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ISSUE 231 OCT 2014  UNITED KINGDOM

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JIM  
MARTIN



# Long live the internet fridge

With the Internet of Things now a proper 'thing', our homes are set to get a lot smarter

**T**he much derided internet fridge may well become a household item now that the Internet of Things is now, well, a thing. It's a buzzphrase you might have heard bandied about, but what it boils down to is a proliferation of 'uniquely identifiable' everyday items that are able to communicate over a network.

A new generation of tiny, low-power and low-cost processors means these connected objects won't cost much more (if any more) than their non-smart counterparts. Hence, when you next upgrade your fridge/freezer, it could tell you when you're running low on the essentials and might even be able to place an order at your local supermarket. And it's not just in the kitchen where electronics are getting smarter.

By 2020, estimates suggest there will be between 25- and 75 billion devices connected to the internet, which is considerably more than there are now (roughly 13 billion). We're already buying these smart objects: thermostats such as the Google Nest and wearable devices such as the Fitbit Flex.

Within the next few years, a smart meter will be fitted in your home, if one hasn't been already. This will do away with the need for the guy who comes to read the meter, and means that your electricity company can bill you for the exact amount you've used rather than estimating.

Of course, as more and more appliances and devices get connected, a few problems arise. One is technical: how do products communicate if they're made by different manufacturers? Currently there's no 'Internet of Things standard', so it's an issue that's yet to be resolved.

Another is the issue of privacy. If devices such as smart meters, thermostats and even your car are sending data back to base, who has access to that data? What will they use it for?

Perhaps more worrying is that these devices could be hacked into and misused. It wouldn't be a disaster if a hacker remotely turned on your kitchen lights, but it's a completely different story when it comes to your car and its electronic fly-by-wire controls.

You can find out more about the Internet of Things on page 80. ☒

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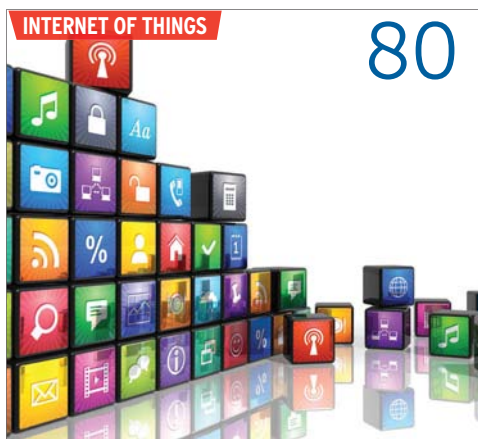
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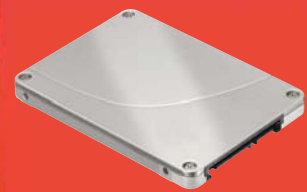




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CHRIS MARTIN

# Microsoft cuts 18,000 jobs and ends Nokia X Android phones

Microsoft reshuffle hits Nokia hard as it ditches Android

Microsoft has announced that it plans to axe 18,000 jobs and cease production of the Nokia X Android smartphones. Such plans had been rumoured, but not on this scale.

A whopping 18,000 employees will lose their jobs - most of which (12,500) are from Nokia, a company Microsoft acquired in April. The bulk of the cuts will be made by the end of the year, with completion expected by 30 June 2015.

Microsoft's last large-scale layoff was in 2009, when the firm cut loose nearly 5,800 employees, making this one the biggest in its entire history.

"The first step to building the right organisation for our ambitions is to realign our workforce," argued Microsoft CEO, Satya Nadella. "Making these decisions to change are difficult but necessary. It's important to note that while we are eliminating roles in some areas, we are adding roles in certain other strategic areas. My promise to you is that we will go through this process in the most thoughtful and transparent way possible."

The Nokia job cuts will be across professional and factory positions. "We will offer severance to all employees impacted by these changes, as well as job transition help in many locations," explained Nadella.

## Nokia X to become Windows Phone Lumia

As part of the firm's restructuring, the Nokia Devices and Services teams will be integrated into Microsoft. "To win in the higher price tiers, we will focus on breakthrough innovation that expresses and enlivens Microsoft's digital work and digital life experiences," revealed Nadella.

