; the rear of the cabinet swells gently to accommodate some creditable drivers, so there's some mid-bass to be heard. That said, a claimed 2x 10W power output seems a tad optimistic.

Verdict

Overall, the Samsung UE40H640 should be considered a great value net-connected flatscreen television. It boasts engaging 1080p image quality, working well with both sport and movie content, offers a wide variety of connected functionality and generally looks the business. We like it a lot. ☒ **Steve May**

GRAPHICS CARD

Asus Radeon R7 250

£65 inc VAT

Contact
■ asus.com/uk
Read more
■ tinyurl.com/p87j7nh

System requirements
AMD Radeon R7 250; 1GB GDDR5; 1000MHz clock (1050MHz Boost); 1150MHz memory clock (4600MHz DDR effective); 128-bit memory interface; 384 stream processors; 56 texture units; PCI-E interface; DirectX 11.2; 1x D-Sub; 1x DVI, 1x HDMI; 2-year warranty

Build:
Features:
Performance:
Value:

The entry-level AMD Radeon R7 240 (tinyurl.com/Lpychjb) is one option for anyone looking for an upgrade to a basic integrated graphics solution. But what if you want something with a little extra firepower, only without paying significantly more? Well, the R7 250 will set you back another £20, but offers rather more in the way of performance.

Not that you'll necessarily detect a dramatic difference in the hardware. Like the 240, the R7 250 is rather hampered by its 128-bit memory interface. This is just too narrow and limited to allow maximum throughput, ensuring that the supply of data is constantly being choked off. But worse news may come when you look at the memory itself. GDDR5 RAM is included in this example – but there are versions of the 250 restricted to GDDR3, and you should avoid those.

The enhanced memory is a feather in the 250's cap but, alas, there's only 1GB of it. Given that many of the 240 cards have 2GB – with some even promising a rather ridiculous 4GB – just 1GB for the R7 250 seems a step backwards.

Speaking truthfully, you won't be wanting to overload these cards with the kinds of high resolutions and chunky graphics textures that demand large amounts of video memory. For most purposes, then, 1GB will be more than enough. However, we would prefer to see 2GB of GDDR5. There are 2GB versions to be had, but these mostly use the inferior GDDR3 RAM.

There is better news elsewhere, though. The 250 has marginally more stream processors – 384 to the R7 240's 320. More crucially, the 250 builds significantly on the R7 240's lowly clock rates.

The 240's 720- to 750MHz core clock, for instance, has been upped to a decent 1GHz – with an extra 50MHz available through Boost. The texture units have also been handsomely upgraded, from 20 on the Radeon R7 240, to a healthier 56 here. That allows the R7 250 to boast a comparatively generous texture fill rate of 58.8GT/s – almost four times the R7 240's feeble figure of 15.6GT/s.

Memory bandwidth scores another victory for the 250, and its 1150MHz memory clock (4600MHz DDR effective) overwhelms the 240's 400MHz (1.6GHz). That amounts to a memory bandwidth figure of 73.6GB/s – almost three times that of the 240's 25.6GB/s.

In practice, the 250 doesn't generate the three to four times the performance that you might expect from the memory bandwidth and texture fill rates. However, it does produce as much as 70 percent higher frame rates when playing games. And at this low level, that's often the difference between 'almost unplayable' and 'relatively smooth'.

The figures we saw of 68.1- and 63.4fps in Stalker: Call of Pripyat (at 1680x1050 and 1920x1200 respectively) will allow for fluid gameplay, and you'll even be able to ratchet up the detail levels, should you wish. In contrast, the 240 was stranded on 43.2- and 37fps.

However, the similarly priced AMD Radeon HD 7770 (tinyurl.com/m6dharb) is still available, and that betters the 250 once more, turning in 87- and 75.8fps.

It's a similar story in BattleForge, where the 250's figures of 60.3- and 56.6fps rather destroyed the 240's 42.6- and 39.9fps – but importantly this year's card was still fall far behind the 7770's 80.3- and 77.4fps.

Bioshock (at low detail levels) stressed this point further. The 250 notched up 70.3- and 57.7fps, far ahead of the 240's 46.3- and 34fps, but trailing in the wake of the 7770's 90.1- and 77.6fps.

Verdict

The Radeon R7 250 is a quiet and cool-running card. But while it should be a significant buy over the underpowered entry-level 240, it's hard to recommend it while the AMD Radeon HD 7770 remains available to buy for another £20 or less. That latter card will probably be falling from the market before long. Until it does, though, it's a much better deal overall than the 250. ☒ **Robin Morris**

Benchmark scores

Stalker: Call of Pripyat (fps)[1]	68.1/63.4
BattleForge (fps)[1]	60.3/56.6
Bioshock (fps)[1]	70.3/57.7

[1]1680x1050/1920x1200

GRAPHICS CARD

XFX Radeon R7 240

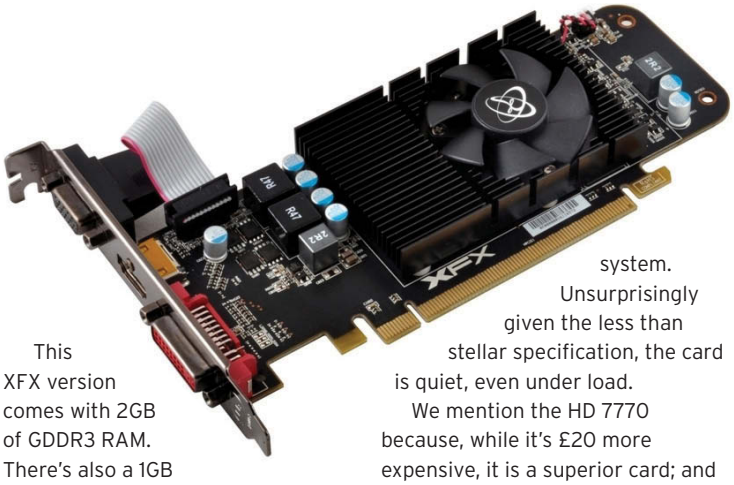
£46 inc VAT

Contact
- xfxforce.com/en-gb

Read more
- tinyurl.com/Lpychjb

System requirements
AMD Radeon R7 240; 2GB GDDR3; 750MHz clock (780MHz Boost); 400MHz memory clock (1.6GHz DDR effective); 128-bit memory interface; 20 texture units; PCIe interface; DirectX 11.2; 1x D-Sub; 1x DVI, 1x HDMI; no power connectors needed; 2-year warranty

Build:
Features:
Performance:
Value:



We've seen some rather impressive pixel-punchers from AMD over the past few months. The new AMD Radeon R7 240 graphics card, though, is about as lowly as it gets – and consequently costs just £46.

On the face of it, such a price tag isn't a great expense. But most of the potential customers of this product will be looking to replace their onboard graphics – which, likely, added next to nothing to the price of the system. Given that it's a choice of spending nothing, or lavishing £46 on a card like this one, the decision over whether to buy suddenly looks more of a dilemma.

So who is such a product aimed at? Onboard graphics solutions are now sufficiently impressive that you can find good video reproduction without feeling the need to upgrade. Where integrated graphics solutions fall down is gaming, though.

This AMD Radeon card won't put you in a position to destroy wave after wave of enemies in a top resolution; but it will, as we're going to see, add a significant burst to sluggish onboard frame rates.

But first, let's get the big disappointment out of the way. Despite being a new product (at least in theory – these cards have effectively been floating around in OEM form for over a year now), the 240 doesn't get the benefit of the new features appearing on some of AMD's latest launches.

The significant omission is TrueAudio. That's a shame, as this feature would better surround sound with some games, and would be an obvious selling point for those looking to add spice to their system. However, you'll get support for Mantle, should AMD's proprietary new graphics API take off, and DirectX 11.2 support is good.

This XFX version comes with 2GB of GDDR3 RAM. There's also a 1GB version, costing £5 less. Sapphire offers its version with 4GB, which takes the card to the £66 mark. Frankly, though, we can't imagine many users needing to push the 240 beyond 2GB, so the 4GB version seems like overkill.

The core-clock speed goes up to 750MHz on this overclocked card. That's actually 20MHz more than the standard-issue R7 240, although all these cards already have a Boost mode that maxes out at 780MHz.

The XFX is slightly behind other examples on memory-clock speeds, and its figure of 400MHz (1600MHz DDR effective) is a notch down on the 450MHz (1800MHz) offered by some of the competition.

The 128-bit memory interface is fairly paltry, and doesn't permit the 240 to stretch its pins fully. Combined with the low 1600MHz clock, the result is a memory bandwidth of 25.6GB/s. The older HD 7770 (tinyurl.com/m6dharb) is similarly hamstrung by its 128-bit interface, although stronger clock speeds do drive it to a better bandwidth figure of 72GB/s. The 240's 320 stream processors also struggle against the competition.

It's a diminutive little card, and there's a low-profile version available for more confined cases – the latter card suffers from a hideous cooling system. Unsurprisingly given the less than stellar specification, the card is quiet, even under load.

We mention the HD 7770 because, while it's £20 more expensive, it is a superior card; and the R7 250 is around £15 to £20 more expensive. Again, there's a marked difference in performance. If £46 is your absolute budget, then clearly those cards will be out of bounds. However, it will be worth the extra if you can find it.

Even at medium and low levels of quality, the R7 240 struggled to get much above 40fps in our tests. Its 43.2- and 37fps in Stalker: Call of Pripyat (at 1680x1050 and 1920x1200 respectively) are playable rates, but struggle to compete with 87- and 75.8fps on the HD 7770; or 68.1- and 63.4fps on the R7 250.

Again on BattleForge, the 240 averaged figures of 42.6- and 39.9fps at those resolutions, while the 7770 managed a much more emphatic 87- and 75.8fps, and the R7 250 60.3- and 56.6fps.

Bioshock would hardly be playable on the 240 at normal settings, so we dropped it to low-quality settings. Here, the 240 managed respectable figures of 46.3- and 34fps, but that's against the 7770's 90.1- and 77.6fps.

Verdict

It's hard to recommend the 240. It's a respectable step up from onboard graphics. But you can get significantly improved firepower if you shop around. **Robin Morris**

Benchmark scores

Stalker: Call of Pripyat (fps)[1]	43.2/37
BattleForge (fps)[1]	42.6/39.9
Bioshock (fps)[1]	42.6/39.9

[1]1680x1050/1920x1200

NAS DRIVE

Synology DS415play

£390 inc VAT

Contact
- synology.com/en-uk

Read more
- tinyurl.com/Ltdzoej

System requirements
1.6GHz Intel Atom CE5335 (dual-core SoC with Hyper Threading); 1GB DDR3 RAM; 4x tool-less drive bays; accepts 3.5in and 2.5in SATA Revision 2 disks; 2x USB 2.0, 2x USB 3.0; gigabit ethernet; Hardware Transcoding Engine; RAID 0, 1, 5, 6, 10 SHR; external disk support – EXT3, NTFS, HFS+; 165x203x233mm; 2.03kg

Build: ★★★½☆
Features: ★★★★½
Performance: ★★★½☆
Value: ★★★★½
Overall: ★★★★☆

The DS415play has been designed to fill a gap in Synology's line-up, and caters for home users. It has some useful specifications, starting with an Intel Atom dual-core CPU running at 1.6GHz and backed up by 1GB of DDR3 memory.

The drive includes a hardware transcoding engine for 1080p video for streaming video to your TV or mobile device. However, it's worth pointing out that despite the media focus of this device it's a streaming device only as there is no HDMI port for direct connection to a TV, as you find on more expensive units such as the QNAP TS-469L or Thecus N4560. However, a great addition for Mac users is native support for external HFS+ formatted drives.

The unit itself is a discrete affair in brushed black plastic with a shiny black front panel. The front doesn't have a hinge like some models, but is held on by rubber-gripped pegs and can be easily pulled off. Inside there are tool-less drive bays, which are a boon for those intimidated by screwdrivers – you unclip the bay put your drive in and slide the bay into the unit. The disks are hot swappable, so can be removed with the unit still powered on.

As with all Synology DSM-based units, setting up and using is a pleasure. This is one area Synology plays its trump card, the software interface. The DSM 5.0 operating system has an attractive and intuitive interface.

The iOS and Android apps add more control. A DS Video app allows you to watch videos, DS Download lets you download files and torrents, while DS Photo is handy for backing up photos from your mobile. These apps also allow you to access your NAS drive when you're out and about thanks to Synology's free DDNS service. This means you don't have to worry about your ISP randomly assigning your home connection a new IP address.

Performance

To test this unit, we installed two Seagate 4TB Enterprise Capacity and two 3TB Enterprise Value disks. We used CrystalDiskMark (CDM), ATTO and file copy on Windows 7; and QuickBench and Blackmagic Disk Speed Test on OS X Mavericks (SMB share). All tests were run over gigabit ethernet, using an Apple Time Capsule as router.

The CrystalDiskMark scores showed 86MB/s read and 83MB/s write speeds on sequential transfers, and 36MB/s read and 86MB/s write on 512kB transfers. These are respectable for this benchmark and far higher than the Synology DS413j (tinyurl.com/pL8xm8s) we tested in 2013.

ATTO showed even higher numbers at transfer sizes over 512kB (up to 8191kB) performance varied between 102- to 111MB/s read and 80- to 91MB/s write.

To get some real-world figures, we also copied a 3.47GB video file from and then back to the DS415play, and timed the copy. The copy from this drive to a laptop (which contained a Samsung EVO 750GB SSD) took 35.6 seconds, which equates to a read speed of 100MB/s. The copy from the laptop to the NAS was completed in 48.7 seconds, suggesting an average speed of 73MB/s write.

For those who are concerned with 4kB file size performance, under CDM the DS415play achieved 0.838MB/s read and 5.19MB/s write. These 4kB numbers are about what you could expect from a HDD-based RAID solution.

On OS X, we used the QuickBench extended test which consists of transfers from 20- to 100MB; and here the NAS averaged 104MB/s read and 88MB/s write, which are good scores. Finally we ran Blackmagic which returned average write speeds of 83MB/s and reads of 93MB/s.

Verdict

When you combine the performance, price and OS, the DS415play could be a crowd-pleaser for the multimedia NAS market. ☒ **John Taylor**

BLUETOOTH SPEAKER

Harmon Kardon Esquire

£169 inc VAT

Contact
- harmonkardon.com

Read more
- tinyurl.com/pn9yLtu

System requirements
Bluetooth wireless speaker; 2x 45mm drivers; 2x 10W Class D amplifier; 80Hz to 22kHz specified frequency response; 80dB specified S/N ratio; dual mics; Bluetooth, 3.5mm audio inputs; five-hour battery charge time; Micro-USB port for charging; USB battery charger; carry case; 29.6Wh lithium-ion battery; 147x147x46.5mm; 750g

Build:
Features:
Performance:
Value:

Harmon Kardon's Esquire is a Bluetooth speaker that will allow you to play music from your smartphone, tablet or laptop. The official price tag is £170, but you should be able to pick one up for less if you shop around.

It has an unorthodox square design, which allows you to either lay it down flat or stand it upright. It's available in black, white and brown. The top side has large buttons for power, volume and other controls like playback. An LED indicates power and connection status, while five small LEDs on the side show the battery level. Also on the side are a 3.5mm auxiliary input and a Micro-USB port for charging.

The device has a premium look and feel, with an aluminium frame running round three sides and a rubbery plastic bottom that provides good grip. The rear cover is finished in leather, while the included carry case is a bonus.

Pairing the speaker is easy using the NFC option, provided you have a suitably equipped Google or Microsoft phone. You'll need to tap the devices together in the right place, which can be a little tricky, but the rest is done for you.

A regular mini-jack input is included, which is handy if your device doesn't have Bluetooth or you prefer the best-sounding connection.

We note that Harmon Kardon doesn't advertise the inclusion of the aptX codec, so we assume the Esquire only uses the lower-quality SBC audio codec when receiving digital audio over Bluetooth.

One feature that's becoming increasingly common on wireless speakers is the ability to use them to make hands-free calls with your smartphone. A button mutes the microphone, while long pressing the phone button activates voice control on your handset.

Audio quality

For its mid-range price point, the sound quality of the Esquire is just satisfactory. It's by no means poor, but equally it doesn't produce anything special.

The speaker has an impressive sense of musical speed and, like many Class D amplifier products, sounds more impressive at higher volume levels. It takes two 45mm drivers, each driven by 10W amplifiers, and with a specified frequency response of 80- to 22kHz.

Overall, we'd describe the sound as flat but with a couple of crests – we expect more for the price. The bass is pretty punchy even without a dedicated bass driver or passive radiator, but it can get overpowering depending on the type of music you're listening. The mid-range is dull, but vocals are usually clear, which makes up for this somewhat. The higher frequency range is drowned out by the mid-range. Pump the speaker's volume up and the sound fills out.

Harmon Kardon lists battery life at 10 hours. However, in our tests, we found that around this point of steady playback, we still had about 40 percent left – according to the LEDs on the side anyway.

Verdict

The Harmon Kardon Esquire delivers on style and build quality, with its premium look and feel. It also provides impressive battery life and additional features like NFC pairing, controls and hands-free calls. Unfortunately, the sound quality doesn't live up to the £169 price tag. ☒ **Chris Martin**

USB CHARGING POINT

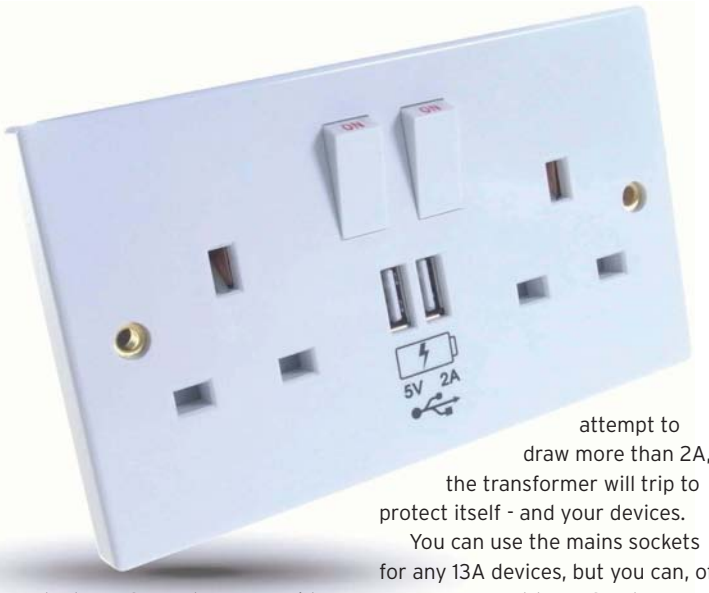
Group Gear USB

£20 inc VAT

Contact
- groupgear.co.uk

Read more
- tinyurl.com/Lffrf49

System requirements
Standard UK two-gang socket faceplate; requires 25mm depth wall box; 2x USB charging ports; output: 5V, 2A shared between ports



It's great that most battery-powered devices charge via USB these days. What isn't so good is that you've probably scores of USB chargers, each of which will charge only one device. Group Gear has a handy solution with its USB charging plate.

This faceplate replaces any standard UK two-gang socket and provides two built-in USB ports for charging your tablet, smartphone and any number of other gadgets.

As long as your pattress box (behind the faceplate) has a depth of at least 25mm, the faceplate should fit just fine. If you're competent with a screwdriver and you turn off the power, then swapping an existing faceplate for the USB version should take about five minutes.

It's a simple case of connecting the live, neutral and earth wires to the clearly marked terminals, and each is easily large enough to take two or three wires, so it doesn't matter if the faceplate you've chosen also feeds (or takes feeds from) other sockets.

The two USB ports can provide 2A at 5V between them. It's a shame it can't provide this output to both ports, as that would allow you to charge two tablets at maximum speed simultaneously. However, thanks to load balancing, you can still charge a tablet and smartphone at the same time since – the 2A is shared between the ports rather than being fixed at 1A per port. If you connect two tablets and they attempt to draw more than 2A, the transformer will trip to protect itself - and your devices.

You can use the mains sockets for any 13A devices, but you can, of course, connect two USB chargers for charging up to four devices from this charging plate.

Verdict

It's a wonder that so few companies have launched similar products: USB charging has been standard for years now. We're sure competition will appear, but for now, the Group Gear USB charging plate is a good deal at £20. ☒ **Jim Martin**

USB CHARGING POINT

ScrewFix LAP 13A 2-Gang Switched Socket and USB Charger Port

£20 inc VAT

Contact
- screwfix.com

Read more
- tinyurl.com/kqrfago

System requirements
USB outputs: 2.1A, 5V, Type A; requires 35mm depth wall box; BS 5733: 2010, BS EN 60950-1: 2006.

With a daily need for charging, smartphones and tablets end up causing more USB and Lightning cable mess than old-fashioned rotary dial phones with their curly cords. Indeed, our wall power sockets are being taken over by plugs for USB charging cables, meaning you need to disconnect the kettle just to charge your iPhone or Android, and vice versa.

The answer could be this product: a wall plate that includes both 3-pin power sockets and USB slots.

ScrewFix's LAP 13A 2-Gang Switched Socket and USB Charger Port Brushed Steel Flat Plate features an integral moisture protection gasket and angled, in-line terminals, and comes supplied with backed out captive screws for easy installation. This isn't difficult, depending on the placement of the plate and your own ability to wire up electrical equipment.

During our tests, we stupidly decided to fit ours as a replacement to a wall plate under a cupboard in a darker corner of a room. This was a bit of a struggle, especially when we left the plastic surround off the first time. But if you have ever switched a wall plate before, you'll know it can be fiddly but not head-scratchingly complex.

Most importantly, before you do anything turn off your home's electricity, double-check that the power is off, and then remove the existing plate before switching to the new one. It's a good idea to take a picture of the back of the old wallplate while the wires are still attached in case you have to revert to the old one again.

The brushed steel wall charging plate features two standard 3-pin sockets and two USB outputs (2.1A, 5V, Type A) and requires a 35mm depth wall box. If your power sockets are all used up with USB plugs, then this is a great solution.

An alternative that at least frees up one power socket – maybe for one of the best Powerline adaptors – is a dual-USB slot plug, which will cost you about £5 and doesn't require a screwdriver.

Verdict

The Screwfix LAP 13A 2-Gang Switched Socket and USB Charger Port Brushed Steel Flat Plate is a great solution if all your power sockets are taken over by USB cable plugs. If you're handy with a screwdriver and can wire a wall plate, then this is straightforward to install. ☒ **Simon Jary**

USB CHARGER

Inateck UC5001

£16 inc VAT

Contact
- inateck.com

Read more
- tinyurl.com/kbxuhdf

System requirements
3x USB ports rated at 5V/1A, 2x USB ports rated at 5V/2.1A; 102x57x21mm; 80g

Build: ★★★½☆
Features: ★★★★½
Performance: ★★★½☆
Value: ★★★★½
Overall: ★★★★☆

Many things charge via USB these days, even some laptops such as the HP Chromebook 11 (tinyurl.com/kpftxmd). It's inconvenient to have several chargers plugged in when you need to recharge multiple smartphones at the same time, but this is where multi-port chargers such as the Inateck UC5001 five-port USB charger come in.

It might look like a USB hub, but this diminutive box – which measures 102x57x21mm – provides enough power to charge two iPads and three iPhones at the same time.

The three USB ports on the left deliver 1A, which is enough for smartphones, while the other two offer up to 2.1A, which should match the requirements of most tablets. You can, of course, charge five smartphones or five tablets at once, but those plugged into the three 1A ports will charge more slowly.

Conversely, plugging a smartphone into either of the 'Super Charger' ports won't make it charge any faster than if it were attached to the 'Universal' ports, since it won't draw any more current than it needs to charge at maximum speed.

Although Inateck makes a big deal of how portable the charger is, the power supply is bigger than the device itself. The brick measures 115x45x30mm, so while it isn't going to be a burden to carry around, this is the kind of gadget you'll leave plugged in at home or in the office.

We tested out the charger by connecting an iPad Air, iPhone 5c, iPhone 5, Google Nexus 5 and Asus Memo Pad 7 and all five devices charged up as quickly as we'd expect. Neither the charger nor power supply became particularly hot. In fact, the only criticism we have of the charger is the lack of rubber feet or any way to stop it moving around. It weighs almost nothing (80g), so you have to hold it firmly when plugging in a device to charge it.

Verdict

As long as you want to use Inateck's UC5001 five-port USB charger somewhere where you can hide the power brick, it's a neat solution to the charging problem. It doesn't really work on a kitchen worktop where it just looks untidy. But on an office desk, it's a very handy gadget indeed. ☒ **Jim Martin**

SOLAR BATTERY PACK

Powertraveller powermonkey extreme 12V

£100 inc VAT

Contact
- powertraveller.com

Read more
- tinyurl.com/mhwvf3z

System requirements
Solar panel and rechargeable battery pack; 33.3Wh lithium-polymer (3.7V, 9000mAh) battery with 5V (700mA) and 12V (800mA) output; solar panel 5V, 600mA (max specified); 110/240V mains charger with international adaptors; battery pack 145x60x28mm; solar panel 170x90x18mm (folded); 1.1 kg total

Build: ★★★★½
Features: ★★★★☆
Performance: ★★★★☆
Value: ★★★★☆
Overall: ★★★★☆

Powertraveller's powermonkey extreme 12V provides power for your smartphone and tablet while you're away from mains power. It comprises two main components: a battery pack and a solar panel.

The battery pack contains a 3.7V lithium-polymer battery with a capacity of 33.3Wh. This is much larger than found in any smartphone and could, therefore, be charged several times. Some tablets have batteries comparable to that in the powermonkey, so they could be charged just the once.

Several converter tips, including the ubiquitous Micro-USB, are included allowing other 5V equipment to be charged. A lead with a car cigarette lighter socket is available for 12V equipment and you'd use this in conjunction with your car charging lead.

Although it folds up for carrying, to a slab measuring 170x90x18mm, the solar panel is hinged and folds opens up to provide a total surface area of about 190cm^2.

Powertraveller says it has a maximum output of 3W (that is, 600mA at its 5V output) and that it'll charge its own battery pack from flat in 18- to 22 hours. Optimal conditions only occurs in the tropics, however, so charging times will be longer in the UK.

At midday on a sunny day with 20 percent cloud cover, we measured a maximum charging current of 400mA at 4.4V and achieved a charging rate of three- to four percent per hour, as indicated on the battery pack's LCD status panel. That suggests it would take at least two days of constant sunny weather, assuming 12 hours sunshine per day, to charge the battery pack from flat to full.

On an overcast summer day, the current varied between 25- and 100mA, but no charge was registered (that is, less than one percent) after three hours.

In each case, the solar panel was facing the sun, but if you're using it attached to your backpack while walking, this won't be assured so charging times will be longer.

Rubber grips mean you're less likely to drop the kit when you've got cold or wet hands and, while a drop test figure isn't quoted, it looks like it'll cope with a moderate amount of rough treatment.

Verdict

Solar power will always be rather hit and miss in the British climate, so don't expect too much except in bright sunlight but, under those conditions, you'll garner a considerable charge during a day's hiking. ☒ **Mike Bedford**

PORTABLE GENERATOR

BioLite CampStove

£150 inc VAT

Contact
■ biolitestove.com
Read more
■ tinyurl.com/Lkrgdx9

System requirements
Wood/biomass-burning stove with thermoelectric generator; four-and-a-half minutes specified boil time per litre; 46g of wood to boil 1 litre; 2W specified continuous charging output via USB; components: combustion chamber, battery/generator, USB-to-USB lead, stuff sack for carrying; 110x210x125mm; 935g

Build: ★★★★☆
Features: ★★★★½
Performance: ★★★★☆
Value: ★★★★☆

The BioLite CampStove is no ordinary camping accessory. In addition to cooking your evening meal, this extraordinary piece of kit also charges your smartphone and tablet or other portable electronics gear. As the name suggests, the CampStove burns any biomass that you can find round the campsite – for example twigs and pine cones – instead of gas or paraffin.

BioLite heralds this as environmentally friendly, though, to get maximum heat from this source of fuel, fan-assistance is necessary. Indeed, the stove has a fan inside that's powered from an internal battery, and while you should charge the battery before you leave home, a built-in generator serves to keep it topped up.

The science behind this electrical generator is not explained by the manufacturer, other than its description as a patent-pending thermoelectric generator.

What's more, it generates more electricity than is required just to maintain battery charge so the excess is available, via a USB port, for charging electronic equipment.

No-one is likely going to buy the CampStove just to charge their phone so we were keen, first of all, to see how good it is at cooking. The bottom line is that we were able to boil 500ml of water in four minutes, which is comparable to similarly-sized gas burners.

Having said that, BioLite claims you can boil a litre in that time and, to be fair, our pot probably wasn't of the optimal size and shape, it didn't have a lid, and we were still getting up to speed on how much fuel to use.

On the other hand, this was summer with no cold wind to rob the unit of heat, so times would be longer under less ideal conditions. We should also point out that, once the fire had become properly established, the stove no longer emitted any visible smoke. In effect, the fan ensures that any combustible material that would normally be lost as smoke is converted to heat, thereby improving efficiency. Similarly, when the fire went out, very little ash remained in the combustion chamber.

Even if the CampStove's battery is fully charged before use, when you first light a fire the energy used by the fan will be greater than that generated. As such, excess energy isn't available initially for charging external devices.

We found that it was ready to charge, as indicated by a green LED, after three minutes, by which time flames were visibly licking around the water pot.

Occasionally thereafter, for example after adding fuel, the green LED may go out momentarily. Generally, once the stove is up and running, there's an almost constant supply of electricity for charging.

Under these conditions, with a Samsung Galaxy Ace smartphone attached, we measured a charging current of 300mA at 5V, with occasional pulses to 450mA. This corresponds to 1.5W (and peaks of 2.25W) – a touch less than the continuous 2W claimed by BioLite. This resulted in the phone's 5Wh battery charging at a rate of just over 0.5 percent per minute. At that rate, it would take three hours, 20 minutes to charge a phone from flat.

Verdict

With very little if any competition, we're not able to compare the BioLite CampStove with similar products. However, in our tests it came close to meeting the manufacturer's claims and proved itself effective both as a camping stove and a charger for portable electronics gear. ☒ **Mike Bedford**

WIND-UP RADIO

Freeplay TUF Radio

£34 inc VAT

Contact
- freeplayenergy.com

Read more
- tinyurl.com/nwh9nyy

System requirements
Crank-powered radio/torch/battery; 3.6V, 600mAh NiMH internal battery; 5V 25mA solar panel (specified); 5V 500mA wind-up generator (measured at 120rpm); mini-USB power in for charging, USB power out for charging, 3.5mm stereo jack for headphones; radio: FM 88- to 108MHz, AM 520- to 1700kHz, SW 3- to 22MHz; 1m drop test; resistant to light rain and splashing water for short periods (no IP specification quoted); 145x60mm; 300g

Build: ★★★½☆
Features: ★★★★½
Performance: ★★★½☆
Value: ★★★★½

★★★★☆

Hand-cranked electronics is a technology that has been widely adopted, with varying degrees of success, since Trevor Baylis invented the wind-up radio and founded Freeplay Energy. The company's product line now includes a wind-up charger for mobile phones but, for just £15 more, you can buy the TUF, which also adds an AM/FM/SW radio, a torch, and a solar panel.

While the TUF has an internal battery – small by comparison to power-hungry smartphones – and this is used to power the radio and torch, it can't be used to charge external electronic gear such as a mobile phone.

Instead, in order to charge other gadgets via the TUF's USB port the rotary handle must be cranked. Freeplay says that a minute of winding will give two to three minutes of talk time but this will depend very much on the phone.

We found that cranking at two turns per minute generated a charging current of 500mA at 5V, which is comparable to what you'd achieve when charging from a PC's USB port.

While these figures will allow charge characteristics to be calculated for any device, we demonstrated that it charged an entry-level smartphone with a 4.1Wh battery at a rate of one percent every two minutes. Given that you wouldn't want to crank at this rate for too long, it would be appropriate to consider this as a device for charging a phone for emergency use, which is what Freeplay envisage.

The theme of emergency preparedness extends to TUF's other elements, namely the radio and torch. FM radio is becoming less common in mobile phones in favour of internet radio, which is a drain on the battery that can be put to better use if you're cut off from mains power. Also, if you're travelling abroad, you'll only hear local stations on FM.

In providing SW, though, you'll probably be able to hear several English language broadcasts, including the BBC World Service.

We found reception on FM and AM to be acceptable for catching up on the news or a weather report, although its sound wouldn't be categorised as high quality. And with the small telescopic antenna, we couldn't find a single broadcast in the shortwave bands during daylight hours although shortwave reception is better at night.

Running out a few metres of wire to act as an antenna, though, and winding the end round the telescopic antenna, we did better, even during the day, receiving a broad range of stations from Europe and beyond.

Freeplay say that the radio will run for 15 hours on a full battery, which can be charged via the USB port, by cranking or via the solar panel. We discovered that a minute of cranking gave 13 minutes of operation – half of that claimed by Freeplay but admittedly dependent on the volume – and that one hour of solar charging in bright sunlight gave 33 minutes.

The torch has a luminous flux (total light output) of 17- to 20 lumens and a luminous intensity (a measure of how bright the beam is, a figure that can be increased by focusing the light to a tight beam) of 184 candela. These are figures which are much less than you'd get with most dedicated head torches – not especially bright but fine for emergency use.

Verdict

If you want to use a phone or a tablet for significant periods of time while you're away from mains power, the TUF isn't for you. This is a device to provide power when you need it in emergencies, a job it does admirably. ☒ **Mike Bedford**

IMAGE-EDITING SOFTWARE

Adobe Photoshop CC 2014

From **£7.49 per month**

Contact
■ adobe.com/uk
Read more
■ tinyurl.com/qyvxd9q

System requirements
Multicore Intel processor with 64-bit support; OS X 10.7, 10.8, or 10.9; 2GB of RAM; 3.2GB of available hard disk space for installation; additional free space required during installation; 1024x768 display with 16-bit colour and 512MB of VRAM; OpenGL 2.0-capable system; internet connection

★★★★☆

Adobe has added some practical features to Photoshop CC 2014, especially where productivity is concerned. These include time-savers such as improved smart guides and smart objects, updatable Layer Comps, a colour picker that stays open and Typekit integration. Other slick new features include a command that automatically selects the in-focus areas in an image, two new motion blur filters, a Package command for corralling linked smart object content, and the ability to edit masks made with Camera Raw's Graduated or Radial filters.

Photoshop's improved graphics engine means that the Smart Sharpen filter and upsampling via the Image Size dialog box is a little faster. All content-aware tools are capable of better colour blending, too, especially when used in gradients, such as skies, water, and so on. So, instead of adaptation presets for the Patch and Content-Aware Move tools, there are Structure and Colour fields that allows you to enter precise settings for more realistic blending. Unfortunately, these are hidden inside a submenu in the Options bar, so they're easily missed (plus the numeric range of what you can enter into either field should be noted in the tooltip). On the other hand, the Fill command's Content-Aware option sports a Colour Adaptation checkbox for better blending, though (oddly), you have to turn it on.

Smart Guides are automatically turned on in Photoshop CC 2014. With the Move or Path Selection tool active, you can see distance measurements between the active layer's content and what your cursor is pointing at, including other layer content and the document's edge. By Alt-dragging layer content, you can duplicate the layer and see the distance between the copy and the original as you drag.

The new Focus Area command automatically selects the in-focus parts of an image. This does a fantastic job on photos that have a strong focal point and blurry background, and its dialog box has a couple of sliders and brushes that let you fine-tune the selection, along with a button that sends the selection to the Refine Edge dialog box for more tweaking.

The improved SMART GUIDES DISPLAY helpful spacing info about your document's content depending on where you point your cursor (circled)

New in the Blur Gallery filter family are two offerings that let you simulate motion in a photo that doesn't have any. The Path Blur filter allows you to create the appearance of motion along a path that you draw – it can be straight or riddled with curves. Fine-tune the blur's direction, angle, speed and even how much blurring occurs at the path's start and end points using a combination of on-image and slider-based controls. The Spin Blur filter lets you put an incredibly realistic spin on an object using a simple set of on-image controls. Happily, both filters work as smart filters.

Font library

One of the benefits of a Creative Cloud subscription is access to hundreds of fonts via the online service Typekit. In CC 2014, you can access this from the font menu and, once installed, use those fonts in any CC program on your computer. Also new is the ability to search installed fonts by typing part of its name or attribute into the font family menu, and preview the active type layer's content in another font by pointing at it in the font menu (you don't even have to highlight the text first).

New to this version of Photoshop is the ability to link to smart object content instead of embedding it (helpful when combining large files into a single document). You can convert an embedded smart object into linked or vice versa. The Properties and Info panels, and the document status bar, keep track of your smart objects, and let you fix broken links (caused by renaming or moving the linked file on your hard drive), as well as update linked content that was changed while the Photoshop document that contains it was closed (if the document is open when you change linked content, it's updated automatically). Finally, the new Package command in CC 2014 copies the Photoshop document and its linked content to a central location for easy delivery to someone else (fonts not included).

Layer Comps, which let you create multiple versions of an image or design within a single document, have also been improved. CC 2014 lets you update layer comps by syncing them with the layers you updated (a big time-saver), plus you can access a document's layer comps after placing that document into another Photoshop document as a smart object without opening (editing) the smart object.

New in an earlier incremental CC release is the ability to edit scripted patterns without resorting to JavaScript. Choose one of eight built-in scripts – Tree and Picture Frame are recent additions – from the Fill dialog box and you'll get another dialog box to customise the pattern's density, size and colour variations. You can apply scripted patterns to paths, too, and save customisations as new presets.

The Perspective Warp command (released in early 2014) lets you change the perspective of a certain area in an image. By drawing a grid on top of your image, you can warp that particular area to make buildings and flat surfaces look straight instead of angled.

The ability to print 3D objects on a local 3D printer or send your file to a 3D printing service from inside Photoshop has been improved in CC 2014. The 3D print preview is incredible and shows any areas that the application has filled in to make the object solid enough to print. If you go down the printing-service route, then the preview estimates how much the project will cost.

Camera Raw's Graduated and Radial filters are perfect for applying gradual changes to a photo in a linear or circular fashion (respectively), though, you can now edit the masks made by both filters using a brush.

To the delight of web designers worldwide, the Generator feature (released in late 2013) lets you instantly export web graphics by using a specific layer naming convention; new in Photoshop CC 2014 is the ability to export those graphics to a subfolder.

Other useful changes include a simplified process for syncing settings to the Creative Cloud, which now includes workspaces, keyboard shortcuts and menu customisations. You can also unlock a background layer by single-clicking its padlock icon, see recently used swatches at the top of its panel, and pick a custom background colour in the New document dialog box.

In Photoshop CC 2014, the Colour panel's new Hue Cube mode turns it into a colour picker that's always open. You can create gradients with a single colour stop, export 3D colour lookup tables for use in Adobe's pro-level video editing applications, and the layer-based Copy CSS command now understands inner-shadow layer styles.

The new **PATH BLUR FILTER** lets you control the direction, angle, and speed of the blur along a path that you draw, enabling you to make an object fly across (top) or fall out of (bottom) the sky

When using the Liquify filter, you can pin the image's edges down so they don't get warped, while the Brushes panel displays the past 30 brushes you used at the top of its panel (an orange outline also highlights any brush you've modified).

Last but not least, there's an Experimental Feature Manager tucked inside Photoshop's preferences that lets you access features that Adobe periodically releases, as well as a checkbox that turns on a narrow Options bar (handy on smaller screens).

On the Mac, Photoshop CC 2014's dialog boxes were redesigned for Apple's Retina displays, so they're noticeably shorter and wider (they're also a darker grey and the buttons are square, making them look more Windows than Mac-like).

Unfortunately, some useful panels have disappeared in Photoshop CC 2014 due to their Flash-based nature. Mini Bridge, Kuler and Adobe Exchange have gone, though, you can download Kuler as an HTML-based panel from the new Adobe Add-Ons website. Sadly, the Oil Paint filter vanished due to outdated code.

Unlike the incremental updates of late 2013 and early 2014, Photoshop CC 2014 is a separate installation. This could be confusing and you may end up with two copies of Photoshop CC on your Mac – just use the Uninstaller program in the older version's folder to zap it. However, if your workflow depends on a feature that was changed or removed in Photoshop CC 2014 – or a plug-in that doesn't yet work in the new release – you can still use the older version.

Verdict

Since Photoshop CC 2014 is only available by subscription – and it's a separate installation – there's no reason not to install it. The productivity enhancements, new selection command and motion blur filters are big time-savers, plus the ability to edit masks made by Camera Raw's Graduated and Radial filters is incredibly helpful. If your workflow depends on some of the missing panels, there's no harm in keeping the older version. And with Adobe's Creative Cloud Photography program – you get Photoshop and Lightroom (along with a slew of Creative Cloud benefits) for £7.49 per month – this level of pixel-pushing power has never been more affordable. ☒ **Lisa Snider**

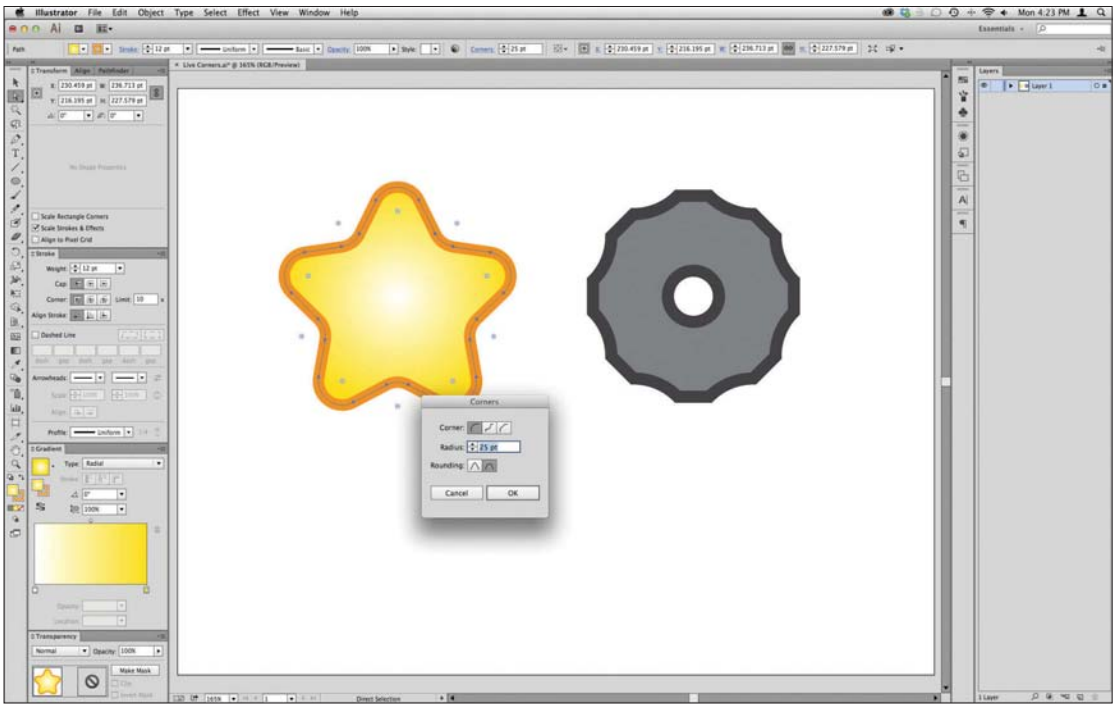
ILLUSTRATION SOFTWARE

Adobe Illustrator CC 2014

From **£7.49 per month**

Contact
■ adobe.com/uk
Read more
■ tinyurl.com/ogtfysp

System requirements
Multicore Intel processor with 64-bit support; OS X 10.7, 10.8, or 10.9; 2GB of RAM; 2GB of available hard disk space for installation; additional free space required during installation; 1024x768 display; internet connection



LIVE CORNERS allow you to quickly create rounded stars and gear-like objects such as those shown here

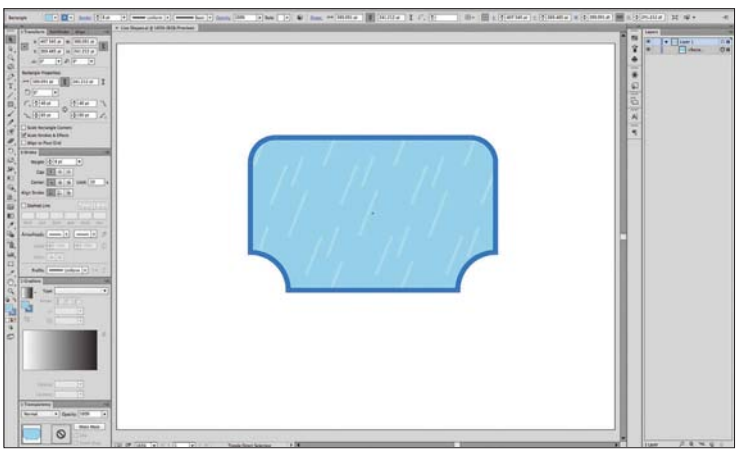
Adobe continues to refine Illustrator CC 2014, a minor update with just a handful of feature additions. Interestingly, far more new features were introduced to the vector app with the mid-cycle Illustrator CC 17.1 update in January. A number of these merit discussion, and combined with the enhancements in CC 2014, they address one of the longest-standing complaints I've had with the software.

Better tools

In the past, I have lamented the application's anaemic object tools. Select the rounded rectangle tool, click the artboard and you'd be asked to specify the corner radius; once this was determined, it was locked in and uneditable. Stretch the object in one direction, and the corners would stretch and distort, too. Similarly, the star and polygon tools provided little in the way of settings, and those too were locked in once set. Creating a star with rounded corners or a polygon in the shape of gear was a logistical nightmare for even the most hardened Illustrator veterans.

Illustrator CC 17.1 took the first step to addressing this issue. It introduced an incredible feature called Live Corners that lets users round, invert, or chamfer one or more corners of an object at a time. Stars can now have rounded corners with a few simple clicks. Create a star object and then choose the direct selection tool; when you do, a series of small control circles appear adjacent to each corner anchor. Drag a control circle and all corners in the object will change at the same time; Alt-click a control circle and the object will alternate between round, inverted round and chamfer corners. Don't want to apply changes to all corners at once? Just select one or more corner anchor at a time. And Live Corners aren't limited to star and polygons – any corner anchor in any object can be edited this way, including those in rectangles.

Unfortunately, rectangle corners in Illustrator CC 17.1 were still subject to distortion when stretched. That's been addressed in this release with a new feature called Live Shapes, which adds a layer of intelligence to rectangle objects. As with live corners, the corners of rectangles can be easily configured with round, inverted round, or chamfer corners of any size, and by selecting a single corner anchor, you can edit each one individually. However, you're now free to resize, rotate and stretch the rectangle as you wish without distorting the corners. Options in the Transform panel allow you to specify the corners' radius and shape, and you can also choose whether you'd like the corners to scale when resized.



LIVE SHAPES mean rectangles can have consistent, shaped corners that do not distort when resized

The feature isn't without its problems, though. Shear the rectangle or reposition a single-corner anchor, and it regresses to a standard object with Live Corners. And for the moment, Live Shapes is a feature that only applies to rectangles, leaving polygons and stars still relatively basic (save for Live Corners enhancements). I look forward to the day when stars and polygons are equally intelligent objects, allowing users to quickly reconfigure the number of points/sides and stretch the objects without corner distortion.

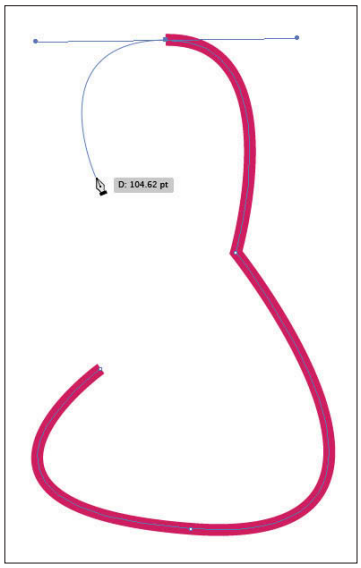
The Illustrator CC 17.1 update also introduced a significant and very sensible change to the perspective grid. Previously, an object attached to the grid stayed in place if the grid was repositioned, requiring the user to remove and reattach objects to the grid to alter the perspective. Now you can lock the Station Point and reposition both the horizon line and vanishing points, and all artwork attached to the grid will change perspective along with it.

Another series of small but meaningful changes come to the Pen tool in Illustrator CC 2014. The most obvious of these changes is new automated preview. As you lay down anchor points, a blue preview line extends from the most recent point you've drawn, so you can see the exact shape of the curve before you drop your next point. Additionally, holding down Command after you drop a point lets you create unequal paired handles, giving you much more control over the shape of an object as you draw. A further refinement to the Anchor Point tool allows you to convert just one side of a corner point back to smooth, a much-needed change that preserves one half of the original curve instead of obliterating both sides. And finally, control handles no longer snap to grid, offering you much more freedom when you must work with grid-based workflows.

What was left out

One thing that struck me as odd was that Illustrator CC 2014 did not import presets from Illustrator CC, whereas Photoshop CC 2014 offers to import presets from Photoshop CC. So once again the tedium falls to user to bring over items such as Variable Width Line presets and Actions. It was refreshing to see this respect for continuity finally added to Photoshop, and Adobe would do well to add it Illustrator as well.

However, it's worth noting that neither application inherits the workspace layout or preferences of its predecessor. Upon installing Illustrator CC 2014, I was required to rearrange panels and reconfigure settings to match my preferred workspace in Illustrator CC. Given that Adobe allows you to sync many settings via the Creative Cloud, it was disappointing that these were ignored upon the launch of the new app, which is, of course, tied to the same Adobe ID.