As per recent rumours, Microsoft will move the Nokia X range of smartphone from Android to Windows Phone with the Lumia branding. The change will take effect immediately, but existing Nokia X models, including the recently launched Nokia X2, will continue to be on sale and to receive support.

"In addition to the portfolio already planned, we plan to deliver additional lower-cost Lumia devices by shifting select future Nokia X designs and products to Windows Phone devices. We expect to make this shift immediately, while continuing to sell and support existing Nokia X products," said Stephen Elop, executive vice president at Microsoft. "We will be particularly focused on making the market for Windows Phone. In the near term, we plan to drive Windows Phone volume by targeting the more affordable smartphone segments, which

are the fastest growing segments of the market, with Lumia," he added.





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# Nokia releases Windows Phone 8.1 Cyan update for Lumia smartphones

**Cortana and Action Center come to Lumia phones with Cyan Windows Phone 8.1 update**

Nokia has finally started rolling out its Cyan software update for Lumia smartphones, bringing Windows Phone 8.1 and other features. The new operating system is being gradually released on a global scale, but is only available for some handsets to begin with. Nokia says the update will make Lumias more personal, fun and indispensable.

Key features include Action Center and a third row of live tiles on the homescreen. The former brings notifications and quick settings to the mobile operating system.

Although the update includes Cortana, it's available in the US only, with other regions to follow later this year. However, if you set the language of your smartphone to US, then the rival digital assistant to Siri should work.

Other new features consist of a WordFlow keyboard, which provides swipe gesture typing, an upgraded Internet Explorer 11, and device search. There's also an enhanced camera app, the Nokia Device Hub and the ability to install apps to microSD storage.

Owners of the Lumia 1520 or Lumia Icon will also get even more camera improvements, such as low light performance and better audio by way of Nokia Rich Recording and Dolby Digital Plus 5.1 sound.

## How to upgrade to Windows Phone 8.1 Cyan

Although the rollout has started, the software may not be available for your



specific device. It will take a number of weeks for the upgrade process to be completed. Your phone will automatically check for updates, so simply wait for the notification and upgrade when it's ready. You can check manually by heading to settings, then phone update.

## How to get Windows Phone 8.1

The Windows Phone 8.1 upgrade is available for Lumia 625 and 925 on some UK networks. You can check the status for your device by visiting [tinyurl.com/pdv2aym](http://tinyurl.com/pdv2aym).

# UK rushes through surveillance bill, extending data retention rules

**Rushing a surveillance bill like this shows disregard for the democratic process, claims privacy group**

The UK government has pushed through a new surveillance law to replace one a European Union court said interfered with fundamental privacy rights. Civil rights campaigners, however, argue that the new law is worse than the one it replaces.

The Data Retention and Investigatory Powers Act 2014, also known as DRIP, was fast-tracked by the government after EU laws requiring communications providers to retain metadata were ruled invalid by the Court of Justice of the EU (CJEU) in April because they interfered with privacy rights.

Under the EU's Data Retention Directive, communication service providers had to retain communications data for law enforcement purposes for periods of between six months and two years. The UK had transposed this directive into law and the ruling affected the secondary legislation.

On 10 July, the UK government introduced an emergency bill to provide law

enforcers and intelligence agencies with access to telecommunications data to help them investigate criminal activity.

They can now access the content of messages, even if they are held by companies outside the UK. "The Bill amends the Regulation of Investigatory Powers Act 2000 (RIPA) to put beyond doubt that requests for interception and communications data to overseas companies that are providing communications services within the UK are subject to the legislation," the government said. Access to message contents requires a warrant signed by a Secretary of State.

The bill has met criticism from privacy and civil liberties groups, which voiced their dismay when the bill passed. Privacy International, for instance, called it "shameful that a year since Edward Snowden revealed the scope of the UK mass surveillance activities, the only

British parliamentary action in relation to surveillance has been to drastically expand the interception powers of intelligence agencies."

Meanwhile, the UK's Open Rights Group (ORG) threatened legal action. "We're already meeting with lawyers and taking counsel's advice to work out the best way to take the Government to court," its director Jim Killock said in a blog post.

The UK has international obligations, he argued, pointing at the European Convention on Human Rights, the European Charter of Fundamental Rights and the UK's own Human Rights Act, which could be used to challenge the new law.

Moreover, the CJEU has stated that blanket data retention is unlawful. "This means we have strong grounds to challenge the new legislation on the same basis," he explained, calling on people to support the legal action by donating money.



### Three customers gain free London Underground Wi-Fi

Customers of mobile network Three can now get free internet access on the London Underground. Virgin Media has confirmed that Three is the latest mobile operator to sign up to the tube Wi-Fi service. It now means that customers of all the UK's networks can use the service - EE O2 and Vodafone had joined previously.

**MORE:** [tinyurl.com/Lrmv7q4](http://tinyurl.com/Lrmv7q4)



### Sonos users can access SoundCloud for free

Sonos has added a new music streaming service in the form of SoundCloud. The online streaming service has 12 hours of music and audio uploaded every minute, and will give Sonos users a new way of discovering artists and new music.

**MORE:** [tinyurl.com/me3ahdr](http://tinyurl.com/me3ahdr)

### BBC and iPlayer problems

The BBC was hit technical problems recently leaving its website and the iPlayer catch-up service unavailable to some users. It's unclear how many users were affected by the outage, but it appears to be widespread. The BBC was forced to use a simplified version of its website due to the problem - see page 27.

**MORE:** [tinyurl.com/o9sqj6](http://tinyurl.com/o9sqj6)

## Post office set to launch mobile network with EE later this year

The Post Office will launch its own mobile network this year with EE

The Post Office has announced plans to enter the mobile network market later this year thanks to a partnership with EE.

It already offers insurance, a home phone service, as well as broadband, but soon you'll be able to get a mobile phone SIM card from your local Post Office. The iconic firm plans to launch as a virtual operator this autumn using EE's network.

The Post Office's mobile services will be launched at 50 branches later this year, as well as online and over the phone ahead of a full national rollout. At the time of writing there wasn't any specific pricing information, but the firm promises great value for money and transparency. It expects to challenge existing providers.

Martin George, chief commercial officer at Post Office, said: "Our research tells us that people are seeking greater value, with one in three of those surveyed saying they intended to move away from one of the mainstream providers for their next service. We believe we are in an ideal position to offer a genuine alternative with over a third also saying they would consider us as



their mobile provider. This is a fantastic vote of confidence in the Post Office brand - voted one of the most trusted brands in the UK."

The announcement follows last year's government funded £640 million boost to support a transformation of the Post Office. It has already been used to revamp more than 2,200 branches and provide over 60,000 extra opening hours.

We've asked the Post Office whether it will provide contracts and SIM-only deals plus whether it will offer smartphones or tablets, too. We'll let you know more details as soon as we hear anything.

## Virgin Media adds new Sky Sports channels and TV season Ticket

Pay £150 for 10 months of Sky Sports with Virgin Media's Season Ticket

Virgin Media has announced that it's adding new Sky Sports channels for its customers, making it the only provider to offer all major live sports channels. It has also unveiled the UK's first TV Season Ticket.

The channels on offer include Sky Sports, BT Sport, ESPN, British Eurosport, Premier Sport, BoxNation and Racing TV, as well as Sky Sports 3, 4 and 5, and Sky Sports F1 in HD quality.

Dana Strong, chief operating officer at Virgin Media, said: "Virgin Media is now the home of all the major live sports in the UK in HD or on the go. This is the first time all the Sky and BT Sport channels will be available in one place, backed by superfast broadband, for a single great value price.

"It doesn't matter if you are watching at home or on the go, you now have front row access to all the top sporting action with Virgin Media."

The new Season Ticket option gives 10 months access to Sky Sports 1, 2, 3, 4 and 5 for a one-off payment of £150. It's available to new and existing



customers until 1 September. Virgin Media says customer can save up to 40 percent this way compared with a monthly fee.

Virgin has also announced that it's adding seven Sky channels to the TV Anywhere service: Sky 1, Sky 2, Sky Living, Sky Living it, Sky Arts 1, Sky News and Sky Sports News.