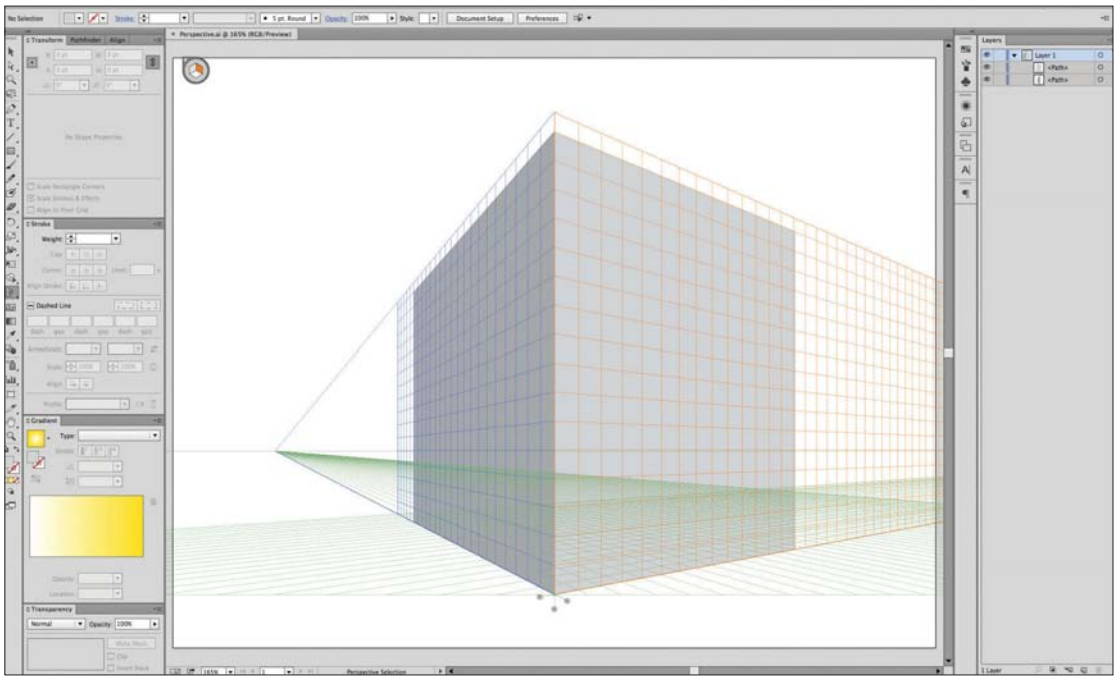


The **PEN TOOL'S** new preview feature shows you the shape of the next line segment before you drop the point

Other minor issues persist. Outline mode still presents jagged lines (aliased) rather than smooth lines (anti-aliased), an anachronism in this day in age. And we're still unable to choose inside or outside alignment for strokes on text, requiring the user to either layer multiple text objects or convert text to paths for more advanced graphic treatments.

Verdict

Illustrator CC 2014 cannot be considered a major new release, but rather, the continued refinement of a venerable tool. It's refreshing to see Adobe go back to the basics, upgrading simple shape tools that have been stagnant for over a decade. ☒ **Tim McVeigh**



The **PERSPECTIVE GRID** now alters the perspective of attached objects when you change the grid itself

AUDIO-EDITING SOFTWARE

Magix Audio Cleaning Lab 2014

£40 inc VAT

Contact
■ magix.com/gb
Read more
■ tinyurl.com/nqth7me

System requirements
Windows XP/Vista/7/8; 1GHz processor; 1GB memory; 1GB drive space; 16-bit sound card

Usability: ★★★★☆
Features: ★★★★☆
Value: ★★★★½
★★★★☆

Magix has been a big player in consumer sound editing for many years, with wave editors and sampling studios, but it also deals with older, pre-recorded media, so you can take beloved vinyl and cassettes, and digitise them for use on PC or mobile devices.

The two products Audio Cleaning Lab 2014 and Rescue Your Vinyl & Tapes use the same software, so if you don't need the turntable pre-amp in the full package, you can save £30 by opting for Audio Cleaning Lab 2014.

Magix is good at interface design and the main editing interface is a single screen, on to which different panels are overlaid as you need them. The full waveform of the current recording is shown in the top half of the screen, with controls below. The main modes of the software are Import, Cleaning, Mastering and Export and the program supports five types of media: files, CD, vinyl, cassette and speech.

The software can import WAV, MP3, WMA, AIF, OGG Vorbis, M3U, Cue, CD-A and Flac format files and export in most of those, plus AAC and several DVD formats. Under CD, the software uses the FreeDB database to recognise and download the track names.

It would be good if you could download FreeDB info by album name, to shortcut the mastering of vinyl and cassette copies, too.

Once you have loaded the tracks, you can work on the whole file or subdivide it into tracks or manually select sections. The software tries to auto-mark tracks, although it has problems with some progressive rock concept albums from the early 1970s. Shame.

AUDIO CLEANING LAB lets you digitise all your old vinyl and cassettes

The Cleaning mode offers modules such as DeClicker, DeCrackler and DeHisser, which as well as providing simple knobs to set levels, also have a series of presets like 'Only remove heavy clicks' and 'Old tape recordings: Pop' to simplify setup. If you have even less time to tailor settings, the Auto Cleaning button analyses the sound and suggests levels for the main cleaning tools. You can preview the results and do direct before and after comparisons.

The presets work pretty well, with obvious improvements to the sound, although you can hear slight drop-offs in bordering frequencies when clicks are removed, for example. There are few auto-repair apps which don't do this, though.

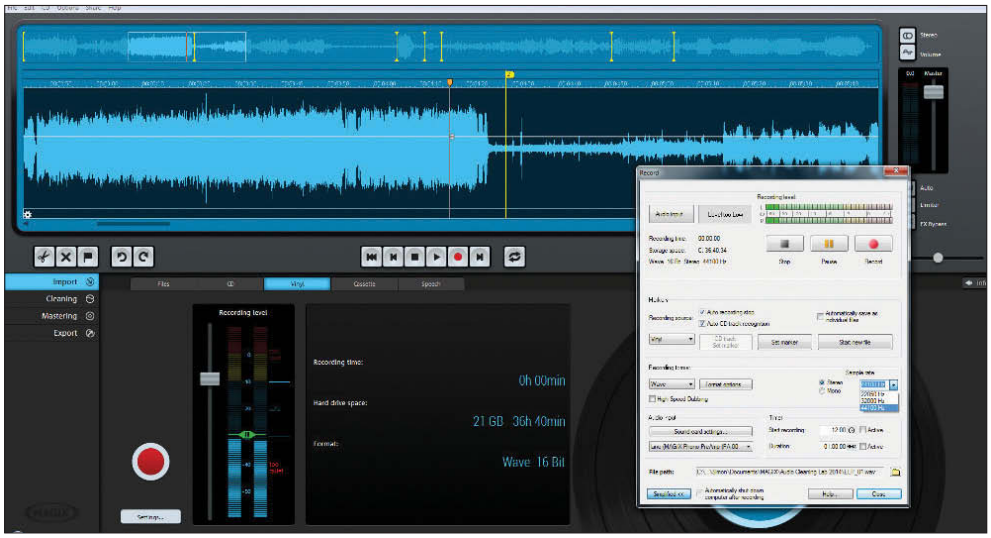
Mastering mode provides other tools, such as expanding the stereo stage, boosting the 'brilliance' of old stereo recordings and adding reverb. Again there are presets available and an Auto Mastering button lets you select music type with, oddly, three settings alone for 1970s disco.

Export offers to share your cleaned recordings with services including SoundCloud, YouTube and Facebook, as well as saving them to file or burning CDs.

The software uses a 16-bit A-to-D converter with 44.1 kHz sampling frequency, which is CD quality and should be adequate for most uses. Audiophiles – who insist on more faithful capture at, for example 24-bit/96kHz resolution for their Naim amps and Quad electrostatic speakers, should to look elsewhere.

The pre-amp in Rescue Your Vinyl & Tapes is powered from the USB port and has phono inputs for a record player, and line-level phono and mini-jack inputs for a tape deck. There's also a headphone socket for monitoring straight off the deck.

We had trouble with two samples of the USB audio capture device, both of which had an audible hum at around -30dBA, clearly audible on recordings. Comparing it with a straight phono-to-phono, battery-powered pre-amp from an earlier version of Rescue Your Vinyl & Tapes, there was no audible hum.



A **TRACK'S WAVEFORM** is shown at the top, with the program's controls located below

Verdict

If you have a library of cherished music on disc or tape, and want to transfer it and tidy it up at the same time, Magix Audio Cleaning Lab 2014 does the job. ☒ **Simon Williams**

SPEECH RECOGNITION SOFTWARE

Nuance Dragon Naturally Speaking 13 Premium

£140 inc VAT

Contact
■ nuance.co.uk
Read more
■ tinyurl.com/owhspsg

System requirements
Windows Vista/7/8; 2.2GHz dual-core processor; 2GB (32-bit) or 4GB (64-bit) RAM; 4GB hard drive space

Usability:
Features:
Value:

When you reach version 13 of a program, you start to wonder what it can do that's new. With speech recognition, you just want it to recognise what you say and set it down on a screen. In fact, version 13 of Nuance Dragon Naturally Speaking manages two significant improvements in what it offers.

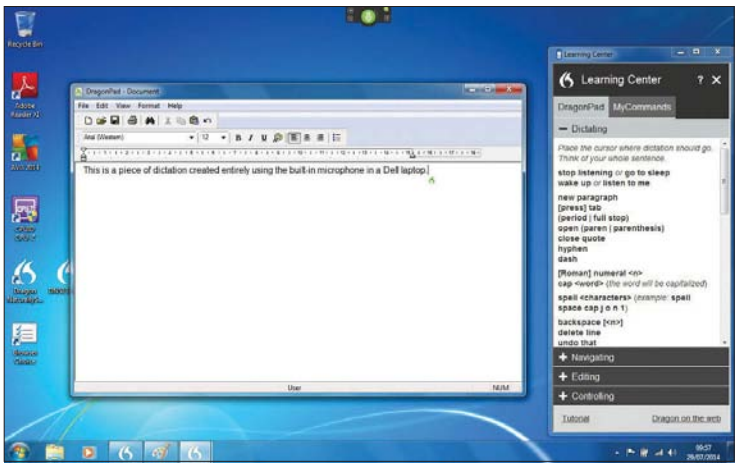
You'll appreciate the first as soon as you run the package. You no longer need to perform any training.

While you can still, optionally, read from Lewis Carroll or Scott Adams, you can also jump straight in and start dictating. Nuance claims that the software's 15 percent more accurate, but since we were already well into the last decile of accuracy, this represents only a small increase.

In use, the program is remarkably good at transcribing speech, even with comparatively technical terms, as found in this review anyway. It still sometimes makes 'an' for 'and' types of error, but for the most part, one error in every two or three paragraphs is about it.

Each iteration of the program seems to have its own idiosyncrasies, which may be tied to individual voice. Dragon 12 often had trouble with 'full stop' from this reviewer, and the new version occasionally produces the word 'stop' rather than '.', too.

The other breakthrough is a move away from having to use a headset. In previous versions, you could use the cabled headset provided in the box, an optional Bluetooth headset or a voice recording from a recorder, media player or phone. Now, you can also use the built-in microphone in a laptop.



Unlike previous versions of the software, you don't need to **TRAIN IT**

As long as you're sat in front with it reasonably close, recognition is claimed to be good, as long as background noise can be kept down. Fine for a hotel room, not so much in an open-plan office.

We tried it on a Dell Latitude E5500, hardly cutting-edge, but with a suitably high enough specification to run the software (Nuance says 2.2GHz dual-core processor or faster).

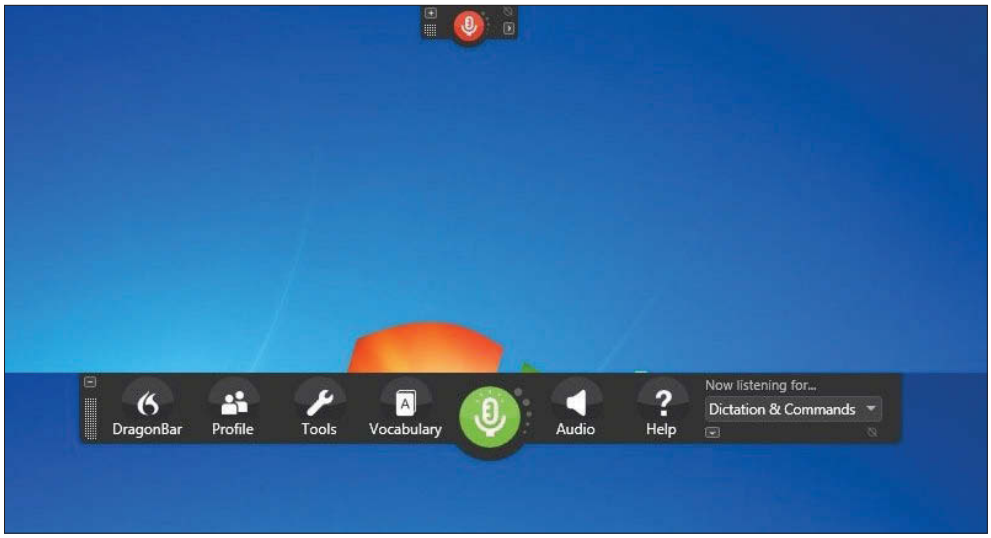
Dragon 13 did very well. Speaking at around 40cm from the laptop, a natural distance for use, there was little noticeable difference in accuracy from using a desktop PC with a cabled headset.

Other innovations include a redesigned control bar (pictured below), which minimises itself to take up less space on the screen. In its reduced state, it shows whether the microphone is live but little else. It then enlarges when you mouse over it to provide quick access to vocabulary, audio and other controls.

Dragon Naturally Speaking 13 can't use user profiles from earlier versions directly, but it can convert them. However, when we tried this, it only managed to convert two out of four old profiles successfully.

Nuance has also revamped the Dragon sidebar, now called the Learning Centre, which offers context-sensitive help and lists available commands when you move between applications or from dictation to command modes. It also provides access to the new interactive tutorials.

Dragon Naturally Speaking 13 works with more Windows programs than previously, so you can now dictate emails into Gmail, Yahoo! Mail or iCloud, through IE, Chrome and Firefox browsers. It also accepts dictation into OpenOffice/Libre Writer 4.1 and WordPerfect X7, although it doesn't offer any further control on these two.



The program's control bar has been redesigned and **MINIMISES ITSELF** in its reduced state

Verdict

There used to be several choices for anybody wanting to use speech recognition on a PC. Now, there's pretty much only Dragon Naturally Speaking, but version 13 is still innovative. The ability to use built-in mics on Windows laptops and tablets works well and gives extra flexibility, but the software still demands high specifications. ☒ **Simon Williams**

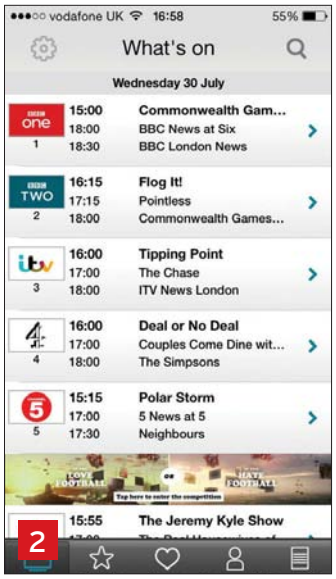
Best TV guide apps for Freeview

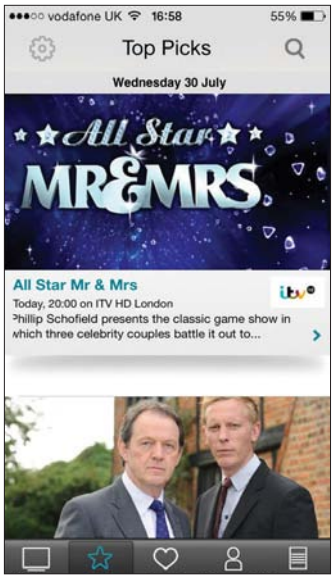
Find out what's on with your smartphone or tablet and one of these five apps. Ashleigh Allsopp reports

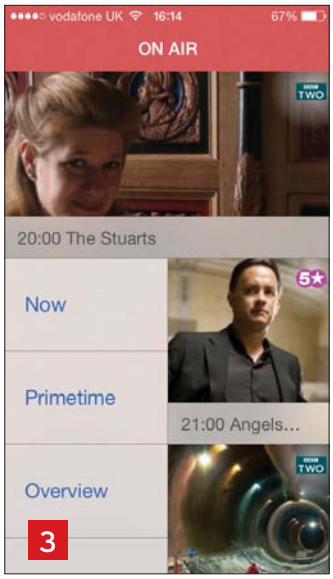
TV guide apps provide a quick and easy way to find out what's coming up on television, and whether those programmes and films are worth the watch. With these five TV guide apps at your fingertips on your smartphone or tablet, you'll be able to avoid channel flicking, instead going straight to the content you want to watch.

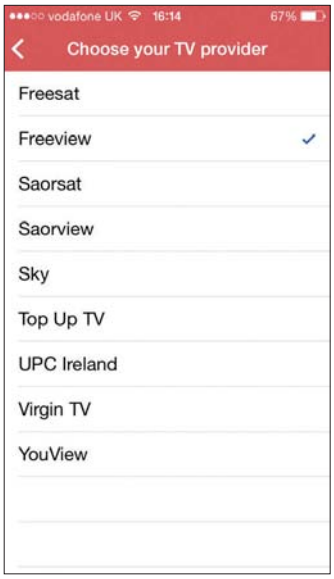
1. TVGuide from TVGuide.co.uk

TVGuide from TVGuide.co.uk is one of our favourites, available for iOS and Android. It seems that a recent update has upset some users, but it's free so it's worth a try.









TVGuide gives you an easy-to-read grid that lets you see what's on for the upcoming week. You can sort and select channels to customise it to your preferences, and, if you've got an internet-connected Samsung TV, you can even use the app as a remote.

The 'Upcoming Films' feature is particularly useful, showing all of the films playing over the next week. You'll find recommendations within the app, too, and you can mark shows as favourites to keep track of when they're next on.

Also useful for Freeview users is the ability to select your country, region and then system. Then tap Freeview in the System menu to see only the channels you've got available to you.

2. Freeview TV Guide app

Alternatively, there's actually an official Freeview TV Guide app for iOS and Android. You'll see only the channels that you've got access to through Freeview, and you can take a look through the Top Picks, Favourites and Recommended sections to find out what's best to watch.

It could do with a bit of a redesign, as it looks a bit clunky, but it's free and it should do the trick.

3. On Air

We quite like On Air, which lets you pick from a variety of TV providers including Freeview. It's nicely designed for both iOS and Android, and offers an easy way to see what's on now or later. You can browse by genre, take a look through the highlights or see your personal favourites. You can also search if there is a particular show you're looking for.

4. Tv24.co.uk TV Guide

Tv24.co.uk TV Guide is another option for iOS and Android. It'll ask you to choose your TV provider, so Freeview users can get rid of the channels they don't have access to from the app's guide.

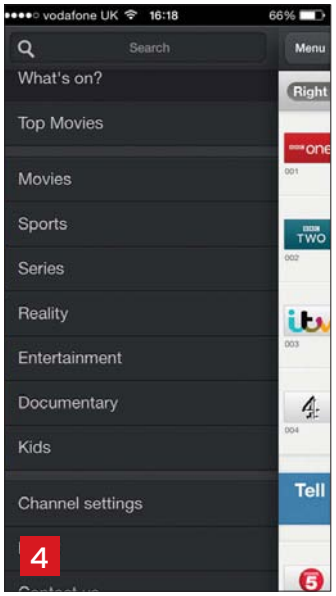
Browsing options include Top Movies, Sports, Series, Reality, Entertainment, Documentary and Kids, in addition to the 'What's on' guide. We like the design of the app, particularly the transparent coloured bars that reveal the length of a programme or display the live progress of a show/movie.

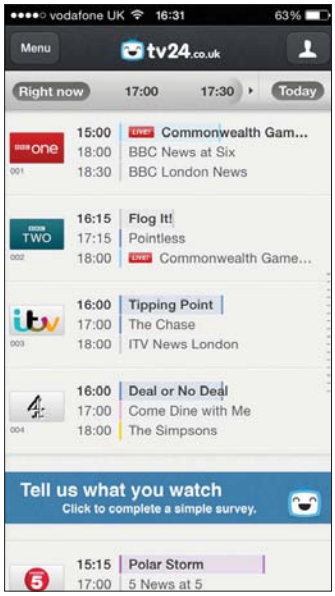
5. Beamly

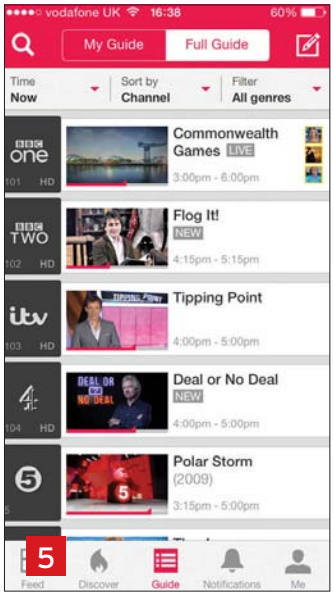
The last offering in our best TV guide apps for Freeview users is a bit different. It aims to make TV more social, by combining a TV guide app for iOS and Android with a social network. You can choose your TV provider in the settings menu, so you don't need to see channels you can't watch.

You can pick your preferred genres, follow your favourite shows and celebrities, and see what your friends are watching, meaning you can view the 'My Guide' TV guide for a guide that's completely tailored to you. You'll also find news about programmes you're interested in, and you'll be able to chat with others about shows you're watching.

It's a great idea, but it needs more users in order to reach its full potential. ☒







GAME

Civilization Revolution 2

£10.49

Contact
■ 2kgames.co.uk
Read more
■ tinyurl.com/px2ssvo

System requirements
iOS 7 or later; iPod/iPhone/iPad

★★★★☆

Less a true sequel and more a glossier version of the original, now carrying a massive price tag, this strategy game may make owners of the original Civilization Revolution a tad grumpy. If you haven't previously dabbled with this streamlined, quicker, mobile interpretation of the long-running PC strategy series, however, you're in for a treat.

Where your average game of Civilization tends to clock in at around a dozen hours, Civilization Revolution condenses your turn-based attempt to conquer the globe with might, science or culture into around an hour. You choose a Civilization to play as from the likes of Egypt, America and the Aztecs, found a few cities and decide whether you're going to seize other capital cities, charm them into joining you or out-research them and win the space race.

Each approach is equally valid and challenging, but you'll need to adapt your tactics on the fly. It's no good being a peaceful Civ that's expanding its borders with culture when you've got a load of angry tanks at your gates, for instance.

It dispenses with so many features – for instance, religion, most types of unit, customising the land around your cities – but manages to remain true to a successful formula that's kept an awful lot of people busy and happy for almost 25 years. Purists are irked, inevitably, but this isn't for them. This is about taking over the world in a lunch break.

Where Civ Rev 2 differs from the now-five-year-old Civ Rev 1 on iOS is in the inclusion of 3D graphics. It looks much nicer, although some of the leaders' faces look like someone mushed their fist into a ball of

plasticine. Kennedy and Churchill are especially disturbing (see below). This is a minor issue, though – the tiny cartoon fights better sword-wielding warriors, cutely chunky tanks and pocket-sized knights look great, happen quickly and offer plenty of scope for shock upsets.

The controls are little iffy, but are a big improvement on Civ Rev 1. Particularly, it's tricky to obtain information about how strong an enemy is or exactly what constructing a new building will do before you commit to the fight or the expense. This is never enough to actually sour a game, but it does create the occasional accident. At least there's a manual save feature, so some disasters can be rewound.

The £10 'premium' price is probably more of a stopping point. It's just about worth it, as this is an uncommonly slick and glossy iOS game, designed to occupy you for hours – much like XCOM, from the same publisher – but it's a shame that the console version's wonderful multiplayer mode is missing. It would have been a perfect fit for leisurely iPad grudge matches against chums.

Let's hope it turns up in a update further down the line. It really is needed, because the AI-controlled Civs aren't the sharpest tools in the box. They'll put up a reasonable challenge, but tend to focus only on military victories and don't team up against you, which robs some of the strategy from CivRev 2.

Verdict

Even so, this is an excellent and charming strategy game. It's extremely hard to justify the purchase if you do already own Civ Rev 1 on iOS, as while the graphics may be prettier you'll stop noticing quickly enough, and the addition of a couple of new leaders doesn't really mix things up. It's pretty darn close to Must Have if you're a strategy lover who doesn't have the first game, though. ☒ **Alec Meer**

LAPTOP

Dell Precision M2800

£1,642 ex VAT
£1,971 inc VAT

Contact
■ dell.co.uk
Read more
■ tinyurl.com/qepL3kt

Specification
15.6in (1920x1080) TFT display, matt-finish; Intel Core i7-4810MQ 2.8GHz (3.8GHz Turbo); Intel HD Graphics 4600 + AMD FirePro W4170M (2GB memory)Windows 7 Pro (64-bit); 8GB DDR3L RAM; 128GB solid-state drive; 802.11b/g/n/ac 2x2 MIMO; Bluetooth 4.0; 1x HDMI 1.4, 1x VGA; 4x USB 3.0; SDXC card slot; 720p webcam/microphone; 1x headphone socket; 97Wh lithium-ion battery; 379x250x33.4mm; 2.85kg

Build: ★★★★☆
Features: ★★★★☆
Performance: ★★★★½
Value: ★★★★½

★★★★☆

Dell has been making an effort to slim down many of its larger 15- and 17in laptops recently, but the Precision M2800 is very much a high-end mobile workstation that focuses on performance rather than aesthetics.

Dell quotes a weight of 2.5kg for the 15.6in M2800, but that's for an entry-level model with an Intel Core i5 processor and six-cell battery. We reviewed one of the top-of-the-range models that is equipped with a more powerful Core i7 and nine-cell battery, and weighs in at a hefty 2.85kg. It also measures a chunky 33.4mm thick, with the large battery protruding out of the back of the unit like a small docking station. This is the sort of laptop that will require a proper carrying case rather than just being slipped into a backpack.

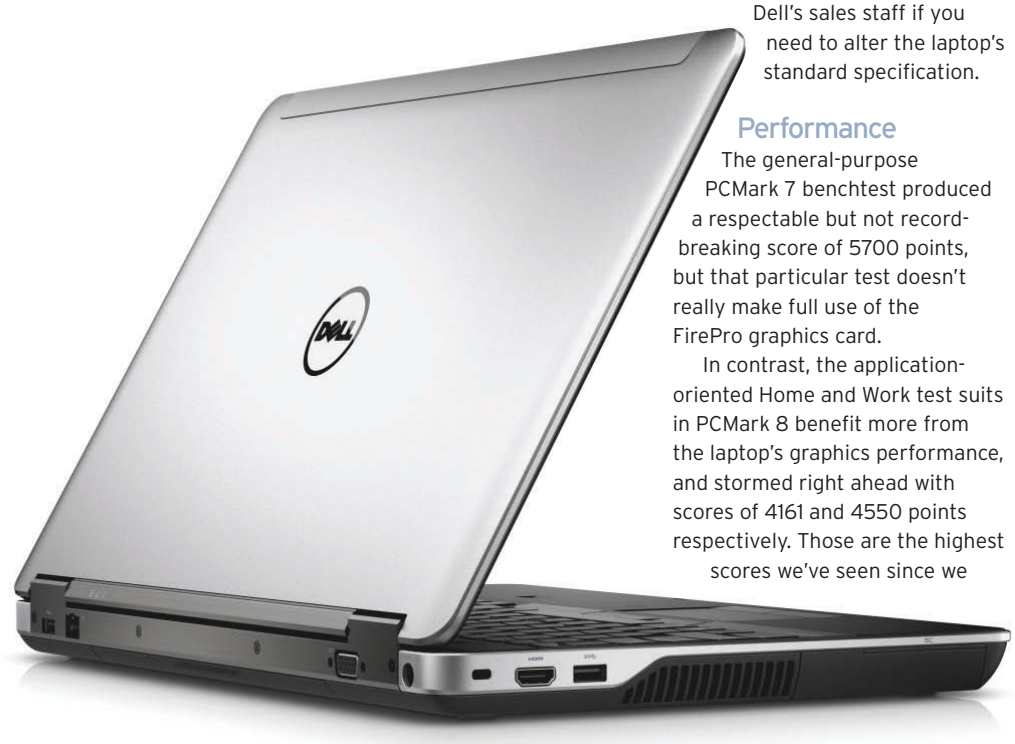
It looks old-fashioned, too, with a chunky black plastic bezel running around the edge of the screen, and running a good old-fashioned copy of Windows 7 Pro. It's very sturdy, with good support for the screen panel, and a firm keyboard with comfortable moulded keys and a separate numeric keypad.

Connectivity

This is good, with four USB 3.0 ports, HDMI, and VGA interfaces, a built-in DVD drive, two-stream 802.11ac Wi-Fi and gigabit ethernet for wired networks. There's also a docking port on the base of the unit – Dell's port-replicator unit will set you back another £179. One complaint here is that the trackpad is also old-style and annoyingly small, at just 80x45mm.

The M2800 packs in plenty of power to justify its above-average size and weight. Prices start at around £1,200 for the dual-core Core i5 model, and our review unit included a quad-core Core i7 processor running at 2.8GHz, 8GB of memory, a 128GB solid-state drive, and an AMD FirePro W4170M graphics card.

This combination currently costs £1,971. There are a number of build-to-order options available as well, but that special offer price only seems to be available for the configuration reviewed here, so you might need to haggle with Dell's sales staff if you need to alter the laptop's standard specification.



Performance

The general-purpose PCMark 7 benchtest produced a respectable but not record-breaking score of 5700 points, but that particular test doesn't really make full use of the FirePro graphics card.

In contrast, the application-oriented Home and Work test suits in PCMark 8 benefit more from the laptop's graphics performance, and stormed right ahead with scores of 4161 and 4550 points respectively. Those are the highest scores we've seen since we started using PCMark 8, so there's little doubt that the M2800 provides true professional-level performance for graphics, video and 3D design work. The only minor disappointment here is that FirePro doesn't score well in Windows gaming performance, only managing a modest 50fps on our Stalker: Call of Pripyat casual gaming test.

Display

The 15.5in screen is a conventional twisted-nematic (TN) panel – and its 1920x1080 resolution is far from state-of-the-art anymore – but the image is bright and colourful, with good sideways viewing angles and a matt finish that reduces glare and reflection.

The battery life is a pleasant surprise, as that huge 97Wh lithium battery pack managed to run the Dell for six hours when using the integrated HD 4600 graphics to stream video from the BBC iPlayer.

The battery pack is designed for easy removal, too, so you can quickly swap in a spare battery (£144) if you need to use the more power-hungry FirePro graphics when you're away from the office. It was also interesting to see the variety of power plans available for the M2800, with a number of power-saving or power-maximising plans – and even a battery plan designed for low-latency audio applications.

Verdict

The Precision M2800 is big and heavy, but its performance is hard to beat if you need a high-end mobile workstation for graphics, video or 3D design. Battery life is respectable for such a powerful laptop, and along with Dell's three-year on-site warranty will ensure that the M2800 earns its keep. ☒ **Cliff Joseph**

PROJECTOR

Optoma EW400

£567 ex VAT
£681 inc VAT

Contact
- optoma.co.uk

Read more
- tinyurl.com/q6ekffa

Specification
Single-chip DLP projector; 1280x800 resolution; 15,000:1 specified contrast ratio; HDMI; 1x USB-A; 1x USB-B; RJ45 ethernet port; composite; 5-pin Mini-USB; 2x 3.5mm analogue audio; stereo speakers with 10W amplifier; 299W (bright mode) average power consumption; 3500 lamp life (6000 hours); 288x220x86mm; 2.04kg

Build: ★★★½☆
Features: ★★★★☆
Performance: ★★★★☆
Value: ★★★★☆

★★★★☆

The EW400 is a plug-and-play desktop DLP projector that manages to combine style with being highly practical, bristling with a range of connectivity options.

Weighing a comfortable 2.04kg and measuring just 288x220x86mm, it's a sturdy projector with an attractive all-white exterior. It can be fixed to a tripod or placed on a flat surface with a 40-degree vertical keystone correction.

The EW400 has a 240W lamp with 3500 hours lamp life in its normal mode, and a native WXGA (1280x800) resolution. Optoma lists it as having a 4000 ANSI lumen brightness rating, and a throw ratio of 1.54:1, which can be cast from 1.28- to 12m away, to create a maximum screen size of 9.21m.

On the back is a selection of ports including a USB connector to PC socket, which can be used for Remote Mouse function, a separate USB input for flash drives, keyboard and mini Wi-Fi dongle. There's also a Mini-USB input for a display.

In addition, there's HDMI, RS-232, VGA out, 2x VGA in, composite video, RJ45 for ethernet connections, and a set of 3.5mm audio jacks and a microphone input.

You'll have to purchase separately the Mini Wi-Fi Dongle kit (WU5205). When we tried it there was a problem with the software version of Optoma Presenter not connecting to the EW400. The Optoma techies told us there might have been a conflict with Windows 7 and have since recommended that anyone wanting to use the Dongle should download a correct version from tinyurl.com/L7ad4mt. Once the update was installed, the connection was established almost instantly.

Controlling your presentations can be organised via PC, via the remote control, or manually via the control panel behind the zoom lever on the EW400. If you have several projectors linked to your network, you can control them simultaneously by downloading the free Crestron RoomView package.

Colour quality is vivid and bright with a 15,000:1 specified contrast ratio. Six preset modes range from Movie and sRGB to Presentation and Blackboard and offer varied contrast and illumination settings.

We found films tended to project in lighter tones than the original but photos and graphics were sharp and documents bold.

Verdict

The Optoma EW400, with its bright and clear presentation is an affordable as well as attractive choice. **Martyn Clayden**

KEYBOARD

Microsoft All-In-One Media Keyboard

£25 ex VAT
£31 inc VAT

Contact
- microsoft.com/uk

Read more
- tinyurl.com/mfxwrqg

Specification
367x132x194mm; 434g; Qwerty keyboard with trackpad; 2x AAA batteries (included); works with Windows or OS X; wireless USB dongle included

Build: ★★★★☆
Features: ★★★★½
Performance: ★★★½☆
Value: ★★★★☆

★★★★☆

The Microsoft All-In-One Media Keyboard is a small, portable, wireless Qwerty keyboard, with an integrated trackpad.

Measuring 367x132x194mm and weighing 434g, the keyboard is finished in smart black plastic and looks much heavier than it is. Everything is black apart from the clear white lettering and numbering, and the blue labels for the function keys. It comes with a tiny USB dongle so you can connect to your PC.

The trackpad is located to the right, and is a large expanse of shiny black. The media hotkeys sit above it, with the volume keys off to the extreme left-hand side. Edges are curved to give the impression of a thinner device than the rather chunky keyboard this is. A shiny clear plastic finish sits in a stripe around the outside, which otherwise has a dusty matt finish. Underneath is a battery tray within which the dongle can sit for journeys.

Build quality feels solid. The plastic finish isn't the most stylish, but is discreet enough to live in your front room and feels built to last.

Connecting the device is easy – simply pop in the dongle, switch on the keyboard and you're good to go. Even in our busy, wireless-keyboard heavy office, we didn't experience any interference.

On the downside, it's about four fifths the size of a full-sized keyboard. The keys are small, and feel spongy in travel, and it sits pretty much flat to the desk.

That's the bad stuff, though, and in the right context it won't be a problem. What's good is the trackpad. This is a decent size and has a nice level of sensitivity. Indeed, during testing, we began favouring the trackpad over a mouse. Moving around by touch is more intuitive, and using swipe-, scroll- and zoom trackpad gestures seems both fresh and time saving in Windows 8. We also liked the fact that the media hotkeys are helpfully positioned above the trackpad. And the volume controls just to the left of the keyboard proper are well placed. It's also easy to use on your lap – the weight isn't a problem and there's no flex, so typing remains accurate.

Verdict

Although Microsoft's device would work okay as a portable keyboard for work purposes, it isn't its intended use. For navigating around a media system or smarthome setup, it will be perfect. At this price it's great value. **Matt Egan**

SHEETFED SCANNER

Canon DR-M1060

£1,416 ex VAT
£1,700 inc VAT

Contact
■ canon.co.uk
Read more
■ tinyurl.com/pqj54xr

Specification
A3 sheetfed; 600dpi resolution; colour duplex; stated speed 60ppm/120ipm; up to 60-sheet ADF capacity); USB 2.0 interface; specified daily duty cycle 7500 sheets; ultrasonic multifeed detection; 3000mm max with straight feeding; TWAIN/ISIS compliant; 424x246x120mm when closed; 424x440x210mm open; 6.1kg

Build: ★★★★☆
Features: ★★★★☆
Performance: ★★★★☆
Value: ★★★★☆

★★★★☆

The Canon DR-M1060 may be one of the most expensive scanners we've reviewed, but it's by no means alone in a £1,500+ marketplace. Indeed, as a sheetfed that can use its automatic document feeder (ADF) to process large volumes of A3-size documents, it's positively cheap.

In fairness, there aren't many models that can offer the same facilities, and none of them can do so for the same price. The Epson WorkForce DS-5000N, for example, is a similarly-priced model, but is limited in its quantity of scans – you'll have to pay an extra £1,000 for the DS-6000 if you want a full ADF.

Xerox has a number of models, but the likes of the DocuMate 4760 are going to cost you another £400 to £500 on top of this Canon's price, while the more affordable DocuMate 4830 lacks the specification of the DR-M1060. Given all that, the £1700 price tag suddenly starts to look like value for money – on paper, at least.

At first glance, you don't get much for your money. Given its A3 size, the DR-M1060 is a rather diminutive model. Two trays slot in and out for easy transport, but you must take care to extend them fully – failure to do so makes the Canon rather prone to chewing up sheets during the scan process.

The DR-M1060 has a depth of 246mm when packed up, but measures 440mm when fully extended. That's not deep for an A3 model, although we recommend leaving plenty of room in front of the scanner, so you can lay down A3 documents fully. The input tray could have been a bit longer, but we appreciate Canon's determination to keep the footprint down.

The DR-M1060 is comfortable with A3 paper, though, and can even handle larger sizes – A1 is available in Folio mode, although you'll want to stick to A3 and smaller for the best results. The interface is USB only, so there's no network connection to scan from afar. The Canon can take in as many as 60 sheets at a time, and has a very robust advertised duty cycle of 7500 scans per day. By way of contrast, the rather more expensive Xerox DocuMate 4760 is rated at just 5000 scans daily, while the 4830 is specified for just 3000.

The control panel is simple, but informative. The Job Number display doubles up as an error indicator, giving you different codes to distinguish between feed problems, skewed source material, double feeds and open compartments.

When we say compartments, there is really only the main one, and clearing blockages is a simple matter of opening the cover and removing the paper.

There's little to confuse users. The clever ultrasonic gadgetry can detect double feeds, and will halt the scan process instantly. This offers some protection to your documents, although you may not want to risk your most precious source material inside any sheetfed.

Double-feed detection

During testing, the double-feed detection wasn't totally flawless, and could be stumped by sticky notes and postage stamps. On these occasions, though, a DFR button can be pressed to tell the scanner to continue on its merry way. Most of the time, though, the only button you're likely to need is the Scan activator. In typical modern-scanner-style, one touch of this initiates the scan, and fires up the software.

The Canon's software bundle defaults to CaptureOnTouch, and this program is perfectly adequate for most everyday office tasks, allowing you to turn out PDF, JPEG, TIFF, BMP and PowerPoint files, and to then whip source material into Evernote, SharePoint, and other third-party programs.

The uncluttered interface doesn't overwhelm you with options, and the results are smooth. Batch scanning, however, will be performed more easily using CapturePerfect, and this powerful package allows for a high degree of customisability, while increasing the range of results. PDF enthusiasts will like the inclusion of eCopy PDF Pro Office, and Kofax VRS offers an alternative to the Canon titles.

Given the relatively modest size of the DR-M1060, we expected it to struggle more with A3 documents. However, it made short work of our test bundles, scanning a 20-page bundle, for instance, at the rate of 39 sheets per minute (or 78 pages per minute) at a resolution of 200dpi.

We pushed this figure to almost 100ppm using A4 material. Even at 300dpi, the scanner managed 28 sheets per minute (56ppm) in A3, although 600dpi was a little slow, at nine sheets (or 18ppm). Our mixed bundle worked well, and we were able to process a range of different items, including embossed business cards.

The scanner wasn't particularly keen on documents with rough edges, and we experienced the odd problem with pages ripped from magazines. In general, though, it scanned smoothly. The results were very nice, with good attention to colour, and clear edges to the characters. Barcode detection isn't included as standard, although you can add such facilities as an option.

Verdict

The Canon DR-M1060 may lack a few of the more advanced features (direct network support, barcode detection as standard) that you might get from the highest end models, but those do tend to be considerably more expensive again. For larger businesses needing simply to convert capacious A3 bundles, this model offers a mix of price and performance that's currently unmatched on the market at this time. **Robin Morris**

BUDGET Gaming PCs

With the release of Intel's Pentium Anniversary processor, powerful entry-level gaming PCs are now a reality. Paul Monckton reviews six wallet-friendly examples

A decent gaming PC can easily outperform any of today's consoles, but it will cost considerably more. However, if you're willing to cut some corners, you can get a speedy model by just spending an extra £100 over the cost of an Xbox One or PlayStation 4 with all the multipurpose benefits of a full PC system.

Processor

Powerful performance like this at under £500 wouldn't be possible without the Intel Pentium Anniversary Edition (G3258) chip, and all the PCs on test use it to great effect.

With its unlocked multiplier, the overclocking potential of the Pentium G3258 is so great that this low-end processor can run at an extra 1GHz above its rated speed without breaking a sweat – and it'll go a lot faster with only moderately priced air cooling systems. The Pentium G3258 is a dual-core processor without Hyper-Threading, so while it's capable of running most games at a decent speed, it's no match for a Core i5 when it comes to running multiple desktop applications simultaneously or multithreaded apps like Adobe Photoshop.

Motherboard

Special considerations apply when building an overclocked gaming PC on a budget. While the Pentium G3258 processor is an inexpensive component, a motherboard with an overclockable Z97 Express chipset is relatively costly. Intel's less expensive H81 Express and B85 Express chipsets, aimed at budget PCs, don't officially support overclocking, but many vendors including MSI and Asus have found a workaround to 'unlock' them. This enables the pairing of a low-cost Pentium Anniversary CPU with a low-cost budget motherboard and is the way most of these PCs have been put together.

The saving allows you to build a less expensive PC, or as is the case in our round-up, to buy a faster graphics card.

Although your warranty protects you from system failures due to overclocking, it's theoretically possible for Intel to pull the plug, and put pressure on vendors to remove the overclocking features in forthcoming BIOS updates. Similarly, Windows Update could also be used to install new processor microcode with the same effect.

Most motherboard manufacturers aren't making a big deal about this feature, either. MSI has issued a statement (tinyurl.com/kvfu6Lf), but that's about it.

So, choosing an H81 Express or B85 Express-based system isn't without risk. You'll need to carefully read through release notes before installing any BIOS updates and also keep an eye on any processor-related fixes via Windows Update. This could cut you off from future bug fixes which may arrive in updates which also disable overclocking.

The Z97 Express chipset brings more than just overclocking features – it also adds more USB 3.0 and SATA ports, support for Intel Smart Response Technology, RAID and PCI-E M.2 SSDs. Your choice comes down to either ultimate performance now, or extra features and the confidence that future updates won't slow down your PC, later.

Graphics card

In nearly all cases, it's the graphics card that's going to determine the overall quality of your gaming experience. The best performance in this group test comes from the MSI GeForce GTX 760. One of these, paired with an overclocked Pentium Anniversary Edition processor can deliver smooth gameplay with high-quality settings at the maximum resolution of a full HD monitor or TV. Want one? You'll have to go with an H81 Express or B85 Express motherboard to stay within our budget.

The next step down in performance comes from the nVidia GeForce GTX 750 Ti, and, if overclocked, it will still enable good gameplay at high resolutions, but you're going to have to bring down the quality a notch or two to maintain high enough frame rates. The difference is noticeable, but it won't prevent you from playing any of your favourite games. Another lower-cost option is an AMD Radeon R7 265, as supplied by Wired2Fire. Although this card didn't perform as well as a GTX 750Ti, there are plenty of games where it will beat the performance of the MSI card quite convincingly.

Cooling

This is essential to stop your CPU from overheating, but it's especially important with an overclocked one. There's not enough money in the budget for fancy liquid-based coolers, so most vendors have opted for traditional heat-pipe based heatsink and fan combos. Low-cost examples of these can still provide better cooling performance and less noise and a stock Intel cooler. The more you overclock your system, the better the cooling needs to be. If you intend to push your pre-overclock PC even further, choose one with a powerful cooling system.

Gamers like their systems to look the part, but the case needs to be practical, too. Smart internal cable management helps with airflow, while fan controllers let you reduce noise or boost cooling as necessary.

Monitor

For more immersive gameplay, go for the largest display you can find and one with a good contrast ratio. A quick response time will ensure that fast, frantic gameplay remains blur free, although not all gamers

Photography by Dominik Tomaszewski

will notice the difference. TN-based monitors cost less and provide most of these features, but IPS-based displays will give you better overall colour reproduction and wider viewing angles, but response times tend to be slower.

The type of controllers you need depends on how your PC is set up, and only Chillblast includes a keyboard and mouse as standard.

If you're using your PC on a desk with a monitor, you'll benefit from the improved responsiveness of wired, rather than wireless, devices. Look for high-resolution mice, and keyboards with programmable keys and backlighting.

High-grade mechanical switches in keyboards have a better 'feel' and last longer than cheap membrane switches. Some draw attention to the W, A, S and D keys with a different colour or texture. A gaming sound card can provide a more immersive experience by adding multiple sound effects. Also consider a gaming headset with a built-in microphone and wireless controllers. We'd recommend a wireless keyboard with its own trackball or trackpad. You may not need an internal optical drive, either.

Warranty

Warranty terms are crucial when it comes to gaming PCs. An advantage of buying a pre-built overclocked computer is that all of the overclocking will be covered by the vendor's warranty. The longer the warranty the better, but be on the lookout for a collect-and-return option rather than a return-to-base one.

CHILLBLAST FUSION SPARTACUS

£599 inc VAT • chillblast.com • tinyurl.com/o7p9z2L

Build	★★★★☆
Features	★★★★½
Performance	★★★★½
Value	★★★★½
Overall	★★★★½

Chillblast's Fusion Spartacus stands out from the crowd with its gleaming white mini tower case and eye-lasering lensed LED indicators. Its AvP Viper chassis (also available in black) is one of the more compact models and its bedroom-friendly proportions are therefore rather densely packed inside, although this seems not to have had any negative effect on airflow.

A modest overclock from 3.2GHz up to 4.3GHz sees the Intel Pentium Anniversary Edition processor running at the slowest overall speed in our group test, and this is reflected in correspondingly lower results in some of our application-based PC Mark tests.

However, this means the Fusion Spartacus runs far cooler and quieter than many of its rivals, with the CPU reaching a maximum temperature of only 75°C. As for gaming, the MSI-branded GeForce GTX 760 graphics card places it at the top of the field alongside both the Cyberpower and Scan PCs – which also use the same graphics adaptor. The fast graphics card results in greater overall system power consumption than those PCs using a GeForce GTX 750 Ti or AMD Radeon R7 265 graphics card.

The Fusion Spartacus is the only PC using an Asus B85M-G motherboard which supports overclocking, albeit without Intel's official support. The board offers several advantages over the H81 Express chipset, including four memory slots, as well as four Intel USB 3.0 ports (three of which are external). There's no optical drive, but a 5.25in external bay is provided if you want to fit your own.

Chillblast's PC is also the only one that comes with an IPS monitor. The 23in Asus VS239HV is smaller than some of the competition and can't match the response times of the faster TN-based competition, but provides superior overall image quality and wider viewing angles.

Other accessories include a Zalman ZM-K200M multimedia keyboard, with coloured WASD and cursor keys for gamers, and a matching 1000dpi ZM-M200 gaming mouse with five buttons.

The system is backed by Chillblast's fabulous five-year warranty, the first two of which include a free collect and return service.

VERDICT: Although its 4.3GHz clock speed isn't much to brag about, the Fusion Spartacus makes a sensible choice at a reasonable price. Gaming performance is on a par with the fastest PCs in this test.

CYBERPOWER INFINITY APOLLO PRO

£599 inc VAT • cyberpowersystem.co.uk • tinyurl.com/nwd6Lte

Build	★★★★★
Features	★★★★☆
Performance	★★★★½
Value	★★★★½
Overall	★★★★½

The subtle wonkiness of The NZXT Source 220 case gives the Infinity Apollo Pro a funny, off-kilter appearance with some jaunty, jutting angles you'll only really notice up close. Inside the spacious case there are plenty of empty tool-free drive bays and smart cable management keeps everything tidy. There's also space to install more fans at the top and the bottom should you wish to increase the cooling even further, but the case looks larger than it needs to be.

More importantly, we find a Pentium Anniversary Edition processor overclocked to 4.5GHz inside with its temperature managed by a sizeable Cooler Master Hyper TX3 heatpipe unit. The CPU is complemented by 8GB of DDR3 RAM and both components are fitted to an Asus H81M-D PLUS motherboard. As its name implies, this motherboard uses an unlocked version of the Intel H81 Express chipset to allow cheaper unofficial overclocking of the CPU.

This cost saving has allowed Cyberpower to install an MSI GeForce GTX 760 graphics card delivering the same level of class-leading gaming speeds those by Chillblast and Scan. The result is top-notch performance in one of the least expensive PCs of the group test. The 4.5GHz overclock gives a slight edge over Chillblast's 4.3GHz system, while the low-cost motherboard makes the Infinity Apollo Pro considerably less expensive than Scan's 3XS Performance GT.

Unfortunately, we encountered a couple of problems during testing. First of all, the built-in network adaptor on the motherboard failed to work, so we had to use an external USB one instead. Then the system crashed during the first run of our torture test. Subsequent runs of this procedure completed successfully, however, and we gave it an extra-long run just to make sure.

The system is supplied with a 23.6in AOC full HD display, featuring an ultra-thin bezel and a subtle red wine colouring. Its TN panel can't match the performance of an IPS display, but its 2ms response time and large screen are ideal for gaming. You also get a Cooler Master Devastator combo comprising a high-resolution MS2K mouse and backlit, toughened MB24 keyboard with dedicated multimedia keys.

VERDICT: The Cyberpower infinity Apollo Pro delivers excellent performance and great features at a great price. The unofficially overclocked H81 Express based motherboard helps keep costs low enough to allow for a speedy graphics card within our budget.

DINO PC MAGMADON GTX 750 TI

£599 inc VAT • dinopc.com • tinyurl.com/o45jcfr

Build	★★★★½
Features	★★★★½
Performance	★★★½☆
Value	★★★★½
Overall	★★★★½

The Magmadon GTX 750 Ti's mid-tower-sized case, makes it one of the largest gaming PCs on test. But this PC features perpendicular drive bays and cable management to keep the internals tidy. A Samsung DVD writer has been installed alongside a 1TB hard drive.

A Pentium Anniversary Edition CPU is installed, overclocked to 4.5GHz and installed in a Gigabyte GA-Z97-HD3 ATX motherboard. Being an ATX board, it offers far more upgrade options than the smaller micro ATX boards used elsewhere. You get not one, but two PCI Express x16 slots (one of which is limited to x4 speeds), plus an extra pair of PCI Express x1 slots and two PCI slots. This makes the Magmadon GTX 750 TI the most upgradable PC of the whole group.

Unfortunately, although 2-Way AMD CrossFire is supported, there's no support for nVidia SLI, so you won't be able to boost the gaming performance by plugging in an extra graphics card.

Despite using the more advanced Intel Z97 Express chipset, the Gigabyte GA-Z97-HD3 is a rather cut-down motherboard, omitting features such as support for M.2 SSDs. However it does offer official overclocking support from Intel.

Also installed is 8GB of DDR3 memory with two memory slots available for upgrades. We were a little surprised to find a stock Intel processor cooler installed, but the system managed to pass our torture tests without crashing. We recorded a maximum core temperature of 95°C, which is a little higher than we would like, but it's still lower than both the Scan and Yoyotech PCs which reached 100 and 99°C respectively. Cooling is assisted by a large front-mounted case fan, illuminated with a cool blue LED.

An Iiyama E2483HS-B1 monitor is included with a 24in screen and fast TN panel technology ideal for action gaming, while a Cooler Master Devastator illuminated keyboard and high-resolution mouse combo is provided. Sadly, these quality components ate up our budget, only leaving enough for a GeForce GTX 750 Ti – which was no match for the frame rates provided by a GeForce GTX 760.

VERDICT: If you can't afford the budget-busting Scan 3XS Performance GT and you want to stick to officially sanctioned overclocking methods, then this is the system for you. The underpowered graphics card is a bit of an issue, but it's still a competitive all-round package.

SCAN 3XS PERFORMANCE GT

£611 inc VAT • scan.co.uk • tinyurl.com/pnxg4nf

Build	★★★★½
Features	★★★½☆
Performance	★★★★★
Value	★★★★☆
Overall	★★★★☆

Scan either misunderstood our review price constraints or chose to ignore them. At £611, including VAT and delivery, but excluding a monitor, keyboard or mouse, the 3XS Performance GT is at least £100 more expensive than any other system-unit-only price in this test.

However, the extra budget allows for some significant improvements in design. First of all, this is the only PC in the group test to provide both the graphics power of an overclocked MSI GeForce GTX 760 and the official overclocking support of the Intel Z97 Express chipset in a single PC.

Scan has overclocked the Pentium Anniversary processor to 4.5GHz which ensures great performance, but it's the GeForce GTX 760 graphics card which pushes this PC into the gaming top three.

We did notice that this system ran hotter than any other under our stress tests, with one processor core peaking at 100°C – a full 25°C hotter than the Chillblast, and hotter than we'd like to see any processor running for any considerable length of time.

The Gigabyte Z97M-DS3H motherboard used here lacks many of the premium features usually associated with the Z97 Express chipset, such as M.2 support and comes with a maximum of only five USB 3.0 ports. However you do get support for RAID and Intel Smart Response Technology if you want to add extra drives later on.

Inside the compact Fractal Design Core 1000 case, the 1TB hard drive is mounted vertically – a far less convenient design than the multiple tool-free drive bays found in Yoyotech's Warbird RS5.

A welcome extra is the inclusion of a multiformat card reader, emblazoned with an illuminated Scan logo and fitted with a pair of from-facing USB 3.0 ports, bringing the total number of external USB 3.0 ports up to six. A pair of small control sliders allow you to change both the brightness and the colour of the logo to suit your preference. You also get a DVD writer combo drive which, uniquely in this group, supports Blu-ray playback. Scan's system is includes a one-year on-site warranty, with the following two years under a return-to-base policy, but covering both parts and labour.

VERDICT: It may flout our pricing rules, but the Scan 3XS Performance GT is still a great system. It offers class-leading graphics performance combined with a high-spec Intel X97 Express-based motherboard which will ensure that you can upgrade it easily in the future.

WIRED2FIRE VX-6

£549 inc VAT • wired2fire.co.uk • tinyurl.com/naf4fmh

Build	★★★½☆
Features	★★★★☆
Performance	★★★★☆
Value	★★★★½
Overall	★★★★☆

The Wired2Fire VX-6 is the most affordable of all our budget gaming PCs. It comes with a monitor, keyboard and mouse, yet still delivers very good performance. Through the transparent side panel of the Cooler Master K350 system case, the bright red of the VTX3D Radeon R7 265 graphics card is complemented by an equally red fan, fitted to the Rajintek Themis heatpipe CPU cooler.

Wired2Fire has boosted the clock speed of the Intel Pentium Anniversary Edition from 3.2GHz to 4.4GHz using the unofficial overclocking features provided by the Asus H81M-E motherboard with its low-cost H81 Intel Express chipset. However, several of our performance measurements yielded higher results than PCs clocked at 4.5GHz, thanks to the speedy 1TB Seagate SSHD hybrid drive.

In our gaming performance tests, the VTX3D graphics card performed very similarly to the GeForce GTX 750 Ti.

A saving has been made by including a relatively small 22in TN display(AOC 2250SWDA). While it offers the same full-HD resolution of the larger displays in the group, it won't deliver such an immersive experience. We were also disappointed by the rather basic and quite miserly two-year return-to-base parts-and-labour warranty.

Also included is a DVD writer and a Cooler Master Xornet gaming mouse, matched with an Octigen keyboard.

VERDICT: A steal at only £549 for the full system, the Wired2Fire VX-6 performs very well as the cheapest PC of the group. It also packs a speedy hybrid drive which increases overall responsiveness.

	CHILLBLAST £599 inc VAT (£499 ex VAT) ★★★★½ PC ADVISOR RECOMMENDED	CYBERPOWER £599 inc VAT (£499 ex VAT) ★★★★½	DINO PC £599 inc VAT (£499 ex VAT) ★★★★½ PC ADVISOR RECOMMENDED
Product name	Fusion Spartacus	Infinity Apollo Pro	Magmadon GTX 750 Ti
Processor	3.2GHz Intel Pentium G3258 (4.3GHz)	3.2GHz Intel Pentium G3258 (4.5GHz)	3.2GHz Intel Pentium G3258 (4.5GHz)
CPU Cooler	Akasa Nero 3 CPU Cooler	Cooler Master Hyper TX3	Intel Stock CPU Cooler
RAM	8GB DDR3 1600MHz	8GB DDR3 1866MHz	8GB DDR3 1600MHz
Storage	1TB SATA 7200rpm HDD	1TB Western Digital Caviar Blue	1TB Toshiba DT01ACA100
Power supply	500W 80+ Aerocool PSU	500W Cooler Master Elitepower	500W Cit 500CB
Motherboard	Asus B85M-G	Asus H81M-D PLUS	Gigabyte GA-Z97-HD3
Operating system	Windows 8.1 64-bit	Windows 8.1 64-bit	Windows 8.1 64-bit
Graphics	MSI GeForce GTX 760 (2GB)	MSI GeForce GTX 760 (2GB)	MSI GeForce GTX 750Ti (2GB)
USB ports	3x USB 3.0, 5x USB 2.0	3x USB 3.0, 3x USB 2.0	5x USB 3.0, 3x USB 2.0
Other ports	PS/2 keyboard and mouse ports	PS/2 keyboard and mouse ports	PS/2 combo port
Display	Asus VS239HV (23in, 1920x1080)	AOC E2461FWH (23.6in, 1920x1080)	Iiyama E2483HS-B1 LED, (24in, 1920x1080)
Optical drive	DVD±RW	BD-ROM/DVD±RW	DVD±RW
Case	AvP Viper Black or White	NZXT Source 220	Corsair Carbide Series SPEC-01 Red LED Mid-Tower Gaming Case
Keyboard & Mouse	Zalman keyboard and mouse	Cooler Master Devastator	Cooler Master Devastator
Warranty	2 years C&R with 3 years further labour-only. Lifetime phone support	3 years RTB (2 years parts, 3 years labour)	3 years RTB warranty (1 year parts, 3 years labour)
PERFORMANCE			
PCMark 7 overall	4110	4325	4657
PCMark 8 home	4250	4191	4630
PCMark 8 work	4818	4607	4757
Games score (fps)[1]	105/56, 259/123/31, 167/88	103/55, 251/122/31, 169/88	74/39, 202/70/17, 171/56
Power consumption[2]	44/300W	51/374W	63/195W

[1]Games tested: Alien vs Predator 720p/1080p, Max; Sniper Elite V2 Low/720p/1080p, Med; Final Fantasy XIV 720p Med/1080p Max [2]Measured when idle and under load respectively

YOYOTECH WARBIRD RS5

£599 inc VAT • yoyotech.co.uk • tinyurl.com/nuwdvho

Build	★★★★★
Features	★★★★☆
Performance	★★★½☆
Value	★★★★☆
Overall	★★★★☆

Yoyotech's large and an imposing Warbird RS5 looks nothing like a budget PC. The EzCool Q7 system case really stands out, with curved coffee-toppling edges at the top, while at the front, USB and audio ports are concealed behind individual plastic flaps. Inside, the case is full of tool-free drive bays and plenty of empty space. In the corner there's an MSI-H81 P33 motherboard fitted with a GeForce GTX 750 Ti graphics card and an Arctic Cooling Freezer 7 heatpipe cooler.

In this system, the Intel Pentium Anniversary Edition has been boosted in speed to a whopping 4.6GHz – the fastest of the group.

Sadly, the supplied CPU cooler wasn't able to keep the processor temperature below 99ºC. Storage results were the best of the group, thanks to having a 120GB SSD installed alongside the 1TB hard drive.

Having blown some of the budget on an SSD, there's enough money left for a GeForce GTX 750 Ti. So, despite the fastest processor and that SSD, the Warbird RS5 can't match the gaming performance of other PCs costing the same. Neither does it use an Intel Z97 Express chipset like the other PCs using a GTX 750 Ti. Also included is a 23.6in AOC E2470SWDA monitor, which is a basic TN-based display with a reasonably fast 5ms response time, but lacking an HDMI port for hooking up external devices. A Gigabyte HM6150 wired keyboard and non-gaming mouse combo is included.

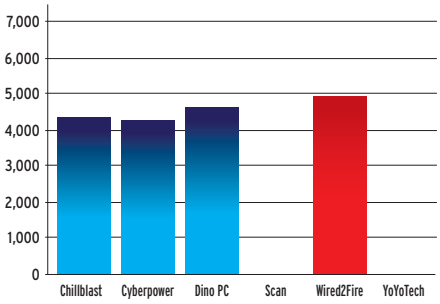
VERDICT: The Warbird RS5 offers a possibly over-ambitious overclock to 4.6GHz, but it comes with an SSD at the expense of a faster graphics card. It's performance will ultimately disappoint gamers.

	SCAN **£611 inc VAT (£509 ex VAT)** ★★★★☆	**WIRED2FIRE** **£549 inc VAT (£457 ex VAT)** ★★★★☆	**YOYOTECH** **£599 inc VAT (£499 ex VAT)** ★★★★☆
	3XS Performance GT	**VX-6**	**Warbird RS5**
	3.2GHz Intel Pentium G3258 (4.5GHz)	3.2GHz Intel Pentium G3258 (4.4GHz)	3.2GHz Intel Pentium G3258 (4.6GHz)
	Arctic Freezer i11	Rajintek Themis	Arctic Cooling Freezer 7
	8GB Corsair Vengeance Pro 2133MHz	8GB 1600MHz	8GB DDR3 1600MHz
	1TB Seagate Barracuda 7200.14	1TB Seagate ST1000DX001 SSHD	120GB SSD, 1TB 7200rpm HDD
	Corsair VS450	500W FSP	500W
	Gigabyte Z97M-DS3H	Asus H81M-E	MSI H81-P33
	Windows 8.1 64-bit	Windows 8.1 64-bit	Windows 8.1 64-bit
	MSI GeForce GTX 760 (2GB)	VTX3D Radeon R7 265 (2GB)	MSI GeForce GTX 750Ti (2GB)
	4 x USB 3.0, 4 x USB 2.0	3 x USB 3.0, 5 x USB 2.0	2x USB 3.0, 4x USB 2.0
	PS/2 combo port	PS/2 keyboard and mouse ports	PS/2 keyboard and mouse ports
	None	AOC 2250SWDA (22in, 1920x1080)	AOC E2470SWDA (23.6in, 1920x1080)
	DVD±RW	DVD±RW	DVD±RW
	Fractal Design Core 1000	Coolermaster K350	EzCool Q7
	None	Coolermaster Xornet mouse, Octigen keyboard	Gigabyte KM6150 combo
	1 year on-site, 2 years RTB, all 3 years include parts and labour	2 years RTB	3 years RTB, 30 days C&R
	4225	5560	3950
	N/A	4900	N/A
	N/A	4742	N/A
	102/55, 266/119/30, 184/85	83/44, 220/74/18, 153/66	73/38, 197/68/16, N/A
	38/324W	41/228W	50/175W

>> How we test and our conclusion

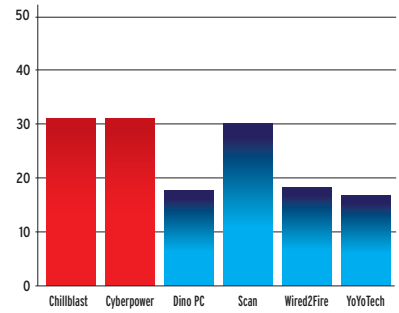
OVERALL SYSTEM PERFORMANCE

PCMark 8 Home (points)



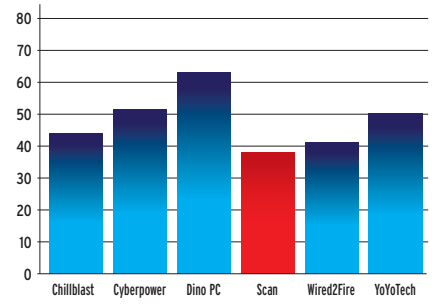
GRAPHICS PERFORMANCE

Sniper Elite 2, 1080p (fps)



POWER EFFICIENCY

Idle power consumption (watts)



Conclusion

We've asked vendors to use whatever tricks they deemed necessary to deliver a fast, fully-featured gaming system for under £600 and, as a result, corners have been cut to deliver the fastest possible performance.

The Systems from Chillblast and Cyberpower both achieve excellent gaming performance at a low price. Because the Cyberpower system suffered a few hiccups during testing, we'd recommend the Chillblast system to anyone demanding the best gaming performance on a budget.

Dino PC's Magmadon GTX 750 Ti takes the official route to overclocking, using the Z97 Express chipset, but the extra expense of the motherboard forces it to use a cheaper graphics card with a drop in gaming performance. Want to stick to Intel's rules and stay within budget? Choose this system.

While nobody can say whether Intel will take steps to stop overclocking on any of these PCs, you need to be aware of that possibility. All of the systems are covered by a full manufacturer's warranty, so you're covered for the next few years at least.

Scan's over-budget 3XS Performance GT is an excellent PC, combining a fast graphics card with a Z97 Express based motherboard.

Wired2Fire's VX-6 which uses an unofficially overclocked motherboard isn't going to win any of the performance tests, but is a great all-rounder (and the cheapest) and its hybrid drive makes it feel snappy.

Lastly, Yoyotech's Warbird RS5 looks impressive, but its over-ambitious 4.6GHz overclock hasn't given it any extra oomph. Its SSD makes a noticeable improvement in day-to-day running, but this does nothing for gaming frame rates, which are held back by its GeForce 750 Ti graphics card. Once again, an unofficially overclocked H81 Express chipset has been used to save money.

Whether or not to pay for a Z97 Express chipset is a decision you'll have to make, and for this reason we're not awarding a Best Buy.

How we test

With this budget gaming PC group test, we've started testing with Futuremark's PCMark 8 v2.0 benchmarking suite. Unlike the previous PCMark 7 benchmark, the new version doesn't produce a single overall figure. Instead, results are divided into Home, Creative, Work and Storage tests.

The Home benchmark reflects command tasks for typical home use with lower computing requirements such as web browsing, photo editing and low-end gaming.

The Creative benchmark is aimed more at enthusiasts and professionals working with multimedia and entertainment content. It is more demanding on the processor and includes transcoding tests as well as further gaming workloads.

The Work test is geared towards office work tasks like creating documents, web browsing, spreadsheets and video conferencing. This test does not stress the gaming and multimedia capabilities of the PCs in this group test.

Gaming performance

We've used three games to evaluate graphics performance. We run our tests at 1280x720- and 1920x1080 pixels at various detail settings. Framerates are recorded using the following games and quality settings.

Final Fantasy XIV: 1280x720, Medium quality; 1920x1080, Maximum quality.

Alien vs Predator: 1280x720, all settings at Maximum quality; 1920x1080, all settings at Maximum quality.

Sniper Elite V2: 1280x720, all options set to Low quality, advanced shadows off, Supersampling off; 1920x1080, All options set to Medium quality, advanced shadows off, Supersampling off; 1920x080, all options set to Ultra quality, Advanced shadows – high, 4x Supersampling.

Power consumption torture testing

We measure the power consumption of each PC base unit when idle, and again while running at its performance limit. During the idle test, the PCs hard drives are still spinning and the power-management features are not enabled. For the full-load torture test, we run Prime 95 to force all CPU processing threads to maximum utilisation and stress system memory. At the same time we run the Geeks3D Furmark benchmark to stress any installed graphics cards. We leave these tests running for 10 minutes, then record the power consumption and the CPU temperature reached.

Overclocking

Because gamers demand the best performance from their hardware, we allow vendors to overclock PCs in this category. We require that any tweaked component is designed for overclocking, and that the PC vendor offers a comprehensive warranty.

Subjective assessment

We pay close attention to the physical characteristics of each PC, its noise output and its build quality, delving inside the case and taking note of the quality of components used, cabling and airflow.

Support

Differences in warranty terms can impact our scoring. Long warranties are sought after, but we also look at the terms and conditions – specifically, whether faulty PCs must be returned to the vendor at your cost and if both parts and labour are included.

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EDITOR'S CHOICE AWARD

802.11AC WIRELESS

Andrew Harrison tests six of the latest 802.11ac-compatible routers that support improved performance, reliability and range

As we mark its second-draft birthday, the latest version of Wi-Fi known as IEEE 802.11ac – or simply 11ac – is slowly becoming available in computing products. While the first 11ac wireless routers were launched in August 2012, it was only when laptops and mobile devices started gaining 11ac capability that these next-gen routers became of much use.

That happened when the first 11ac mobile devices finally trickled out last year, with first the HTC One (M7) smartphone and then the Apple MacBook Air series, released in June 2013. Yet, even today, the greater majority of laptops, phones and tablets on sale rely on 11n for their wireless connectivity.

That looks all set to change this autumn, if, as expected, Apple's iPhone and iPad gain 11ac compatibility.

Why an 11ac router is a good idea

Lessons learned over 15 years and more of development means that 11ac is better than every version of Wi-Fi before it. The principle benefits of 11ac are increased throughput and longer range. In other words, data can be sent much quicker, and you're more likely to maintain a usefully fast connection when you're further away – even several rooms or floors removed from your wireless router.

One way the latest wireless version been optimised is by using multiple aerials, as we've already seen with 11n Wi-Fi. But 11ac raises the speed here through more efficient modulation, to a maximum of 433Mb/s per stream. Compare this with 150Mb/s for 11n on the 5GHz radio band. So in a three-stream setup, as we find with all the 11ac routers reviewed here, the total theoretical peak wireless sync speed is 1300Mb/s.

Expanding on a technique actively in use with 11n wireless on the 5GHz band, two wireless channels can be bonded together to increase data capacity. The current draft of 11ac allows channels 80MHz wide (already four times that of 2.4GHz Wi-Fi); but there's talk of expanding this to 160MHz-wide channels in the future.

Another trick used to good effect is beamforming, a way to aim radio energy more directionally from router to laptop. This is achieved through a phased-array technique, where signals from one aerial are fractionally delayed compared to another, to create areas of constructive interference in the direction required.

Why an 11ac router is a bad idea

The 11ac specification still only in its draft form today. But, like 802.11n, which wasn't formally ratified until several years after the first 11n products appeared, you can be sure that your new 11ac-equipped laptop will work successfully with any existing 11ac wireless router.

As ever with consumer electronics technology though, there's always something better just around the corner. Ignoring the next-next-generation of Wi-Fi – likely to be called 802.11ad and potentially moving into whole new radio spectra – there's still plenty of improvements planned for 11ac. One mooted change will be to use four spatial streams, from four separate antennas, to give a total theoretical sync speed of 1732Mb/s. Another possible upgrade may be the widening of radio channels, from 80- to 160MHz, which may even double throughput.

However, it's not clear how many of the new features being discussed for 11ac will be available to the wireless routers currently on sale. While wider-channel capability may be available after a router firmware upgrade, we can be more sure that to create a four-stream network, you'll need a router with four antennas and four separate radio amplifiers – and that means buying anew.

What to look for

For best results, look for an 11ac wireless router with at least three aerials – although, in some cases, these will be mounted discreetly inside, so check the specs or our expert reviews to be sure what you're getting.

You can safely ignore claims of 600Mb/s speed for 11n Wi-Fi on the 2.4GHz band – even though all the brands represented here except Apple are doing just that. It's the bogus '600' number that's currently inspiring router brands to print AC1900 on the boxes, the sum of 600 and 1300 from two independent radio systems.

The top theoretical Wi-Fi speed in the 2.4GHz spectrum is 450Mb/s; but with encouragement from chipset impresario Broadcom, router makers are marketing a speed breakthrough based on a proprietary and non-standard technique.

Unique to Broadcom, and outside of the IEEE 802.11 standard, they have cooked the books to use 256-QAM technology from 11ac on the older 11n connections, promoted by Broadcom as 'TurboQAM'. Without going into the unavailability of the necessary 40MHz channels, suffice to say there are no laptops or mobile devices which can join this particular wireless network. It's worth noting that in the real world, the best theoretical wireless sync speed on the 2.4GHz band using three streams is 217Mb/s. This can give a best-case real-world throughput closer to 170Mb/s.

For the router's hardware design, you may prefer something that looks less like

ROUTERS

Photography by Dominik Tomaszewski

GCHQ's Bude listening station, and more like something you'd want in your lounge. Our extensive lab testing suggests that internally mounted antennas can be just as effective as routers that rock the stealth bomber look.

With many homes still finding a need for wired ethernet connections, it makes sense to have a good number of ethernet LAN ports. These are all, thankfully, at least gigabit spec nowadays, and four ports seems to be standard issue, with the exception of the Apple AirPort range which settles for just three. Even a limited array can be easily and cheaply extended though with a gigabit switch at any time, although that creates more wires and boxes and wallwarts to hide. Some brands are now touting 'smart routers', which can allow access to the router's setup admin interface by people outside of your home network. Given the number of security vulnerabilities already included in most domestic routers (see tinyurl.com/qzsn4st), we would not encourage additional ways to compromise your home than is necessary. In our experience with Linksys, for example, this 'smart' technology actually blocked our initial setup of the router until we'd created an online account with the maker just to access the router.

Above all, a home router needs stability and security, as it's the gateway to every wired and Wi-Fi-connected device you use at home. These are harder to gauge before you install and use the product, but it's worth checking online forums for reported issues, and looking at the history of the manufacturer for timely patches and security updates.

Bear in mind that none of these routers here have built-in ADSL modems, so they are best suited to those with cable broadband. Otherwise, you'll need to buy a separate ADSL modem that plugs into the router's WAN port.

PC ADVISOR RECOMMENDED

Build	★★★★★
Features	★★★½☆
Performance	★★★★½
Value	★★★★☆
Overall	★★★★☆

APPLE AIRPORT EXTREME 802.11ac

£169 inc VAT • apple.com/uk • tinyurl.com/p8c6heo

For Mac users, the Apple AirPort base station has long been the go-to wireless router over various incarnations. That's not least because the AirPort units are about the easiest in the world to set up, beside the obvious design aesthetic which recommends them to people that don't like ostentatious or ugly IT boxes in the lounge.

But users of Windows PCs shouldn't feel left out as the AirPort Extreme is a standards-compliant wireless router that works with any IEEE 802.11 device. There is the unusual issue of setup and administration though – unlike every other wireless router that's configured by a web browser, AirPort hardware can only be accessed through dedicated software, available for iOS and OS X.

At its core, the AirPort Extreme is a fairly conventional dual-band 11ac router, based on a Broadcom chipset, with three stream capability. But there are many details that set it up from the larger crowd of routers, which often seem to be based on a reference design from Broadcom that's been cloned into different-shaped boxes.

Unlike any other router, its power supply is mounted internally, so there is no unsightly wallwart and its thin tangly cable to hide. On the rear face are just three gigabit LAN ports, a gigabit WAN port for a separate DSL modem, mains cable inlet and a USB 2.0 port. It's also the only premium wireless router here without a USB 3.0 port.

In place of a full-screen web page, the setup utility offers all options through a small application window, or through an iPad or iPhone app. Most of the usual features are included, to configure each radio network with its own name and password, automatic or manual selection of channel. You can select a bridged mode if you don't wish to use the AirPort as a DHCP server, and it's a straightforward operation to introduce additional AirPort Extreme or Express units to extend the wireless network.

Access Control is offered to restrict named wireless clients using a prearranged schedule. VPN passthrough is available, but there's no VPN server option or the ability to change the MAC address.

VERDICT: The AirPort Extreme is superbly built and engineered internally, while its performance on 11n, in particular, is outstanding even if its 11ac speed was behind the leaders of the pack. If you have a Mac or even just iPhone or iPad, it's a doddle to set up and use, and is well supported with essential firmware and software updates.

PC ADVISOR RECOMMENDED

Build	★★★★☆
Features	★★★★☆
Performance	★★★★½
Value	★★★★☆
Overall	★★★★☆

D-LINK DIR-880L

£173 inc VAT • dlink.com • tinyurl.com/oz5g7kg

With the exception of Apple, few other routers come in white. But beneath its high-gloss pale skin, there's a lot less to separate the DIR-880L's features from other brands' routers.

The DIR-880L is D-Link's best router, which the company claims delivers 'the ultimate wireless connectivity'. It's a dual-band design with three external antennas, and is specified for 600Mb/s operation on the familiar 2.4GHz band, and 1300Mb/s on 5GHz using draft 11ac.

The DIR-880L is a flat table-top design with three tall removable aerials ranged along the back panel. A mounting kit also enables you to fix the unit upright to a wall. Six LEDs light across the top to denote various modes of operation, and cooling vents can be seen around the front and side edges.

On the back are the standard one gigabit WAN port to plug into an outboard modem, and four gigabit LAN ports. Also present is one USB 2.0 port for connecting USB storage or a printer; while another USB 3.0 port is sited on the left of the case when viewed from the front. A power button behind lets you easily switch off the router without having to pull the DC cable from its wall-wart adaptor, but there's no facility to switch off wireless radio.

Wi-Fi Protected Setup (WPS) is available via a button in the router's right side. Features found in the admin interface include a web filtering firewall that can be set to a daily schedule, system logging, and traffic statistics with a graph view.

The overall wireless performance of the D-Link DIR-880L was one of the best in this group. Using 2.4GHz 11n, and in common with most other routers here, it averaged 171Mb/s at short range. At 10m its 11n performance was in the middle of the pack, averaging 120Mb/s.

On the open 5GHz plains using draft-11ac, it returned the highest recorded average figure here of 625Mb/s – including a 636Mb/s result from StC flow. In the longer range test, it also returned a relatively healthy 389Mb/s average.

Its USB 3.0 port will only accept Microsoft formatted drives, and had read speeds up to 51MB/s, but writing data speeds were 24MB/s.

VERDICT: The DIR-880L is an easy-to-configure wireless router with enough advanced features to also keep some power users happy. Its nearby wireless performance with 11ac was the best of on test, and it also worked well at range, gaining it a worthy Recommended award.

Build	★★★★½
Features	★★★★☆
Performance	★★★★☆
Value	★★★½☆
Overall	★★★★☆

LINKSYS EA6900

£150 inc VAT • linksys.com • tinyurl.com/nczr2db

The Linksys EA6900 is a dual-band draft-11ac wireless router that, like several competitors, idly promises a '1900' speed rating. It closely follows the design introduced by former Linksys owner Cisco with the Cisco Linksys E4200, and now includes three stumpy external aerials.

Alongside the retro-styled Linksys WRT1900AC router (right), the EA6900 is the Linksys flagship device and one of a range of seven routers packing 11ac offering a full feature set, administered through an online cloud portal provided by Linksys called Smart Wi-Fi.

The EA6900 is a compact, flat table-top design in matt black with cooling vents around the sides, underside and also on top, with a metal-coloured plastic strip running along its middle, with a Linksys logo backlit in white when the router's powered up.

At the back are the familiar four gigabit ethernet LAN ports and single WAN port labelled Internet. Two USB ports are sited horizontally next to each other, one USB 2.0 and one USB 3.0.

Build quality is good and the EA6900 is stylish, if spoiled by its flashy aerials. Cisco-owned Linksys introduced the Connect Cloud software management for its EA (enabled app) router series, which has now been ported to the range sold by new owner Belkin, and renamed Smart Wi-Fi. Once you log in to the administrator interface, you find a modern, stylised and animated environment with all the usual features of a high-end domestic router.

Performance wise, at close range, the EA6900 was able to lock to the maximum 2.4GHz 11n rate for suburban dwellings, and provided real-world transfer speeds of 170MB/s, in line with the group. Longer range speed was in the upper half of those tested, averaging 126Mb/s, but was let down by a low client-to-server performance of 97Mb/s.

Using its draft-11ac mode, we saw a respectable 571Mb/s at 2m, but in the 10m test it slipped to 308Mb/s. The USB ports can accept storage formatted with either MS FAT and NTFS, or Apple HFS+. In speed tests, it had the second-lowest result for a USB 3.0 port, able to read at 44MB/s, but write at only 18MB/s (closer to USB 2.0).

VERDICT: The EA6900 is a relatively competent draft-11ac router that performs as well as or better than its more expensive sister product, the WRT1900AC (on the right). It offers cloud access if you don't object to Belkin's current terms of use, and an attractive modern interface with which to configure the unit even if you do.

Build	★★★★½
Features	★★★★☆
Performance	★★★½☆
Value	★★½☆☆
Overall	★★★½☆

LINKSYS WRT1900AC

£220 inc VAT •linksys.com • tinyurl.com/p7gf7s8

If you don't mind its geeky looks, the Linksys WRT1900AC is one of the most impressive-looking routers available today. Based heavily on the industrial design of the classic WRT54G, the WRT1900AC looks back to the glory days of the Linksys company just before it was bought by Cisco. The WRT1900AC has the same black-and-blue two-tone colour scheme, and the classic aspect that makes it seem to magically hover in mid-air on four corner posts.

This new product is right up-to-date though with draft-11ac wireless, and it's the only UK router on sale with four separate external antennas, bristling from all around the chassis.

While the 11ac draft specification allows for four MIMO streams, the WRT1900AC, like every other router here, only uses three.

Linksys bills the WRT1900AC wireless router as '600 + 1300', promising 600Mb/s on the 2.4GHz band, but, uniquely, it uses a Marvell processor and RF chipset. The dual-core Marvell Armada is clocked higher than any other router CPU at 1.2GHz.

Construction is first-class. Four removable aerials are screwed in place with the usual RP-SMA type connectors – two on the back plate, and one on each side of the chassis. At the back we also find the typical four gigabit LAN and one gigabit WAN port, plus two separate USB ports. One is USB 3.0 and the second is an unusual combination USB 2.0 and eSATA port. The eSATA is a strange choice as these ports are effectively obsoleted by USB 3.0.

Like the Linksys EA6900 (left), the WRT1900AC uses Linksys' Smart Wi-Fi interface with remote management, but its results were disappointing. On the 2.4GHz band at short range, we saw an average throughput of 158Mb/s, where most other routers plateaued at 170Mb/s or above. At 10m, the Linksys turned in just 101Mb/s.

Switching to draft 11ac on the 5GHz band, we were similarly underwhelmed by a limited 408Mb/s at close range, followed by a poor 212Mb/s at 10m. The router's USB results were joint second-best with 51MB/s read speed and 34MB/s for writing large files.

VERDICT: The Linksys is a well-constructed unit with distinctive style and strong build quality. It's wireless performance can only be described as disappointing. It's possible that future firmware tweaks could improve its prospects, but, as it stands, the industrial-looking WRT1900AC is markedly over-priced and under performs.

Build	★★★☆☆
Features	★★★½☆
Performance	★★★½☆
Value	★★★½☆
Overall	★★★½☆

TRENDNET TEW-818DRU

£130 inc VAT • trendnet.com • tinyurl.com/Lon6j6f

TRENDnet has a wide range of wireless routers and modem routers, with five models that support draft 11ac in some way. From the 11ac range, two are equipped with full three-stream radios and the TEW-818DRU is currently their top-of-the-range model.

With the same Broadcom processor and RF chipset as the D-Link DIR-880L and Linksys EA6900, it boasts a similar 600Mb/s performance on 2.4GHz band. Like those models, this chimera specification can be viewed as '1517' (217 + 1300) rather '1900'.

Where the TEW-818DRU does stand out is its price. At around £130, it's one of the cheapest new 11ac routers that supports three streams, but its budget price tag is reflected in a plasticky build.

This router is designed as an upright block, rather than flat table-top case, with its three aerials placed out of sight inside. From the front edge you can read numbers one to four, backlit to show operation on any of the four available LAN ports. Green LEDs also indicate when its 2.4- and 5G radios are switched on, with another graphic indicator light for attached USB devices.

On the back are the gigabit ethernet ports, along with an on/off rocker switch and two USB ports. One is designated USB 3.0 and mounted vertically; the other is a standard USB 2.0 port and fixed horizontally. A little button enables WPS pairing, while the typical recessed Reset button is on the underside of the case.

In wireless tests at short range and on 2.4GHz, the TEW-818DRU was just below the group average of around 170Mb/s, here averaging 168Mb/s at 1m. From 10m away, in our longer-range test, it showed weaker performance with an average of 106Mb/s – and was only kept from the bottom slot by the under-performing Linksys WRT1900AC.

When set to 5GHz 11ac, it was also a mixed bag. At short range, it proved one of the fastest on test, returning an average just under 600Mb/s. But in the 10m test, average speed tumbled to 270Mb/s, just ahead of the lowly Linksys. If you decide to attach USB storage to the TEW-818DRU, it only supports MS FAT-formatted drives with reads and writes averaging a lowly 31- and 22MB/s respectively.

VERDICT: The TEW-818DRU looks like great value, but it lacks a few user-friendly features, and its performance is rather spotty. If you're on a tight budget, look out for the first-generation Netgear R6300 which has been discounted to around a similar price.

Build	★★★★½
Features	★★★★½
Performance	★★★★½
Value	★★★★☆
Overall	★★★★½

PC ADVISOR BEST BUY

NETGEAR NIGHTHAWK R7000

£165 inc VAT • netgear.co.uk • tinyurl.com/q2nrq8q

The R7000 is boldly styled after the Lockheed F-117 Nighthawk stealth fighter as a dark and angular slab with no parallel surfaces. Three large removable antennas span the router's back plate – 163mm-tall truncated triangles that are jointed at their base, to allow even more rakish looks. We found best performance with the central aerial vertical, and side aerials at 45 degrees outwards. It's another AC1900 router, based on the latest Broadcom silicon which includes a BCM4709 SoC with 1GHz ARM Cortex-A9 dual-core processor.

The Nighthawk is a substantial-feeling piece of kit, weighing 854g and sitting a low 285mm wide. Cooling vents are found on the sloped side edges and underside, and also along the angled backplate.

Unlike the Apple AirPort Extreme and Linksys WRT1900AC which use internal fans, the Netgear's cooling is passive with a large metal heatsink sitting at the bottom of the unit. You also have four gigabit LAN and one WAN port, plus one USB 2.0 port. Another blue USB 3.0 port is added to the front, under the overhanging sloped top.

While the front USB 3.0 port's location makes ad-hoc thumb drive use simpler, it's a pain if you want to connect USB storage permanently, as you're left with an ugly cable dangling out the front.

There's no shortage of status LEDs along the top deck, which will flash by default to indicate activity. To the right are two matching backlit buttons – one for WPS, and one to toggle its wireless radios.

Alongside the Apple AirPort Extreme and D-Link DIR-880L, the Nighthawk demonstrated the best short-range 2.4GHz performance, averaging 171Mb/s in our tests. Longer-range performance in the 10m test – still over 2.4GHz using 802.11n – remained excellent, beaten only by the class-leading Apple AirPort base station (159Mb/s), and averaging 137Mb/s over both directions of traffic.

This kind of top-tier wireless performance continued when set to draft-11ac mode – nigh-on 600Mb/s at 2m – with an average result of 592Mb/s. Also, over 10m, the Nighthawk recorded speeds of 365Mb/s and an impressive 511Mb/s, for client-to-server and vice-versa traffic respectively, for a final average of 438Mb/s.

VERDICT: Netgear's R7000 make good use of available components from its Broadcom supplier. Faster routers are available for 11n, but from every 11ac wireless router we've tested, the Netgear sets the benchmark of what's possible with the draft technology.

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How we test

All wireless routers in this group were tested at the same site, a house with few neighbouring networks. Any outside wireless networks were on the 2.4GHz band and low level, while radio channels for testing were chosen well away from such networks. RF interference was reduced by switching off all client Bluetooth devices and Wi-Fi radios.

Data throughput speed tests were conducted at two different ranges, 2m line-of-sight and 10m – with one intervening internal wall. This longer-range test was set up with router and test laptop at normal incidence, and the wall was a standard UK 150mm-thick plaster/wood stud type.

We measured real performance on both radio bands, using the 802.11n protocol on 2.4GHz and draft-802.11ac on 5GHz.

Wireless speed measurements were made between a Mac mini (late 2012) as a server with gigabit ethernet connection to the router under test, and a MacBook Pro (15in, Retina, late 2013) as the wireless client. The laptop was selected as the only known model equipped with built-in 3x3 MIMO draft-11ac wireless capability.

Both computers were running WiFiPerf 1.6 to measure data throughput and tests were run over a two-minute timespan. To better simulate real-world transfers such as data backup, the application was set for TCP rather than UDP traffic. We made measurements from both client to server (MacBook to Mac mini) and vice versa. The final numbers for each distance are a mean average of the two results (in Mb/s).

With all these higher-specification routers now equipped with USB ports, we ran QuickBench storage benchmark tests to gauge their speeds. Average speed results are reported with 2- to 10MB data using the normal convention for storage-device speed of megabyte per second (MB/s).

Note, that while many routers now boast USB 3.0 ports, you will not see anything close to the promised '5Gb/s' speed with which the interface is attributed – while USB 3.0 storage drives can reach up to 440MB/s, the highest speed we recorded was 56MB/s.

For a domestic appliance left on all year round, power consumption should be a consideration. We measured this figure with the router idle and no active wireless clients; and again with the router working wirelessly.

	APPLE £169 inc VAT ★★★★½ PC ADVISOR RECOMMENDED	D-LINK £173 inc VAT ★★★★½ PC ADVISOR RECOMMENDED	LINKSYS £170 inc VAT ★★★★½	
Model name	AirPort Extreme (6th gen)	DIR-880L	EA6900	
Product code	A1521 (ME918B/A)	DIR-880L	EA6900-UK	
Firmware	7.7.3	1.01	1.1.42.161129	
MIMO	3x3:3	3x3:3	3x3:3	
Manufacturer's rating	1300 + 450	1300 + 600	1300 + 600	
Antennas	6x internal	3x external detachable	3x external detachable	
RF chipset	2x Broadcom BCM4360	2x Broadcom BCM4360	2x Broadcom BCM4360	
Processor	Broadcom BCM53019	Broadcom BCM4708A	Broadcom BCM4708A	
Memory	32MB flash, 512 MB RAM	Unknown	128MB flash, 256MB RAM	
WAN ports	1x gigabit	1x gigabit	1x gigabit	
LAN ports	3x gigabit	4x gigabit	4x gigabit	
USB ports	1x USB 2.0	1x USB 3.0, 1x USB 2.0	1x USB 3.0, 1x USB 2.0	
Dimensions	98x98x168mm	247x190x47mm	256x186x45mm	
PERFORMANCE				
802.11n, 2.4GHz, 2m	171Mb/s	171Mb/s	170Mb/s	
802.11n, 2.4GHz, 10m	159Mb/s	120Mb/s	126Mb/s	
802.11ac, 5GHz, 2m	572Mb/s	625Mb/s	571Mb/s	
802.11ac, 5GHz, 10m	328Mb/s	389Mb/s	308Mb/s	
Power consumption [1]	8/9W	10/11W	10/10W	

[1]Idle/use

Conclusion

Interest in 11ac is likely to blossom by the end of the year when Apple includes the facility with its popular iOS devices. The natural choice for anyone with an iPhone, iPad or Mac is the AirPort Extreme, and in our tests it proved itself a worthy choice. It's very simple to use, has the finest build quality and an easy style that will blend into the home. But crucially, it has very good wireless performance using 11ac; and the quickest 2.4GHz 11n performance of any router that's passed through our test lab. That's key to getting the best out of all the legacy 11n devices we'll be using for years to come.

If you're looking for a taste of 11ac, but would rather not stretch to £169, we'd still advise steering clear of the TRENDnet TEW-818DRU. Its wireless performance was spotty and its feature list rather basic. Instead, find a first-gen 11ac router such as the Netgear R6300, now available for around £130.

Linksys is extending its 11ac range under new owner Belkin, with two flagship routers from different design eras – the EA6900 which follows the arc described by the Cisco Connect Cloud range before the networking giant sold its consumer division; and the WRT1900AC which tries to bank on the cult following of the classic WRT54G. Both run the cloud-connected software that enables you to keep tabs on your home network, and Linksys to keep tabs on you. The performance of the EA6900 was good, around the middle of the pack, although the shock and awe of the WRT1900AC was undermined entirely by its weak wireless credentials. At the ambitious price of £220 it's easier to ignore.

The D-Link DIR-880L has broadly the same feature set and performance as the EA6900, and even runs practically the same components internally. It just edges out the latter with its better long-range 11ac speed, freedom from intrusive privacy policies and lower retail price to earn a Recommendation.

But if the best dual-band wireless performance and overall feature set is what you seek, today's choice all-rounder must be the Netgear Nighthawk R7000. There's plenty of on-board options to keep technical users amused, and if you can live with its arresting alien spaceship looks, it will make a good, secure hub for all your wired and wireless home networking needs. ☒

	LINKSYS £250 inc VAT ★★★½☆	NETGEAR £190 inc VAT ★★★★½ PC ADVISOR BEST BUY	TRENDNET £132 inc VAT ★★★½☆
	WRT1900AC	Nighthawk R7000	TEW-818DRU
	WRT1900AC-UK	R7000-100UKS	TEW-818DRU/UK
	1.1.8.161917	1.0.3.60_1.1.27	1.0.8.0
	4x4:3	3x3:3	3x3:3
	1300 + 600	1300 + 600	1300 + 600
	4x external detachable	3x external detachable	3x internal
	Marvell 88W8864	2x Broadcom BCM4360	2x Broadcom BCM4360
	1.2GHz Marvell Armada	Broadcom BCM4709 (1GHz ARM Cortex-A9)	Broadcom BCM4708A
	128MB flash, 256MB RAM	128MB flash, 256MB RAM	16MB flash, 128MB RAM
	1x gigabit	1x gigabit	1x gigabit
	4x gigabit	4x gigabit	4x gigabit
	1x USB 3.0, 1x USB 2.0/eSATA	1x USB 3.0, 1x USB 2.0	1x USB 3.0, 1x USB 2.0
	247x194x52mm	285x185x50mm	48x155x180mm
	158Mb/s	171Mb/s	168Mb/s
	101Mb/s	137Mb/s	106Mb/s
	408Mb/s	592Mb/s	598Mb/s
	212Mb/s	438Mb/s	270Mb/s
	11/16W	9/10W	9/10W

BACK TO SCHOOL!

Looking for the ideal study partner? Jim Martin explains how to buy the best laptop, tablet, smartphone and printer, so you can be top of the class next year

Priced £499, Samsung's slimline **ATIV BOOK 9 LITE** offers decent performance, has an SSD and has an impressive battery life

Now's the time to start thinking of the tech you're going to need to take to school, college or university. Every student needs a laptop or PC; tablets are great for note taking, but when you need to get down to some serious work, only a fully-fledged PC will do. Or will it?

Deciding whether you should buy a tablet or laptop is a tricky proposition. In years gone by, tablets were devices for entertainment, not work, but with convertibles – or 'hybrid' – devices, companies such as Microsoft, Asus and Lenovo say you get the best of both worlds at a great price.

However, most people still prefer to own both a laptop and a tablet rather than compromising and ending up (if you buy the wrong convertible, that is) with the worst of all worlds: an underpowered laptop and bulky, too-heavy-to-carry-everywhere tablet. Sometimes, it might even be cheaper to buy separate devices: a top-end Microsoft Surface, for example, costs more than a decent budget laptop and tablet.

We'll explain how to choose the best laptop, tablet and convertible here, as well as what to look for in a smartphone and printer. That's all the essential kit you'll need for your research, note-taking and assignments – and most of it will double up as entertainment because, as any student knows, it's not all about work.

> **"When choosing a laptop, it's important to consider factors other than merely price and screen size. Those are important, of course, but getting the best value for money means understanding the rest of the specifications as well"**

The best laptop for studying

When choosing a laptop, it's important to consider factors other than merely price and screen size. Those are important, of course, but getting the best value for money means understanding the rest of the specifications as well.

Comparing specs will get you only so far, because numbers won't tell you whether the keyboard is comfortable to type on for long periods, or if the screen has accurate colours, good viewing angles, brightness and contrast. That's where our reviews come in: they give you the inside information that you won't get from a retailer's web page or by going into a high street store.

Which is the best laptop for students, though? Weight is an issue if you'll be carrying it to every class, so aim for 2kg or less. Power supplies can add a surprising amount of weight to your backpack, so a slightly heavier laptop that has a longer-lasting battery could be a better choice than a lighter laptop, which you'll need to plug in everywhere.

Battery life, then, is another factor. This varies from just a couple of hours to over 12 hours, but don't take the manufacturer's word for it. We always run the same tests to find out how long a laptop lasts so – again – check our reviews to see if the claims stand up.

Processing power isn't usually an issue even in budget laptops, so unless you need to run demanding 3D- or video software, there's no need to pay extra for the top processor such as the Intel Core i7. Look out for an Intel Core i3 or Core i5, and consider 3GB of RAM a minimum. For laptops with AMD processors, look for an A8 or A10 series.

Many laptops dispense with an optical drive to save weight, bulk, cost and battery life. That's not usually a problem and even

if you really do need one, a USB DVD writer costs less than £15 now.

Laptop screens range from 12- to 17in, measured diagonally, and most have 15.4in screens. A 14in display is a good compromise in usability and portability. Importantly, resolution is usually the same on 13.3-, 14- and 15.4in screens: 1366x768 pixels. That means everything looks bigger on a larger screen, but there's no more detail. Generally a higher resolution is always better, though.

The displays themselves differ in quality, but most under £1,000 use so-called TN technology, rather than the IPS panels found in many tablets these days. That means viewing angles are more restricted and colours aren't usually as vibrant. A TN screen isn't a reason not to buy a laptop, but since quality varies enormously, it's crucial to read reviews to find out if your chosen laptop has a good one or not. After all, since you'll be using it for research and writing essays, you want a screen that displays text and images clearly.

Some budget laptops have touchscreens, but you'll probably find this is more of a gimmick than a benefit. Unless the display is on a hinge that lets you fold it flat against the desk, or it swivels and lays flat on top of the keyboard, it's usually too uncomfortable to use for anything other than the odd stab to launch an application.

APPLE'S iPAD MINI is easy to use, has a great-looking Retina display and will easily fit into a bag or backpack

> **"If you can afford one, you won't regret it – iOS is a slick system which also happens to offer the best range of apps because developers make their apps for iPhone and iPad first"**

Last but not least, look for a laptop with a solid-state drive (SSD) instead of a hard drive. These are much faster than traditional hard drives and aren't as delicate. The only drawback is capacity: budget laptops might come with a 128GB SSD, while the equivalent hard drive-equipped laptop will have 500- or even 750GB.

The best tablet for studying

Tablets are marvellous for many reasons. One is that they're so versatile. They're great for browsing the web (that's research, right?), and reading books (text books, of course).

You can also use a tablet for making notes, or even type long essays by pairing it up with a Bluetooth keyboard. Their batteries last longer than most laptops, and they're lightweight and easy to carry everywhere. They are also great value for students because they double up as an entertainment device for catch-up TV, videos, music, YouTube and games.

How do you choose a tablet then? The obvious question for most people is: "do I need to buy an iPad?" and the short answer is no. If you can afford one, you won't regret it – iOS is a slick system that offers the best range of apps because developers make their apps for iPhone and iPad first.