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# Free Wi-Fi could be stealing your data

Free Wi-Fi spots are incredibly handy, but are they really what they say they are? We look at the dangers involved with conducting your private affairs over networks that could be heavily compromised

**C**offee shops seem to have become the open-plan office of the 21st century. Visit any branch of Costa or Starbucks on the high street and, chances are, you'll be met with a sea of laptops, iPads, and mobile phones, all bathing their users in a gentle glow of distraction. But while people might feel that their islands of tables, lattes and devices create a form of private space, the truth is they might not be the only ones looking at their personal information.

"Sadly," states Kaspersky security blogger Stefan Tanase, "most people don't realize how easily your data could be intercepted by a stranger 10 metres away."

Free Wi-Fi normally does have a cost, and that's safety. While the idea of being able to roam around a city, connecting to several open Wi-Fi spots without incurring any fees is a convenient one, we should always remember that cyber-criminals use the same connections to conduct their attacks.

"One of the easiest ways for hackers to capture information," reveals Sian John, security strategist for Symantec, "is to set up a friendly or 'safe' sounding Wi-Fi network, by using a hotel or restaurant name. It's then amazing to see what people will do online without ensuring that their communication is protected or encrypted."

These spoof networks will look real, allowing you to navigate the web as you would normally, but everything you do is being watched and logged. It won't be long before you're prompted to download some innocent-looking malware, or to confirm your login details to a secure site (say your bank or PayPal account) and then the criminals will have their prize.

In fact, it doesn't even have to be a network to which you've never before connected. There are gadgets that make use of a built-in vulnerability in mobile devices to turn your regular haunts against you.

When you log on to any network your device will store those details so that it will be able to automatically repeat the process next time you visit the same location. This is very useful as it means you don't have to manually input any kind of information when you return, the device will just go online. For trusted sites like your home and office networks it's fine, but when you're out and about, it can become a serious weakness.

The Wi-Fi Pineapple is a small, lightweight unit that acts like a Wi-Fi hotspot which can masquerade as another network. Due to its

powerful antennas it will push its way to the front of the queue, obscuring the authentic network, when your device tries to log on to a known connection. It then redirects your traffic - and all sensitive data - through its rogue proxy, leaving you unaware that you're on a compromised version of the network.

The most surprising thing is that this isn't some expensive, military-grade device, but it fits neatly in a backpack, is virtually undetectable to passers-by, and is available online, completely legally, for around £60.

## Corporate compromise

The dangers of leaving yourself open to an attack aren't limited to just personal information either. Enterprising hackers are also becoming alive to a potentially easy route to valuable corporate data.

"You go to a hotel network and there's no security on them," says Sean Newman, security strategist at Cisco. "They just have a hotspot thing to sign you onto the network. But anyone can sign on to the network and there's no encryption or protection of the traffic. You might think - who's going to follow me to a hotel? Well, when I'm going to a hotel, it's usually because there's an event on, some security conference, and every hotel has multiple conferences for multiple reasons going on at any period of time."

"So if you wanted to attack a particular target [industry] you'd simply go to that conference and you could almost have your pick of who you want to compromise."

This problem is exacerbated by the rise of the Bring Your Own Device (BYOD) culture that has become the bane of IT professionals in recent years. Traditionally, your work- and personal devices were separate, making securing the data an easier task, but with many phones and tablets now acting as both work- and leisure devices, the risks are harder to ignore. Probably the best way to prevent this loss of privacy is to use a Virtual Private Network (VPN), which creates an encrypted connection between your machine and a secure server when you're online.

You can pay for a VPN through services such as Cyberghost or Hotspot Shield, who also offer free versions with some limitations, but, for most people, this will seem an overly complicated procedure that's too intimidating to pursue. A more accessible option might be to install the free Firefox- and Chrome plug-in HTTPS Everywhere, which tries to ensure that,

where possible, sites you visit use secure connections. It's not a guarantee by any means, but it can certainly take away some of the risks involved.

One relatively simple idea we discovered recently was to create a dummy wireless network on your PC and give it a name that will immediately warn you that something is wrong. Make one called something like 'I'm Being Hacked' (you don't need any actual network settings), then move it to the top of your networks list so that it has the highest priority. Now, whenever your PC tries to automatically log on to a network it will search for that one first, and if a hacker is pretending to be it you'll know when your computer connects. Don't rely on this solution to thwart the danger, nothing's ever that simple in security, but it could be a useful warning against casual hacks.