Tablets that run Google Android can be just as good, though, and are often better value. The cheapest current iPad costs £319, although you'll save money thanks to Apple's student discount scheme which gives around a 10 percent saving. Apple still sells the original iPad mini for £249, but that's relatively poor value compared to some of the more recent Android tablets, such as the LG G Pad 8.3 (tinyurl.com/n8obc7n), which costs £189.

Things to look for when buying a tablet include battery life, screen size and resolution, features such as Bluetooth, GPS and cameras, and the ports and connections on offer. As with laptops, you'll learn only so much about a tablet from its list of specs. You'll need to read our reviews to find out whether it has a good- or poor-quality screen, and exactly how long its battery lasted in our tests. Some, but not all, manufacturers exaggerate their battery life figures, and we've seen tablets last anywhere between three- and 12 hours.

It's unlikely that a GPS receiver will be an essential feature, but bear in mind that only 3G/4G iPads have these. Wi-Fi only models don't have GPS.

You might also think you'll never use a tablet's camera, but it's worth knowing if it's

If you can't manage the expense of an iPad there are plenty of **MORE AFFORDABLE ALTERNATIVES**

capable of taking good-quality photos and videos or not. Our reviews will tell you this.

A front camera isn't always a given – some of Amazon's Kindle Fire tablets omit one – but you'll need one if you plan to use Skype or another app for video calls.

Generally speaking, you're wasting your money if you spend less than around £120 on a tablet, but there are exceptions. One in particular is the Nook HD (tinyurl.com/cm8Lqkg), which can be found for £90 or less. Like the Kindle Fire HD (tinyurl.com/ch6cLnz), it runs a highly customised version of Android but now offers access to the Google Play store. It's always worth checking that the Play store is included on an Android tablet because you don't want to be stuck with an inferior app store.

Finally, if you want a tablet primarily to take notes, consider a Samsung Galaxy Note. These tablets (there are several models) come with a stylus, which Samsung calls an S-Pen. These are far better than using a generic stylus on any old tablet, since they're pressure sensitive.

Also, Samsung's software makes it easy to add notes and annotations. Plus, you can make clippings by drawing around what you see on screen. Possibly the biggest advantage is for artists or design students as it's possible to accurately draw and sketch with an S-Pen – you won't get nearly the precision with an iPad and a standard stylus for capacitive touchscreens.

The best smartphone for students

Unless money is no object, iPhones are probably going to work out too expensive for many students. You could go for a refurbished or second-hand iPhone 4s (tinyurl.com/n28ws67) or 5 (tinyurl.com/mhhv5Lf), but for even less money, you can pick up a budget Android smartphone. You might choose to sign up for a contract and get the phone free, but the best value always comes from buying the smartphone outright (SIM free and unlocked) and then choosing a pay as you go tariff.

Unlocked smartphones start at around £60, such as the ZTE Open C Firefox Phone (tinyurl.com/p2gjsLr), but the cheapest Androids – those that are worth buying – start at £80 to £90. Motorola's Moto E (tinyurl.com/moj7L7e) is a bargain at £90, but if you want a 4G handset, try the EE Kestrel (tinyurl.com/kf2Lccw) for £99 (but bear in mind it will be locked to EE).

Android isn't the only sensible option at the budget end of the price range: Windows Phones are coming of age, and there are bargains to be had for cash-strapped students. You can buy a Nokia Lumia 520 (tinyurl.com/p76qavy) for just £80 SIM free, or the newer 630 (tinyurl.com/Lobc7uy) for

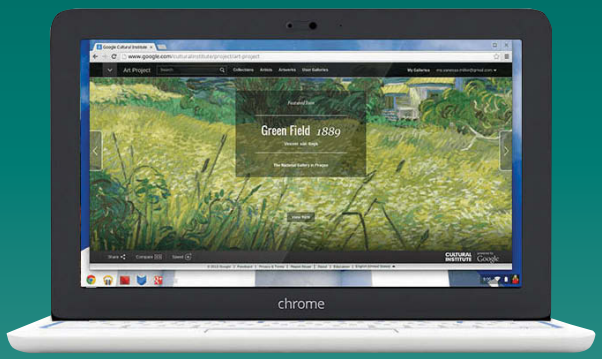
CHROMEBOOKS

When searching for the best laptop, you'll probably come across Chromebooks. These look like laptops, but instead of running Windows 8, they run Google's Chrome OS. This is much like the Chrome web browser: everything is done online using web apps.

As long as you have an internet connection, Chromebooks can be just as good as a regular laptop since most of what you do is on the web these days. It's possible to create and edit documents without a connection but Chromebooks are severely limited when they're not online.

Since they don't run Windows, you can't install Windows applications and games on a Chromebook. You can't really edit video, or run Photoshop, but you can edit photos and play casual games online. Printing from a Chromebook is possible, but it requires a printer that supports Google Cloud Print.

The real benefit of Chromebooks is their price: they usually cost less than £300 and some are under £200. Certain models



have a SIM card slot so you can pop in a 3G SIM and get online almost anywhere, but they are at the top end of the price scale and you'll then have to pay extra for the mobile data.

£110. Neither supports 4G or has a front-facing camera, but the 630 comes with Windows Phone 8.1.

If you want to go it alone and choose your own smartphone, the things to look for include the latest version of Android or Windows Phone: don't be fobbed off with old handsets running ancient versions which won't be updated to get new features that you'll see with new smartphones.

For Android, that's KitKat 4.4 and for Windows Phone, it's version 8.1. Soon, iOS will be updated to version 8, and all iPhones back to the 4s will be able to download it for free.

At the time of writing, the NOKIA LUMIA 630 was the only handset to come with Windows Phone 8.1

The size and resolution of the screen isn't critical, but the more pixels the crisper everything will appear. Some people like big displays, while others prefer a smaller phone that fits easily into a pocket, so bigger isn't always better.

Battery life is important, but most phones last a similar amount of time – between one and two days' of normal use. Plus, the proliferation of inexpensive USB batteries means that it's easy to top up your phone's level in your bag while you're not using it.

Performance is arguably more important as it's frustrating to use a sluggish smartphone. Simply looking for a quad-core processor rather than dual-core isn't enough, as it depends on the speed of those cores. As a general rule, phones with a Qualcomm Snapdragon 400 or 800 processor should be zippy enough, but check our reviews to make sure speed is up to scratch.

There are other features to watch out for, too. For example, if you plan to use Bluetooth gadgets such as activity trackers, you need Bluetooth 4.0. With Android, even that

There's a wide range of BUDGET ANDROID SMARTPHONES for your to choose from

isn't enough as apps have to be written for specific smartphones rather than Android in general. For this reason, it pays to have a popular model such as a Samsung Galaxy S5 (tinyurl.com/nhdz6od) or Google Nexus 5 (tinyurl.com/nhLgc74).

NFC is non-essential, but one thing you will want is expandable storage. iPhone users quickly discovered that apps, games and videos use up the internal storage and there's no way to add more. Many Android smartphones have a microSD slot for cheaply adding capacity, and Windows Phones with memory card slots are beginning to appear, too. If your chosen smartphone doesn't have a slot, check how much storage is available to the user out of the box. Just because the specs state 16GB, it doesn't mean that is free storage for your files. We've seen smartphones with as much as 4GB used by the operating system and preinstalled apps.

The **CANON PIXMA MG5550** offers excellent speed and print quality at a low price

The best printer for students?

People print much less these days, but you'll probably find you still need a printer for proofing course work before handing it in.

Which is the best printer will depend on where and how it will be used. Inkjets are usually the best choice, as opposed to lasers, because they're cheaper and most have a built-in scanner for standalone copying. They're cheap, too, starting at around £50.

Although toner works out cheaper per page than ink cartridges, a set of toner cartridges for a colour laser is often more expensive than the printer was in the first place, and they tend to come with 'starter' cartridges that last a thousand pages or so, rather than the 2,000- to 4,000 page yields of standard cartridges. By contrast, cartridges for an inkjet will print 'only' several hundred pages, but are more affordable when funds are limited.

Laser printers are faster, but they don't print images and photos as well as inkjet printers. If you're not worried about colour prints and you don't need a scanner, a mono laser is a good alternative. Prices start around £50, and you'll get page after page of crisp text in next to no time.

Look out for built-in Wi-Fi, since this means you can print directly from various devices without having to share the printer via a PC or laptop. It also pays to look for a model that works with those devices. For example, if you want to print from an iPad, then you'll want a printer that supports AirPrint.

Those with a Chromebook or Android tablet or smartphone will want something that supports Google Cloud Print. If you'll be using the printer in a dorm room and don't have a wireless router, look for a printer that supports Wi-Fi direct. As the name suggests, you can send documents directly to the printer without needing a home network setup.

With inkjet printers, there are different cartridge systems. Some models have an individual cartridge for each colour, such as cyan, yellow, magenta and black. Others combine the coloured inks in one cartridge and force you to throw it away when one of the colours runs out – yellow is typically used up faster than the others. However, combined cartridges also tend to have a built-in print head which means you get a new one when you buy a new cartridge. Printers that have the print head built into the printer can be a hassle as the ink nozzles can get blocked if the printer isn't used regularly.

As ever, check our reviews to get the lowdown on a particular printer, and also to find out whether or not its prints are good quality, as well as running costs.

CONVERTIBLES

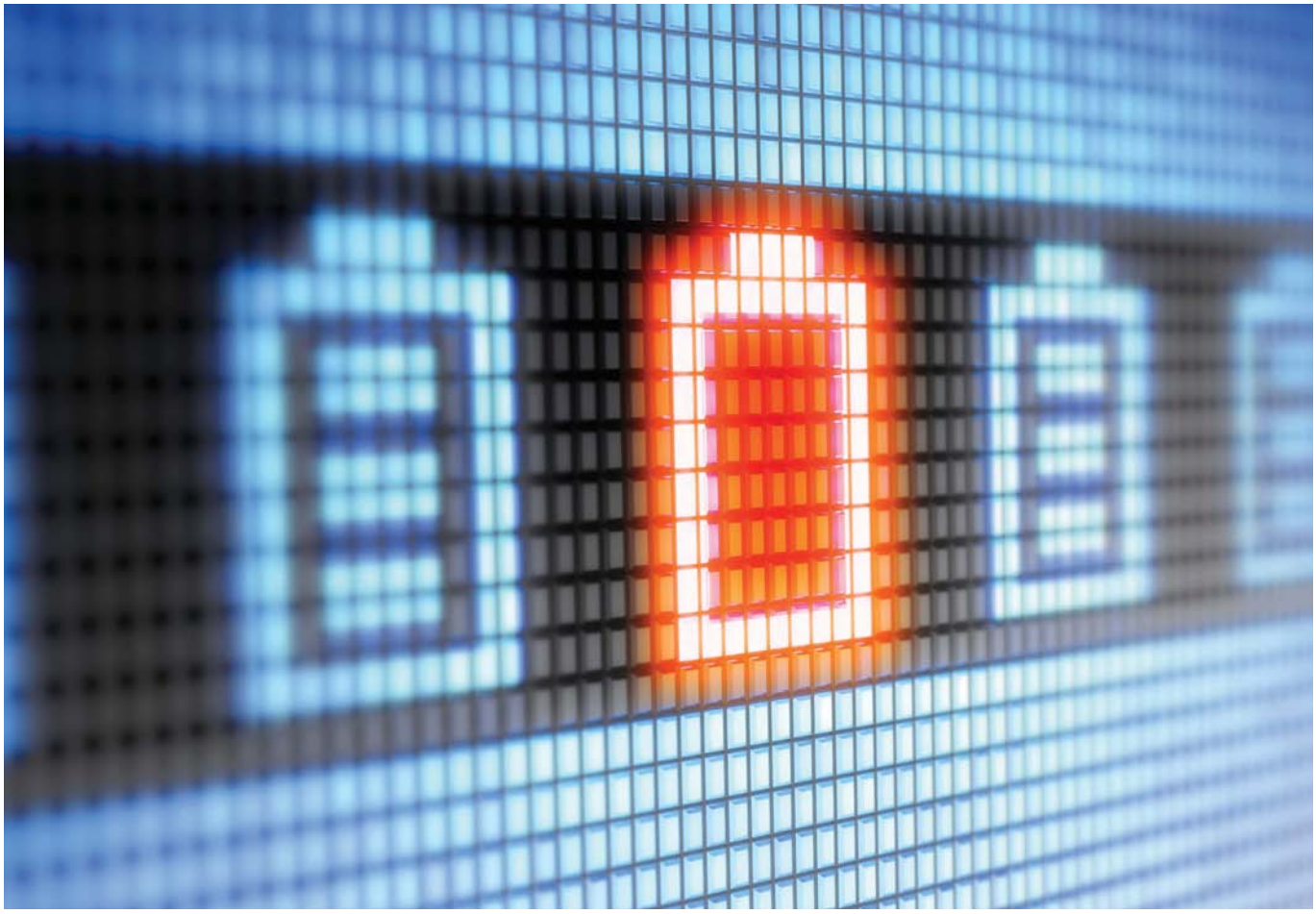
If you like the idea of having one device that can be a laptop and a tablet, there's a reasonable range of models to choose between. Lenovo, Asus, Dell and Microsoft among others have convertibles, with the Surface Pro 3 (tinyurl.com/neLnz52) being the newest addition to Microsoft's range.

One thing to consider is that most convertibles run Windows 8. That's fine for laptop use, but as a tablet, you're limited to Windows apps as opposed to Android or iOS apps. Currently, the Windows 8 app store still lags behind Android and iOS.

There's also the confusion of Windows RT. This tablet operating system is available on some devices that look like convertibles but aren't – they're tablets with a detachable keyboard. These can't run traditional Windows software such as Photoshop – they can only run apps from the Windows Store.

As we said right at the start, we still think that convertibles are a compromise over having a separate laptop and tablet. However, the low prices of some models such as the new Acer Aspire Switch 10 (tinyurl.com/qddgkg2) can be tempting. This

sub-£300 tablet runs full Windows 8 and comes with a 'proper' keyboard. Beware, though, that a 10in screen is rather small. Consider 13.3in a minimum for a usable convertible device.



Power your kit more effectively

Mike Bedford explains how to extend your mobile phone's battery life and beat power cuts at home

Commonly, when we use tablets, smartphones and other portable devices on the move, battery life is often shorter than we might expect. The good news is that restricted operating time isn't necessarily a fact of life that we have to live with – we have some expert guidance on how to overcome this annoying limitation.

First we'll look at how to configure the myriad settings on your Android phone – most of which also apply to your tablet – to conserve battery life. Although this can make a huge difference, you're never going to get more than a day's intensive use from a smartphone if you're away from a power socket. In this instance, you need some means of charging the battery without resorting to mains power. We look at the options which range from large external batteries, to solar and wind-up chargers, and – for those in the middle of nowhere – a high-tech camping stove with a built-in generator.

Even at home, power or the lack of it, can impact our productivity. Thunderstorms can cause mains power to be interrupted, while light bulbs can trip a circuit breaker, potentially disrupting your mains supply when they fail. If you're working on a desktop PC, the result is inconvenience at the best of times, and losing hours of work at the worst.

How do you protect yourself? We investigate a solution that takes the form of an uninterruptible power supply, which probably isn't as expensive as you'd think.

Configuring smartphones

Battery life is something that you should take into account when buying a smartphone or tablet, so it would be sensible to take a look at our comparative reviews before taking the plunge. In reality, though, other qualities are going to be higher up your list of requirements, so battery life will only affect your decision if choosing between a pair of otherwise very similar devices. However, you don't have to use all your phones facilities all the time, and by configuring it correctly, and turning on features only when you need them, you can do a lot to increase battery life.

Perhaps the most power-hungry parts of a phone or tablet that are only used for certain tasks are the GPS circuitry and the Bluetooth

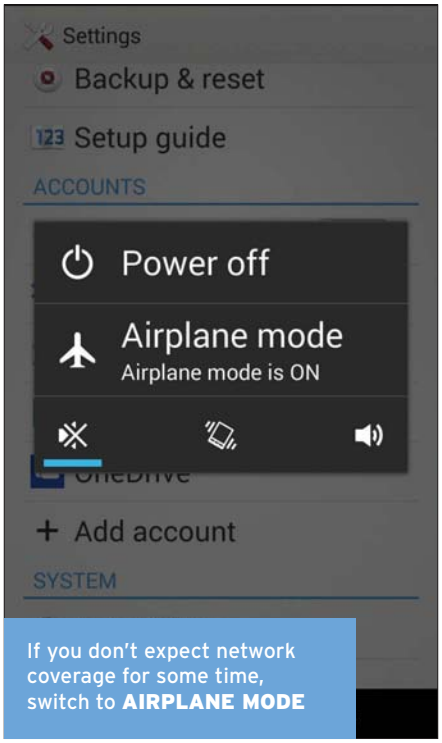
interface. It makes a lot of sense, therefore, to keep these turned off – switching them on only if you intend to use a navigation app or a Bluetooth headset or a hands-free kit. As luck would have it, these are most commonly used in a car where you have external power available. Wi-Fi circuitry can be a drain on the battery, too, so you may want to turn this off, too, if you're not at home or using a Wi-Fi hotspot. But be sure to enable it when you have Wi-Fi connectivity – especially if you've configured apps to update only when you're connected to Wi-Fi to save on data charges.

It might seem paradoxical, but you could even consider turning off your smartphone's phone circuitry, by putting it into Airplane mode, if you don't anticipate making or receiving calls or text messages. This is particularly beneficial if you're in a poor coverage area, as indicated by the phone's reception indicator, because the phone will turn the power up to try to compensate for the poor signal. What's more, if you're on a train in the Scottish Highlands, you probably won't be able to make or receive calls anyway.

Big screens can use a lot of power, especially if they're set at full brightness. Use the lowest brightness setting that allows you to read the screen easily, bearing in mind that this implies turning it up when you're outdoors in bright sunlight.

Alternatively, configure your phone to adjust the brightness depending on the ambient light level, if the option is available, but remember that this probably won't be as efficient as adjusting the brightness manually. Also, try to avoid having the screen on when you're not reading it by configuring the time-out setting to a suitably low value.

Save power by **TURNING OFF THOSE FUNCTIONS** that drain your phone's battery



If you don't expect network coverage for some time, switch to **AIRPLANE MODE**

Many trains have **POWER SOCKETS**, so you can keep your phone's battery topped up while you're travelling

Another unnecessary drain on the battery is caused by apps that you're not using, but are still active – so close the ones you don't want that are running in the background.

Finally, because it automates a lot of what we've discussed, you might want to enable the Power Saving mode that's available on many modern devices. This will make various changes, such as turning off GPS and Bluetooth and dimming the screen, when the battery charge drops below a preset level.

Portable power solutions

It pays to get into the habit of charging your phone or tablet whenever possible. So, put your phone on charge if you're at home or on a train by a power socket, plug it into the USB port when you're working at a desktop PC, and use your car's 12V socket to keep your battery topped up when you're driving.

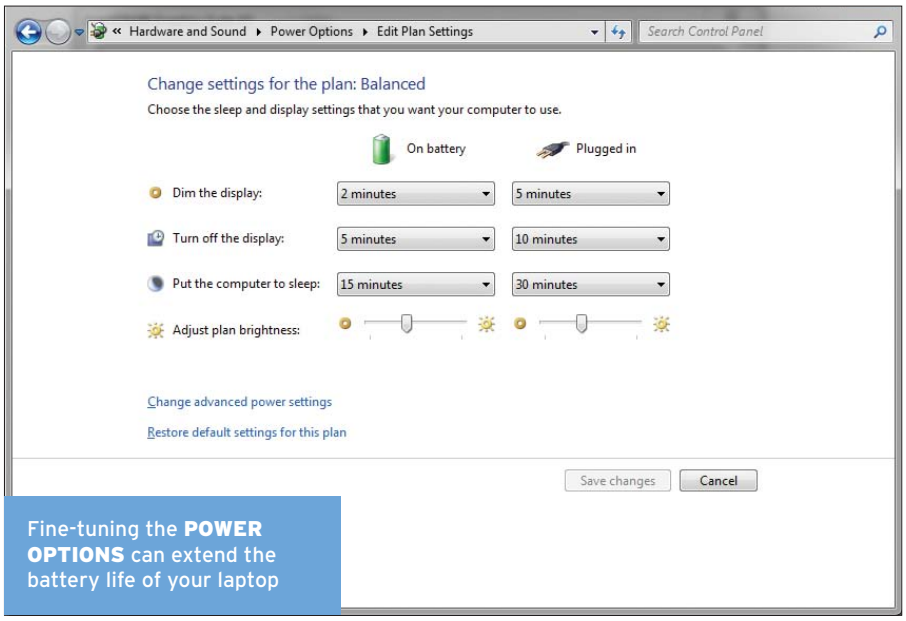
Even when you're away from these sources of power, though, there are ways of charging your device although it involves investing in some additional kit.

The simplest go-anywhere chargers are nothing more than external batteries which are charged normally from the mains or USB (although a few of the cheaper ones take non-rechargeable AA batteries) and can then be used to charge portable equipment via its USB port. The number of charges you can get from one of these devices depends on the capacity of the battery in your phone, and of the battery in the external power pack.

For example, if your phone contains a 2,070mAh battery, as the Moto G does, and the external battery pack has a 10,000mAh battery, assuming it's fully charged, it'll charge your phone almost five times.

Battery packs vary from small, cheap ones with a capacity of about 1,000mAh to top-of-the-range ones with 20,000mAh batteries and above. In addition to the extra cost, the packs with the highest capacity will also be the biggest and heaviest with the largest ones being larger than most phones. Manufacturers of these devices include Anker, Powertraveller, Tylt and Lumsing, and prices range from about £15 for small ones that use AA batteries to well over £100.

If you anticipate being away from mains power for a long time, or don't want to have to carry a huge external power pack around, some go-anywhere charges can, themselves, be charged without having access to mains power. We took a look at three, that operate in quite different ways. The Powermonkey Extreme – see page 49 – (£105 from outdoorchargers.co.uk) is a 9,000mAh battery pack with a solar charger as an alternative to mains charging. Its manufacturers claim that it can charge to



Fine-tuning the **POWER OPTIONS** can extend the battery life of your laptop

full capacity in 18- to 22 hours using optimal illumination, but this take considerably longer in the UK. On a sunny summer afternoon, we were able to put three to four percent of charge per hour into its internal battery, this being enough to charge a typical smartphone by about 15 percent. On an overcast day, it performed very poorly in comparison.

The Freeplay TUF – see page 51 – (£34.99 from tinyurl.com/LumaLhh) is a multifunctional device comprising an AM/FM/SW radio, torch and USB charger. Its internal battery can be charged either via its solar panel, which is much smaller than that of the Power Monkey Extreme, a cranking handle, or its USB port. Because the internal battery is small compared to that of a phone, though, it's only used to power the radio or the torch, but an external device can only be charged directly from the cranked generator while you're actually winding. Given that you're not going to want to crank it for minutes on end, this is probably best considered as a device for providing a bit of power for emergencies.

Manufacturers Freeplay say that a minute of cranking will provide two or three minutes of talk time. We found that two minutes of cranking at two turns per second was enough to inject one percent of charge into a typical smartphone with a 2000mAh battery.

A very different solution, if you're going to be well off the beaten track, is the BioLite CampStove – see page 50 – (£129.95 from outbacktrading.co.uk). This is a camping stove that burns material such as twigs, fir cones or other dry biomass that you might find near your campsite, and generates electricity while it boils water for your tea. Although it has an internal battery, this is also used to power the stove's fan than assists combustion and will only charge a smartphone or tablet from the surplus power once the battery is fully charged. This means that charging has to be done while you're cooking. Its manufacturers claim that 20 minutes of charging will give an hour of talk time. We found in practice that it could put one percent charge per minute in to an average smartphone's battery.

Laptop issues

Smartphone and tablet battery life might be an issue we hear a lot about, but laptops often have a much poorer battery life. There's not as much scope for turning features off to save power (as with Android devices) but you should ensure that Windows is configured optimally to prolong battery life.

In the Windows 7 or 8 Control Panel, select Hardware and Sound, and then Power Options. By default, the balanced mode will be selected, but for extra battery life, at the cost of slightly less convenient settings, you can select the Power Saver mode (not available on all PCs). Having made your choice, by clicking on 'Change plan settings' against your selected mode, you can fine tune it by selecting, for example, how soon to dim or turn off the display after a period of inactivity. Although laptops differ in which options are available. To further tweak the power usage, click on the 'Change advanced power settings' link.

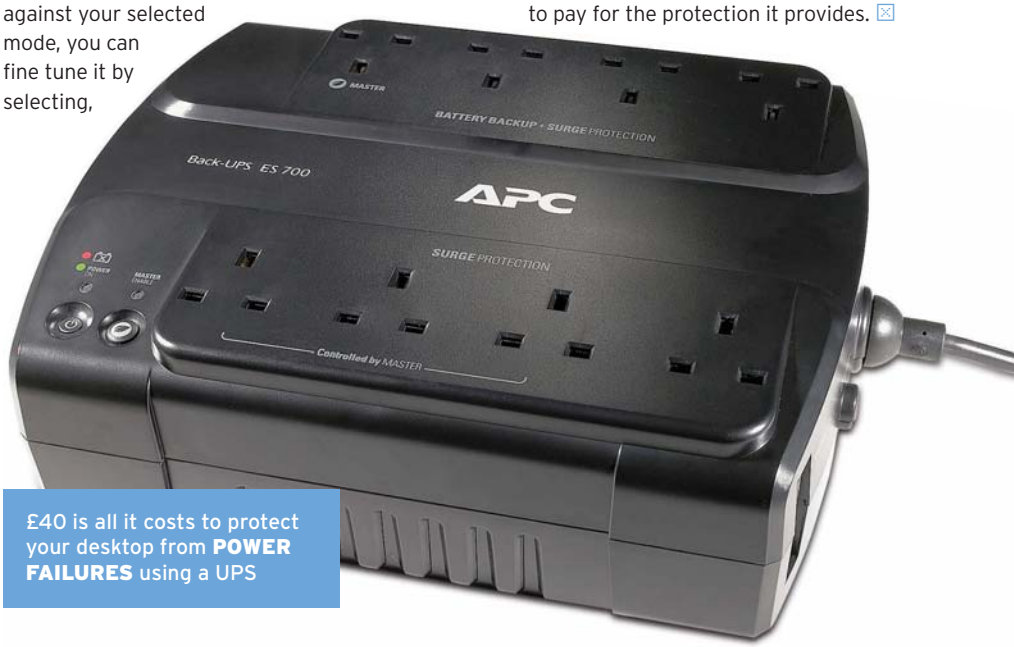
Power rangers

Living in the UK, power cuts are a relatively rare occurrence for most of us, although rural communities, that little bit away from major conurbations, tend to suffer power outages on a not-infrequent basis. What's more, even if the neighbourhood supply isn't interrupted, your home's own supply, or part of it, can be lost if a circuit breaker or RCD trips.

If you're working on a document that you haven't saved for a while, this will result in lost work, but it can be worse. Switching off a PC by cutting the power is bad practice as Windows isn't given the opportunity to close down in a controlled manner. Under such circumstances there's a possibility – albeit a fairly remote one – that the file system could become corrupted which will result in the loss of some of the files on your hard disk.

The solution to these problems is to invest in an uninterruptible power supply (UPS). These are devices that plug into your mains supply and into which you plug your PC, and potentially other hardware. The UPS contains a battery that's charged up when a mains supply is present and from which a mains-like supply is generated whenever power is lost – so that your PC continues to operate.

The more you pay for the UPS, the larger the battery and the longer you can use your PC during a blackout. However, for most people, a small battery that's sufficient to allow you to save any documents you're working on and shut down Windows properly will be adequate. If you're away from your PC when the power fails, some devices are able to shut it down, automatically. You can pick up a small UPS for about £40 which isn't a lot to pay for the protection it provides.



£40 is all it costs to protect your desktop from **POWER FAILURES** using a UPS

Make HD phone calls

Making high-quality calls on your mobile is trickier than you might think, writes Andrew Harrison

For many people using smartphones today, a telephone call will come some way down in their list of communication priorities, now that text, emails, IM, Skype, Twitter and assorted social networks meet most personal needs.

But if you do need that real-time chat, there's still the option to dial out and chat over the GSM mobile network. Shame then, in this ultra-high-definition world, that most of the time, for the majority of people who chat, their call will feature low-quality audio.

Have you ever wondered why the sound of a voice chat on your mobile is little different to that experienced by your parents, or even grandparents – when they used the GPO landline many decades ago? There is some sign of improvement to the situation, though – thanks to a not-so-new technology that's being slowly rolled out across the UK mobile networks, although to hear the benefits requires several strict conditions to be met.

The technology is variously called HD Voice (a proprietary name coined by video-conference specialist Polycom), or generically as 'wideband audio'. It has been commercially available for five years and, even now, in 2014, has limited availability within the UK.

Voices on the line

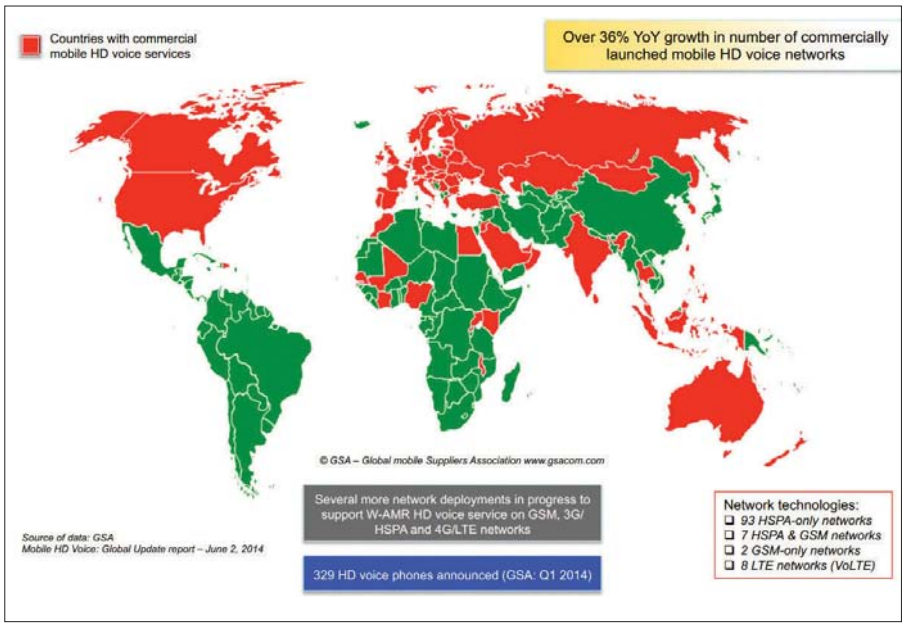
Capturing and sending the human voice for a telephone call in the digital age is like any other sampling of real-world analogue data. Here, digital quality can mean life-like preservation of the original – but, so often, it's severely compromised and weakened by commercial or technological requirements.

In the case of telephone communications, we now have the capability to conduct phone calls from anywhere from 1920s crackly quality up to nearly CD-quality; but wireless connectivity issues and the need to cram in as many concurrent calls as possible to maximise profit, usually means we're only provided with calls at the lower, early-20th century, end of that spectrum.

When digital mobile phones were first launched with the GSM (Global Systems for Mobile telecommunications) in the early 1990s, the standard voice codec was GSM-FR (full-rate), which required a datarate of 13kb/s, and then only provided mediocre quality. But it was at least better than its half-rate alternative running at 6.5kb/s.

These codecs have now been largely replace by either GSM-EFR (enhanced full-rate) which runs at about the same datarate as GSM-FR, but with quality closer to a landline connection; or the later adaptive multirate (AMR) narrowband codec, which is technically close to today's HD Voice technology. With both these two latter 'telephone-quality' audio codecs, the resulting call is quite comprehensible, but still a rather long way from high-fidelity.

The audio bandwidth of these systems – that is, the range of frequencies that can be reproduced – is less than 4kHz, and focused on just the midrange frequencies that dominate in the spoken voice. In the case of AMR, the digital sampling frequency is 8kHz, which can only provide theoretical bandwidth



to a maximum of half that frequency. In actual application, it nominally extends from 200Hz to just 3.4kHz. Compare this with the bandwidth of the spoken voice of between around 80Hz and 14kHz.

HD Voice is based on a codec named G.722.2, and also known as AMR-WB – adaptive multirate wideband. It's still far from high-fidelity specification, using 14-bit sampling and 16kHz sampling frequency, but at its best, can reproduce sounds from 50Hz to 7kHz. In other words, the nominal range of frequencies that make up our speech.

Using a modern mobile phone and one specific network provider, the result can be clear, crisp and cleanly intelligible speech. Heard in your eyepiece after being familiar with restricted and grainy regular-fidelity calls, the quality comes as a sonic revelation.

Better voice clarity helps reduce cognitive load – meaning that we needn't concentrate as hard to make out the sense and meaning of the speaker's conversation. This will be of enormous benefit when used in a car, for example, when the driver needs to focus on the road and not on making sense of a call.

Wideband audio reduces the confusion between spoken letters and numbers, such as the classic mishearing of 'f' and 's', which are rendered almost identically in narrowband transmissions. Regional dialects or foreign accents are more easily understood, and differentiation between multiple speakers on the same line is made even simpler.

How to make HD phone calls

In order to experience wideband audio while making a mobile telephone call, you must have a suitable handset and be using a network that supports the technology. That's not all, though. In addition to both these specific conditions, they must also be met by the person whom you are calling.

Supporting networks in the UK

The first UK network to offer wideband-audio mobile telephony was Orange, which rolled out its HD Voice service in 2010. Next up was 3 in the following year, and then T-Mobile in 2012. EE – the joint venture of Orange and T-Mobile founded by the merger of the two companies in 2010 – supported HD Voice from its inception in summer 2010.

Unlike its overseas divisions in Ireland, Australia and New Zealand, British operator Vodafone has been slower to support wideband audio in the UK. We asked Vodafone for an update and were told: "We are currently rolling out HD voice technology across the UK. The rollout is well under way and will continue until late summer when we plan to have introduced the technology across our entire 3G UK network. The service is available between Vodafone-to-Vodafone calls and customers will automatically switch to HD Voice technology when in coverage including those on our 4G service (when their phone connects to 3G to make calls)."

This leaves O2 as the only UK network without the facility, and currently, with no official plans to add it, either.

The absence of AMR-WB technology on the Spanish company's network also affects associated budget MVNO operators giffgaff and Lycamobile, which both piggyback on O2's network in the UK.

Most of the countries found in the NORTHERN HEMISPHERE supports mobile HD services (see map, left)

Supporting hardware

Many of the current popular smartphone handsets can support wideband audio voice calls. The current iPhone 5 series all support AMR-WB, but older iPhone models don't.

Smartphones running Google's Android with wideband audio support include the Samsung Galaxy, from S2 to S5; many Sony Xperia models; the HTC One and its variants the One (M8), One S and X; and LG models such as the G2, G3 and Nexus 4 and 5.

In the Windows Phone category, most Nokia Lumia models 520, 610, 620, 635, 920, 935 and 1020 all support wideband audio – perhaps unsurprisingly, since Nokia was the original developer of this technology.

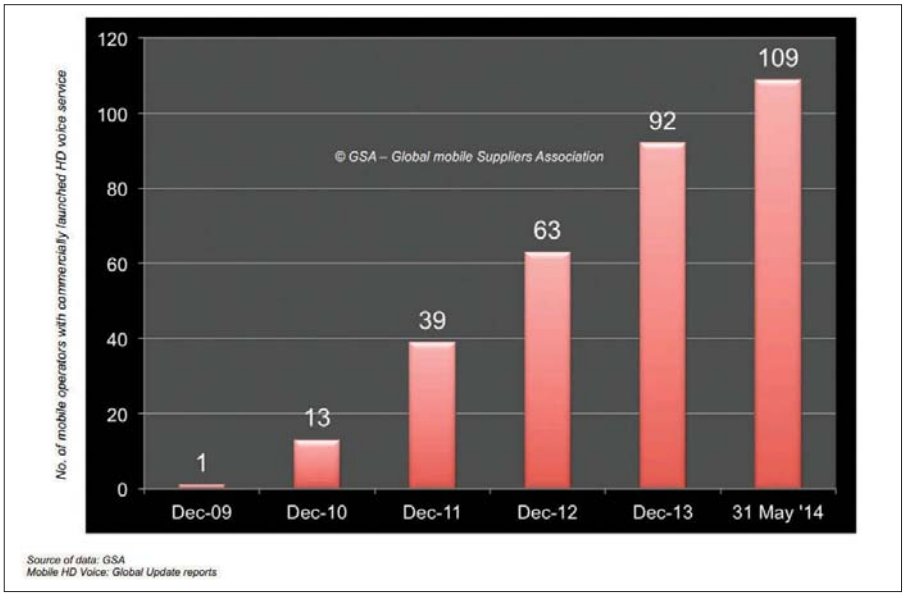
Network conflicts

Besides having to be on the right network and using right handset, there is one main barrier from preventing wideband audio calls from becoming more prevalent. At present, both parties must be subscribed to the same mobile network.

So a telephone call between two 3 subscribers each using an iPhone 5, for example, will benefit from the improved sound quality of HD Voice. But if one caller is with 3 and the other is using EE, the call

Most of today's Nokia Lumia models, including the NOKIA LUMIA 1020 (below) all support wideband audio

The **GLOBAL GROWTH** of mobile operators with HD voice services has boomed to over 100 since 2009



will be carried out in traditional narrowband quality – even if both callers are using compatible phones, it makes no difference.

We asked all current participating wideband audio-capable UK networks to explain the obstacle that prevents cross-network compatibility. It's unclear if the reason for low-resolution calls between operators is a technical one – such as slightly differing implementations of the 3GPP G.722.2 standard – or purely a commercial one. As a premium features, the UK companies may be withholding access to wideband audio calls in order to encourage subscribers to join, or stay with, their network.

At the time of going to press, only 3 had replied with an answer to this thorny question. The company has no plans to extend wideband audio beyond its existing customers, it told us, and 'to enable this in a practical way, networks would need to move to an IP interconnect. This will come when UK operators introduce VoLTE' (voice over LTE). This suggests that cross-network support of HD Voice will only be viable when 4G LTE becomes the dominant mobile-communications system.

A similar problem is presented while attempting to make wideband audio calls between countries, although the first such breakthrough has already been made by Orange in 2012, with HD Voice calls between Moldava (the first territory in the world to introduce the technology) and Romania.

Other methods

Besides the traditional phone call over GSM, there are other ways to enjoy better-than-telephone-quality voice chatting.

The most ubiquitous of all these choices must be Skype, which, as well as allowing familiar video conferencing, can also be used with audio-only chat. Both of the popular iOS and Android smartphone operating systems include apps that allow voice chat as well as video and IM. Microsoft also includes apps for its Skype service from Windows phones.

The audio codec used by Skype is a proprietary wideband compression system it calls Silk that's been in use since 2009. Like the codecs used in HD Voice, it adapts to network conditions. With poorer/slower broadband connections, Silk will drop to a lower audio quality to maximise intelligibility and reduce the chance of drop-outs that can remove entire syllables or whole words from any transmitted conversation.

Apple iPhone users are also able to use FaceTime for purely audio communications. Older handsets such as the iPhone 4 must connect to a Wi-Fi network first, while iPhone 5 and later are able to use FaceTime over 3G and 4G LTE where appropriate.

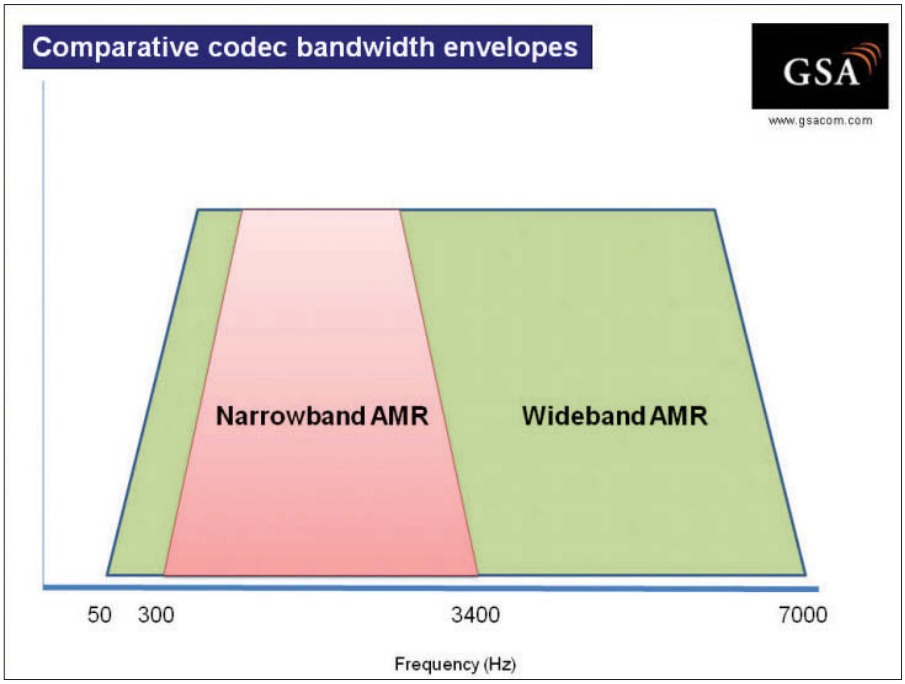
We compared the three options of HD Voice over 3G GSM, Skype and FaceTime. With both callers using an iPhone 5 and connected to the 3 mobile network, each service provided superb voice clarity.

In the case of the 3G GSM call, we noticed that the iPhones' noise-cancellation facility was engaged (where two or three spaced microphones help to focus on the caller's voice by subtracting ambient noise); but voice calls made through the purely IP-based Skype and FaceTime were subject to plenty of background noise. Given the resolving power of wideband audio, this could sometimes detract from overall clarity, as distant sounds could be all-too effectively amplified and accidentally mixed with the caller's voice.

Better bandwidth

Note that despite the popularly used name of HD Voice, the quality isn't actually high-definition in the usual sense of better-than-CD quality. It's only used as a relative term compared to the very limited bandwidth of familiar narrowband telephony. But it's a significant step-up from the low-resolution telephone sound we've had to endure ever since Alexander Graham Bell first said to Mr Watson "Come here – I want to see you" with the very first working acoustic telegraph apparatus in 1876; which later gained the altogether snappier name of 'telephone'.

Looking at the **VOICE COMPARISON BANDWIDTH** chart (right), it's easy to see why Wideband calls are far clearer



Android L vs iOS 8

Fancy a new mobile OS this autumn? Ashleigh Allsopp compares the latest offerings from Google and Apple as she takes a look at what's in store for iPhones, iPads, Android smartphones and Android tablets later this year

Availability

Both iOS 8 and Android L will be released to the public this autumn, but you don't have to wait. There are ways to get your hands on iOS 8 and Android L right now, though – as they're both in beta or preview versions. Still, it's advisable not to install them on your main device as they're still 'work in progress'.

You'll have to pay to join Apple's developer program if you want to start using iOS 8 (it's £60 per year), but you can get your hands on the beta version of Android L for free.

To run iOS 8, you'll need an iPhone 4s or later, iPad 2, iPad mini or later, and for Android L; a Google Nexus 5 or Nexus 7.

Design

The design of iOS 8 is mostly unchanged from that of iOS 7, which is no surprise as it was iOS 7 that brought the major design changes. iOS 8 has that 'flat' design, ditching all signs of skeuomorphism for minimalism.

This year, it's Android's turn for a bit of a design shakeup. Google has introduced a new 'Material Design' look for Android, which has also been offered to developers for use in their Android apps. Android L brings more depth to the operating system's appearance using shadows, and also automatically generates little patches of colour based on the content being displayed.

Additionally, there are new animations and touch feedback, so the overall look and feel is both smooth and responsive.

Notifications

In Android L, you'll find new, enhanced notifications. You'll be able to get see them on your lock screen, and they'll be automatically listed in priority order. Swipe them away to dismiss them, or you can double tap to open them in the relevant app.

Similarly, notifications have improved in iOS 8. They're now interactive, so you'll be able to reply to text messages, accept calendar invitations, snooze reminders and even Like Facebook statuses you've been tagged in – all without having to leave your current app. You can already swipe them to automatically go to the relevant app, but you can't yet swipe to dismiss them (that's new).

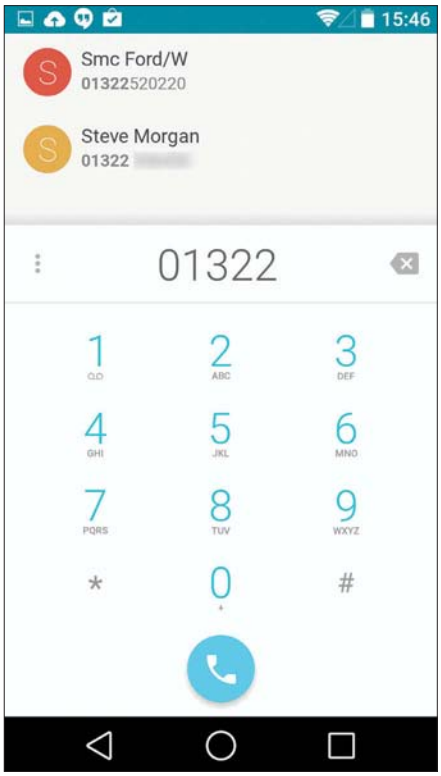
So which one comes out on top? We'd say iOS 8 when it comes to its new notification features, and we're particularly excited about the new interactive capabilities they'll offer.

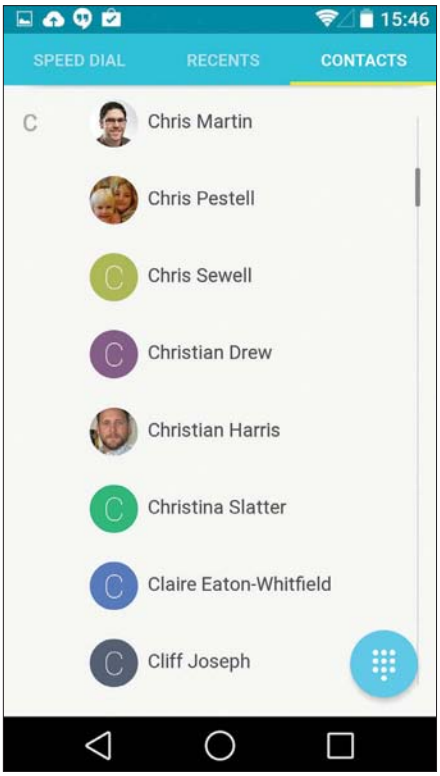
Lock screen

As mentioned above, Android L brings a new lockscreen to its devices. As well as being able to see notifications, you'll also be able to swipe up to unlock, right to launch the dialler or left to launch the camera.

In iOS 8, the lockscreen is as it was before. Simply slide right to unlock it or upwards to access the camera. There's no way to quickly access the dialler, though.

The **DIALLER IN ANDROID L** is a good example of the new design. It uses circles instead of squares, and looks both brighter and lighter





Multitasking

Multitasking in iOS 7 was already pretty good, but Apple has taken it a step further by adding recent and favourite contacts to the screen when you double click the home button to access the multitasking menu. These contacts appear in a handy list along the top of your screen, to allow you to quickly call, text or get in touch via FaceTime.

Android L brings multitasking to a new level for its users, too. Now, open apps will appear as cards in a carousel, which you can browse through by sliding up or down on the screen. To close a particular app, simply swipe the card to the left or right.

What's cool (and it's something that iOS can't do yet) is some apps will show multiple cards depending on how you're using them. For example, if you've got multiple tabs open in Chrome, you'll see each of them as an individual card on the multitasking screen.

Security

Google has introduced a new personal unlocking feature that will enable users to unlock their smartphone or tablet without entering their passcode, but only when they're close enough to a device such as an Android Wear smartwatch.

Apple has its Touch ID fingerprint sensor, which is built-in to the home button of the iPhone 5s. In iOS 7, it was only able to unlock the device or be used instead of entering Apple ID details, but this will be opened up to third-party developers with iOS 8 – so users will be able to use their fingerprint to access other apps such as banking applications.

The wealth of new security features in both Android L and iOS 8 won't be available to everybody, of course. If you don't own an iPhone 5s or an Android Wear smartwatch, you won't be able to use them.

Battery life

We don't yet know exactly how Android L and iOS 8 will affect the battery life of the devices they're running on, but both let you identify how individual apps are draining power, and to make improvements based on their consumption. Android L has an additional battery saving mode, which iOS 8 doesn't.

Google claims that the new battery-saving mode bundled with Android L will give the Nexus 5 about 90 minutes more battery life.

We'd like to see Apple seriously consider introducing a similar feature in the next big iOS update, as iPhones are notorious for their less-than-stellar battery life.

New developer features

Both Google and Apple have added some new tools for developers that could mean lots of exciting new abilities will arrive on Android and iOS devices soon. It's particularly surprising that Apple has opened up iOS to developers – as it's a company that has always been known for its closed nature.

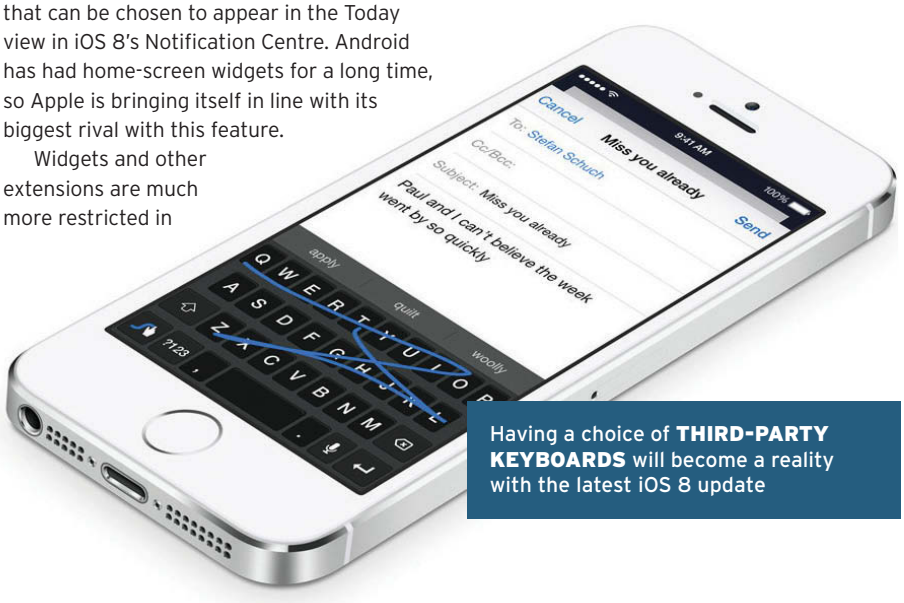
Apple has introduced what it calls Extensibility, which basically means that apps in iOS will be able to 'talk to each other' like never before. For example, using Action extensions, Safari could gain a Bing translate feature, taking advantage of the Bing app's capabilities. Or, Safari could gain a Pin button for Pinterest users if that app is installed. The possibilities here are endless, and extremely exciting for iOS users and developers.

Another element of Apple's extensions is 'Today extensions' which are actually widgets that can be chosen to appear in the Today view in iOS 8's Notification Centre. Android has had home-screen widgets for a long time, so Apple is bringing itself in line with its biggest rival with this feature.

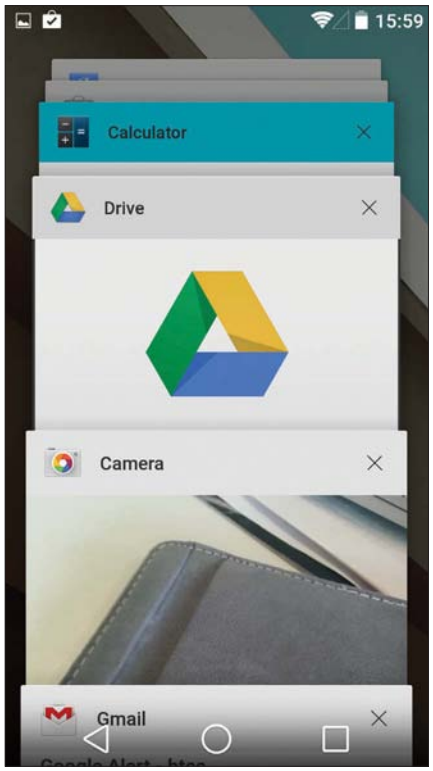
Widgets and other extensions are much more restricted in iOS 8 compared to those in Android, though. Apple is keen to keep its OS secure, and historically, didn't allow developers to release apps that were just widgets, or keyboards. For the first time, iOS 8 allows users to install third-party keyboards.

Google has added several new features in Android L for developers, such as direct links to apps from Google searches carried out using the Chrome browser (something that's already been available for a while, but only for a select bunch of developers).

There are many more new features for developers in both Android L and iOS 8, but we'd argue that iOS 8's changes in this area are a little more exciting than in Google's latest OS, even if they're now playing catch up in some cases (like the 'Android-had-it-first' voice-activated search function.)



Having a choice of **THIRD-PARTY KEYBOARDS** will become a reality with the latest iOS 8 update



Any apps you currently have open in **ANDROID L** will form part of an easy-to-navigate flick-through carousel

64-bit compatibility

Apple used last year's iOS 7 to first introduce 64-bit compatibility to the operating system, and that continues with iOS 8.

For Google, however, Android L represents the first time the operating system has been compatible with 64-bit devices. We expect to see many more smartphones and tablets with 64-bit chips to emerge in the coming year following the announcement. This should mean speedier and smoother performance and a big power boost for Android devices.

Health and fitness

Both Apple and Google have unveiled fitness and health-tracking platforms for their upcoming operating system updates. Apple's offering is called Healthkit, which works with the new Health app; while Google's is called, not surprisingly, Google Fit for Android.

Both have similar purposes: they'll help you keep an eye on your health and fitness thanks to the sensors on your mobile or wearable devices, and also some input from you. Healthkit and Google Fit are platforms for developers to take advantage of, but Apple's Health app is a bit like Passbook, pulling together data from other health and fitness apps into one, easy-to-access place.

Hey, Siri; OK, Google

There's no doubt that Apple's new 'Hey, Siri' trigger to activate the voice assistant hands-free, is a feature borrowed from Android's 'Okay, Google' activation for Google Now. However, this works only if the device is running on external power or if Siri is already open on-screen.

Plus, in a similar way to Google Now, Spotlight in iOS 8 will let you search more than just the contents of your phone, including the App Store, iBooks Store, Wikipedia, Maps and iTunes. It'll also display local film times and friends' trending news.

iOS 8's new **HANDOFF FEATURE** is going to be a real bonus for anyone who owns multiple Apple devices

Handoff

Also new in iOS 8 is Handoff, a feature that's going to be a huge bonus for anyone with multiple Apple devices. It'll mean that, if you've been writing an email on your way home and have just got in the door, your Mac will automatically ask whether you'd like to continue writing it on OS X instead. It's not just for emails, either. Most Apple apps that work across both OS X and iOS will work with Handoff. You'll also be able to pick up calls on your Mac, and see all of your text messages, even if they're not part of iMessage.

Some of these features are available for Android, too, though third-party apps are required, and it's not all quite as seamless or refined as Apple's Handoff. If you own a Chromebook, Android L will automatically unlock your laptop when your smartphone or tablet is close by, and notifications will appear on both your laptop and mobile device.

CarPlay and Android Auto

With Android L, Google has introduced Android Auto, which is similar to Apple's CarPlay feature unveiled with iOS 7 last year.

They are both very similar services, using your smartphone to offer you information and controls on your dashboard's screen including maps, music and other apps.

Compatibility

Another factor to take into consideration when comparing these two upcoming updates is compatibility. iOS 8 will be able to run on the iPhone 4s or later, the iPad 2 or later and both generations of iPad mini.

Those with Android devices might have more trouble getting their hands on Android L straight away. If you own a flagship phone or tablet from Samsung, HTC, LG, Sony, Motorola or any other big name brand, you should get the update quite quickly. Everyone with a Google Nexus 5 or Nexus 7 should get access to Android L right away when it's released to the public.

HTC has said that HTC One M8 owners will get Android L within 90 days of its release, but we've not yet heard specific details from any other manufacturers. ☒

Why is my Wi-Fi so slow?

Andrew Harrison explores the reasons why your Wi-Fi is so much slower than the router manufacturer promised you, and how to make the most of what you can realistically achieve

As computing devices become increasingly reliant on wireless connectivity, so does our dependency on good and reliable Wi-Fi. But compared to steady wired connections over ethernet, Wi-Fi links can be quite ethereal and liable to slow to a crawl or fail entirely just when you need them. Here we investigate why Wi-Fi underperforms, and provide a few practical steps that everyone can take to improve their precious wire-free data links.

PART I: MANAGING EXPECTATIONS

When it first appeared as a usable commercial solution – launched in 1999 by Apple under the name AirPort – 802.11b had an advertised speed of 11Mb/s. Four years later, and by now becoming more common among Windows users, the latest wireless data standard was 802.11g with an indicated speed of 54Mb/s. Yet neither could come close to transferring user's data at those nominal speeds. In the case of 11b, you would have seen transfer rates at around 2Mb/s while 11g could stretch to perhaps 20Mb/s. Under even ideal wireless conditions, the reasons for the shortfall are manifold, but many are linked to the rather lossy nature of wireless communications, and the techniques used to ensure data's integrity when it flies through the uncertain medium that is the electromagnetic aether.

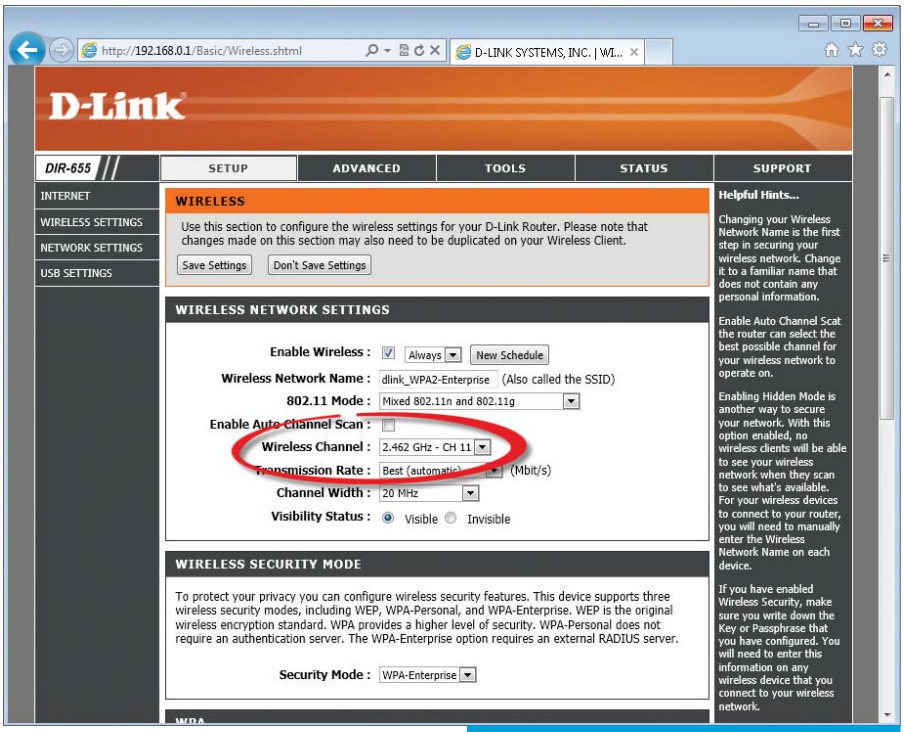
Half a duplex

Unlike most modern ethernet networks, Wi-Fi is a half-duplex communication system that can pass data in both directions (for example, router-to-laptop as well as laptop-to-router), but crucially, only in one direction at a time.

It's comparable to a walkie-talkie radio system with push-to-talk (PTT) communication: only one party can talk at any one time, and they must sign off their sentence with an 'over' or other agreed codeword to let the other party know they can now use the open channel.

Wi-Fi is the same, with the additional channel overhead created by a signal that must be returned by the receiver to acknowledge receipt of each small bundle of data. The ACK packet is analogous to one party in a walkie-talkie conversation saying "Roger that" or "I copy", to confirm they received the packets intact and without corruption. When more than one client device is on the same wireless network, they must share bandwidth and airtime with all the others. So a nominal 300Mb/s may sound impressive (once the standard advertised speed of 11n), but shared between 50 users in an office, all of whose phones are polling the wireless base station for push email and Facebook updates, the available bandwidth for each device soon drastically plummets.

Apple's original **AIRPORT** had a maximum transfer speed of 2Mb/s



Change the **WI-FI CHANNEL** on your router to avoid interference from neighbouring routers

Forward error correction

To help prevent the constant resending of packets that were lost or corrupted in transit, Wi-Fi uses a form of error correction. Like the redundancy available in RAID arrays of hard disks – and in particular RAID 5 and RAID 6 systems – an allotted amount of available space is reserved for 'spare' data that can be used to reconstruct some of the lost data.

In a RAID 5 setup with four 2TB disks, for example, the total available capacity is about 6TB out of the pooled total of 8TB. But if one disk, any disk, should fail, then the entire volume can be reconstructed from the 'spare' bits distributed among all four disks.

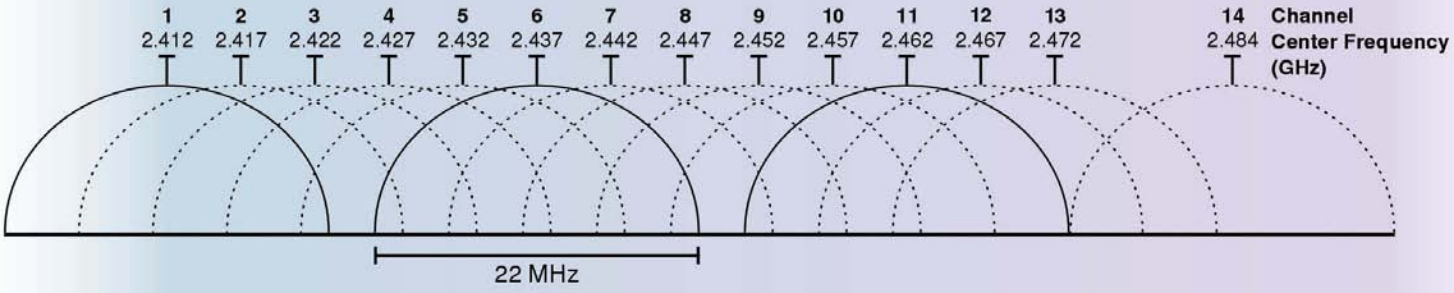
Forward error correction (FEC) does a similar job, with a choice of coding rates depending on the quality of the current connection. In an area of relatively clear signal, a more efficient CR ratio of 5/6 can be used, which means that around 83 percent of the transmitted data is the required payload, and 16 percent is parity information used to rebuild any minor losses.

In a noisier environment, this is scaled back to a coding rate of 3/4, 2/3 or even just 1/2. So in the latter example, your data is being distributed at only half that of the containing envelope.

Channel widths and guard intervals

As standard, 802.11n transmits on radio channels whose frequency is around 2400MHz or 2.4GHz. There are 13 channels commonly available, ranged between 2412 and 2472MHz. Each channel is usually 22MHz wide, although the channels themselves are only spaced 5MHz apart from each other, giving considerable overlap between consecutive channels. Even using these comparatively narrow channels, there are only three channels available at one time which will not interfere with each other – channels 1, 6 and 11. This congestion would be made even worse if Wi-Fi devices make use of a provision in the IEEE standard for 40MHz-wide channels. An agreed 'good-neighbour policy' means that wireless routers working at 2.4GHz only stick to 20MHz-wide channels.

For 802.11n Wi-Fi, there are 13 (22MHz-wide) channels available ranged between 2412- and 2472MHz



That hasn't stopped manufacturers of wireless routers from quoting maximum speeds available if the wide channels are used. This typically enables greater than two-times faster data rates. Different types of modulation are used in Wi-Fi's radio broadcast. Guard intervals are the tiny time gaps between discrete chunks (called 'symbols') in these different RF modulation schemes. The standard is 800ns, or 0.8µs, but in clearer conditions, the radio adaptors can agree to shorten this time to 400ns, thereby increasing datarate by a few percent.

TCP/IP versus UDP

The raw speed at which two wireless devices communicate is called the PHY rate, and this 'sync speed' is the number you'll see advertised by Wi-Fi device manufacturers.

But our user data moves at a slightly slower rate on a different level below this indicated speed. There are two principle protocols to send data between devices. The most widespread is TCP/IP, chosen as it ensures data integrity by checking that every bit that lands is equal to that sent. A faster system used when lost data is less of an issue is the user datagram protocol (UDP), employed for less critical applications such as VoIP and streaming music, where the timeliness of data arrival is more important than getting every bit perfectly preserved.

TCP/IP tends to push data at its maximum rate until packets are lost entirely, at which point it backs off to a lower rate; but with the additional overhead of resending corrupted packets it's a much slower transmission system than UDP – especially over wireless communications.

The net result of the various systems in place used to ensure sent and received data is free of errors and corruption is a major overall slowdown of data traffic. You can start to get an idea of the possible throughput to expect by finding out the modulation coding scheme (MCS) in use, represented by an index number from 0 to 31 for most 11n connections. When devices are talking to each other over Wi-Fi, the MCS index is likely to change as both ends negotiate the best link for the extant environmental conditions.

To give an example of an 11n-capable laptop connected to a wireless access point, if MCS index is negotiated as '15' the coding rate will be set at 5/6, for a nominal data rate of 130Mb/s (using two antennas/streams, 20MHz channels and standard 0.8µs guard interval). If network conditions worsen, the wireless controllers at each end can agree to drop down to MCS = 14 with a 3/4 coding rate; or MCS 13 whose coding rate is 2/3, by which time the nominal data rate is 104Mb/s.

In a recent group test of draft-802.11ac wireless routers, the best-case connections we saw on the 2.4GHz radio band used an MCS index of 23. That indicates a maximum nominal speed of 216.7Mb/s, by using three separate spatial streams sent over the same 20MHz-wide channels, with a coding rate of 5/6 and guard interval down at the optimum 0.4µs level. While this was the 'handshake' or sync speed of the laptop and router at the PHY level, data sent using the most prevalent TCP/IP reached a maximum of 172Mb/s. That's almost 80 percent of the nominal speed – but only realistically available at a short range of 2m or less between devices, in near-ideal low RF-interference conditions. So what can we do to help Wi-Fi work at its best?

PART II: MAKE THE BEST OF WHAT YOU'VE GOT

Radio interference is one of the main reasons for slowdown, as any radio signal received that isn't part of the expected data protocol will be perceived as noise, and can cause packet loss or corruption to the required wireless data payload.

Channel dodging

The biggest source of radio interference is often from Wi-Fi itself, with overlapping base stations interfering with each other.

Try to ensure that the channel on which your router is broadcasting and receiving is as far away from other routers as is possible. Using various software utilities available for desktop Windows and Mac computers (with one built-in for OS X for example), and also for Android devices, you can scan the Wi-Fi radio bands and see what devices are already on any particular channel.

Check each devices' received signal strength – if it's at a significantly lower level (as measured in dBm) you may be able to set your channel close to it without suffering much data-slowing interference.

Other people's radio

Wi-Fi works on an unlicensed part of the radio spectrum called the ISM (industrial, scientific and medical) band. As such, it must share the available space from 2.4- to 2.5GHz with other non-Wi-Fi radio-broadcasting devices. These include older indoor cordless phones and baby alarms. But for personal and mobile

Baby monitors and microwaves operate on 2.4GHz and can cause **INTERFERENCE** with Wi-Fi devices

The latest **MACBOOK PRO** supports the fastest 11ac wireless protocol

computers, the most troubling spectrum neighbour can be Bluetooth, working from 2402- to 2480MHz.

To help optimise the integrity your Wi-Fi link, try moving away from any other devices that share this band (including microwave ovens, which can leak radio noise), and disabling Bluetooth on your laptop, phone, tablet, mouse and computer keyboard.

Modern laptops often include clever power-saving techniques to reduce power drain when running from battery. In our tests, we've found this power throttling may extend to wireless transmission power, as better results have been recorded when the laptop was running from its charger.

Distance between devices is, of course, an important factor in deciding Wi-Fi speed. But there's also the matter of intervening matter. A free air, line-of-sight connection is preferred, but when you must go through walls or floors, try to do so with the wall at a right angle when referenced to a straight line between wireless devices. If the angle is reduced to a few degrees, the amount of material through which the electromagnetic radio wave must propagate is increased.

Screening effect

Be mindful of what lies between your mobile device and the wireless router. Wi-Fi works in the microwave part of the radio spectrum and is severely reduced by metal and water. A mirror hanging on the wall is a potential screen, as is your own body, made from at least 60 percent water.

But one of the best ways to improve Wi-Fi performance is to ensure you have the best available stream setup on both your router and the receiving device.

Most laptop manufacturers don't advertise the Wi-Fi configuration inside, but for both the established 802.11n and the emerging 802.11ac systems, the radio system can use one, two or three independent aerials. These work together to form a multiple-in/multiple-out (MIMO) system which can greatly enhance performance.

Similarly, wireless router can be equipped with one, two or three antennas. When mounted externally, their potential is more obvious, although internal fixtures mean you must check the maker's specification or an expert review to find its specific capability.

The three antennas on **NETGEAR'S** router each account for a data stream

Modern 11n Wi-Fi can already use more than one aerial to good effect. Each aerial is responsible for its own stream of data, and we already see many 11n routers with three visible antennas. Using the most common 2.4GHz radio band, the maximum wireless sync speed theoretically available with three aerials is 450Mb/s, although for most of the UK, that figure is 216.7Mb/s; typically rounded up to '217'. The 217Mb/s figure is the sum of three separate streams, one to each aerial, with each operating at 72Mb/s.

One way of improving performance is by increasing the maximum datarate per spatial stream. In the case of 11ac working on the currently emptier 5GHz frequency spectrum, that figure has been radically increased to 433Mb/s per stream – principally by packing in more data per stream through more efficient modulation techniques.

With both your wireless router and laptop armed with the current optimum 3x3:3 arrangement (three transmitting aerial and three receiving aerial, providing three spatial streams), and with interference reduced to a minimum, you should expect a sync speed of up to 217Mb/s using 11n on the 2.4GHz band. And on the 5GHz band, up to 450Mb/s for 11n and 1300Mb/s with draft 11ac.

But be watchful for wildly misleading performance claims made by a coterie of wireless router manufacturers. Most importantly, the speed printed on the box isn't the actual speed with which your data will travel over your network. With some forewarning of the reality, and a few steps to optimise what you can achieve, Wi-Fi can work to your advantage much better than you may have previously imagined. ☒

Manage your money online

If you're always struggling to make ends meet and your bank account is constantly overdrawn, an online money manager can help organise your finances. Roland Waddilove examines the available options

Numerous companies want to look after your savings, lend you money, provide credit cards, ISAs, cheque accounts and more. You might have an account at one bank, savings at another, a credit card with a building society and so on. It's hard to get an overall picture of your financial health, and an online money manager can help with the big picture.

Most people use one or two companies, having just a cheque account and credit card. Although it's easier to see your net worth, you might want to analyse your spending and see where your money is going. Money managers can show the amount you spend on your car, what your groceries cost each month, as well as your utility bills, and so on. This is useful if you're trying to cut spending, or saving up for a new house or car.

Banks and credit card companies are beginning to offer money managers themselves, and, if you haven't done so, explore the options in your online accounts to see if you are able to access one already.

You obviously trust your bank to look after your money, but what about third-party companies? Would you trust an internet startup that's only been around for a few years with access to your bank, savings and credit card accounts? This is a big drawback, and it's an uncomfortable feeling giving someone else access to your money.

One limitation – and advantage – of money managers is they only show and categorise transactions. You can't put money in, take it out or transfer it, so if a hacker gained access to your account, they could look at your statements, but wouldn't be able to spend your money.

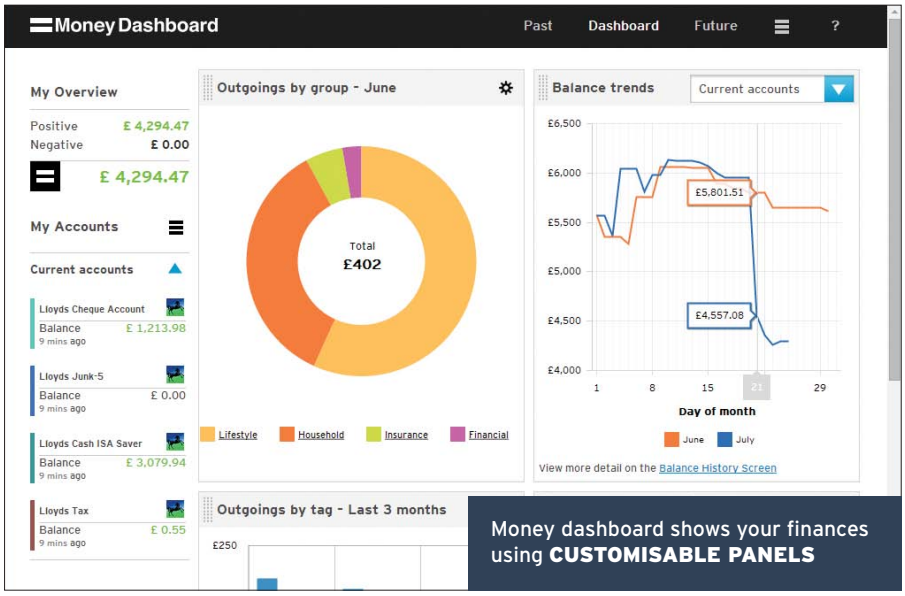
Money Dashboard

Money Dashboard (tinyurl.com/Lgonyh4) is free and quick to set up. It requires one or more bank or credit card accounts to work with, including HSBC, NatWest, Barclays, Lloyds and Halifax. Enter your login details and it reads your account details and transaction history. The dashboard provides

an account overview, and on the left are your accounts. There are four panels (left) that show outgoings by group, balance trends, outgoings by tag and recent transactions. This is all useful information and it can be configured to only show what you need.

The Past menu has options to show Transactions, Income:Spend, In:Out, and Balance History. When transactions are listed, they can be assigned to groups and have tags associated with them. Many transactions were automatically grouped and tagged, such as spending at a garden centre, gas and electric bills, cash machine withdrawals and so on. Some transactions must still be set manually, but, in general, automatic categorising is effectively done.

Money Dashboard predicts what will happen to your finances in the future. After confirming regular transactions, like income and bills, it predicts your balance and charts it for the months to come. It also builds a calendar that shows upcoming bills. You can see when these must be paid, who they are paid to, and the amount you need to pay. Apps are available for both Android and iOS.
Score: 4/5



Money dashboard shows your finances using **CUSTOMISABLE PANELS**

OnTrees

OnTrees (tinyurl.com/Lex43hf) is part of Money Supermarket and it's a free service. Eleven financial institutions are supported, and this includes many high-street favourites. Provide your log-in details and it fetches the transactions from your accounts. The Accounts screen shows your accounts and balances. You can see recent transactions for the last week, 30 or 90 days. Many transactions are automatically categorised, such as cash withdrawals, credit card payments, and utilities like gas and electricity.

However, it wasn't as proficient as Money Dashboard at automatically categorising transactions, and you must go through slightly more manual categorising, than with that app to achieve the same results.

Once you have everything labelled, transaction filters can be used to show only certain types, and this is where OnTrees comes in useful. There are 11 transaction categories, and selecting one displays a summary. You could, for example, show all ATM withdrawals, see how much you have spent on groceries or utility bills, and so on. It shows the total amount spent, the percentage of total spending, each of the transactions, and even which day of the week you spend most in the selected category.

OnTrees is a service that analyses and categorises transactions and then lets you view the spending categories. You can view both incoming and outgoing money. It doesn't predict future balances based on income and spending, and you can't set budgets for categories to help you to take control of future spending. It's still a reasonably good service, though, and its simplicity is its strongest feature. If you're seriously thinking about money management software, then this is one of the best apps to consider.
Score: 4/5

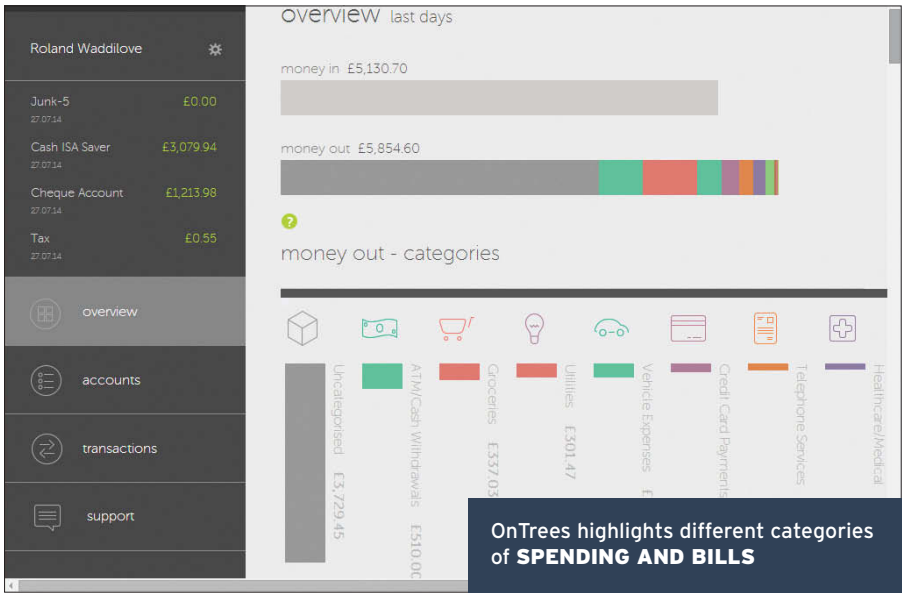
Banks, building societies, credit cards

Everyone seems to be adding money management features to their internet services, and it's interesting to compare them with the independent companies. Lloyds Bank (tinyurl.com/kkafLb9), for example, offers a good money manager. A Spending Analysis report shows where your money is going, such as household bills, cash withdrawals, motoring expenses, home and garden, and so on. It shows monthly money in and out totals and compares them to your average.

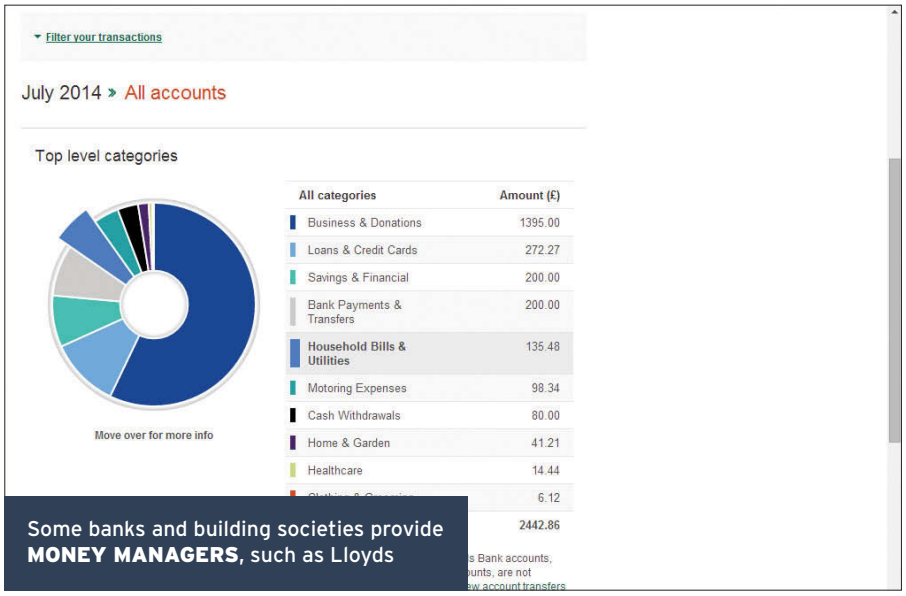
Transactions are listed and most are automatically categorised. Any that are not, or are wrongly categorised, can be manually changed. A budget can be set for each category and you can see whether you're currently under or over budget on the dashboard display. Savings Goals enables you to set a target amount to save for a specific date, and a Calendar automatically identifies and highlights recurring payments.

Barclaycard (tinyurl.com/c325cqh) has useful analysis tools and you can choose any time period and see your spending as a pie chart organised by category. Transactions are automatically categorised, but can be edited where needed. There's a bar chart breakdown of spending by retailer, and this enables you to see how much you've spent at Amazon, your local petrol station or the supermarket.

A major drawback of all these apps is that they don't allow you to add accounts from elsewhere, and so you have an incomplete financial picture. Some, such as Yorkshire Building Society (tinyurl.com/m7bnrnp), let you add other accounts, but this feature is an exception and far from the norm.
Score: varies with each company



OnTrees highlights different categories of **SPENDING AND BILLS**



Some banks and building societies provide **MONEY MANAGERS**, such as Lloyds

Your Wealth

The brilliantly titled Your Wealth (tinyurl.com/me669yg) is different to many other money managers. It's free if you want to manually set it up, but it costs £9.99 a year to integrate your bank accounts. The site is bright, colourful and uses large text and buttons.

Unlike the other money managers, there's plenty of information you can add and analyse with the free service, and you start with sources of income. All of your regular payments – like a mortgage, utility bills and so on – must be manually added. Spending limits for various activities like entertainment, groceries, home, travel and other categories can then be set.

Finally, a savings goal can be added, so that you can see how your finances are progressing towards saving for an expensive item, like a new car. After adding a few transactions, you can begin to explore features like Your Spending. This shows the total spend so far, your budget limit, and your amount left to spend. You can see whether spending categories are on target, as well as how much money you'll have in the future.

The Tools and Calculators section of Your Wealth is excellent, and it's worth getting a free account just for this alone with four tax, six mortgage, and three pensions calculators. A loan calculator shows how you'll repay, and there's a life insurance cover calculator, too. These are all excellent and available for free. The iOS and Android apps are both great, too.

Score: 3/5

To integrate your bank accounts to **YOUR WEALTH** costs £9.99 a year

Toshl

Toshl (tinyurl.com/7vc8wvd) doesn't have access to your bank, credit card and other financial accounts, which puts it at a disadvantage compared to the others, but its modern design and support for Android and iOS apps makes it fun to use. Toshl can be accessed on the web by phone or tablet, and it simply records whatever you put into it. For example, you can enter sources of income, add regular payments such as utility bills and so on. You can also add cash withdrawals, payments like petrol for the car and groceries bought at the supermarket, and, because Toshl is on your phone, you can do it there and then, so you don't forget – or have to power up your computer when you get home.

Transactions can be viewed on a timeline, and the account balance is shown at the top. A tags view shows categories of expense as bubbles. The larger the bubble, the larger the proportion of your spending. There are a few limitations, and the main one is that only one account is supported. Toshl isn't much use for people with multiple accounts across several companies. Most features can be accessed for free, but full access costs £11.80 a year.

Score: 2/5

LoveMoney

LoveMoney (tinyurl.com/k4q2tz7) offers a free service that tracks multiple accounts at different companies. The usual suspects are supported, and many high-street banks and credit cards are among the list of accounts you can add. After entering your login details, LoveMoney fetches all the transactions and automatically categorises them. It did a good job and managed to work out where most of the money went, and with a bit of effort, you can manually correct or add categories to missing or wrong categories, too. Transactions can be viewed and filters applied, such as a category, account or date, so you could list all your transactions for groceries, for example, and see how much you've spent over a set period.

The website has a very clean and easy-to-read design, and this helps to make the information easily readable. There's a dashboard that shows an overview of account balances and spending. It's really handy how it compares 'this month' to 'last month' as coloured bars, and there's a pie chart and a speedometer-style display too.

Budgets can be easily created so that you can keep to a predefined limit on groceries, entertainment, cash withdrawals and so on. You can analyse spending by category and dig down deeper to view individual transactions. Income vs spending is another of the ways to look at your finances and this is a simple chart showing your cashflow.

Score: 4/5

Conclusion

A money manager that pulls in all your accounts, wherever they may be, is better than one that's tied to one specific financial institution. Your Wealth is a good choice and the tools and mobile apps are excellent, but it's only really useful if you use the paid-for version. There isn't a lot of difference between Money Dashboard, OnTrees and LoveMoney, but the former has the edge. ☒

PAUL MONCKTON

YOUR QUESTIONS ANSWERED

Expert computing advice

We tackle readers' hardware and software conundrums

Q I've recently updated the drivers on my graphics card, but now I can't display the right resolution and my screen is a mess. How can I put things back to how they were before?

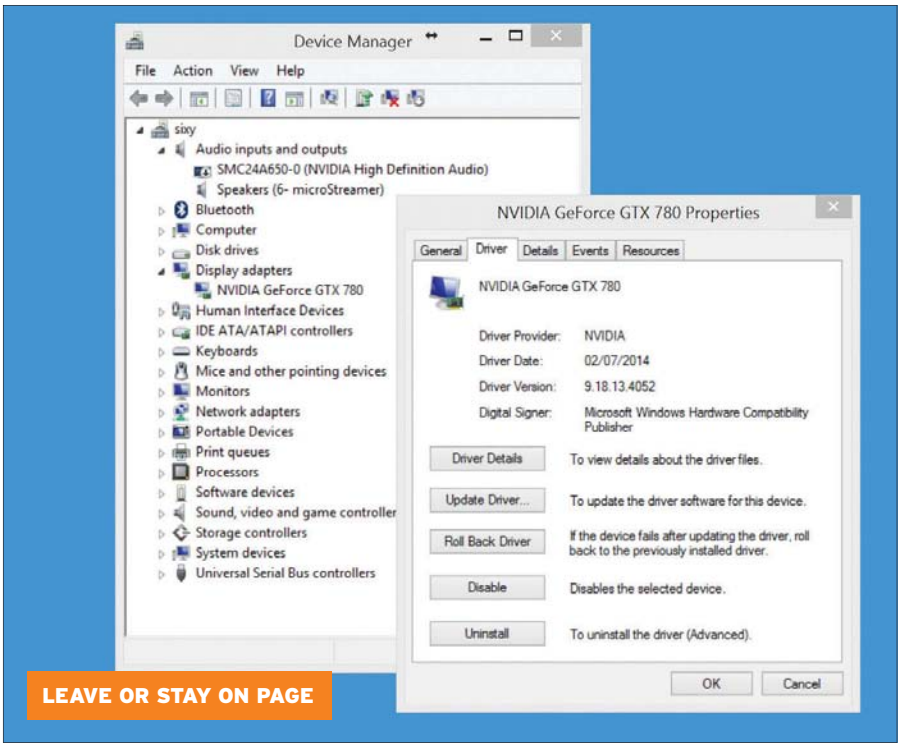
The driver installation should have created a system restore point, so try doing a System Restore to before you installed the driver.

Alternatively, Windows includes an option to 'Roll back' device drivers to the previously installed version. You can use this feature to revert your graphics driver to the previous version without resorting to System Restore. This is especially useful if you don't want to undo any other changes you may have made since installing the problematic driver.

Start Windows device manager (On Windows 8.1, press <Windows>+X and select Device Manager from the menu). Now locate your device in the Device Manager – in your case it should be under 'Display adapters'. Right-click on your display device and select the Driver tab. Next, click Roll Back Driver and follow the onscreen instructions. This should revert the graphics driver to the previous version and fix the problem.

You should, however, be aware that graphics drivers are packaged with many additional files that may not be effectively rolled back using this procedure. Indeed, nVidia offers a specific warning to this effect in the driver release notes, though, in an emergency you can usually get away with it as a temporary measure at least.

If your display is working well enough for you to see what you're doing, it's best to remove the driver using the 'Uninstall or change a program' feature and then reinstall the previous driver from scratch. You will generally find previous versions of graphics drivers are still available for download from their respective manufacturer's sites.



WINDOWS 9

Q I am still running 32-bit Windows XP on a 2.9GHz Pentium 4-based PC. Will it be able to run Windows 9, possibly with a RAM upgrade?

It's too early to give you a definitive answer as most current Windows 9 information is based on a combination of rumour, speculation and leaks, plus titbits pieced together from Microsoft communications. We do know that Windows 9 is set to run across a wide variety of devices.

The Windows 8.1 Update 1 reduced the minimum amount of RAM required to run the operating system to allow it to run on PCs with only 1GB of RAM and 16GB of hard disk space – so-called 116 devices.

We might hope then, that Windows 9 will also run on 116 devices, but whatever the final hardware requirements turn out to be, we wouldn't expect you to have a rich, smooth computing experience with the system you're currently using. This is due to other limiting factors such as memory speed, hard drive performance and older processing technology.

You don't say how much RAM you have installed at the moment, but adding more will almost certainly help, especially if you have less than 4GB now. However, it's

probably not worth spending much money on upgrading the system you have, as you could buy a considerably faster PC for relatively little money, and the DDR2 memory modules required for your current PC won't fit in a modern system. So, we'll just have to wait and see before we know whether Windows 9 will run well on your PC.

Going for a 64-bit version is probably a good idea, and if you're upgrading to more than 4GB of RAM, you'll need a 64-bit operating system to take advantage of the extra memory. We don't yet know whether a 32-bit version of Windows 9 will be available.

Pricing hasn't been announced, although there's speculation that certain upgrades will be free. This is unlikely to be the case when moving from XP, though, as direct upgrades to Windows 8.1 from XP aren't available. You'll have to back up your files and settings, install the new OS from scratch and then restore all your data.

Some have asked whether it will be available on disc. Probably, but don't worry too much about that as it will be possible to make an installable copy for your system. Microsoft generally releases 'Upgrade Assistant' tools to help potential users work out whether their hardware will work with the latest version of Windows. So, nearer the time of release, look out for a Windows 9 Upgrade Assistant on the Microsoft site.

For further details about Windows 9, go to tinyurl.com/nhdbcjb.

UPDATE ERROR 80072F8F

Q I have a Nokia Lumia 1020 and I've been eagerly awaiting the latest Cyan release of the operating system, but when I try to check for updates I just get the following message: 'Windows Update error 80072f8f'. Can you help?

Double-check that the date and time are set correctly on your phone. This error occurs when attempting to run Windows Update while your clock is set incorrectly. Simply correcting the date and time usually makes this error go away. The same issue can also occur on desktop PCs when running Windows Update.

ELDERLY ADVICE

Q My parents' old PC has died and they'd like to replace it with a simple and inexpensive laptop. They use Microsoft Office (probably 2003

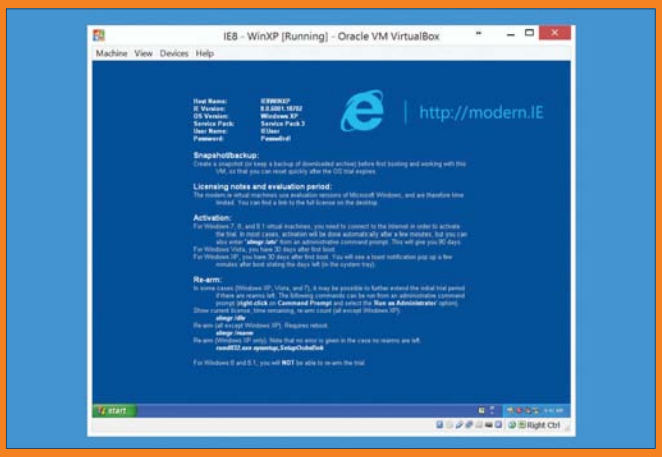
Continues >>

DOWNLOAD AND INSTALL XP USING ORACLE VIRTUALBOX

If you still have a few legacy applications that require Windows XP or you just want to test a program to make sure it works on the legacy operating system, it's relatively simple to install and run it in a virtual PC environment.

Windows XP is no longer available to buy and although there are illegal copies to be found circulating the internet, you can download a pre-built virtual PC directly from Microsoft, which you can be confident will be malware-free. Microsoft provides these virtual machines to help developers test old versions of Internet Explorer, but they provide a full XP environment in which you can run any programs you wish.

Virtual PCs are available for a number of platforms, but we'll use Oracle's free VirtualBox software in this example. Once you have VirtualBox installed and working, go to tinyurl.com/kkcn6Lc and select 'VirtualBox on Windows', then scroll down to Windows XP. Download the three files listed under IE8 and save them to a folder on your hard drive. Once they have downloaded, run the file called part1.exe and it will extract a file called IE8 – WinXP.OVA. Double-click this file to import it into VirtualBox and your Windows XP virtual PC will be installed.



You can now launch Windows XP from within VirtualBox and install any software you wish. The operating system is time limited to 30 days, but it's possible to activate it for permanent use if you are in possession of a valid key.

version) for email and word processing, and also shop online and print Word documents, but that's all they want to do. They have an old printer that they want to keep.

I think it's best to retain familiarity, as far possible, to keep to Windows, avoid touchscreen, avoid Apple and iPads, and to have as large a screen as possible. My father would also prefer an old-style standalone keyboard rather than use a small laptop keyboard.

It would also be good to remotely access the computer, so I could sort out problems for them as they live some distance away.

We agree that familiarity is the number one priority here and, we almost hate to say it, a replacement desktop PC may be the most sensible option for you.

You don't say what has actually gone wrong with their existing computer, but assuming the keyboard, mouse and monitor are still working, simply replacing the main PC unit will keep everything as close as possible to what they had before. A small change in screen size or switching from a mouse to a laptop touchpad can both be major obstacles to an elderly person with little inclination to master new technologies.

Assuming you have a backup of their data, we'd suggest sticking to the existing version of Windows and setting everything up as closely as possible to how it was on the original PC. If you have no backup, it's worth pulling the hard drive out of the dead PC and seeing what can be recovered. It may be the case that you can copy all their files and settings over.

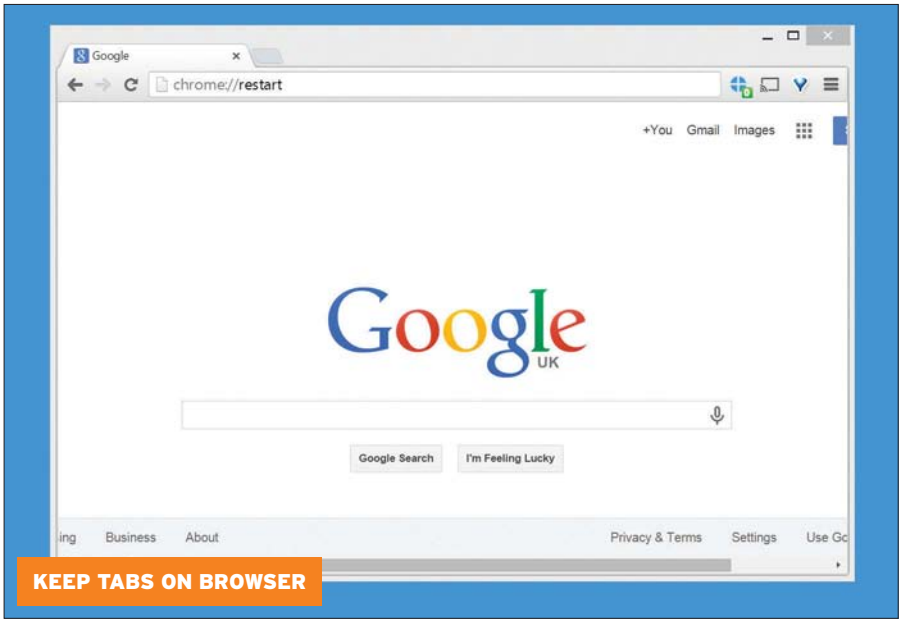
Of course, you could still do this with a laptop, depending on the operating system installed, but you may find some laptops lacking support for Windows XP if that's the operating system they're currently using. Take a look at our laptop buyer's guides for something within your budget. If you match the spec of their current PC and keep the screen as large as you can afford, then we're sure you'll find some well-reviewed examples to choose from.

For remote access, we'd recommend installing TeamViewer from teamviewer.com, which can be used free of charge for personal use and will allow remote access from another PC, Mac or mobile device.

KEEP TABS ON BROWSER

Q How can I restart my browser with all my current pages and tabs open?

With Google Chrome, just type **chrome://restart** into the address bar and press Enter. However, do not do this if you have Chrome set up to restore a previous session upon restart, otherwise you may find the browser attempts to reload a tab containing 'chrome://restart', putting you in an infinite loop of restarting.



KEEP TABS ON BROWSER

If this happens, try editing the Chrome shortcut and adding **--disable-restore-session-state** to the target entry.

Firefox users can press Shift-F2 and then type **restart** into the console window before pressing Enter.

With Internet Explorer, you can close the application and then relaunch it before selecting Tools > Reopen previous browsing session. Unfortunately, this will restore the tabs on your last Internet Explorer window, but it won't reopen multiple windows if you had them open.

DOWNLOAD FACEBOOK VIDEOS

Q How can I download Facebook videos onto my PC? I've stupidly deleted them from my hard drive, so Facebook is the only place when I have them stored. I would also like to be able to download videos posted by other people. Is there a way to do this?

There are a few ways to achieve this and there are free downloadable applications which can do it for you. However, many such applications also like to install various undesirable features at the same time, such as browser toolbars and other nonsense.

Here's how to download any Facebook video to which you have access, using only your web browser.

Method 1:
Downloading your own video
If you're trying to download one of your own videos, the process is easy. Go to your timeline and click 'Photos'. Next, click 'Albums' and then the album called 'Videos'. If you hover the mouse over a video thumbnail, you'll see a small pencil icon appear in the top right-hand corner. Click this icon to bring up a menu. From here you'll be able to select 'Download in SD' or 'Download in HD'. You may find that clicking on one of these links plays the video instead of downloading it. If this happens, you can right-click on the video as it plays and select 'Save video as...' to download it.

Alternatively, you can right-click on 'Download in SD' or 'Download in HD' in the menu and select 'Save link as...' to save the video to your hard drive.

Method 2:
Downloading someone else's video
If you want to download a video posted by someone else, the above method won't work. You can, however, still download any video you can view on Facebook, by switching to the mobile site first.

Click on the video you want to download, then go to the address bar and change 'www.facebook.com' to 'm.facebook.com', leaving the rest of the URL as it is. This will take you to the mobile version of the page containing the video. Click the video to play it – don't omit this step or the next step won't work. Right-click on the video and select 'Save video as...' to download the video to your PC.

Method 3:
Downloading someone else's video in HD
Method 2 will only download a standard definition version of the video, though. To download an HD version is more convoluted and requires use of your browser's developer tools. There are many freeware tools and websites that offer to do this for free, but you should steer clear of these.

In Google Chrome, navigate to the page containing the video you want to download.

DOWNLOAD FACEBOOK VIDEOS

Be sure to click on the video to bring it up in its own window, don't try this with a video embedded in your news feed.

Press Ctrl-Shift-I to bring up the Developer Tools pane. This should appear either at the bottom of the page you're viewing or in its own pop-out window. Click on 'Network' in the top of the Developer Tools pane and play the video you want to download. Next, click the HD icon in the bottom-right corner of the video to play the HD version of the video.

The developer panel should start to fill up with information on all the elements of the page as they load. Click the funnel icon, three icons in from the top left of the developer panel. This allows you to filter the results to help you find what you want. Type **video** into the box and you should see at least one entry of the type 'video/mp4'. If you see two of these, then one will be the standard definition video and the other will be the HD video.

You can follow a similar procedure in other browsers. First open up the Facebook video in its own page, then:

In Firefox, press Ctrl-Shift-Q to bring up the Network developer tab, then click 'Media' at the bottom to show only the videos on the page.

In Internet Explorer, press F12 to open developer tools. Then select the icon on the left which resembles a wireless router. Click the green triangle to enable network capturing and then play your video in HD. Scroll through the results until you find video/mp4 entries. Right-click on the video/mp4 entry and select 'Open link in new tab'. This will open the video in its own browser tab where you can right-click and select 'Save video as...' to save the video to your hard drive. These last steps are the same in all the major browsers, although the exact wording may vary a little.

CATALOGUE MUSIC LIBRARY

Q I've transferred my entire CD collection to Windows Media Player. Is there any way in which I can produce a printed catalogue or list of the entire collection? I want to show the artist name and track name, and preferably also do some disc labelling. I'm still using Windows XP with Service Pack 3, but I also have access to Windows 7.

Windows Media Player does not have such a feature built in, but there is an additional Microsoft download that will enable you to export and print your media info. Go to tinyurl.com/mb45shj and download the Windows Media Player 9 Series Winter Fun Pack 2003.

Since you're running XP, this software should install without issues. However, it won't install on later versions of the operating system, due to changes in folder permissions used during the installation.

Once you've installed the fun pack, launch Windows Media Player and press the Alt key, so you can see the menus along the top. Now select Tools, Plugins Media Info Exporter. Now choose 'All Music' from the drop-down menu and then click Properties. Here, you can select the application you want to export your music info to: Internet Explorer, Microsoft Word or Notepad. Click OK and then Export. You can now print your library directly from your chosen program.

If you try to install the fun pack on Windows 7, it will probably fail with an Error code 1303. This is because the installer is attempting to write to a folder to which the installer no longer has access permission. To make the installer work, you'll need to manually change the permissions on this folder. Note the name of the folder mentioned in the error message.

For 32-bit Windows, it will be 'C:\Program Files\Windows Media Player', while for the

Continues >>

TECH JARGON BUSTER

BITTORRENT: BitTorrent is a widely-used peer-to-peer file sharing protocol, designed to dispense high-volume data via the Internet. It's used for distributing large files, such as Linux distributions and also for illegal file sharing. The protocol was invented by Bram Cohen in 2001.

CMOS BATTERY: This is a battery, located on a PC motherboard, which provides the small amount of power required for your PC to retain its BIOS or EFI settings, including the date and time.

EASTER EGG: As well as being a delicious seasonal chocolate-based confectionery, an easter egg is a hidden feature inserted into any media, sometimes for the amusement of the creator and other times to increase user engagement. Examples include 'cheat codes' in video games, hidden extras on DVDs and even a flight simulators hidden within early versions of Microsoft Excel. (Try searching Google for 'askew').

MICROSOFT CORTANA: Named after a character in the Halo series of video games and voiced by the same actor, Cortana is Microsoft's personal assistant. It's built in to the Windows Phone 8.1 operating system and will respond to natural voice commands. It can access Bing, as well as the user's personal information and settings, to provide personalised output and perform functions based on the user's requirements, such as setting reminders.

PEER-TO-PEER (P2P): In a peer-to-peer network, each computer or device both sends and receives data without the need for a central server. This results in a sharing of resources and bandwidth, which reduces the demand on any individual participant.

SANDBOXING: This is a security technique whereby a program has access only to a predefined set of resources and can't therefore interfere with other programs or portions of the core OS. This limits the impact of bugs or malicious code, but can make the sharing of data between applications more difficult.

SMARTWATCH: A wristwatch with built-in computing features. The first models appeared in the early 1980s and enabled simple data entry and memory features. Modern smartwatches generally integrate with mobile phones to provide app support and notifications.

CATALOGUE MUSIC LIBRARY

64-bit version it will be 'C:\Program Files (x86)\Windows Media Player'. If your system drive has a drive letter other than C:, then use that drive letter instead.

Open Fire Explorer and open the relevant Windows Media Player folder for your system. Right-click on the Icons folder and select the Security tab. In here, click Advanced and select the Owner tab. Click Edit and set the Owner to Administrators. Close all dialog boxes by clicking OK.

On Windows 8, there is a link at the top of the security settings to change the owner. Click this and type **administrators** in the box marked 'Enter the object name to select'. Click 'Check Names' and then OK. Right-click on the Icons folder again, go back to the security tab and click Edit. Select Administrators and then the Full Control option. Close all dialog boxes by clicking OK.

Once these options have been set, you should be able to install the fun pack.

An alternative method is to use a utility such as Windows Media Player Playlist Print, available from tinyurl.com/365344. This program is able to print any of your saved playlists with customisable fields, such as Title, Artist, Album, and so on.

If you want to print out your entire music collection, you will first need to add all of your music to a playlist in Windows Media Player and save it

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Use your smartphone as a Wi-Fi hotspot

It's easy to connect your tablet (or laptop) to your smartphone and get internet access on the move. Jim Martin explains everything you need to know to use your phone as a portable Wi-Fi hotspot

Unless you happen to own a tablet with 3G or 4G connectivity, your mobile internet connection will likely be through your smartphone. However, its small screen isn't as good as your tablet's display for browsing the web or streaming videos from Netflix. The good news is that it's possible to use your smartphone as a portable Wi-Fi hotspot, and share its data connection with your Wi-Fi-only tablet. This setup is called 'tethering' or internet sharing, and many smartphones provide this feature out of the box, including iPhones, BlackBerrys, Windows Phones and, of course, Android handsets.

Tethering is when you turn you smartphone into a mobile Wi-Fi hotspot and share your phones 3G/4G data connection. Once you've turned tethering on, any device with a wireless connection can connect to the internet via your smartphone's data connection. It means the same thing no matter what smartphone OS you're using. The only difference is how you enable it on each platform.

Does my smartphone work as a Wi-Fi hotspot?

Not all smartphones support tethering, but most popular models do, including the iPhone, Samsung Galaxy S5, Nokia Lumia 930 and LG G3. You don't have to use Wi-Fi to share your phone's internet connection: some allow you to connect a laptop (or tablet) via a USB cable. Alternatively, you might be able to use Bluetooth.

Regardless of the connection method, it's important to check whether your mobile tariff allows tethering before using your smartphone as a Wi-Fi hotspot. In some cases, the mobile operator can prevent the option from appearing on your handset if tethering isn't part of the deal – iPhone owners will notice that Personal Hotspot doesn't show up in the General settings menu, for example.

In other cases, it's physically possible to set up tethering, but if it's forbidden on your tariff you could find yourself with a warning, or even being cut off for breaking the rules. Some operators are more lenient than others, but always check if you're not sure.

I'm not allowed to tether on my tariff. What are the alternatives?

First, and most obviously, you could switch to a different operator or tariff (or request a bolt-on to your current one) that allows you to use your smartphone as a Wi-Fi hotspot. This might mean that you pay a little more each month for your mobile contract, but it's likely to work out cheaper in the long run than many alternatives.

If you haven't bought a tablet, you might consider buying one with 3G or 4G support. You'd then have to get a data-only SIM card for it, and take out a pay monthly or pay-as-you-go contract.

Another option is to invest in a portable Wi-Fi hotspot, also known as MiFi. These battery-powered devices are essentially wireless routers into which you pop a SIM card, just as you would a 3G or 4G tablet. They cost from around £50 or might come as part of a package with a data SIM. If you want a device that will work in other countries, you should investigate Globalgig (globalgig.com).

How does tethering work?

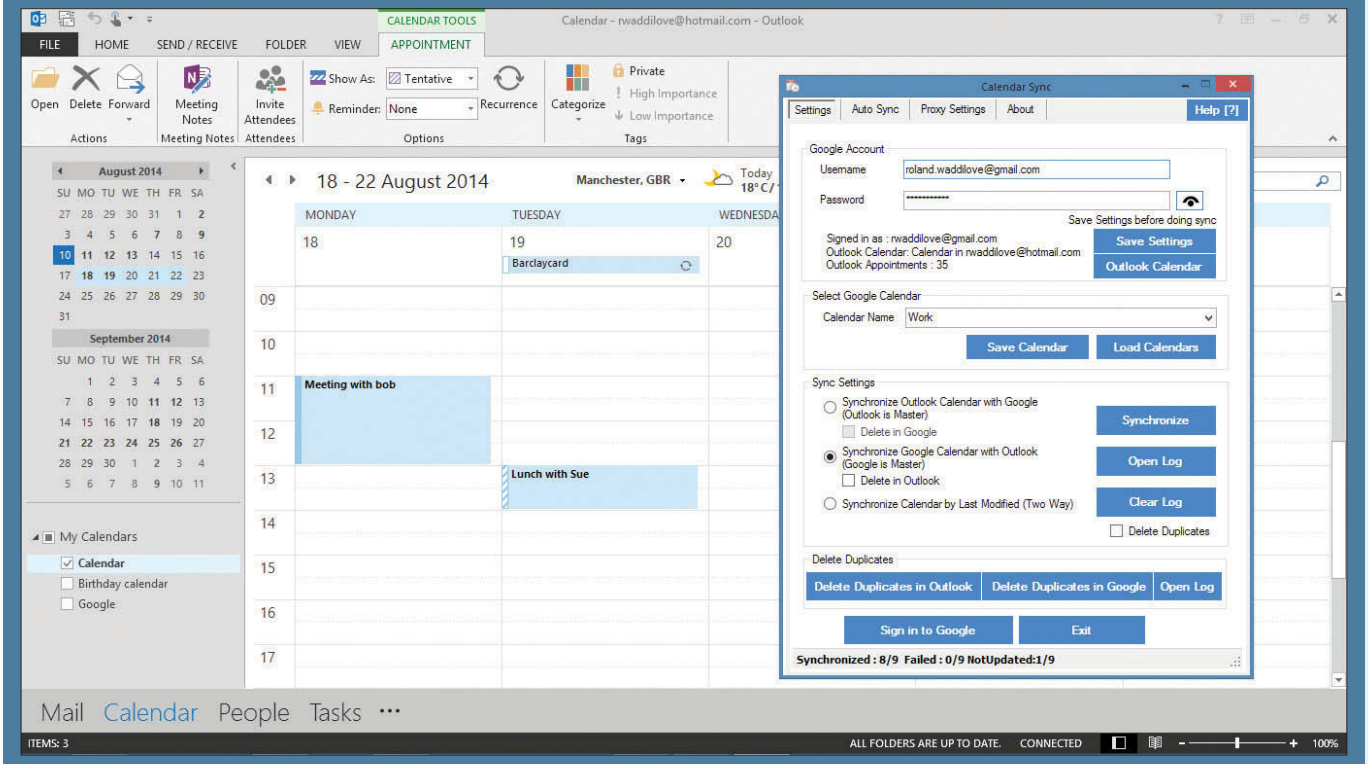
Put simply, the process involves enabling the hotspot option on your phone, configuring wireless security with a password to prevent other people piggybacking on your connection, then connecting your tablet to the wireless network just as you would with any hotspot. You'll have to enter the password the first time you connect, but subsequently, your tablet should connect automatically. It's the same process if you have a MiFi dongle.

Pitfalls to watch out for

One of the potential problems with using your phone as a portable Wi-Fi hotspot is that your tablet will think it's connected to a fixed broadband line, rather than a mobile connection. This means it could gobble up your limited monthly data allowance very quickly.

While your smartphone will avoid downloading app updates and any other large data files on 3G, your tablet could assume that's perfectly fine. For this reason, either disable automatic updates or downloads. Or keep a close eye on how much data is being used by via the settings menu or through a dedicated app.

On your smartphone, disable the hotspot running when you're not using it as this will help to prolong battery life. ☒



Sync your Google and Outlook calendars

Google recently pulled the plug on its Outlook calendar sync utility, so what is the alternative? Roland Waddilove has a few suggestions

The diary is dead and most people remember appointments and events using a calendar on their phone, tablet or computer. It's simply more convenient. Some people prefer to use Google Calendar, but others like Outlook. Quite a few people use both and the reason is because they're used for different categories of event or appointment, such as work and personal.

Google provided a utility to sync both Outlook and Google calendars for people that had both, and an appointment that was added to one would automatically appear in another. This is no longer the case, because Google closed down the service on 1 August 2014, causing considerable anguish for the people that relied on it. What's the solution? Well, there are three options...

Choose one calendar and stick to it

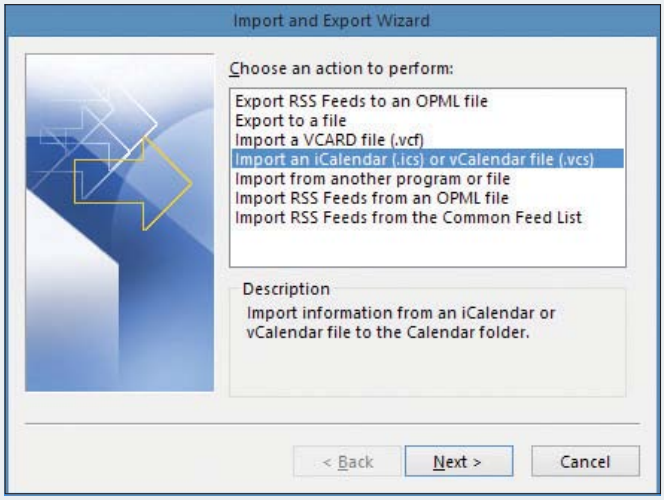
Using two calendars services from two different companies inevitably leads to problems, and you should seriously consider using just one. Doing so simplifies scheduling appointments and events and solves the whole sync problem. Both Google and Microsoft support multiple calendars, such as work and private, and offer single calendar or combined views. When adding a new event, you can choose which calendar to add it to.

To use Google or Outlook, just export one calendar and import it into the other. For example, to export Google Calendar, click the gear button, Settings, Calendars, then Export calendars. It downloads your data as a zip file, so copy the .ics file out. To import this into Outlook, go to File, Open and export, then Import and export. Select the option to import an iCalendar (.ics) file.

To export Outlook calendar, go to File, Open and export, Import and export. Select Export to a file and save it to a .csv file. To import it into Google Calendar, click the down arrow next to Other calendars and select Import calendar.

What about the Outlook.com Calendar, also used by Windows 8 Calendar app? Just click Import in the menu and select the Google Calendar .ics file to import it. To export Outlook Calendar events to Google Calendar is more difficult. First click the Share menu, then Get a link. Select the ICS URL with the mouse and press Ctrl+C.

Next, Go to Google Calendar, click the down arrow next to Other Calendars and select Add by URL. Press <Control>+V to paste in the URL you copied, but replace webcals:// at the start with http://. All your Outlook events and appointments are now in Google Calendar.



Outlook enables you to **IMPORT CALENDARS** from Google

View both calendars

Some people either can't switch to one single calendar or prefer to continue using both. This is possible and phones and tablets combine Google and Outlook.com calendars (and Outlook Calendar if it's synced with Outlook.com) into one calendar display.

On an Android phone or tablet, add the Outlook.com email app from the Google Play Store. It reads the Outlook.com Calendar and merges it with the one on the device. This means that no matter which calendar an appointment or event is added to, it appears in the Android Calendar app. It does not sync calendars and make them identical, it just looks that way and the Android app can read Outlook.com Calendar, but not write to it.

The iPhone and iPad can display a combined Google Calendar and Outlook Calendar too. Go to Settings, Mail, Contacts, Calendars and tap Add Account. Use the options to add both Google and Outlook.com accounts, then accept the offer to sync calendars. Now events added to Google Calendar, Outlook.com Calendar or Outlook if it's synced with Outlook.com, appear in the iOS Calendar app.

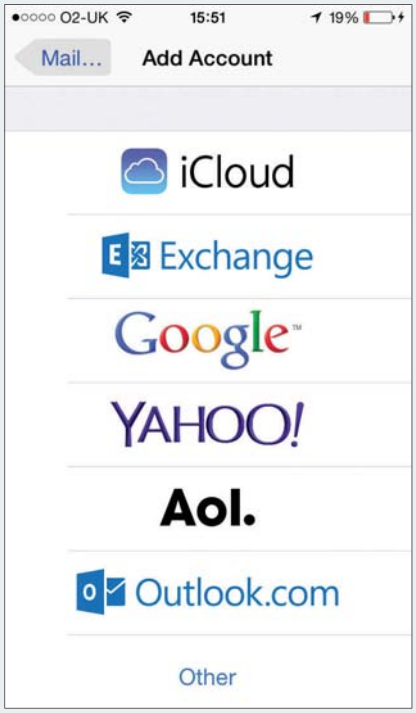
Sync calendars

One way to make an appointment appear in both Google and Outlook calendars is to invite yourself by entering your email address when creating a new event. You create a meeting with yourself, so in Google Calendar you would invite yourself by adding your Outlook or Outlook.com email address.

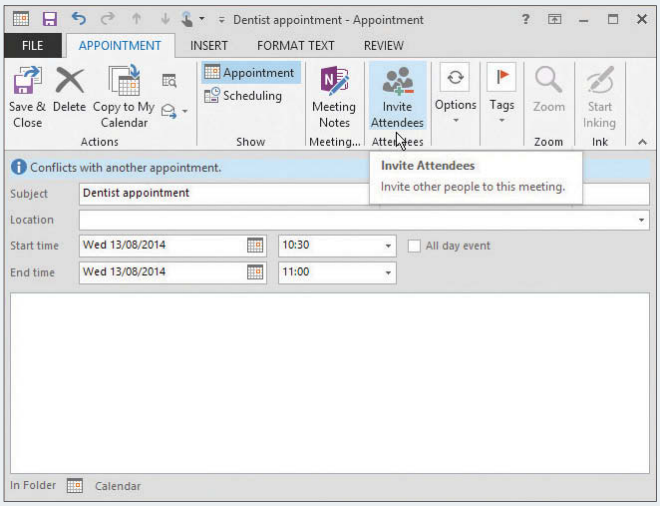
Outlook adds a calendar invitation from Google as an unconfirmed event. You can leave it like this or click the Accept button in the email. Outlook.com doesn't automatically add invitations to the calendar and you have to click Accept in the email.

You can manually accept emailed invitations sent from Outlook/Outlook.com to Google Calendar in Gmail, but there is a better way. Click the gear button in Google Calendar and select Settings. On the General tab there's an option to automatically add invitations to your calendar.

If you don't want to use invitations to sync calendars, there are utilities that sync Google and Outlook calendars. At the time of writing, some of these are still in beta (pre-final) form, but full versions may be available by the time you read this.



Add Google and Outlook.com calendars to your **PHONE AND TABLET**

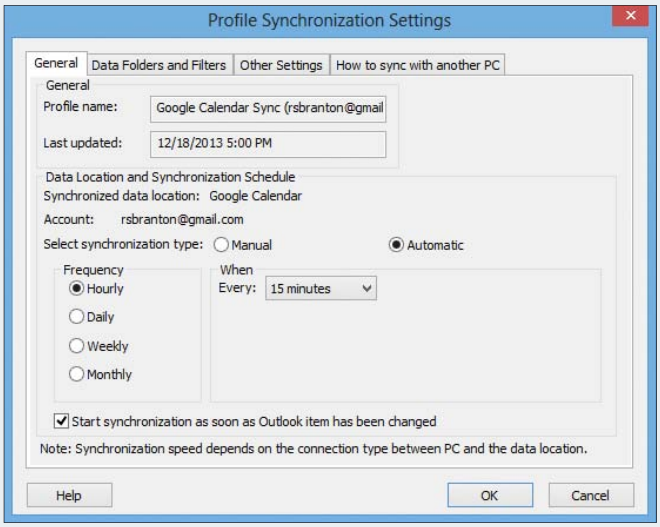


INVITE YOURSELF to events to make sure that they appear in both Outlook and Google if you're only using one calendar

gSyncit v4 (tinyurl.com/kr6ulao) is a £12 Outlook add-on that enables one and two-way syncing between Outlook and Google calendars. Sync2 (tinyurl.com/pcvcyz7) syncs Outlook with Google Calendar and does a lot more besides for £29.95. It can sync on a schedule or whenever a change in Outlook is detected. OggSync (tinyurl.com/5oqwz5) does a similar job, and v8.1 fixes sync problems introduced by changes at Google, but costs £18 a year.

Calendar Sync (tinyurl.com/l2ugrvb) appears to be the perfect replacement for the old Google sync tool for Outlook users. It's a free app that's very easy to use and does exactly what you want. To use it, enter your Google username and password and click Save Settings. Click 'Sign in to Google' at the bottom to authorise it. Now you can select a Google calendar to sync it, if there's more than one, and whether Google or Outlook is the master calendar.

A two-way sync by 'last-modified date' is also possible and you can choose to delete duplicates that appear in Outlook or Google. The Auto Sync tab enables you to sync automatically, but don't do this too often as Google imposes limits on this kind of activity. ☒

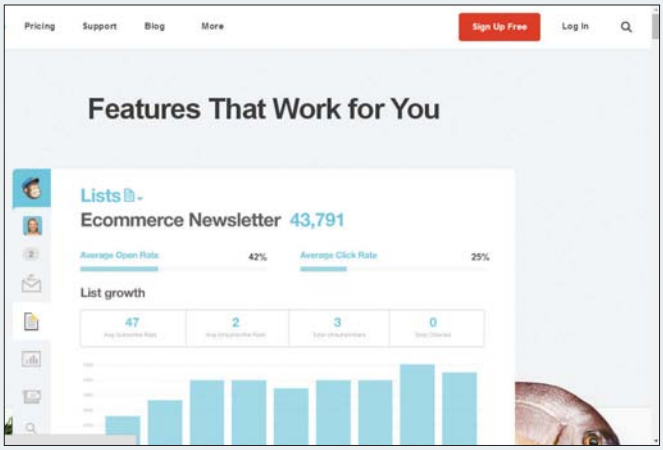


Sync2 enables you to **CREATE SYNC PROFILES** to keep your Google and Outlook calendars synchronised across your devices

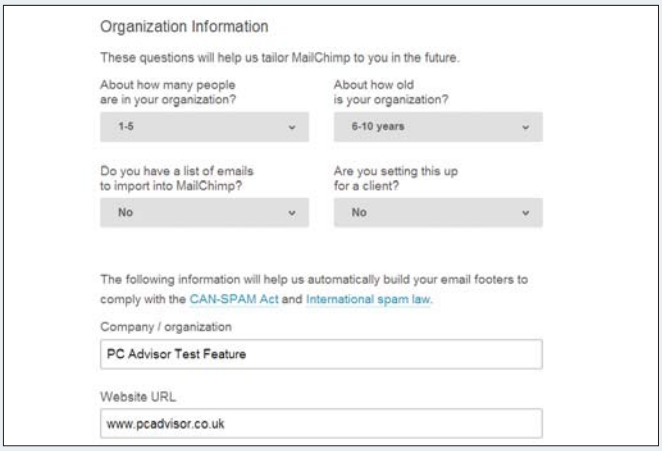
Manage group emails

Keeping your team up to date is tricky with traditional email. Martyn Casserly shows how to set up a professional-looking message using MailChimp

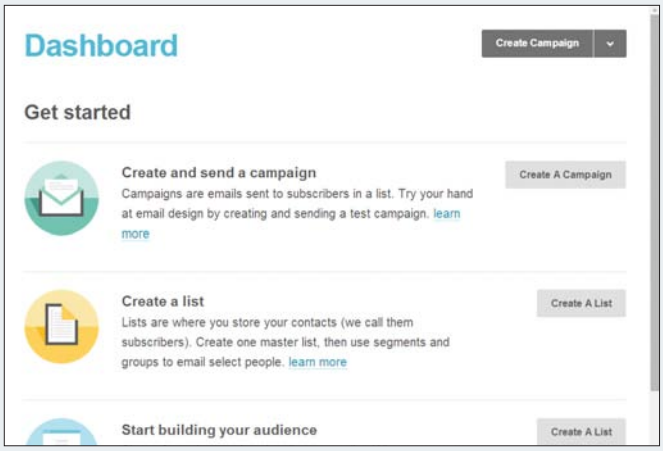
If you've ever had to run a group or team then you'll know that effective communication is very important. The normal way to ensure that these days is via an email list, where you send out news, dates for upcoming events, and any other ephemera relating to those involved. If you use Gmail, Hotmail, or any other web-based email service then your missives can look pretty bland, and it isn't easy to know if people have opened new mails. Turning to a service like MailChimp (mailchimp.com) can instantly give your mailing lists a far more professional appearance, alongside providing you with access to analytical features and other useful tools.



START Set your browser to mailchimp.com, where you'll find an explanation of the various features on offer. In the top-right corner there's a red button marked Sign Up Free. Click on this and enter your details.

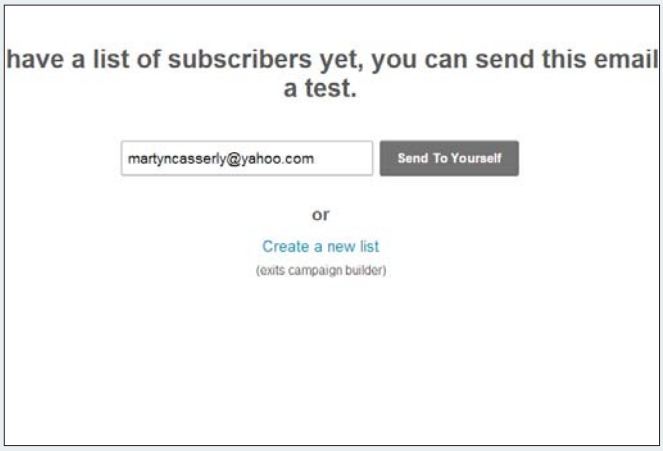


2 Alongside the normal data fields, you'll also be asked about your organisation – number of people, how long you've been around, and so on. Filling these out accurately can help MailChimp provide you with additional data.

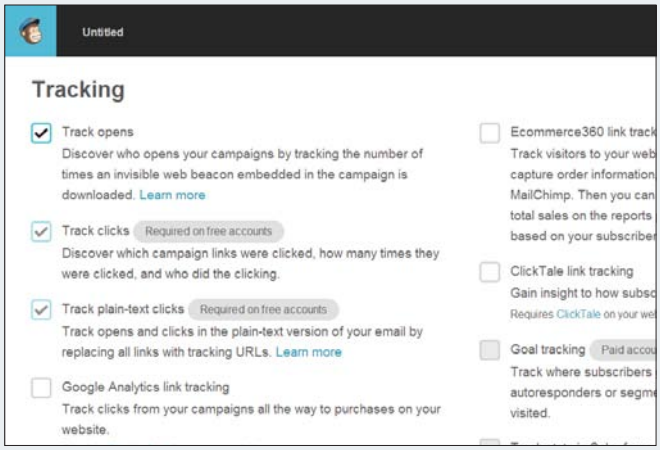


3 Once you've set up your account you'll be taken to the Dashboard. As you might expect this is the hub of your account. All of the important sections are available from the list on the left. To get started click Create a Campaign.

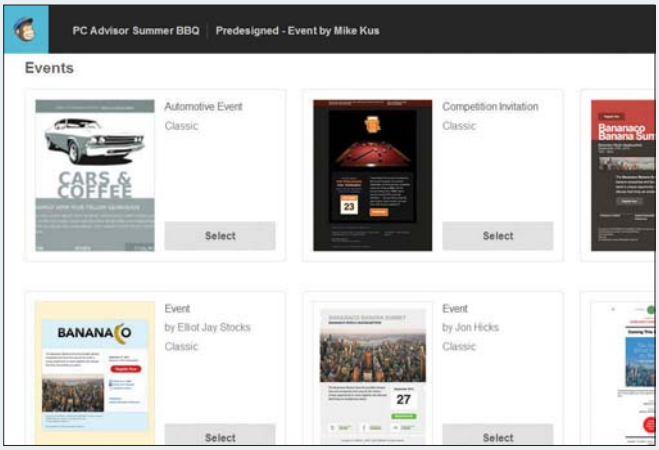
4 Now you'll see a list of the different types of emails that you can use for your campaign. At the top of the list is Regular Ol' Campaign, which is a standard HTML format that can incorporate template designs. Click on this to continue.



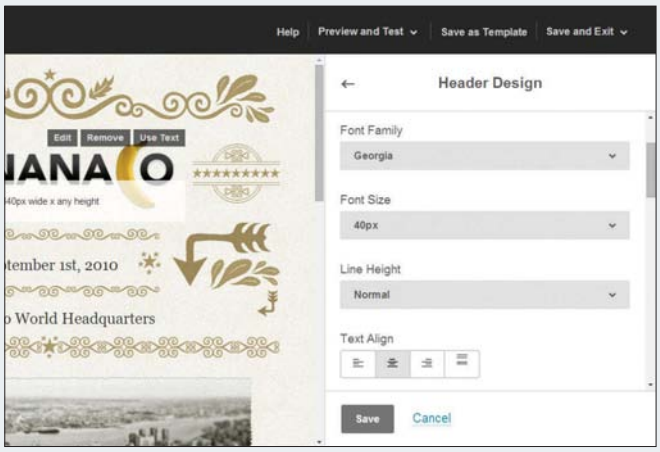
5 Unless you've imported a contact list, you'll see a message that this campaign will be sent to your email address as a test. To add other addresses, simply click Create a New List, otherwise select Send to Yourself.



6 The next screen begins to show you the power of MailChimp. Here you'll find a number of settings that can be applied to your email. These include tracking responses, social media posts, and even auto converting any video to more email friendly formats.

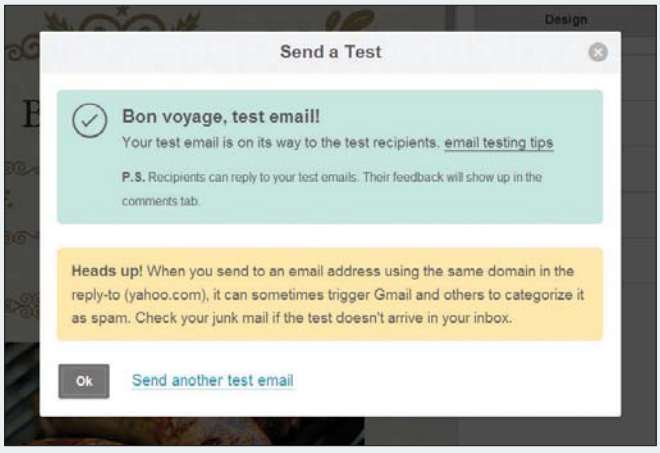


7 Now you can start to put together your cool new email. Either choose a simple template and assemble your own from scratch, or browse through the wide range of free themes, which include relevant images. We'll choose a template for now.

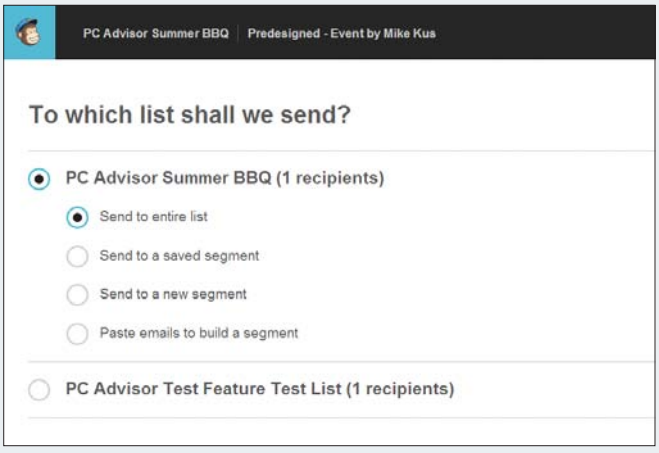


8 The text and pictures on each email can be changed now via the editor. Simply hover the pointer over each area to reveal the options. There's also the menu on the right that allows fine tuning of general formatting. Try replacing some of the details now.

9 When you're happy with your creation, it's a good idea to get a proper look at it. Click on Preview and Test > Enter Preview Mode, then check if all the details, and spellings, are correct. You can also see how it will appear on a mobile phone.



10 To see how it will actually work click on Preview and Test > Send a Test Email. A dialog box will appear where you can enter the address of a willing test subject. Send it out, then confirm that it was successful.



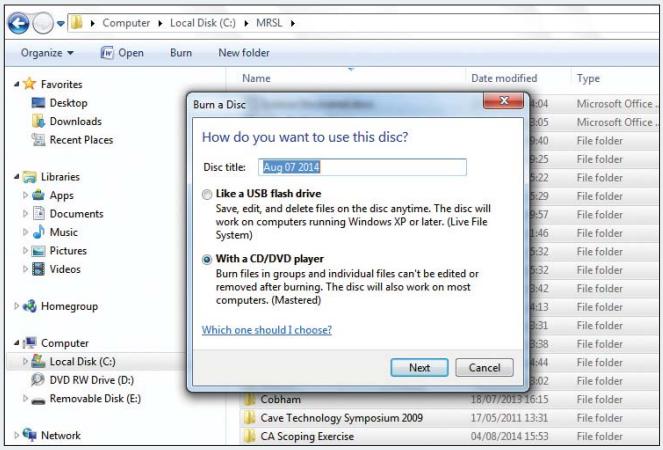
11 Click on Save and Exit in the template, select Lists, then create a new list. Fill out the details, add your addresses, and repeat the campaign. You'll find you can add the list this time and send out your smart email to everyone in one go. ☒

Reinstall Windows 7

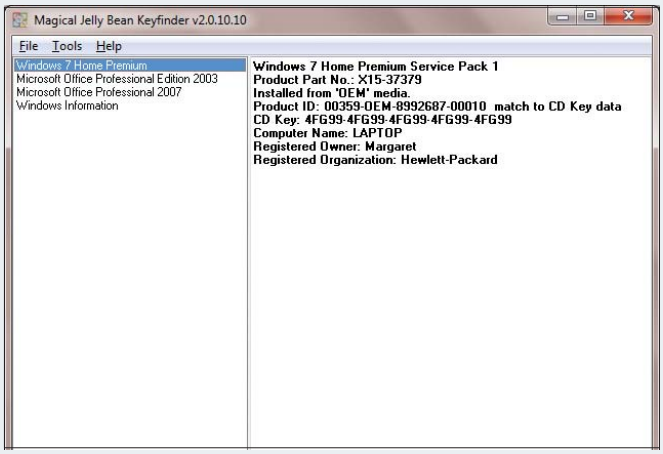
Is your PC crawling along? Or not working? Reinstalling Windows could be the answer. Mike Bedford explains how you can make it as good as new

It's a fact of life that PCs get slower with age. However, reinstalling Windows will restore your computer to its former glory. Reinstallation might also be the only solution if your PC refuses to boot, system restore won't work, and you've been able to discount any hardware fault. It's also necessary if you decide to swap your hard disk for an SSD (see tinyurl.com/pwby3yv).

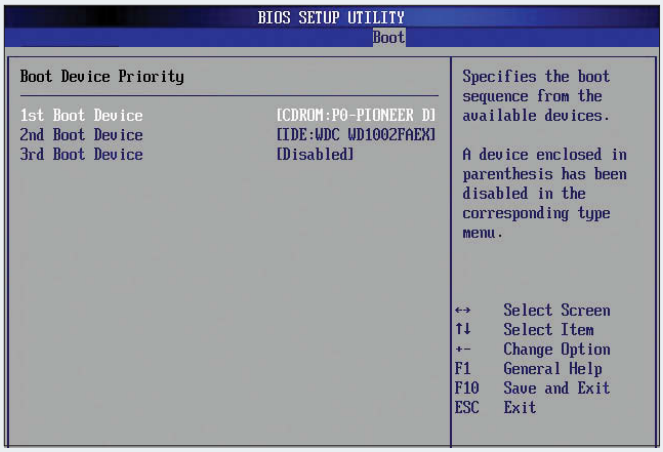
Here we'll show you how to reinstall Windows 7 from a DVD. Some PCs allow you to reinstall Windows from a separate recovery hard disk partition and, in that case, you should follow the manufacturer's instructions. Alternatively, see our guide to reinstalling Windows without a disc at tinyurl.com/qa9b2fy.



START Reinstalling Windows will result in all the data being lost from your hard disk, so it's essential to make a copy of everything you want to keep. Depending on the size of backup, you could use a stack of DVDs or an external (or networked) hard drive .

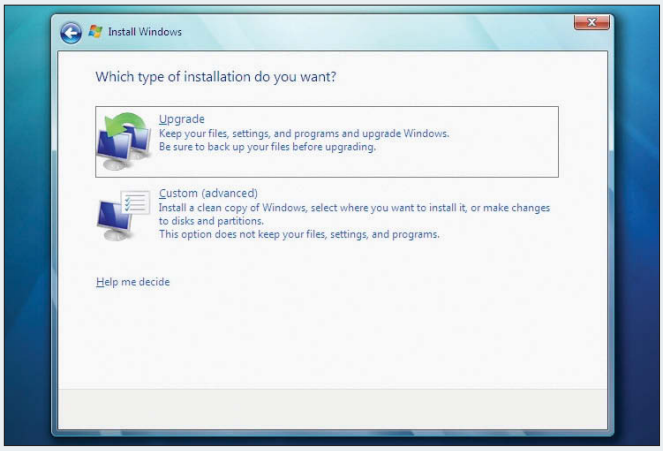


2 Later, you'll need to activate Windows using its product key (five groups of five characters) so make sure you can find it on a Microsoft sticker on your PC. If there's no sticker or it's illegible, locate it using Magical Jelly Bean Keyfinder (tinyurl.com/obvwuqg).

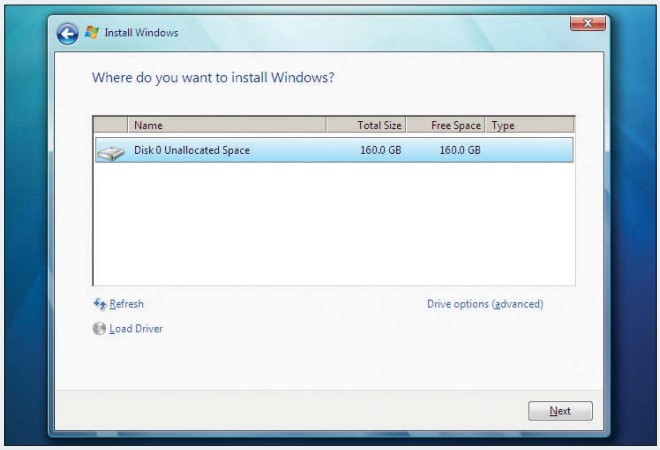


3 Shut down your PC, put the Windows disc in the CD/DVD slot and start it up. All being well, it should boot from this disk. If it boots to Windows normally, you'll have to use the BIOS menus to make your PC boot from a disk – see tinyurl.com/pjt5x3p for details.

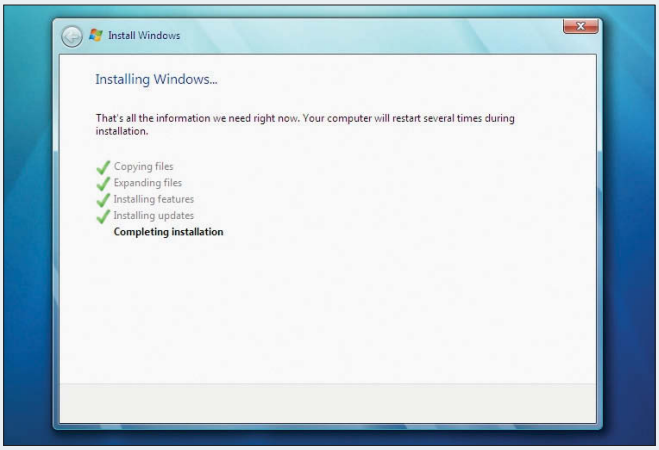
4 Windows Setup will start and, on the first screen you should specify your preferred language, time and currency format, and the nationality of your keyboard. You'll also be shown a screen on which you're required to agree to the licence conditions.



5 You'll now be asked 'Which type of installation do you want?' and both options will be explained in some detail. Choosing the 'Custom (advanced)' option will take your computer back to the way it was configured when it first left the factory.



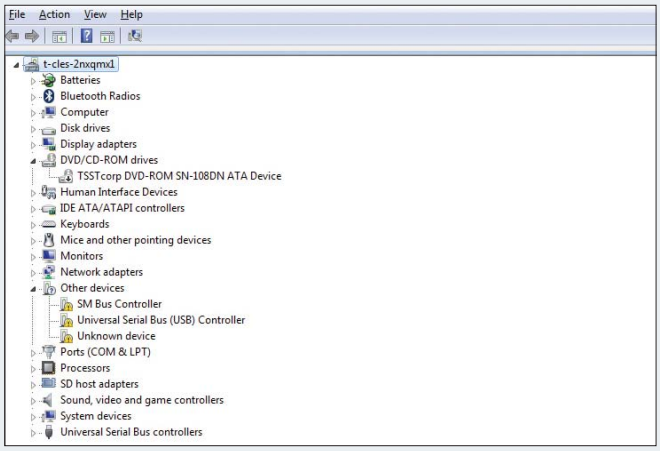
6 Next you'll be asked 'Where do you want to install Windows?'. Sometimes only one partition will be shown, in which case simply click on Next. If multiple partitions are displayed, select the first primary partition (usually the largest) before doing so.



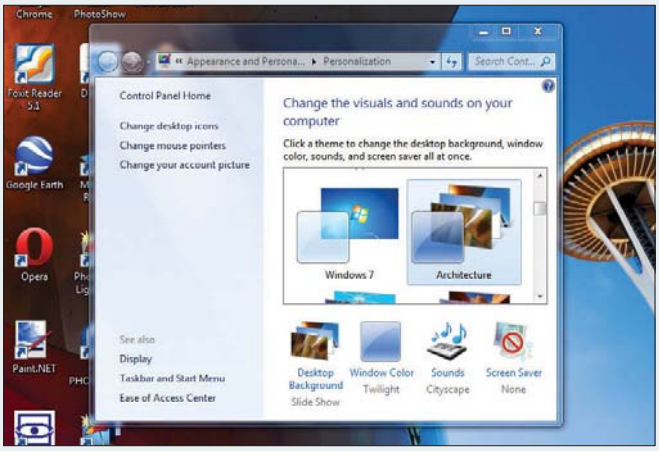
7 Windows 7 will now be installed, and its progress will be reported in the list of actions and the progress bar. This could take some time. Often, it'll seem that the installation has got stuck in the 'Completing installation' phase, so be patient.

8 Next, you'll be guided in setting up a new user account. Also, you'll need to provide the product activation key that you identified in Step 2 to complete the process. This will be used later when you're online, to activate the new installation of Windows.

9 Follow the instructions on screen and once done, Windows will start. Your next job is to reinstall the various applications that you use on a regular basis. Resist the temptation to reinstall everything or you'll be heading for a cluttered system again.



10 Now go to Device Manager – search for it in the Start menu – and check that drivers have been installed for all the hardware (especially graphics cards and printers). If not, go to the manufacturer's website and download the latest versions.

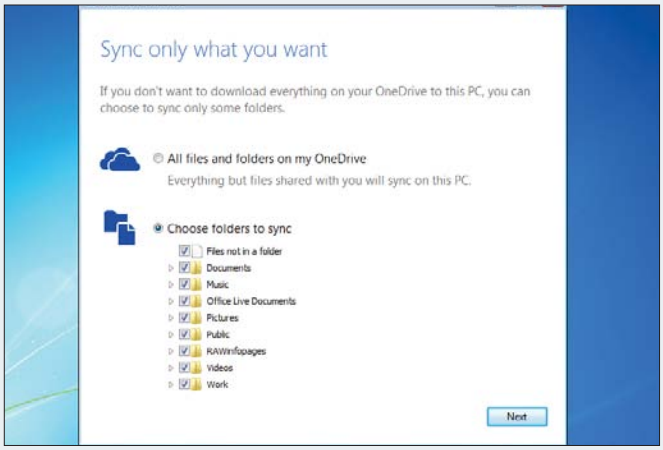


11 Now, using the backup you created in Step 1, copy all your files back onto your PC. You'll probably also want to select your favourite wallpaper at this point too, and make all the other changes necessary to customise your PC exactly the way you like it. ☒

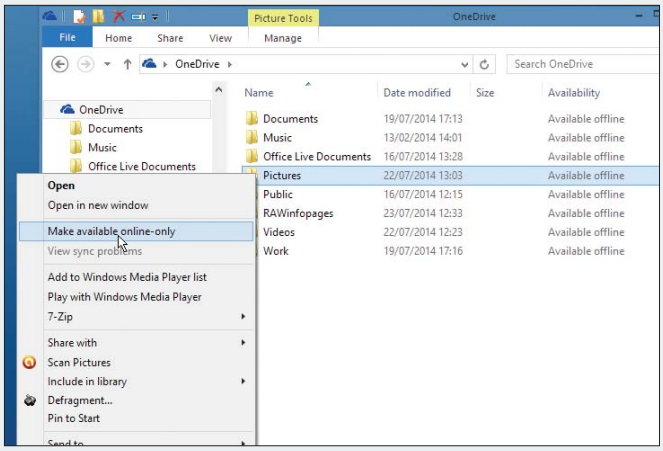
Use OneDrive's tools

Microsoft's OneDrive does more than simply provide online storage space. Roland Waddilove shows how to make the most of your free storage

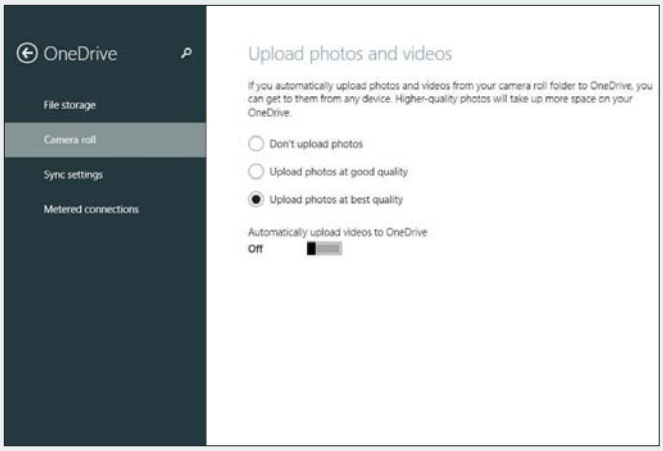
Microsoft has steadily improved OneDrive, formerly SkyDrive, and the service is now excellent. With 15GB of online storage for free and more that can be earned in various ways, it has become a valuable tool. Mobile apps for Android and iPhone can upload your photos and access your online files, and you can share files and folders. OneDrive goes further than storing and sharing files, and you can choose whether they are stored on the PCs disk or online. You can also access the disk drive of any PC you own, which is great if you have left a file on another PC and need to access it. You can even edit Word, Excel and PowerPoint files – click the Create menu in a browser at the OneDrive.com website.



START When installing the app in Windows 7, you can choose which folders to sync. A synced folder means that it is stored both online and on your PC. Files on the PC can be accessed offline, but you must be online to access other files.

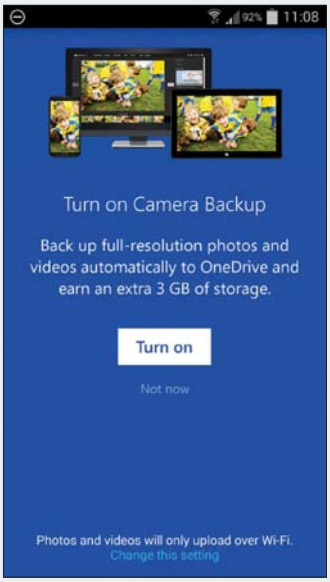


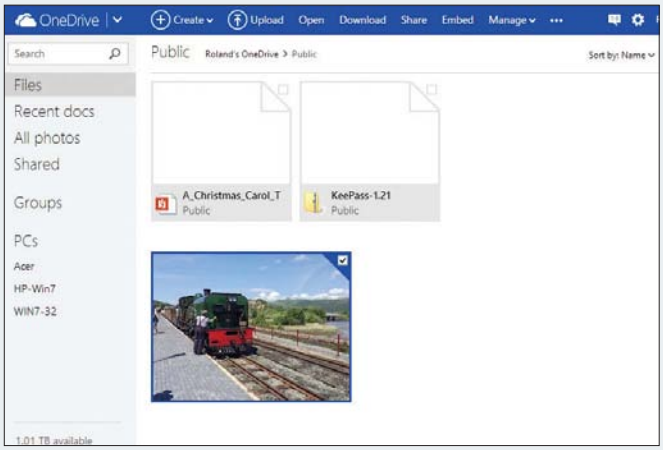
2 Here is OneDrive in Windows 8.1. The Availability column tells you whether the files/folders are online or offline. Right-click a folder or the whole OneDrive, and you can choose to switch from online to offline, or offline to online.



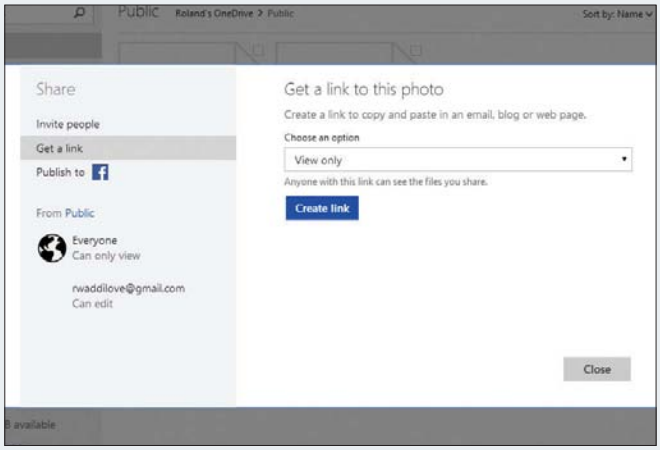
3 In Windows 8, go to the charms on the right, Settings > Change PC settings > OneDrive. Do you want to upload photos transferred from a digital camera? What quality setting should be used? Choose the best quality if there's enough space.

4 When OneDrive is run on a phone, there's an option to back up photos. Agree and you'll get an extra 3GB of online storage space in addition to the 15GB you get for free. It's an easy way to transfer photos to your PC.

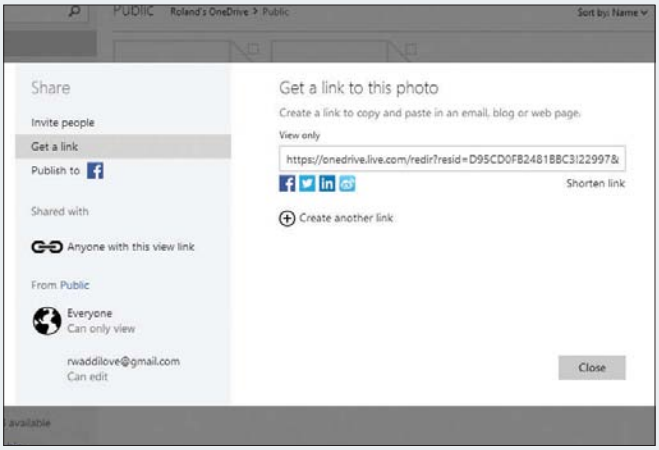




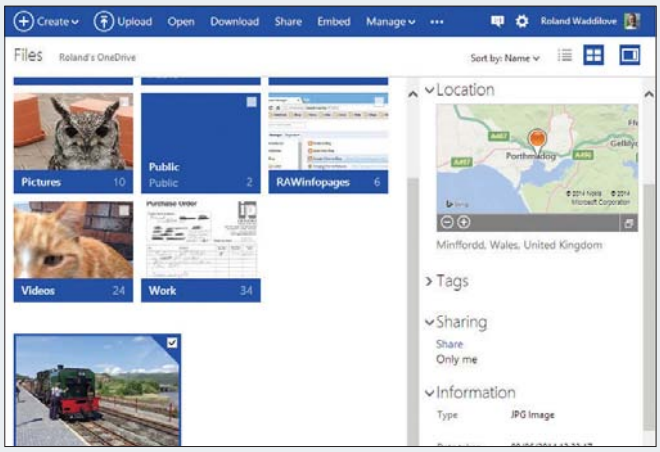
5 Sharing files must be done online, so go to onedrive.com and log in. The Public folder is created by default and is designed for sharing files. Copy or move a file to the folder, such as a photo, using the Manage menu options.



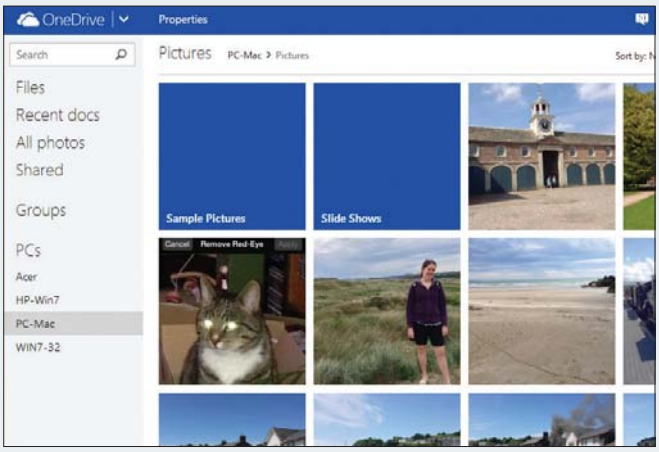
6 Select a file in the Public folder and click Share at the top. There are options to invite people, get a link, or publish to Facebook. We will use Get a link. You can choose whether people can view the file or edit it. It's your choice.



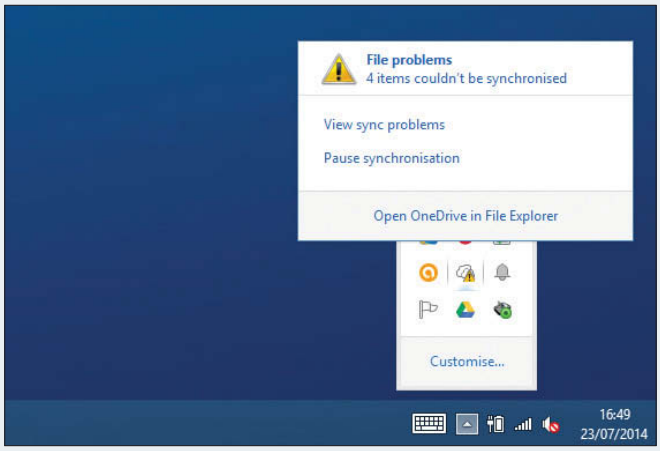
7 The link has been created, but it is long and complicated. Click the option to shorten it and press <Ctrl>+C afterwards to copy it to the clipboard. It can then be pasted in an email, on a blog or sent via an instant message.



8 To stop sharing a file, select it and use the Manage menu to move it out of the Public folder. If you right-click it and select Properties, the panel on the right shows that now only you can access it in the Sharing section.

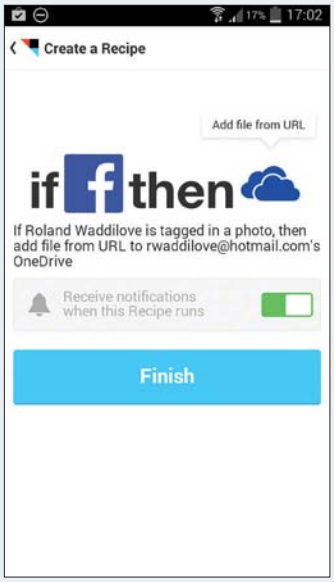


9 Through PCs on the left, you can access the disk drive of any PC you own running OneDrive. This is Chrome on a Windows 8 PC accessing the Pictures folder on an Apple Mac running Windows 7 in Bootcamp.



10 To check whether there are any problems syncing files, click the icon at the right side of the taskbar. Click 'View sync problems' and a new window appears that enables you to sync again or try to resolve the problem.

11 OneDrive can do more than you think. Install IFTT (If This Then That) on your mobile phone and create rules like, if someone tags me in a photo on Facebook, copy the photo and store it on OneDrive. That's clever. ☒



Set up a Raspberry Pi

You don't need an engineering degree to build a robot army. As Alex Campbell reveals, with the Raspberry Pi B+, you can create robots on the cheap

The £30 Raspberry Pi B+ is a credit card-sized computer. The darling of the DIY electronics crowd, it was originally designed to teach kids computer and programming skills, but it's since been used to create everything from robots to home media centres.

The device has four USB ports, HDMI video and a host of other peripherals. The latest version, the B+, comes with 512MB of RAM and uses a microSD card.

Most people install a Linux distribution called Raspbian on to the SD cards needed to boot the Pi. This is a version of Debian Linux (the distribution Ubuntu is based on), designed specifically for use on the Pi. It's also recommended for new Pi users to familiarise themselves with the device and the Linux operating system. If the big 'L-word' scares you, rest easy knowing that

Raspbian ships with a familiar graphical environment, complete with a web browser. And you can get your Pi up and running in less time than it takes to bake an edible raspberry pie.

Raspbian Raspberry Pi

Yield: one web-ready Raspberry Pi B+
Processing time: about 20 minutes
Prep time: about 20 minutes

Before you start, gather everything you require in one place:

1x Raspberry Pi B+, bare
1x USB mouse
1x USB keyboard
1x ethernet cable
1x monitor with HDMI (preferred) or DVI input
1x HDMI-to-DVI adaptor (optional)
1x USB cable with Micro-USB connector and wall adaptor
1x 8GB microSD card with standard SD adaptor
Windows PC with SD card reader and internet connection

START On the Windows PC, download Win32 Disk Imager from tinyurl.com/ouqgnjx and a copy of Raspbian from RaspberryPi.org. Set aside time for these downloads to finish. Win32 Disk Imager should take about 30 seconds to download on a fast connection, while Raspbian will take around 12 minutes.

2 While files are downloading, connect the mouse, keyboard, HDMI cable and ethernet cable to the Raspberry Pi.

3 Link the other end of the ethernet cable with your home router and the other end of the HDMI cable to your monitor.

4 Connect the Micro-USB-tipped USB cable to the wall adaptor, and the microSD card to the SD card adaptor.

5 Once Win32 Disk Imager has downloaded, install the software.

6 When Raspbian has downloaded, extract the IMG file.

7 Insert the SD card adaptor into the PC's SD card reader and start Win32 Disk Imager as an administrator. Click the folder icon to browse for the Raspbian IMG file, click the drop-down menu under Device and select the appropriate drive letter for the SD card. Click Write and let the program run for about 7- to 8 minutes. When Win32 Disk Imager is finished writing, click OK and Exit.

8 Remove the SD card from your PC and pull out the microSD card from the SD card adaptor. Insert the microSD card into the Raspberry Pi until it clicks securely.

9 Plug USB power cable into the wall and into the Raspberry Pi to boot the computer.

10 When the Pi boots, select the first option to format the remaining memory of the microSD card for use as storage. By default, Raspbian is set to use a UK language and keyboard for layout, so you won't need to change this.

11 Once you've configured your options in the setup program, hit Tab and select Finish. On the next screens, select appropriate 'compose' keys, which are used to create special characters. I used the right Ctrl and Alt because I rarely use them.

12 When the setup program finishes, log in to Raspbian with the user name pi, and the password **raspberry**. Next, type **startx** to open the LXDE graphical desktop environment.

Once the graphical environment starts, you're good to go. While the Pi can handle web applications such as Google Apps, don't expect desktop-like performance. Remember it's running desktop software on really cheap hardware meant for mobile phones.

Raspbian comes preloaded with the Midori web browser. To install another browser, you'll have to use a couple of commands with console program **apt**. But first, you'll have to update the list of packages available to apt. Type or paste the following into a console window: **sudo apt-get update**. Next, open up a terminal and type **sudo apt-get install <package name>** to install the appropriate software package.

Once you feel at home with Raspbian, you can try writing programs for the Raspberry Pi using Python, or try your hand at other distributions like Pidora or the Pi version of Arch Linux. ☒

Use an Xbox One controller for your PC games

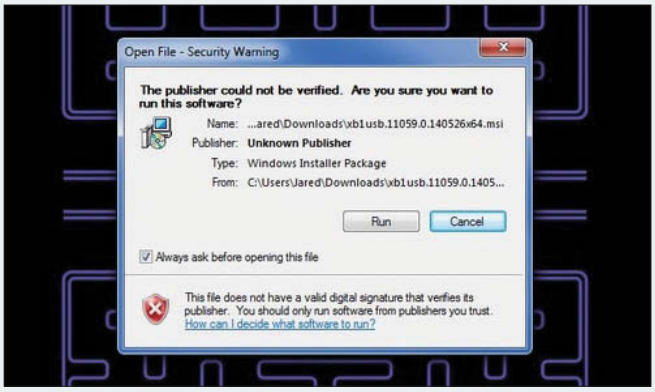
Microsoft has released Windows drivers for its Xbox One controller, allowing it to pull double duty as wired controller for PC gaming. Jared Newman explains how

Unlike the Xbox 360 wireless controller, which required a separate dongle for PC use, all you need to use the Xbox One controller on PC is a standard Micro-USB cable. The wired connection provides the power, so you don't even need batteries. Unfortunately, you can't use the Xbox One controller wirelessly on a PC at this time.

Driver installation

To set up the controller, head to Major Nelson's blog (tinyurl.com/paftbox) and download the drivers for either a 32- (x86) or 64-bit (x64) machine. (If you're unsure which file to grab, open Control Panel, type About in the search bar and click System. Then, look under 'System Type.')

Open the downloaded file. Amusingly enough, Windows will show an 'unknown publisher' warning, even though the drivers are coming from Microsoft. Click Run in the box that pops up. You don't have to plug in the controller to install the drivers.



Although the drivers are Microsoft's they **APPEAR UNSIGNED**

A setup wizard should appear. Read and accept the license agreement, wait for the installation to finish, then click Finish.

Now, plug in your Xbox One controller. It may vibrate briefly, and you should see a 'driver software installed successfully' error on the System Tray. At this point, you should be ready to play. Games that support Microsoft's Xbox 360 controller should automatically recognise the Xbox One controller without any additional setup (with some exceptions described below).

Potential issues

The biggest problem is that several of the games we tested wouldn't recognise the controller, including Dark Souls II, Transistor and Eldritch. The controller did identify several other games, including Dishonored, Super Meat Boy and Trials Evolution. Uninstalling and reinstalling the drivers didn't help, so hopefully this is just a temporary issue that Microsoft and game developers can resolve through updates.

Also, the first time we installed the driver, Windows 7 showed a 'Runtime Error' after plugging in the controller, followed by an 'XboxStat.exe has stopped working' error. The controller still worked, but the messages were a nuisance. They went away after reinstalling the driver.

Finally, keep in mind that plugging the controller into a PC will break its wireless connection to the Xbox One. You'll have to plug the controller back into the console via USB to pair them again. ☒

Avira Antivirus Pro 2014

ONLINE REGISTRATION REQUIRED

FULL PROGRAM (60 DAYS' WORTH OF UPDATES) AVAILABLE ONLY ON THE DISC+

Installation details

Go to My Computer, right-click the DVD icon and open the disc. Next, select Files 232\Avira Antivirus Pro 2014 and then open the install file

Online registration required: go to avira.com/en/pc-advisor and use the following activation code: WBVVV-VVVZB-CCZ59-GPGXA-NS9S5 before 9 Dec 2014

System requirements

Windows 7/8, 1024MB RAM; Windows XP, 768MB RAM; 1GHz processor; 800MB drive space (additional temporary and quarantine space needed); internet connection; Administrator rights during installation

Complete malware protection

Avira Antivirus Pro combines an award-winning antivirus engine with advanced heuristics and cloud-enabled scanning, to deliver comprehensive protection against all types of threats, including viruses, Trojans, worms, spyware, adware, ransomware, and more.

Runs silently in the background

Easy to install and even easier to use, Antivirus Pro delivers swift and smooth system scans at the push of a button. Recent innovations have drastically reduced scan times by half, while using 38 percent less RAM on your PC. And as the scanning of unknown files is done in the cloud, resource consumption is truly ultra-light.

Secure financial transactions

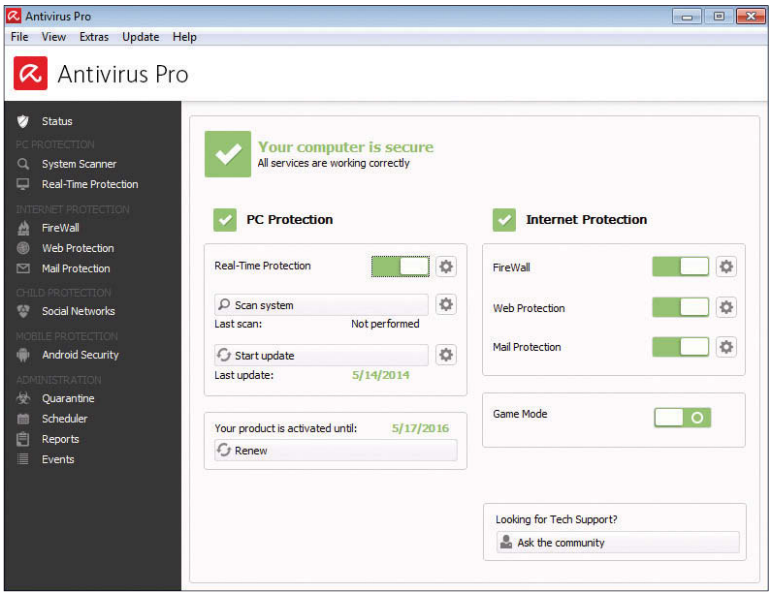
Avira Antivirus Pro safeguards your online environment. Email clients are scanned for infected attachments and poisoned links, while websites you visit are checked ahead of time, so you'll never have to worry about web injects, phishing links or fake web shops trying to steal your account details while shopping online.

Share safely

Avira Antivirus Pro includes network protection that scans not only your own folders, but also the ones you share with others. This ensures that any infections on the machines of your friends or family do not spread via a shared network or a removable USB memory stick.

Tech support included

With Antivirus Pro, you'll have unlimited access to Avira's customer support team. In addition, a vibrant online community is available to crowd-source any tech-related challenge you may have.



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1-abc.net Hot Key Organizer 4

FULL PROGRAM

ONLINE REGISTRATION REQUIRED

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Installation details

Go to My Computer. Right-click the disc icon and open the disc. Select Files 232\1-abc.net Hot Key Organiser 4 and open the file

Online registration required: follow the onscreen instructions at 1-abc.net/0036/ed/idg_uk/m1.htm before 9 Dec 2014

System requirements
Windows XP/Vista/7/8

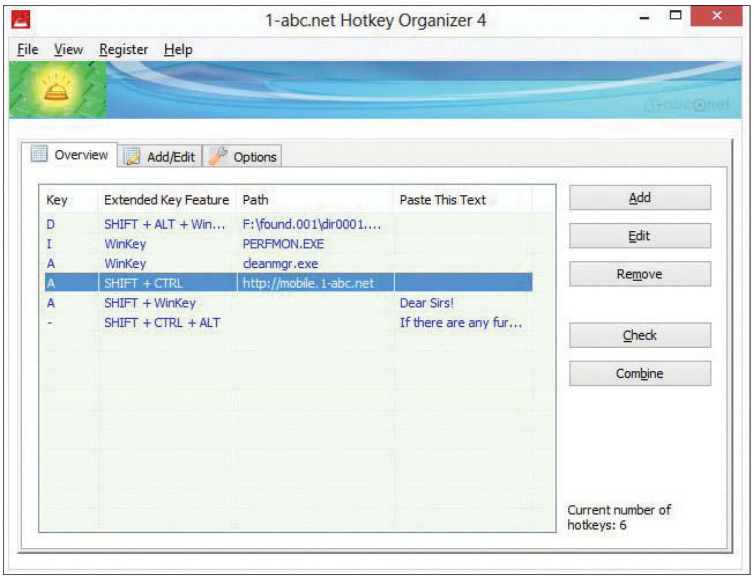
Do you ever think about how much time you waste on your computer? You start your favourite program by double-clicking on a desktop icon or – even worse – from the program menu, you open your browser and visit the same website again and again, or you have to repeatedly copy and paste the same text.

Would it not be better to execute or paste what you like with a global key combination (also called hotkey or shortkey)? 1-abc.net Hotkey Organizer was developed especially for this and allows you to create and to save these.

You can use any character, figure or key – just combine it with the Shift, Alt, Ctrl or Windows key. This means you can create hotkeys such as 'Ctrl+Shift+Windows+X', which won't collide with any shortkey used by other applications or the system itself.

As long as the program is active, you can press your hotkey on your keyboard and Hotkey Organizer will execute a command line you entered before (such as 'msconfig' for the Windows configuration tool), a full path to a file, or a program or a website that's opened in your default browser automatically.

You can create, save and open project files, so your hotkeys don't have to be configured again each time. You can also set a default project path to get your favourite project opened whenever 1-abc.net Hotkey Organizer is opened. And, of course, the program can be executed with Windows automatically, so all your shortkeys are available with each system start.



Ashampoo Photo Optimizer 5

ONLINE REGISTRATION REQUIRED

FULL PROGRAM AVAILABLE ONLY ON THE DISC+

Installation details

Go to My Computer. Right-click the DVD icon, and open the disc. Select Files 232\ Ashampoo Photo Optimizer 5 and open the install file

Online registration required: follow the links during installation before 9 Dec 2014

System requirements

Windows XP/Vista/7/8; 1500MHz processor; 1GB RAM; 75MB hard disk space; 1280x800 screen resolution; internet connection

Ashampoo Photo Optimizer 5 has a redesigned, more intuitive user interface, which gives you quick access to your digital photographs. It offers a variety of options to share your pictures. Send your photos by email, share them with your friends on Facebook or upload them to Picasa. You can also protect your images with a watermark to prevent them from spreading around the internet without your consent.

Features

- One-Click-Optimization for unique pictures
- New image viewer with explorer-like navigation
- Before/after effect in real-time
- Red-eye correction
- Amazing effects for your images – one by one or batch processed
- Individually positioned watermarks
- Colour correction with adjustable values
- Optimise multiple pictures at once by batch processing entire photo collections
- Convert your images to different file formats
- Image aging, and much more ☒

DISC INSTRUCTIONS

Place disc in drive. Open the file 'Click here to begin.pdf' for extra information.

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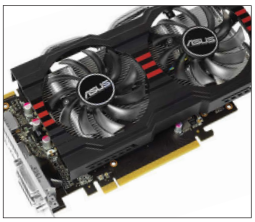
Graphics cards


Flat-panel displays

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Printers
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Ultraportable laptops

	1 PC ADVISOR GOLD	2 PC ADVISOR GOLD	3	4	5
	Apple MacBook Pro 13in Retina	Apple MacBook Air 13in	HP Spectre 13-3010ea	Toshiba Kira-101	Acer Aspire S3-392G
Price	**£1,399 inc VAT**	**£849 inc VAT**	**£999 inc VAT**	**£1299 inc VAT**	**£800 inc VAT**
Website	Apple.com/uk	Apple.com/uk	Hp.com/uk	toshiba.co.uk	Acer.co.uk
Launch date	Feb 14	Apr 14	Sep 14	Aug 14	Jun 14
Build rating	★★★★★	★★★★½	★★★★½	★★★★½	★★★★☆
Features rating	★★★★½	★★★★☆	★★★★☆	★★★★☆	★★★★☆
Performance rating	★★★★☆	★★★★☆	★★★½☆	★★★★☆	★★★★☆
Value rating	★★★★☆	★★★★½	★★★★☆	★★★½☆	★★★★☆
Overall rating	★★★★½	★★★★½	★★★★☆	★★★★☆	★★★★☆
Processor	2.8GHz Intel Core i5	1.4GHz Intel Core i5	1.6GHz Intel Core i5-4200U	1.8GHz Intel Core i7-4500U	1.6GHz Intel i5-4200U
RAM	8GB DDR3L	4GB DDR3L	8GB DDR3	8GB DDR3	4GB DDR3
Storage	512GB SSD	128GB SSD	256GB SSD	256GB SSD	500GB Hybrid
Screen size	13.3in glossy (anti-glare)	13.3in glossy (anti-glare)	13.3in glossy	13.3in glossy	13.3in glossy touchscreen
Screen resolution	2560x1600	1440x900	1920x1080	2560x1440	1920x1080
Graphics	Intel Iris Graphics	Intel HD Graphics 5000	Intel HD Graphics 4400	Intel HD Graphics 4400	nVidia GeForce 735M GT
Video memory	N/A	N/A	N/A	N/A	1GB
Wireless	802.11a/b/g/n/ac	802.11a/b/g/n/ac	802.11a/b/g/n/ac	802.11b/g/n/ac	802.11a/b/g/n
Ethernet	Optional	Optional	None	None	10/100
Bluetooth	✓	✓	✓	✓	✓
USB	2x USB 3.0	2x USB 3.0	2x USB 3.0	3x USB 3.0	2x USB 3.0, 1x USB 2.0
FireWire	×	×	×	×	×
Thunderbolt	✓	✓	×	×	×
DisplayPort	×	✓	✓	×	×
HDMI	✓	×	✓	✓	✓
DVI	×	×	×	×	×
VGA	×	×	×	×	×
eSATA	×	×	×	×	×
Media card slot	✓	✓	✓	✓	✓
Audio	Headphone jack, mic	Headphone jack, mic	Headphone jack, mic	Headphone jack, mic	Headphone jack, mic
Optical drive	N/A	N/A	N/A	N/A	N/A
Extras	HD webcam, multitouch trackpad, backlit keyboard	HD webcam, multitouch trackpad, backlit keyboard	1080p webcam	720p webcam	None
Operating system	Mac OS X 10.9 Mavericks	Mac OS X 10.9 Mavericks	Windows 8.1 64bit	Windows 8.1 Pro 64bit	Windows 8.1 64-bit
Bundled software	iLife 11	iLife 11	None	None	Acer bundle
Fear (Max detail)	Not tested	Not tested	31fps in Stalker (720p)	17fps (1080p)	62/34.5fps
Battery	71.8Wh lithium-polymer	54Wh lithium-polymer	51Wh lithium-ion	52Wh lithium-polymer	36.4Wh lithium-polymer
Battery life	9 hrs 55 mins	12 hrs 57 mins	7 hrs 30 mins	7 hrs 10 mins	5 hrs
PC Mark 7 score	Not tested	4602	5006	5100	4282
Dimensions	314x219x18mm	325x227x4-17.5mm	324x220x15mm	316x207x19.8mm	324x255x18mm
Weight	1.57kg	1.35kg	1.52kg	1.26kg	1.65kg
Warranty	1-year return-to-base	1-year return-to-base	2 year return-to-base	2-year onsite	1-year return-to-base
FULL REVIEW	TINYURL.COM/M3TNC29	TINYURL.COM/KNXWZW3	TINYURL.COM/N4CJQL9	TINYURL.COM/QHP9F9T	TINYURL.COM/QFGQOOP

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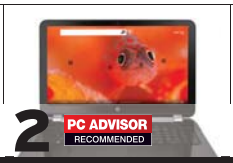
Sub-£500 laptops



	Asus X102BA	HP Pavilion TouchSmart 15	Toshiba Satellite L50-B-1DV	Toshiba CB30-102	Asus X552CL
Price	**£270 inc VAT**	**£500 inc VAT**	**£500 inc VAT**	**£250 inc VAT**	**£500 inc VAT**
Website	Asus.com/uk	Hp.com/uk	Toshiba.co.uk	Toshiba.co.uk	Asus.com/uk
Launch date	May 14	May 14	Jul 14	Jun 14	Jun 14
Build rating	★★★☆☆	★★★★☆	★★★½☆	★★★½☆	★★★★☆
Features rating	★★★½☆	★★★½☆	★★★½☆	★★★½☆	★★★★☆
Performance rating	★★☆☆☆	★★★½☆	★★★☆☆	★★★★☆	★★★½☆
Value rating	★★★★☆	★★★★☆	★★★★☆	★★★★☆	★★★★☆
Overall rating	★★★★☆	★★★★☆	★★★½☆	★★★★☆	★★★½☆
Processor	1GHz AMD A4-1200	1.6GHz Intel Core i5-4200U	1.6GHz Intel Core i5-4200U	1.4GHz Intel Celeron 2955U	1.8GHz Intel i5-3337U
RAM	4GB DDR3L	8GB DDR3	8GB DDR3	2GB DDR3	6GB DDR3
Storage	500GB HDD	750GB HDD	1TB HDD	16GB SSD	750GB HDD
Screen size	10.1in glossy touchscreen	15.6in glossy touchscreen	15.6in glossy	13.3in glossy	15.6in glossy
Screen resolution	1366x768	1366x768	1366x768	1366x768	1366x768
Graphics	AMD Radeon HD 8180	GT 740M/Intel HD 4400	Intel HD Graphics 4400	Intel HD Graphics	nVidia GeForce GT 710M
Video memory	N/A	N/A	N/A	N/A	1GB
Wireless	802.11b/g/n	802.11b/g/n	802.11b/g/n	802.11a/g/n	802.11b/g/n
Ethernet	10/100	10/100	Gigabit	Gigabit	Gigabit
Bluetooth	✓	✓	✓	✓	×
USB	1x USB 3.0, 2x USB 2.0	2x USB 3.0, 1x USB 2.0	2x USB 3.0, 1x USB 2.0	2x USB 3.0	2x USB 3.0
FireWire	×	×	×	×	×
Thunderbolt	×	×	×	×	×
DisplayPort	×	×	×	×	×
HDMI	✓	✓	✓	✓	✓
DVI	×	×	×	×	×
VGA	✓	✓	✓	×	✓
eSATA	×	×	×	×	×
Media card slot	✓	✓	✓	✓	✓
Audio	Headphone jack, mic	Headphone jack, mic	Headphone jack, mic	Headphone jack, mic	Headphone jack, mic
Optical drive	None	8x DVD±RW	N/A	None	8x DVD±RW
Extras	Webcam	Webcam	Webcam	Webcam	Webcam
Operating system	Windows 8 64-bit	Windows 8 64-bit	Windows 8.1 64bit	Google Chrome OS	Windows 8 64bit
Bundled software	MS Office Home & Student	None	None	None	None
Battery	33Wh lithium-ion	60fps (720)	52Wh lithium-ion	Lithium-polymer	37Wh lithium-ion
Battery life	4 hrs 20 mins	41Wh lithium-ion	4 hrs 15 mins	7 hrs 25 mins	3 hrs 20 mins
PC Mark 7 score	1100	5 hrs 45 mins	2500	N/A	2700
Stalker (Low/High)	N/A	2860	23fps (720p)	N/A	50fps (720p)
Dimensions	266x185x29mm	386x258x25mm	380x260x24mm	454x268x56mm	380x251x34mm
Weight	1.1kg	2.6kg	2.2kg	1.5kg	2.4kg
Warranty	1-year return-to-base	1-year return-to-base	2-year return-to-base	1-year return-to-base	1-year return-to-base
FULL REVIEW	TINYURL.COM/PLAUQCG	TINYURL.COM/L2JAXH7	TINYURL.COM/L76JXUV	TINYURL.COM/LQEBYPA	TINYURL.COM/JWFOQJL

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£501-£1,000 laptops

	1 PC ADVISOR RECOMMENDED	2	3	4	5
	 Scan 3XS Graphite LG156	 Dell Inspiron 17-7737	 Chillblast Defiant 2 Mini	 Chillblast Helium	 Toshiba Portégé R30-A-14K
Price	**£899 inc VAT**	**£849 inc VAT**	**£899 inc VAT**	**£899 inc VAT**	**£910 inc VAT**
Website	3xs.scan.co.uk	Dell.co.uk	Chillblast.com	Chillblast.com	Toshiba.co.uk
Launch date	Jul 14	Jul 14	Jul 14	Jul 14	Mar 14
Build rating	★★★★☆	★★★★½	★★★★☆	★★★½☆	★★★★☆
Features rating	★★★★☆	★★★★☆	★★★★☆	★★★½☆	★★★★☆
Performance rating	★★★★☆	★★★★☆	★★★★☆	★★★★☆	★★★☆☆
Value rating	★★★★½	★★★★☆	★★★★½	★★★★☆	★★★☆☆
Overall rating	★★★★☆	★★★★☆	★★★★☆	★★★★☆	★★★½☆
Processor	2.5GHz Intel Core i7-4710MQ	2GHz Intel Core i7-4510U	2.5GHz Intel Core i7-4710MQ	1.8GHz Intel Core i7-4500U	2.4GHz Intel Core i3-4000M
RAM	8GB DDR3	16GB DDR3	8GB DDR3	16GB DDR3	4GB DDR3
Storage	1TB SSHD	500GB HDD + 8GB NAND	1TB SSHD	500GB HDD + 120GB SSD	500GB HDD
Screen size	15.6in matt	17.3in glossy	13.3in non-reflective	14in	13.3in matt
Screen resolution	1920x1080	1920x1080	1920x1080	1600x900	1366x768
Graphics	GTX 860M/Intel HD 4600	GT 750M/Intel HD 4400	GTX 860M/Intel HD 4600	Intel HD Graphics 4400	Intel HD Graphics 4600
Video memory	2GB	2GB	2GB	N/A	N/A
Wireless	802.11a/b/g/n/ac	802.11a/b/g/n	802.11a/b/g/n	802.11b/g/n	802.11b/g/n/ac
Ethernet	Gigabit	Gigabit	Gigabit	Gigabit	Gigabit
Bluetooth	✓	✓	✓	✓	✓
USB	3x USB 3.0, 1x USB 2.0	4x USB 3.0	2x USB 3.0	2x USB 3.0	3x USB 3.0
FireWire	×	×	×	×	×
Thunderbolt	×	×	×	×	×
DisplayPort	×	×	×	×	×
HDMI	✓	✓	✓	✓	✓
DVI	×	×	×	×	×
VGA	✓	✓	✓	✓	✓
eSATA	✓ (shared USB 3.0)	×	×	×	×
Media card slot	✓	✓	✓	✓	✓
Audio	Headphone jack, mic	Headphone jack, mic	Headphone jack, mic	Headphone jack, mic	Headphone jack, mic
Optical drive	N/A	N/A	N/A	N/A	N/A
Extras	1080p webcam	720p webcam	1080p webcam	720p webcam	2Mp webcam
Operating system	Windows 8.1 64-bit	Windows 8.1 64-bit	Windows 8.1 64-bit	Windows 8.1 64-bit	Windows 8.1 64bit
Bundled software	None	None	None	None	None
Stalker (720p/1080p)	178/102fps	104/63fps	180/100fps	29fps (720p)	25fps (720p)
Battery	77Wh lithium-ion	58Wh lithium-ion	62.2Wh lithium-ion	44.6Wh lithium-ion	66Wh lithium-ion
Battery life	4 hours	5 hrs	5 hrs 33 mins	5 hrs 20 mins	8 hrs 4 mins
PCMark 7 score	4846	4260	4456	5100	2660
Dimensions	374x250x43mm	412x269x28mm	330x227x32mm	337x236x21mm	316x227x27mm
Weight	2.7kg	3.3kg	2.1kg	2.1kg	1.5kg
Warranty	2-year return-to-base	1-year NBD	2-year collect-and-return	1-year return-to-base	3-year return-to-base
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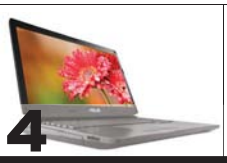
£1,001+ laptops	1 	2 	3 	4 	5 
	Gigabyte P35W v2-CF2	**Schenker XMG P304**	**Dell XPS 15**	**Asus G750JZ**	**Alienware 17**
Price	**£1,399 inc VAT**	**£1,100 inc VAT**	**£1,499 inc VAT**	**£1,770 inc VAT**	**£1,699 inc VAT**
Website	Uk.gigabyte.com	Mysn.co.uk	Dell.co.uk	Asus.com/uk	Alienware.co.uk
Launch date	Jul 14	Jul 14	Sep 14	Jul 14	Jul 14
Build rating	★★★★½	★★★★☆	★★★★½	★★★★☆	★★★★☆
Features rating	★★★★☆	★★★★☆	★★★★☆	★★★★★	★★★★½
Performance rating	★★★★½	★★★★½	★★★★½	★★★★½	★★★★½
Value rating	★★★★½	★★★★☆	★★★★☆	★★★½☆	★★★★☆
Overall rating	★★★★½	★★★★☆	★★★★☆	★★★★☆	★★★★☆
Processor	2.5GHz Intel Core i7-4710HQ	2.2GHz Intel Core i7-4702MQ	2.2GHz Intel Core i7-4702HQ	2.4GHz Intel Core i7-4700MQ	2.4GHz Intel Core i7-4700MQ
RAM	16GB DDR3	8GB DDR3	16GB DDR3	16GB DDR3	8GB DDR3
Storage	1TB/2x 128GB SSD	250GB SSD	512GB SSD	1TB/256GB SSD	1TB + 80GB SSD
Screen size	15.6in matt	13.3in matt	15.6in gloss	17.3in matt	17.3in anti-glare
Screen resolution	1920x1080	1920x1080	3200x1800	1920x1080	1920x1080
Graphics	nVidia GeForce GTX 870M	nVidia GeForce GTX 860M	nVidia GeForce GT 750M	nVidia GeForce GTX 880M	nVidia GeForce GTX 880M
Video memory	6GB	2GB	2GB	4GB	8GB
Wireless	802.11a/b/g/n	802.11b/g/n/ac	802.11b/g/n/ac	802.11a/g/n	802.11b/g/n
Ethernet	Gigabit	Gigabit	×	Gigabit	Gigabit
Bluetooth	✓	✓	✓	✓	✓
USB	2x USB 3.0, 2x USB 2.0	3x USB 3.0, 1x USB 2.0	3x USB 3.0, 1x USB 2.0	4x USB 3.0	4x USB 3.0
FireWire	×	×	×	×	×
Thunderbolt	×	×	×	✓	×
DisplayPort	✓	×	✓	×	✓ (mini)
HDMI	✓	✓	✓	✓	✓
DVI	×	×	×	×	×
VGA	✓	×	✓	✓	×
eSATA	×	✓	×	×	×
Media card slot	✓	✓	✓	✓	✓
Audio	Headphone jack, mic	Headphone jack, mic	Headphone jack, mic	Headphone jack, mic	Headphone jack, mic
Optical drive	N/A	None	N/A	N/A	None
Extras	720p webcam	720p webcam	720p webcam	720p webcam	720p webcam
Operating system	Windows 8.1 64bit	Windows 8.1 64bit	Windows 8.1 64bit	Windows 8.1 64bit	Windows 8.1 64bit
Bundled software	None	None	None	None	None
Stalker (720p/1080p)	185/122fps	115fps (1080p)	68fps (1080)	182/135fps	150fps (1080)
Battery	75.8Wh lithium-polymer	62Wh lithium-ion	91Wh lithium-ion	88Wh lithium-ion	86Wh lithium-ion
Battery life	4 hrs	5 hrs 5 mins	5 hrs	4 hrs 32 mins	4 hrs 20 mins
PCMark7 score	6226	5500	5833	5929	5600
Dimensions	385x270x21mm	374x250x37mm	372x254x18mm	410x318x58mm	414x299x48.5mm
Weight	2.5kg	2kg	2kg	4.5kg	4.2kg
Warranty	2-year return-to-base	2-year collect-and-return	1-year next day in-home	2-year return-to-base	1-year next day in-home
FULL REVIEW	TINYURL.COM/O9WUF8S	TINYURL.COM/Q4JWVSM	TINYURL.COM/N9GRT4U	TINYURL.COM/O8AGBOL	TINYURL.COM/Q6DUD64

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Tablets

	1 PC ADVISOR GOLD	2 PC ADVISOR GOLD	3 PC ADVISOR RECOMMENDED	4 PC ADVISOR RECOMMENDED	5 PC ADVISOR RECOMMENDED
	Google Nexus 7 (2013)	**Samsung Galaxy Tab S 8.4**	**Apple iPad Air**	**Samsung Galaxy Tab S 10.5**	**Sony Xperia Z2 Tablet**
Price	**£199 inc VAT**	**£319 inc VAT**	**£399 inc VAT**	**£399 inc VAT**	**£399 inc VAT**
Website	Play.google.com	Samsung.com/uk	Apple.com/uk	Samsung.com/uk	Sony.co.uk
Launch date	Jul 13	Aug 14	Oct 13	Aug 14	Apr 14
Overall rating	★★★★½	★★★★½	★★★★☆	★★★★½	★★★★½
Platform	Android 4.3 Jelly Bean	Android 4.4.2 KitKat	Apple iOS 7	Android 4.4.2 KitKat	Android 4.4.2 KitKat
Screen size/resolution	7in/1280x800	8.4in/2560x1600	9.7in/2048x1536	10.5in/2560x1600	10.1in/1920x1200
Storage/media card slot	16GB/none	16GB/32GB	16GB/none	16GB/32GB	16GB/none
Connectivity	802.11b/g/n, Bluetooth 4	802.11a/b/g/n/ac, Bluetooth 4	802.11a/b/g/n, Bluetooth 4	802.11b/g/n/ac, Bluetooth 4	802.11b/g/n/ac, Bluetooth 4
Processor	1.5GHz Snapdragon S4 Pro	Exynos 5	Apple A7	Exynos 5420	2.3GHz Snapdragon 801
RAM	2GB	3GB	1GB	3GB	3GB
Claimed battery life	9 hrs	12 hrs	10 hrs	Not specified	Not specified
Cameras (front/rear)	1.2/5Mp	2.1/8Mp	1.2/5Mp	2.1/8Mp	2.2/8.1Mp
Dimensions	114x200x8.7mm	126x213x6.6mm	169x240x7.5mm	247x177x6.6mm	266x172x6.4mm
Weight	299g	294g	469g	465g	439g
Warranty	1 year	1 year	1 year	1 year	1 year
FULL REVIEW	TINYURL.COM/QYUDY5C	TINYURL.COM/KL6G9FJ	TINYURL.COM/LSB84EE	TINYURL.COM/OESDFZQ	TINYURL.COM/M8BZZUN

Tablets

	6 PC ADVISOR GOLD	7 PC ADVISOR RECOMMENDED	8 PC ADVISOR RECOMMENDED	9 PC ADVISOR RECOMMENDED	10 PC ADVISOR RECOMMENDED
	Apple iPad mini (1st gen)	**Google Nexus 10 by Samsung**	**Sony Xperia Tablet Z**	**LG G Pad 8.3**	**Advent Vega Tegra Note 7**
Price	**£249 inc VAT**	**£319 inc VAT**	**£339 inc VAT**	**£199 inc VAT**	**£129 inc VAT**
Website	Apple.com/uk	Play.google.com	Sony.co.uk	Lg.com/uk	Currys.co.uk
Launch date	Nov 12	Nov 12	May 13	Feb 14	Nov 13
Overall rating	★★★★½	★★★★½	★★★★☆	★★★★☆	★★★★☆
Platform	Apple iOS 7	Android 4.4 KitKat	Android 4.1 Jelly Bean	Android 4.2 Jelly Bean	Android 4.3 Jelly Bean
Screen size/resolution	7.9in/1024x768	10.1in/2560x1600	10.1in/1920x1200	8.3in/1920x1200	7in/1280x800
Storage/media card slot	16GB/none	16GB/none	16GB/microSDXC	16GB/microSDHC	16GB/microSDHC
Connectivity	802.11b/g/n, Bluetooth 4	802.11b/g/n, Bluetooth 4, NFC	802.11a/b/g/n, Bluetooth 4	802.11a/b/g/n, Bluetooth 4	802.11b/g/n, Bluetooth 4
Processor	1GHz Apple A5	1.7GHz Cortex A-15	1.5GHz SnapDragon S4 Pro	1.5GHz Snapdragon 600	1.9GHz nVidia Tegra 4
RAM	512MB	2GB	2GB	2GB	1GB
Claimed battery life	10 hrs	9 hrs	10 hrs	8.5 hrs (actual)	10 hrs
Cameras (front/rear)	1.2/5Mp	1.9/5Mp	2.2/8.1Mp	1.3/5Mp	0.3/5Mp
Dimensions	135x200x7.2mm	178x264x8.9mm	172x266x6.9mm	127x217x8.3mm	120x190x10mm
Weight	308g	603g	495g	338g	320g
Warranty	1 year	1 year	1 year	1 year	1 year
FULL REVIEW	TINYURL.COM/CLJWUVS	TINYURL.COM/ARL2KDG	TINYURL.COM/ODTP6B8	TINYURL.COM/N8OBC7N	TINYURL.COM/PMCO4H4

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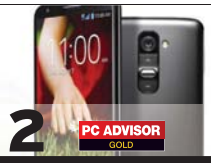
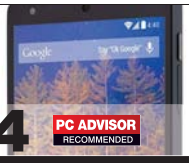
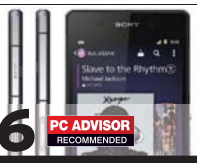
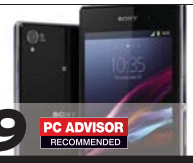
Smartphones

	1 PC ADVISOR GOLD	2 PC ADVISOR GOLD	3 PC ADVISOR RECOMMENDED	4 PC ADVISOR RECOMMENDED	5 PC ADVISOR GOLD
					
	LG G3	**LG G2**	**HTC One (M8)**	**Google Nexus 5**	**OnePlus One**
Price	**£499 inc VAT**	**£279 inc VAT**	**£550 inc VAT**	**£299 inc VAT**	**£229 inc VAT**
Website	Lg.com/uk	Lg.com/uk	Htc.com/uk	Play.google.com	Oneplus.net/uk
Launch date	Jun 14	Sep 13	Apr 14	Oct 13	Jul 14
Overall rating	★★★★½	★★★★½	★★★★½	★★★★☆	★★★★½
Platform	Android 4.4.2 KitKat	Android 4.2 Jelly Bean	Android 4.4 KitKat	Android 4.4 KitKat	CyanogenMod 11S
Processor	2.5GHz Snapdragon 801	2.26GHz Snapdragon 800	2.3GHz Snapdragon 801	2.3GHz Snapdragon 800	2.5GHz Qualcomm
Storage/media card slot	16GB/none	16GB/none	16GB/microSD	16GB/none	16GB/none
Screen size/resolution	5.2in/1440x2560	5.2in/1920x1080	5in/1920x1080	4.95in/1920x1080	5.5in/1920x1080
Screen type	Capacitive multitouch	Capacitive multitouch	Capacitive multitouch	Capacitive multitouch	Capacitive multitouch
Connectivity	4G, HSPA+, Bluetooth, Wi-Fi	4G, HSPA+, Bluetooth, Wi-Fi	Bluetooth, NFC, Wi-Fi ac	HSPA+, Bluetooth, Wi-Fi ac	4G, NFC, Bluetooth, Wi-Fi
Claimed battery life	Not specified	Not specified	Not specified	17 hrs/300 hrs	Not specified
Cameras (front/rear)	13Mp, 1080p video	13Mp, 1080p video	5Mp, 1080p video	8Mp, 1080p video	13Mp, 720p video
GPS	A-GPS	A-GPS	A-GPS, Glonass	A-GPS	Glonass
Dimensions, weight	75x146x8.9mm, 149g	71x139x9.4mm, 143g	146.4x70.6x9.4mm, 160g	69x138x8.9mm, 130g	152.9x75.9x8.9mm, 162g
Warranty	1 year	1 year	2 years	1 year	Not specified
FULL REVIEW	TINYURL.COM/MQ8DHUU	TINYURL.COM/PAFK4SZ	TINYURL.COM/NGBWXY9	TINYURL.COM/PAFK4SZ	TINYURL.COM/KYW977U

Smartphones

	6 PC ADVISOR RECOMMENDED	7 PC ADVISOR RECOMMENDED	8 PC ADVISOR RECOMMENDED	9 PC ADVISOR RECOMMENDED	10 PC ADVISOR GOLD
					
	Sony Xperia Z2	**Sony Xperia Z1 Compact**	**HTC One mini 2**	**Sony Xperia Z1**	**Apple iPhone 5s**
Price	**£599 inc VAT**	**£401 inc VAT**	**£359 inc VAT**	**£430 inc VAT**	**£549 inc VAT**
Website	Sonymobile.com	Sonymobile.com	Htc.com/uk	Sonymobile.com	Apple.com/uk
Launch date	May 14	Jan 14	Jul 14	Jul 13	Sep 13
Overall rating	★★★★½	★★★★½	★★★★☆	★★★★½	★★★★½
Platform	Android 4.4 KitKat	Android 4.3 Jelly Bean	Android 4.4 KitKat	Android 4.2 Jelly Bean	Apple iOS 7
Processor	2.3GHz Qualcomm	2.2GHz Snapdragon 800	1.2GHz Qualcomm	2.26GHz Snapdragon 800	1.3GHz Apple A7
Storage/media card slot	16GB/microSDXC	16GB/microSDXC	16GB/microSD	16GB/microSDXC	16GB/none
Screen size/resolution	5.2in/1920x1080	4.3in/1280x720	4.5in/1280x720	5in/1920x1080	4in/640x1136
Screen type	Capacitive multitouch	Capacitive multitouch	Capacitive multitouch	Capacitive multitouch	Capacitive multitouch
Connectivity	4G, NFC, Bluetooth, Wi-Fi	4G, HSPA+, Bluetooth, Wi-Fi	4G, HSPA+, Bluetooth, Wi-Fi	4G, HSPA+, Bluetooth, Wi-Fi	4G, HSPA+, Bluetooth, Wi-Fi
Claimed battery life	17 hrs/740 hrs	18 hrs/670 hrs	Not specified	14 hrs/880 hrs	10 hrs/250 hrs
Cameras (front/rear)	20.7Mp, 1080p video	20.7Mp, 1080p video	13Mp, 1080p video	20.7Mp, 1080p video	8Mp, 1080p video
GPS	A-GPS	A-GPS	A-GPS	A-GPS	A-GPS, Glonass
Dimensions, weight	146.8x73.3x8.2mm, 163g	127x64.9x9.5mm, 137g	137x65x10.6mm, 137g	144x74x8.5mm, 169g	59x124x7.6mm, 112g
Warranty	1 year	1 year	2 years	1 year	1 year
FULL REVIEW	TINYURL.COM/NXB5SWV	TINYURL.COM/KAU7DYR	TINYURL.COM/M6U427B	TINYURL.COM/NJPM4DE	TINYURL.COM/MZ8JHLF

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Gaming PCs	1 PC ADVISOR GOLD	2	3	4 PC ADVISOR RECOMMENDED	5
	Chillblast Fusion Probe	Chillblast Fusion Ranger	Gladiator Firestorm OC	CyberPower Infinity Perseus XT	Computer Planet GX 760
Price	**£1,299 inc VAT**	**£1,249 inc VAT**	**£695 inc VAT**	**£1,499 inc VAT**	**£983 inc VAT**
Website	Chillblast.com	Chillblast.com	Gladiatorpc.co.uk	Cyberpowersystem.co.uk	Computerplanet.co.uk
Launch date	Feb 14	Jul 14	Mar 14	Feb 14	Mar 14
Build rating	★★★★☆	★★★★☆	★★★★☆	★★★★☆	★★★★½
Features rating	★★★★½	★★★★☆	★★★½☆	★★★★★	★★★½☆
Performance rating	★★★★½	★★★★½	★★★★☆	★★★★½	★★★★☆
Value rating	★★★★☆	★★★★☆	★★★★½	★★★½☆	★★★½☆
Overall rating	★★★★½	★★★★☆	★★★★½	★★★★½	★★★★☆
Processor	3.4GHz Intel Core i5-4670K (OC 4.4GHz)	3.4GHz Intel Core i5-4670K (OC 4.2GHz)	3.4GHz Intel Core i5-4670K (OC 4.2GHz)	3.4GHz Intel Core i5-4670K (OC 4.4GHz)	3.4GHz Intel Core i5-4670K
CPU cooler	Corsair H55 Liquid Cooler	Corsair H60 Liquid Cooler	Be Quiet Dark Rock 3	Cooler Master Seldon 120mm	Corsair H60 Hydro
Memory	16GB DDR3	16GB DDR3	8GB DDR3	16GB DDR3	8GB DDR3
Storage	120GB SSD + 2TB HDD	120GB SSD + 2TB HDD	2TB HDD	256GB SSD + 2TB HDD	120GB SSD + 2TB HDD
Power supply	750W Corsair	750W Corsair	500W Corsair	750W Corsair	450W Corsair
Motherboard	Gigabyte GA-Z87N-Wi-Fi	Asus Maximus VII Ranger	MSI Z87M Gaming	Gigabyte GA-Z87-HD3	Gigabyte GA-Z87N-Wi-Fi
Operating system	Windows 8.1 64-bit	Windows 8.1 64bit	Windows 8.1 64-bit	Windows 8.1 64-bit	Windows 8.1 64-bit
Screen	23.6in Iiyama X2377HDS	None supplied	None supplied	23in AOC i2367fh	None supplied
Graphics	Palit Jetstream GeForce GTX 780, 3GB VRAM	PowerColor AMD Radeon R9 290 OC, 4GB VRAM	MSI nVidia GeForce GTX 750 Ti Gaming, 2GB VRAM	Powercolor AMD R9 290, 4GB VRAM	Zotac GeForce GTX 760, 2GB VRAM
Sound	Onboard	Onboard	Onboard	Onboard	Onboard
Connectivity	Gigabit ethernet, 802.11n	Gigabit ethernet	Low-lag ethernet	Gigabit ethernet	2x gigabit ethernet, 802.11n
Ports	6x USB 3.0, 4x USB 2.0	6x USB 3.0, 2x USB 2.0, 2x DVI, HDMI, DP	8x USB 3.0, 4x USB 2.0, 2x eSATA	6x USB 3.0, 4x USB 2.0	6x USB 3.0, 2x USB 2.0
Optical drive	DVD±RW (Blu-ray optional)	24x DVD±RW	24x DVD±RW	DVD±RW, BD-ROM	None supplied
Case	Aerocool Dead Silence Gaming Cube	Corsair Graphite 230T	Aerocool Dead Silence Cube Window Red	Cooler Master Dominator 690 III	Fractal Design Node 304
Keyboard & mouse	Gigabyte M6800 mouse, Force K3 keyboard	None	None	Gigabyte M6900 mouse, Force K3 keyboard	None
Other	Optional family pack	None	None	None	None
PC Mark 7 score	6965	6852	5124	6731	5508
Alien vs Predator score (720p/1080p)	169/93fps	173/97	103/54fps	172/96fps	103/54fps
Final Fantasy XIV (720p/1080p)	218/96fps	N/A	N/A	167/87fps	N/A
Sniper Elite V2 (Low/High/Ultra)	308/187/49fps	321/164/42	194/81.6/18.6fps	352/155/39fps	261/119/29fps
Power Consumption	52/407W	67W/386W	70W/166W	68/484W	53W/271W
Warranty	2-year collect-and-return	2-year collect-and-return	4-year return-to-base	3-year RTB (2 years parts, 3 years labour)	3-year return-to-base
FULL REVIEW	TINYURL.COM/OWQ24QQ	TINYURL.COM/MEGK9O9	TINYURL.COM/PKDV2NG	TINYURL.COM/NKWN7V4	TINYURL.COM/MJZKS7G

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Mini PCs

	Yoyotech Warbird RS4.0	Chillblast Fusion Xcalibur	Mesh Elite Mini Gaming OC	Dino PC Microraptor GTX 770	Quiet PC Serenity Nano
Price	**£999 inc VAT**	**£849 inc VAT**	**£1,499 inc VAT**	**£999 inc VAT**	**£1,238 inc VAT**
Website	yoyotech.co.uk	chillblast.com	meshcomputers.com	dinopc.com	quietpc.co.uk
Launch date	Mar 14	Mar 14	Mar 14	Mar 14	Mar 14
Build rating	★★★½☆	★★★☆☆	★★★★☆	★★★½☆	★★★½☆
Features rating	★★★★½	★★★★☆	★★★★½	★★★★☆	★★★★☆
Performance rating	★★★★☆	★★★½☆	★★★★★	★★★★☆	★★★★☆
Value rating	★★★½☆	★★★★☆	★★★☆☆	★★★½☆	★★★☆☆
Overall rating	★★★★☆	★★★★☆	★★★★☆	★★★★☆	★★★★☆
Processor	3.4GHz Intel Core i5-4670K	3.2GHz Intel Core i5-4570	3.5GHz Intel Core i7-4770K (4.3GHz OC)	3.4GHz Intel Core i5-4670K (4.3GHz OC)	3.4GHz Intel Core i5-4670K (3.8GHz OC)
CPU cooler	Noctua L9i low-profile cooler	Scythe Shuriken low-profile cooler	Corsair Hydro Series H60 liquid cooler	Corsair Hydro Series H80 liquid cooler	Noctua L9i low-profile cooler
RAM	8GB DDR3 1600MHz	8GB DDR3 1600MHz	16GB DDR3 2133MHz	16GB DDR3 1600MHz	16GB DDR3 1600MHz
Storage	128GB SSD, 2TB HDD	120GB SSD, 1TB HDD	240GB SSD, 2TB HDD	128GB SSD, 1TB HDD	120GB SSD, 2TB HDD
Power supply	Seasonic Evo 520W Bronze-rated	450W Silverstone SFX	750W Cooler Master GX RS-750	600W Corsair Builder Series CX600	FSP Aurum 750W modular PSU
Motherboard	Asus Z871-Pro	Asus H811-PLUS	MSI Z871 Gaming AC	Gigabyte GA-Z87N-WIFI	Gigabyte H87N-WIFI
Operating system	Windows 8.1	Windows 8.1/7 Home Premium	Windows 8.1	Windows 8.1	Windows 8.1
Graphics	Asus GTX 770 (2GB)	EVGA GTX 760 (2GB)	AMD Radeon R9 290X (4GB)	Zotac nVidia GeForce GTX 770 (2GB)	Palit GTX 770 Jetstream (2GB)
Networking	Gigabit ethernet, 802.11n Wi-Fi	Gigabit ethernet, 802.11n Wi-Fi	Gigabit ethernet, 802.11n Wi-Fi	2x gigabit ethernet, 802.11n Wi-Fi	Gigabit ethernet, 802.11n Wi-Fi
USB ports	6x USB 3.0, 4x USB 2.0	4x USB 3.0, 4x USB 2.0	6x USB 3.0, 2x USB 2.0	6x USB 3.0, 3x USB 2.0	5x USB 3.0, 4x USB 2.0
Other ports	3x DVI (2x DVI-I), 2x HDMI, 2x DisplayPort	2x DVI, HDMI, DisplayPort	3x DVI, 2x HDMI, 2x DisplayPort, eSATA	1x DVI, 2x HDMI, 1x PS/2	2x DVI, HDMI, DisplayPort
Optical drive	Pioneer BDR-S07XLT Blu-ray writer	Optional	External Blu-ray drive	LiteOn iHAS122 DVD writer	Optional
Case	Cooler Master Elite 130	Silverstone RVZ01	Fractal Design Node 304	Cooler Master Elite 130	Cooler Master Elite 130
Keyboard & mouse	None	Logitech MK520	None	None	None
PCMark 8 score	6403	6334	6678	6861	6403
Alien vs Predator score (720p/1080p)	127/68	104/56	186/104	121/65	127/68
Sniper V2 Elite score (Low/High/Ultra)	303/161/40	263/124/31	387/169/43	313/150/38	303/161/40
Games score (Final Fantasy XIV)	200/76	155/63	183/94	220/81	200/76
Power consumption (idle/max)	49/330W	39/278W	54/548W	71/384W	49/330W
Warranty	3-year Silver (1-year parts, 3-year labour)	2-year collect-and-return (5-year labour)	3-year collect-and-return (2-year parts, 3-year labour)	3-year return-to-base (1-year parts, 3-year labour)	2-year collect-and-return
FULL REVIEW	TINYURL.COM/MQ8POPQ	TINYURL.COM/NFQ6EGO	TINYURL.COM/PWCACV2	TINYURL.COM/MXMJ6QT	TINYURL.COM/O4QDH7Y

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All-in-one PCs	1 PC ADVISOR BEST BUY 	2 PC ADVISOR RECOMMENDED 	3 PC ADVISOR RECOMMENDED 	4 	5 
	Dell XPS 2720	**Apple iMac 27in (Late 2012)**	**Medion Akoya P2002**	**Chillblast Fusion AIO Ultima**	**MSI Wind Top AE2712G**
Price	**£1,749 inc VAT**	**£1,699 inc VAT**	**£449 inc VAT**	**£1,199 inc VAT**	**£1199 inc VAT**
Website	Dell.co.uk	Apple.com/uk	Medion.com/gb	Chillblast.com	Uk.msi.com
Launch date	Sep 13	Sep 13	Sep 13	Sep 13	Sep 13
Build rating	★★★★½	★★★★★	★★★★☆	★★★½☆	★★★★☆
Features rating	★★★★½	★★★★½	★★★½☆	★★★★☆	★★★★☆
Performance rating	★★★★½	★★★★☆	★★½☆☆	★★★½☆	★★½☆☆
Value rating	★★★½☆	★★★★☆	★★★★★	★★★½☆	★★★½☆
Overall rating	★★★★½	★★★★½	★★★★☆	★★★½☆	★★★½☆
Processor	3.1GHz Intel Core i7-4770S	3.2GHz Intel Core i5-3470	3.3GHz Intel Core i3-3220	3.1GHz Intel Core i7-3770S	2.9GHz Intel Core i5-3470S
RAM	16GB DDR3	8GB DDR3	4GB DDR3	16GB DDR3	4GB DDR3
Storage	2TB HDD + 32GB SSD	1TB HDD	1TB HDD	1TB HDD + 120GB SSD	1TB HDD
Screen	27in IPS touchscreen	27in IPS	23.6in TN	21.5in IPS touchscreen	27in TN touchscreen
Screen resolution	2560x1440	2560x1440	1920x1080	1920x1080	1920x1080
Graphics card	nVidia GeForce GT 750M	nVidia GeForce GTX 675MX	Intel HD Graphics 2500	Intel HD Graphics 4000	nVidia GeForce GT 630M
Video memory	2GB	1GB	N/A	N/A	2GB
Wireless	802.11b/g/n	802.11b/g/n	802.11b/g/n	802.11b/g/n	802.11b/g/n
Ethernet	Gigabit	Gigabit	Gigabit	Gigabit	Gigabit
Bluetooth	✓	✓	×	✓	✓
USB	6x USB 3.0	4x USB 3.0	2x USB 3.0, 4x USB 2.0	4x USB 3.0, 2x USB 2.0	2x USB 3.0, 4x USB 2.0
FireWire	×	×	×	×	×
Thunderbolt	✓	✓	×	×	×
HDMI	✓	×	✓	✓	✓
Media card slot	✓	✓	✓	✓	✓
Optical drive	Blu-ray combo drive	None	DVD drive	Blu-ray combo drive	Blu-ray combo drive
Other	2.1Mp webcam, wireless keyboard and mouse, dual digital microphone array	1.3Mp webcam, wireless keyboard and mouse	Wireless keyboard and mouse, CyberLink software, Kaspersky Internet Security	Webcam, Microsoft Wireless Desktop 3000	2Mp webcam, DVB-T TV tuner, wireless keyboard and mouse, CyberLink software
Operating system	Windows 8	Mac OS X 10.9 Mavericks	Windows 8	Windows 8	Windows 8
Power consumption (idle/max)	54/84/220W	53/84/243W	34/42/92W	32/40/119W	44/53/110W
Sniper V2 Elite (Low/High/Ultra)	6/25/94fps	12/54/197fps	5/5/16fps	5/7/28fps	5/6/17fps
PCMark 7 score	6091	4141	3298	5195	3138
Dimensions	492x664x72mm	650x203x516mm	580x196x430-460mm	338x541x61mm	672x483x66mm
Weight	16kg	9.5kg	10.3kg	9kg	13kg
Warranty	1-year next-day in-home	1-year return-to-base	1-year return-to-base	2-year collect-and-return	2-year collect-and-return
FULL REVIEW	TINYURL.COM/KWZ4KLL	TINYURL.COM/A95Q9VY	TINYURL.COM/MEVSJ9D	TINYURL.COM/LQ4U8FW	TINYURL.COM/MUGFKQ7

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Business PCs

	Aria Gladiator Logic N200-3220M	Chillblast Fusion Opal	Wired2Fire Business Accelerate	Dino PC Synergy 4430	Eclipse Precision A856F85
Price	**£509 inc VAT**	**£549 inc VAT**	**£689 inc VAT**	**£569 inc VAT**	**£519 inc VAT**
Website	Aria.co.uk	Chillblast.com	Wired2fire.co.uk	Dinopc.com	Eclipsecomputers.com
Launch date	Aug 13	Aug 13	Aug 13	Aug 13	Aug 13
Build rating	★★★★½	★★★★☆	★★★½☆	★★★★☆	★★★☆☆
Features rating	★★★½☆	★★★½☆	★★★★½	★★★½☆	★★★½☆
Performance rating	★★★½☆	★★★★☆	★★★★½	★★★½☆	★★½☆☆
Value rating	★★★★☆	★★★½☆	★★★☆☆	★★★½☆	★★★½☆
Overall rating	★★★★☆	★★★½☆	★★★½☆	★★★½☆	★★★½☆
Processor	3.3GHz Intel Core i3-3220 (dual-core)	3.2GHz Intel Core i5-4570 (quad-core)	3.4GHz Intel Core i5-4670 (quad-core)	3GHz Intel Core i5-4430 (quad-core)	3.6GHz AMD Trinity A8-5600K (quad-core)
RAM	8GB DDR3	8GB DDR3	8GB DDR3	8GB DDR3	8GB DDR3
Storage	500GB HDD + 80GB SSD	1TB HDD	120GB SSD	1TB HDD	1TB HDD
Motherboard	Gigabyte GA-B75M-D3H	Asus B85M-G	ASRock B85M-HDS	Gigabyte GA-H87M-HD3	Asus F2A85-M LE
CPU cooler	Arctic Cooling Alpine 11 GT Quiet	Standard Intel cooler	Standard Intel cooler	Standard Intel cooler	Standard AMD cooler
Power supply	Corsair 430W	CiT 500W	Xigmatek 400W	CiT 500W	Alpine 600W
Screen	21.5in AOC E2260SWDA	23.6in Iiyama X2377	2x 21.5in AOC E2260SWDA	23in Iiyama XB2380HS-B1	23in AOC i2369Vm
Screen resolution	1920x1080	1920x1080	1920x1080	1920x1080	1920x1080
Graphics	Intel HD Graphics 2500	Intel HD Graphics 4600	Intel HD Graphics 4600	Intel HD Graphics 4600	Integrated
Video memory	N/A	N/A	N/A	N/A	N/A
USB	2x USB 3.0, 4x USB 2.0	3x USB 3.0, 6x USB 2.0	2x USB 3.0, 8x USB 2.0	4x USB 3.0, 4x USB 2.0	4x USB 3.0, 4x USB 2.0
Sound	Onboard	Onboard	Onboard	Onboard	Onboard
Speakers	Not specified	Not specified	Not specified	Not specified	Not specified
Case	Cooler Master N200	CiT Fortress	In-Win Em040	CiT Templar	K2 Gamer
Keyboard	Microsoft Desktop 400 keyboard and mouse (wired)	Cherry J82-16001 keyboard, M-5450 mouse (wired)	Gigabyte K6800 keyboard, M6800 mouse (wired)	Logitech K120 keyboard, B110 mouse (wired)	Microsoft Optical Desktop 800 (wired)
Optical drive	24x DVD±RW	24x DVD±RW	DVD±RW	Samsung DVD±RW	Samsung DVD±RW
Operating system	Windows 7 Home Premium 64-bit	Windows 8 Professional	Windows 7 Professional 64-bit	Windows 7 Home Premium 64-bit	Windows 8 Professional
Bundled software	None	None	None	None	None
PCMark 7 overall score	3524	4257	5667	3458	2349
PCMark 7 Productivity score	4056	2685	5929	2529	1883
PCMark 7 Computational score	3321	21490	13651	9377	3899
Power consumption (idle/max)	27/69W	47/124W	37/135W	37/115W	34/145W
Warranty	1-year return-to-base, phone support	2-year collect-and-return, phone support	2-year return-to-base, phone support	3-year return-to-base, phone support	1-year return-to-base, phone support
FULL REVIEW	TINYURL.COM/OSW55A8	TINYURL.COM/KGGE98T	TINYURL.COM/PCSKWVS	TINYURL.COM/PF8LUXD	TINYURL.COM/MQFWJ3R

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* Chillblast won more awards in the leading IT press publications PC Pro, PC Advisor and Computer Shopper combined than any other retailer 2010-2013
** World`s fastest PC as tested by PC Pro Magazine - http://www.pcpro.co.uk/reviews/desktops/371152/chillblast-fusion-photo-oc-iv

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Family PCs

	1 PC ADVISOR BEST BUY	2	3	4	5
	 Chillblast Fusion Commando	 Wired2Fire Diablo Reactor	 Mesh Elite 4670-PCA	 Dino PC Raging Lizard V2	 Arbico Family i3 4185
Price	**£799 inc VAT**	**£668 inc VAT**	**£799 inc VAT**	**£780 inc VAT**	**£675 inc VAT**
Website	Chillblast.com	Wired2fire.co.uk	Meshcomputers.com	Dinopc.com	Arbico.co.uk
Launch date	Jul 13	May 14	May 14	May 14	May 14
Build rating	★★★★☆	★★★★☆	★★★★☆	★★★½☆	★★★☆☆
Features rating	★★★★☆	★★★½☆	★★★★½	★★★½☆	★★★☆☆
Performance rating	★★★★½	★★★★½	★★★★½	★★★★☆	★★★☆☆
Value rating	★★★★☆	★★★★½	★★★★☆	★★★★☆	★★★★☆
Overall rating	★★★★½	★★★★½	★★★★☆	★★★★☆	★★★★☆
Processor	3.2GHz Intel Core i5-4570	3.4GHz Intel Core i5-4670	3.4GHz Intel Core i5-4670	3.5GHz Intel Core i5-4690	3.4GHz Intel Core i3-4130
RAM	16GB DDR3	8GB DDR3 1600MHz	16GB DDR3 1600MHz	8GB DDR3 1600MHz	8GB DDR3 1600MHz
Storage	1TB HDD + 120GB SSD	1TB HDD	2TB HDD + 120GB SSD	1TB HDD + 128GB SSD	1TB HDD + 120GB SSD
Motherboard	Asus B85M-G	Asus B85M-G	MSI B85M-E45	Gigabyte H97M-D3H	MSI B85M-E45
CPU cooler	Arctic Cooling Freezer 7 Pro	Standard Intel Cooler	Standard Intel Cooler	Standard Intel Cooler	Arctic Cooling Freezer 7 Pro
Power supply	600W CiT	500W FSP	500W FSP	500W CIT	650W Arctic Red
Screen	23in Iiyama X2377	24in AOC E2495Sh	24in Iiyama E2483HS-B1	24in Iiyama E2483HS-B1	23.6in AOC E2470SWHE
Screen resolution	1920x1080	1920x1080 pixels	1920x1080 pixels	1920x1080 pixels	1920x1080 pixels
Graphics	Zotac nVidia GeForce GTX 650 Ti	AMD Radeon R7 265	nVidia GeForce GTX 750 Ti	nVidia GeForce GTX 750 Ti	MSI AMD Radeon R7 250
Video memory	N/A	2GB	2GB	2GB	2GB
Connectivity	802.11b/g/n, gigabit ethernet	Gigabit ethernet	Gigabit ethernet	Gigabit ethernet, 802.11b/g/n	Gigabit ethernet
USB	3x USB 3.0, 6x USB 2.0	3x USB 3.0, 6x USB 2.0, 2x HDMI, VGA	4x USB 3.0, 8x USB 2.0, HDMI, VGA, DVI-D, DVI, DP	5x USB 3.0, 3x USB 2.0, 2x HDMI (1x e-Mini), VGA, 2x DVI	2x USB 3.0, 6x USB 2.0, HDMI, VGA, DVI-D
Media card slot	None	None	None	None	None
Sound	Onboard	Onboard	Onboard	Onboard	Onboard
Speakers	2x Logitech LS220	None	None	None	None
Case	Cooler Master Force 500	Zalman Z3 Plus	Zalman Z3 Plus	Fractal Design Core 1000 USB3	CIT Templar
Keyboard	Logitech MK260	Octigen Wireless combo	Logitech MK270 (wireless combo)	Gigabyte KM6150 (wired combo)	Logitech MK120
Optical drive	LG BD-ROM/DVD±RW	LiteOn DVD RW	24x DVD RW	None	Samsung DVD RW
Operating system	Windows 8 64-bit	Windows 8.1 64bit	Windows 8.1 64bit	Windows 8.1 64bit	Windows 8.1 64bit
Bundled software	None	None	None	None	Ahead Nero, CyberLink PowerDVD
Sniper V2 Elite score (Low/High/Ultra)	147/59/14fps	240/76/18fps	195/68/16fps	196/83/20fps	62/22/5fps
Alien vs Predator score (720p/1080p)	52/27fps	83/44fps	71/37fps	102/53fps	22/11fps
PCMark 7 score	6177	3938	7304	6431	4800
Warranty	2-year collect-and-return	2-year return-to-base	3-years labour (2-year parts, 3-months free C&R)	3-year labour (2-year parts)	2-year return-to-base
FULL REVIEW	TINYURL.COM/KF6G3T7	TINYURL.COM/OA8UKDP	TINYURL.COM/OZCSHYU	TINYURL.COM/PFA55F7	TINYURL.COM/NU7FSGB

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Sub-£150 printers

	Samsung Xpress M2070W	Canon Pixma MG5550	Samsung Xpress M2022W	Canon Pixma MX535	Brother MFC-J870DW
Price	**£99 inc VAT**	**£65 inc VAT**	**£59 inc VAT**	**£70 inc VAT**	**£137 inc VAT**
Website	Samsung.com/uk	Canon.co.uk	Samsung.com/uk	Canon.co.uk	Brother.co.uk
Launch date	Mar 14	Apr 14	Aug 14	Jul 14	Jul 14
Overall rating	★★★★½	★★★★☆	★★★★☆	★★★★☆	★★★★☆
Technology	Mono laser	Colour inkjet	Mono laser	Colour inkjet	Colour inkjet
Max print resolution	1200x1200	4800x1200dpi	1200x1200dpi	4800x1200dpi	6000x1200dpi
Actual print speed	B=17.1ppm	B=11.8ppm C=8.7ppm	B=18ppm	B=9.7ppm C=3.8ppm	B=18ppm C=11ppm
Scan/fax facilities	1200x1200 scans	1200x2400 scans	None	1200x2400 scans/fax	1200x2400 scans
Supported interfaces	USB 2.0, 802.11b/g/n, NFC	USB 2.0, 802.11b/g/n	USB 2.0, 802.11b/g/n	USB 2.0, 802.11b/g/n, AirPrint	USB 2.0, 802.11b/g/n, NFC
Cost per page	B=3.8p	B=2.4p C=4.8p	B=5p	B=2.7p C=4.8p	B=3.9p C=2.5p
Media card/auto duplex	××	×✓	××	×✓	✓✓
Input capacity	150 sheets	100 sheets	150 sheets	100 sheets + 30-sheet ADF	150 sheets + 20 ADF
Dimensions	406x360x253mm	455x369x148mm	332x215x178mm	458x385x200mm	410x374x180mm
Weight	7.4kg	6.3kg	4kg	8.5kg	9.5kg
Warranty	1 year	1 year	1 year	1 year	1 year
FULL REVIEW	TINYURL.COM/OYZKJKE	TINYURL.COM/LKWLJDE	TINYURL.COM/NFJHDOR	TINYURL.COM/N9LXVN7	TINYURL.COM/M52V29R

£151+ printers

	Canon i-Sensys MF6180dw	Brother HL-L9200CDWT	HP OfficeJet Pro X551dw	Kyocera Ecosys P6030cdn	Lexmark CS410dn
Price	**£305 inc VAT**	**£575 inc VAT**	**£410 inc VAT**	**£546 inc VAT**	**£195 inc VAT**
Website	Canon.co.uk	Brother.co.uk	Hp.com/uk	Kyoceradocumentsolutions.co.uk	Lexmark.co.uk
Launch date	May 14	Aug 14	Aug 13	Jul 14	Jul 14
Overall rating	★★★★½	★★★★½	★★★★½	★★★★☆	★★★★☆
Technology	Mono laser	Colour laser	Colour inkjet	Colour laser	Colour laser
Max print resolution	1200x600dpi	2400x600dpi	2400x2400	9600x600dpi	1200x1200dpi
Actual print speed	B=24ppm	B=30ppm C=30ppm	B=42.9ppm C=15.8ppm	B=27ppm C=27ppm	B=23.1ppm C=13.6ppm
Scan/fax facilities	600dpi scanner, 33.6Kbps fax	None	None	None	None
Supported interfaces	USB 2.0, ethernet, 802.11b/g/n	USB 2.0, ethernet, 802.11b/g/n	USB 2.0, ethernet, 802.11b/g/n	USB 2.0	USB 2.0, ethernet
Cost per page	B=1.5p	B=1p C=5.9p	B=1p C=4.3p	B=1.2p C=1.7p	B=1.8p C=9.5p
Media card/auto duplex	×✓	×✓	×✓	×✓	×✓
Input capacity	250 + 50 sheet + 50 ADF	750 sheets + 50 sheet	500 + 50 sheet	500 sheets + 150 (2150 max)	250 + 1 sheets
Dimensions	390x473x431mm	410x495x445mm	517x399x414mm	345x518x480mm	291x442x407mm
Weight	19.1kg	28.3kg	17.1kg	29.5kg	20.5kg
Warranty	1 year	1 year	1 year	2 years	1 year
FULL REVIEW	TINYURL.COM/LE9WA5N	TINYURL.COM/PT52MH6	TINYURL.COM/CZO5P65	TINYURL.COM/N4MCYLF	TINYURL.COM/MJG33UL

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Blu-ray drives

	1 Pioneer BDR-209EBK Retail	2 Pioneer BDR-209DBK OEM	3 LG LN48919	4 LG BP40NS20	5 Lite-On IHES112-115
Price	**£59 inc VAT**	**£54 inc VAT**	**£60 inc VAT**	**£90 inc VAT**	**£54 inc VAT**
Website	Pioneer.eu/uk	Pioneer.eu/uk	Uk.lge.com	Uk.lge.com	Liteonit.eu
Launch date	Nov 13	Nov 13	May 12	Jan 13	Oct 12
Overall rating	★★★★½	★★★★½	★★★★½	★★★★☆	★★★½☆
Blu-ray speeds	16x -R, 14x -R DL, 2x -RE, 12x -ROM	16x -R, 14x -R DL, 2x -RE, 12x -ROM	16x -R, 12x -R DL, 12x -RE, 12x -ROM	6x -R, 6x -R DL, 2x -RE, 6x -ROM	12x -ROM
DVD speeds	16x ±R, 8x ±R DL, 6x -RW, 8x +RW, 16x -ROM	16x ±R, 8x ±R DL, 6x -RW, 8x +RW, 16x -ROM	16x ±R, 8x ±R DL, 6x -RW, 8x +RW, 12x -RAM, 16x -ROM	8x ±R, 6x ±R DL, 6x -RW, 8x +RW, 5x -RAM, 8x -ROM	8x ±R, 8x ±R DL, 6x -RW, 8x +RW, 8x -ROM
Max storage	128GB	50GB	50GB	100GB	8.5GB
Interface type	SATA (internal)	SATA (internal)	SATA (internal)	USB 2.0 (external)	SATA (internal)
Label technology	None	None	LightScribe	None	None
Software	ArcSoft TotalMedia Extreme	None	CyberLink Blu-ray Suite	PowerDVD, PowerProducer	None
Dimensions	148x180x42mm	148x180x42mm	146x170x41mm	160x153x22mm	158x145x22mm
Weight	740g	740g	749g	380g	700g
Warranty	1 year	1 year	1 year	1 year	2 years
FULL REVIEW	TINYURL.COM/LD47X7K	TINYURL.COM/LD47X7K	TINYURL.COM/8YTUJEF	TINYURL.COM/BS8UAFF	TINYURL.COM/8SYECMW

Wireless routers

	1 Apple AirPort Extreme	2 AVM FRITZ!Box 7490	3 TP-Link Archer C7	4 Asus RT-AC68U AC1900	5 TP-Link TL-WDR4900
Price	**£169 inc VAT**	**£240 inc VAT**	**£80 inc VAT**	**£140 inc VAT**	**£80 inc VAT**
Website	Apple.com/uk	Fritzbox.eu	Tp-link.com	Uk.asus.com	Tp-link.com
Launch date	Jan 14	Jul 14	Jan 14	Jan 14	Dec 13
Overall rating	★★★★☆	★★★★☆	★★★★☆	★★★★☆	★★★★☆
Standards supported	802.11b/g/n/ac	802.11a/b/g/n/ac	802.11a/b/g/n/ac	802.11a/b/g/n/ac	802.11a/b/g/n
Frequency modes	2.4GHz/5GHz (concurrent)	2.4GHz/5GHz (concurrent)	2.4GHz/5GHz (concurrent)	2.4GHz/5GHz (concurrent)	2.4GHz/5GHz (concurrent)
Antennae	6x internal	3x3 MIMO	3x external, 3x internal	3x external, 3x internal	3x external, 3x internal
128bit/256bit WEP	✓×	✓×	✓×	✓×	✓×
Modem/Parental Control	×✓	✓✓	×✓	×✓	×✓
Firewall	NAT/SPI	NAT/SPI	NAT/SPI	NAT/SPI	NAT/SPI
Ports	Gigabit WAN, 3x gigabit LAN, USB	4x gigabit LAN, 2x USB	Gigabit WAN, 4x gigabit LAN, 2x USB	Gigabit WAN, 4x gigabit LAN, 2x USB	10/100 WAN, 4x 10/100 LAN, 2x USB
Average power use	Not tested	Not tested	Not tested	Not tested	Not tested
Throughput (near, far, ac)	124, 105, 578/540Mbps	130, 109, 330/125Mbps	110, 89, 505/468Mbps	98, 69, 610/570Mbps	127, 111Mbps, N/A
Dimensions, weight	98x168x98mm, 945g	245x174x45mm, 476g	32.5x243x160mm, 508g	160x83x220mm, 640g	243x161x33mm, 1.1kg
Warranty	1 year	5 year	3 years	2 years	1 year
FULL REVIEW	TINYURL.COM/MFDLLSC	TINYURL.COM/MUAFBHP	TINYURL.COM/KKJMPCE	TINYURL.COM/K4ZATKV	TINYURL.COM/MUXCBNM

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NAS drives

	Synology DS413j	Qnap TS-421	Synology DS1813+	Asustor AS-604T	WD My Cloud EX2
Price	**£245 inc VAT (diskless)**	**£382 inc VAT (diskless)**	**£770 inc VAT (diskless)**	**£435 inc VAT (diskless)**	**£468 inc VAT**
Website	Synology.com	Qnap.com	Synology.com	Asustor.com	Wdc.com
Launch date	Oct 13	Mar 14	Jan 14	May 14	Jul 14
Overall rating	★★★★☆	★★★★☆	★★★★½	★★★★☆	★★★★☆
Drive bays	4	4	8	4	2
Processor	1.6GHz Marvell mv6282	2GHz Marvell single-core ARM	2.13GHz Intel Atom D2700 dc	2.13GHz Intel Atom	1.2GHz Processor
Memory	512MB DDR3	1GB DDR3	2GB DDR3	1GB DDR3	512MB DDR3
Remote access	✓	✓	✓	✓	✓
eSATA	×	✓	✓	✓	×
USB port	2x USB 2.0	2x USB 3.0, 2x USB 2.0	2x USB 3.0, 4x USB 2.0	2x USB 3.0, 4x USB 2.0	2x USB 3.0
Raid options	0/1/5/6/10/JBOD	0/1/5/6/10/JBOD	0/1/5/6/10/JBOD	0/1/5/6/10/JBOD	0/1/JBOD
Software	DSM 4.1	Backup Station	DSM 4.3	Asustor utilities, App Central	Downloadable My Cloud
Dimensions	184x168x230mm	177x180x235mm	175x340x233mm	230x170x185mm	99x155x171mm
Weight	2kg	3kg	5.2kg	3.5kg	2.3kg
Warranty	2 years	2 years	3 years	2 years	2 years
FULL REVIEW	TINYURL.COM/PL8XM8S	TINYURL.COM/MCYWUB8	TINYURL.COM/PWO4M6J	TINYURL.COM/NX5QO8M	TINYURL.COM/LTCNFEX

USB drives

	G-Technology Professional	WD My Passport Pro 4TB	LaCie Little Big Disk	G-Technology Thunderbolt	Toshiba Stor.E Basics
Price	**£250 inc VAT**	**£350 inc VAT**	**£770 inc VAT**	**£599 inc VAT**	**£80 inc VAT**
Website	G-technology.com	Wdc.com/en	Lacie.com/uk	G-technology.com	Toshiba.co.uk
Launch date	Sep 13	Aug 14	Feb 14	Aug 12	Nov 13
Overall rating	★★★★☆	★★★★☆	★★★★☆	★★★★½	★★★★☆
Capacity tested	4TB	4- to 8TB	1TB	8TB	2TB
Capacity range	2TB to 4TB	2- to 4TB	512GB to 2TB	4TB to 8TB	320GB to 2TB
Disk size	3.5in	2.5in	2.5in	3.5in	2.5in
Spin speed	7200rpm	7200rpm	5400rpm	7200rpm	5400rpm
Transfer speed	N/A	230MB/s	635MB/s	329MB/s	94MB/s (USB 3.0)
Encryption	None	None	None	None	None
Other interfaces	FireWire 800	None	None	None	None
Software	None	None	LaCie Backup Assistant	None	None
Dimensions	235x130x46mm	88x143x44mm	40x140x85mm	235x130x85mm	119x79x21mm
Weight	1.35kg	700g	650g	2.3kg	215g
Warranty	3 years	3 years	1 year	3 years	1 year
FULL REVIEW	TINYURL.COM/NV7F32F	TINYURL.COM/QAGQEUG	TINYURL.COM//KRCL3VZ	TINYURL.COM/CXEF6MH	TINYURL.COM/LBHC8EL

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SSDs

	Crucial M550	OCZ Vector 150	Crucial M500	Samsung 840 EVO	Seagate 600 SSD
Price	**£344 inc VAT**	**£131 inc VAT**	**£169 inc VAT**	**£359 inc VAT**	**£202 inc VAT**
Website	Crucial.com/uk	Ocz.com	Crucial.com/uk	Samsung.com/uk	Seagate.com/gb
Launch date	May 14	May 14	Aug 13	Nov 13	May 14
Overall rating	★★★★½	★★★★☆	★★★★½	★★★★½	★★★★☆
Capacity tested	1TB	240GB	480GB	750GB	480GB
Price per GB	34p	55p	35p	48p	43p
Memory cache	1GB LP DDR2	512MB	512MB DDR3	1GB LPDDR2	N/A
Controller	Marvell 88SS9189	Indilinx Barefoot 3 M00	Marvell 88SS9187	Samsung MEX (3-core ARM)	Link A Media Device
Encryption	AES 256-bit	AES 256-bit	AES 256-bit	AES 256-bit	None
Flash	Micron 20nm MLC NAND	Toshiba 19nm MLC	Micron 20nm MLC NAND	Samsung 19nm Toggle NAND	Toshiba 19nm MLC
Firmware updated via	Bootable CD	OCZ Toolbox, bootable	ISO boot disc	SSD Magician for Windows	Seagate Firmware, bootable
ATTO peak sequential	R: 563MB/s; W: 514MB/s	R: 557MB/s; W: 534MB/s	R: 539MB/s; W: 433MB/s	R: 554MB/s; W: 537MB/s	R: 555MB/s; W: 474MB/s
CDM peak IOPS	100 / 91.7	92.9 / 94.7	89.8k (read)	104K (read)	96.8 / 88.6
CDM 4kB rnd	30/99	25/97	N/A	N/A	28/78
Warranty	3 years	5 years or 91TB writes	3 years	5 years	3 years
FULL REVIEW	TINYURL.COM/MSWD98Z	TINYURL.COM/KBED2W6	TINYURL.COM/M2NCSMJ	TINYURL.COM/L5EDQOY	TINYURL.COM/N58RB8G

Projectors

	BenQ W1300	Optoma W316	NEC M352WS	Optoma ML1500	Optoma HD30
Price	**£767 inc VAT**	**£463 inc VAT**	**£780 inc VAT**	**£657 inc VAT**	**£1,098 inc VAT**
Website	Benq.co.uk	Optoma.co.uk	Nec-display-solutions.com	Optoma.co.uk	Optoma.co.uk
Launch date	Jun 14	Jul 14	Jul 14	Jul 14	Jun 14
Overall rating	★★★★☆	★★★★☆	★★★★☆	★★★★☆	★★★★☆
Projection technology	DLP	DLP	DLP	DLP	DLP
Resolution (pixels)	1920x1080	1280x800	1280x800	1280x800	1920x1080
Brightness, Contrast	2000, 10,000:1	3400, 15,000:1	3500, 10,000:1	1500, 15000:1	1600, 25,000:1
Image size	300in	300in	150in	100in	362in
Supported aspect ratios	16:9 native	16:10, 16:9, 4:3	16:10	16:10, 16:9, 4:3	16:10, 16:9, 4:3
Noise levels (dB)	33 (30 eco)	29db	33 (39 bright mode)	30db	26db
Connections	VGA, 2x HDMI, USB, 3D	VGA, HDMI, Mini-USB, 3D	2x VGA, 2x HDMI, USB	HDMI, 2x USB-A, SD	2x VGA, 2x HDMI, 3D
Lamp/lamp life	240W/6000 hrs	190W/10000 hrs	278W/8000 hrs	LED/20,000 hrs	240W/6000 hrs
Dimensions	330x257x128mm	315x223x102mm	368x268x97mm	270x170x48mm	324x234x97mm
Weight	3.4kg	2.5kg	3.6kg	1.4kg	3.1kg
Warranty	3 years	2 years	3 years	2 years	3 years
FULL REVIEW	TINYURL.COM/K4FA89Q	TINYURL.COM/OCWTHGW	TINYURL.COM/Q6J2N6W	TINYURL.COM/QBFRYR7	TINYURL.COM/K4FA89Q

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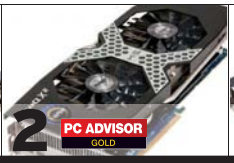
Sub-£150 graphics cards

	MSI Radeon R9 270	MSI HD 7770	MSI R7 260X OC	XFX Radeon R7 265	Gigabyte GTX 750 Ti WindForce
Price	**£130 inc VAT**	**£66 inc VAT**	**£90 inc VAT**	**£116 inc VAT**	**£115 inc VAT**
Website	Uk.msi.com	Uk.msi.com	Uk.msi.com	Xfxforce.com	Uk.gigabyte.com
Launch date	Jul 14	Sep 12	May 14	Jul 14	May 14
Overall rating	★★★★½	★★★★☆	★★★½☆	★★★★☆	★★★½☆
Graphics processor	AMD Radeon R9 270	AMD Radeon HD 7770	AMD Radeon R7 260X	AMD Radeon R7 265	nVidia GeForce GTX 750 Ti
Installed RAM	2GB GDDR5	1GB GDDR5	2GB GDDR5	2GB GDDR5	2GB GDDR5
Memory interface	256-bit	128-bit	128-bit	256-bit	128-bit
Core clock/Boost	900MHz/975MHz	1GHz/none	1175MHz/none	900MHz/925MHz	1033MHz/1111MHz
Memory clock/Effective	1.4GHz/5.6GHz	1125MHz/4.5GHz	1625MHz/6.5GHz	1.4GHz/5.6GHz	1.35GHz/5.4GHz
Stream processors	1280	640	896	Varies	640
Texture units	80	40	56	64	40
Power connectors	1x 6-pin	1x 6-pin	1x 6-pin	1x 6-pin	N/A
DirectX	11.2	11.1	11.1	11	11.2
Digital interface	2x DVI, HDMI, DP	DVI, HDMI, Mini-DP	2x DVI, HDMI, MiniDisplayPort	2x DVI, 1x HDMI, 1x DP	2x DVI, 2x HDMI
Warranty	3 years	3 years	3 years	2 years	3 years
FULL REVIEW	TINYURL.COM/MCE7353	TINYURL.COM/BWJ7BL9	TINYURL.COM/OZ6WUYT	TINYURL.COM/LV69BEM	TINYURL.COM/Q7K4ESV

£151+ graphics cards



	Gigabyte GeForce GTX 770 2GB	Sapphire Radeon R9 280X	XFX Radeon R9 290X	MSI Radeon R9 270X	MSI Radeon R9 295 X2
Price	**£240 inc VAT**	**£240 inc VAT**	**£380 inc VAT**	**£155 inc VAT**	**£1,050 inc VAT**
Website	Uk.gigabyte.com	Sapphiretech.com	Xfxforce.com	Uk.msi.com	Uk.msi.com
Launch date	Aug 13	Mar 14	Apr 14	Dec 13	May 14
Overall rating	★★★★½	★★★★½	★★★★½	★★★★☆	★★★★☆
Graphics processor	nVidia GeForce GTX 770	AMD Radeon R9 280X	AMD Radeon R9 290X	AMD Radeon R9 270X	AMD Radeon R9 295 X2
Installed RAM	2GB GDDR5	3GB GDDR5	4GB GDDR5	2GB GDDR5	8GB GDDR5
Memory interface	256-bit	384-bit	512-bit	256-bit	2x 512-bit
Core clock/boost	1137MHz/1189MHz	950MHz/1070MHz	1GHz/1GHz	1030MHz/1120MHz	1018MHz/N/A
Memory clock/Effective	1752MHz/7010MHz	1.55GHz/6.2GHz	1.25GHz/5GHz	1.4GHz/5.6GHz	1.25GHz/5GHz
Stream processors	1536	2048	2816	1280	2x 2816
Texture units	128	128	176	80	2x 176
Power connectors	1x 6-pin, 1x 8-pin	2x 8-pin	8-pin, 6-pin	2x 6-pin	2x 8-pin
DirectX	11	11	11	11	11
Digital interface	2x DVI, HDMI, DisplayPort	DVI, HDMI, 2x Mini-DisplayPort	2x DVI, HDMI, DisplayPort	2x DVI, HDMI, DisplayPort	DVI, 4x Mini-DP
Warranty	3 years	2 years	3 years	2 years	3 years
FULL REVIEW	TINYURL.COM/OAG6277	TINYURL.COM/OWVAP37	TINYURL.COM/NPET8ER	TINYURL.COM/OYA2DFJ	TINYURL.COM/POTAOGZ

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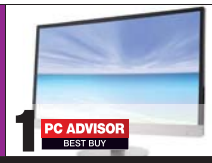
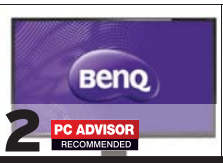
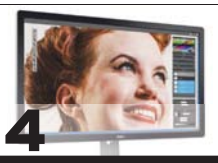
Sub-£200 flat-panel displays





	AOC i2369Vm	BenQ GW2760HS	Philips 234E5QHAW	NEC MultiSync E243WMi	BenQ EW2740L
Price	**£130 inc VAT**	**£170 inc VAT**	**£130 inc VAT**	**£185 inc VAT**	**£178 inc VAT**
Website	Aoc-europe.com/en	Benq.co.uk	Philips.co.uk	Nec-display-solutions.com	Benq.co.uk
Launch date	Jul 14	Dec 13	Jul 14	Jun 14	Aug 14
Overall rating	★★★★½	★★★★☆	★★★★☆	★★★★☆	★★★★☆
Screen size	23in	27in	23in	23.8in	27in
Panel type	IPS matt	A-MCA	IPS matt	IPS matt	VA semi-matt
Native resolution	1920x1080 pixels	1920x1080 (82ppi)	1920x1080 pixels	1920x1080 pixels	1920x1080 pixels
Pixel density	96ppi	82ppi	96ppi	93ppi	82ppi
Brightness	220cd/m²	300cd/m²	187cd/m²	250cd/m²	300cd/m²
Static contrast ratio	630:1	950:1	210:1	650:1	280:1
Response time	6ms	4ms	5ms	6ms	4ms
Ports	HDMI, HDMI/MHL, DP, VGA	HDMI, DVI, VGA	2x HDMI (QHAB) or 1x HDMI (QDAB), VGA	DP, DVI-D, VGA	2x HDMI, VGA
Dimensions	531x204x398mm	472x191x623mm	532x213x414mm	558x214x380-490mm	623x191x451mm
Weight	3.75kg	4.5kg	3.5kg	6.3kg	4.2kg
Warranty	3 years	2 years	2 years	3 years	2 years
FULL REVIEW	TINYURL.COM/OOEFYPR	TINYURL.COM/NF3WVFY	TINYURL.COM/KLYLW4V	TINYURL.COM/KNCGVOU	TINYURL.COM/OO6EC5L

£201+ flat-panel displays



	BenQ BL2411	Asus ProArt PA279Q	AOC Q2963PM	Dell UltraSharp 32 Ultra	ViewSonic VP2772
Price	**£218 inc VAT**	**£663 inc VAT**	**£300 inc VAT**	**£1,575 inc VAT**	**£540 inc VAT**
Website	Benq.co.uk	Asus.com/uk	Aoc-europe.com/en	Dell.co.uk	Viewsoniceurope.com/uk
Launch date	Apr 14	Jul 14	Mar 14	Jun 14	Jun 14
Overall rating	★★★★½	★★★★½	★★★★☆	★★★★☆	★★★½☆
Screen size	24in	27in	29in	31.5in	27in
Panel type	IPS	IPS matt	AH-IPS	IGZO	AH-IPS
Native resolution	1920x1200 (94ppi)	2560x1440	2560x1080 (96ppi)	3840x2160 pixels	2560x1440 pixels
Pixel density	94ppi	108ppi	96ppi	140ppi	109ppi
Brightness	300cd/m²	350cd/m²	240cd/m²	350cd/m²	350cd/m²
Static contrast ratio	650:1	640:1	530:1	550:1	560:1
Response time	5ms	6ms	5ms	8ms	6ms
Ports	DVI, DP, VGA	DVI, HDMI, 2x DP, 6x USB 3.0	HDMI, DVI, DP, VGA	HDMI, DP, Mini-DP, 4x USB 3.0	HDMI, DVI, Mini-DP, 4x USB 3.0
Dimensions	366x555x236mm	641x560x240mm	714x214x388mm	750x214x483-572mm	643x348x470mm
Weight	6.7kg	10kg	6.9kg	9.2kg	8.5kg
Warranty	3 years	3 years	3 years	3 years	3 years
FULL REVIEW	TINYURL.COM/PMV5L5V	TINYURL.COM/NR8RDQ6	TINYURL.COM/NXDAGMK	TINYURL.COM/O4CTO3S	TINYURL.COM/LLQRWTX

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Schoolyard antics

At a recent bullying-prevention class in her school, my nine-year-old daughter was given some rather interesting advice. 'Say something to confuse them!' was what it boiled down to. This left me wondering if the teacher in question thought that bullies were, in fact, evil robots from 1970s sci-fi TV shows? Indeed, if they were, then this is sound advice, as a surreal response would instantly send the automaton into a spiralling frenzy of logic, bleating "Does not compute! Does not compute!", until finally its circuits exploded in a cloud of confusion.

Like a playground spat, anyone who followed the patent disputes between Apple and Samsung over the past year or so will be able to tell you, the two companies aren't very fond of each other.

The two companies locked horns repeatedly until it was decided that Samsung had to pay around a billion dollars in damages. This sparked one of our favourite modern internet rumours, when some people suggested that Samsung were filling up a fleet of trucks to deliver the blood money to the Apple campus all lovingly counted out in individual cents. As wonderful as this seemed, the logistics alone would probably have doubled the cost of the suit itself, so the literal mountain of money never came to be. Shame.

Not to be outdone, Microsoft flexed its advertising budget in the direction of Google, launching the Scroogled campaign. In this series of ads, the search specialist was presented as an untrustworthy menace, reading your emails, stealing your data, setting fire to your favourite scarf, mugging your cats, and generally being a jolly nuisance. Chromebooks had a separate mini-campaign, which included Z-list celebrities explaining how it wasn't a real laptop because it didn't run Windows or Office – which, of course, would be seen as a selling point by others. Microsoft got so excited with its Scroogled catchphrase that it even had T-shirts printed and sold them in its store. Google responded to the attacks by saying that competition in the wearable sector was indeed heating up, then dropped the microphone and left the stage.

China, seeing that the market for petty squabbles presented opportunities to create even more rabbit hutches for its citizens to live and work within, stepped up and made copious laptops in its own vast empire unreal by banning Windows 8 entirely on any government-linked machines. The reasons for this OSacide boiled down to the country mumbling something about energy emissions, but those of us who live to draw wild assumptions think it's more likely linked to Microsoft's outrageous behaviour when it prematurely ended support for Windows XP (which runs on an estimated 50 percent of PCs in China) after a paltry 13 years. How dare they.

Of course, it could also have had something to do with the US House Intelligence Committee declaring several months before that Chinese technology manufacturers Huawei and ZTE were spying on Americans through their routers and other branded devices. This became a particularly ironic claim when reports were subsequently leaked showing that the NSA had used invasive techniques to spy on Huawei corporate servers.

Of course, the NSA hadn't just kept its generous surveillance and freedom-bringing joy to the Far East. Oh no. Sadly, it came as no great surprise when, now infamous whistleblower, Edward Snowden revealed that the agency had, in fact, been watching and storing pretty much everything that happened anywhere in the world – except for its own offices, which somehow seemed incapable of presenting records of its endeavours. So in a short space of time we've gone from a spat over how round a phone's corner should be, to everyone in the world essentially living in the *Big Brother* house. To quote that paragon of modern journalism Ron Burgundy, 'Wow, that escalated fast'.

The truth is, they're usually such good companies. But when everyone's watching, they sometimes get over-excited. A good night's sleep and they'll be as right as rain. What's that Microsoft? Yes, you can wear the Scroogled shirt in bed, but tomorrow that goes to the charity shop. Now, no talking to Google or brokering trade agreements with China, you need your rest. Samsung, I don't care what Apple's doing. Does that mean you have to do the same? No. So put down that prototype and brush your teeth.

> **"In a short space of time we've gone from a spat over how round a phone's corner should be to everyone living together in the *Big Brother* house"**

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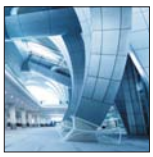

Without HD

With HD

Picture

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