Of course, the ideal solution lies with the hotspot providers implementing encryption on their service, but this isn't as simple as it sounds. As always, the biggest threat to security lies in the need for convenience.

Most of these locations are casual-use spaces for customers, meaning that they want to log on and off quickly and without fuss. Having to input a key to access an encrypted hotspot might prove simply too much effort for many people, who'll just walk on until they find the next open connection.

Without a customer revolt to improve the security of free Wi-Fi hotspots, you can expect things to carry on much as they are. Therefore the responsibility to protect personal data lies firmly in your own hands.

"I'd advise people simply not to use unsecured access points altogether," states Jean Taggart, senior security researcher at Malwarebytes. "But that isn't always an option. If you have to connect to public Wi-Fi hotspots, you should consider using a VPN - because the tunnelling process encrypts the traffic. Another option is to use a 3G card, rather than free Wi-Fi, as this completely bypasses the problem, albeit at a greater cost. Finally, definitely avoid online banking when on an untrusted network."

"In fact, avoid using anything which you would deem sensitive." Great advice. ☒

MARTYN  
CASSERLY



# Where will Google, Apple and Microsoft go next?

We look at this year's announcements that point to the way ahead for consumer technology

**W**ith Google's I/O event in June drawing the developer conference season to a close, we're all now a little clearer on the paths that lay ahead for the big three players in technology. Or at least, we think we are. While many of the headline-grabbing innovations look amazing when Tim Cook, Sundar Pichai, or Satya Nadella demonstrate them on those huge, barren stages, most of the wonders on display aren't actually finished yet. It'll be a few months before we'll be able to check the veracity of claims that things 'just work', but we can see already that the next year could be a hugely significant one as technology continues to come of age.

Microsoft has seemingly set its eyes on reclaiming the mobile space it conceded to Apple and Google in recent years. This is hardly surprising as PC sales show little signs of increasing consistently and a few manufacturers are adopting Android and Chrome OS alternatives as they scramble to stay relevant in this rapidly changing landscape. HP even announced 'The Machine', a new kind of computer aimed at data centres and one which will run a bespoke Linux OS rather than using a Windows server variant. Microsoft is responding to this uncertainty by bolstering its own line of hardware with the Surface Pro 3, an excellent device which is certainly the best hybrid yet. As a benchmark for how Windows 8.1 can truly make sense, it's a fabulous feat of engineering, but the high price of around £1,000 for a usable system means few people will buy it. That being said, it was never intended to be for a budget device, but instead take the fight to Apple in the premium market. How it will fare against the new iPads when they appear towards the end of the year, or even the much-rumoured 12in MacBook Air's with high-resolution Retina screens, remains to be seen.

It was interesting to note that Google announced at I/O that there are now over a billion Android users, which is a huge deal when

you consider that Windows as a whole currently boasts around 1.5 billion users. How soon before Android becomes the most-popular OS in the world? To hasten this changing of the guard, Google also revealed its Android One initiative, which lays out the template for low-cost devices that manufacturers in developing markets can build themselves and take advantage of Google Play services. This puts them in direct competition with Windows Phone, which has begun to see some solid traction in this part of the market.

Expect an aggressive campaign from both sides as this battle for the 'next billion' starts to heat up.

## Digital assistants

Windows Phone also had some big news with the introduction of Cortana, a digital, personal assistant that brings the platform in line with its peers. It also immediately leaps to the front in the all-important territory of which has the coolest name. The launch demo wasn't without its awkward moments, as Cortana embarrassed the increasingly sweaty Joe Belfiore by mistranslating several commands, but features such as being able to set reminders that trigger the next time you talk to a certain person, or Cortana interacting with non-native apps, will make it an interesting service to watch as the rough edges are smoothed out.

All of the companies revealed various refinements to their operating systems, interfaces, and general features, but the most curious trend to emerge was the subtle switch of focus from traditional devices such as phones, PCs, and tablets, towards lifestyle services that look set to dominate future consumer technology.

Google dedicated a significant portion of its mammoth keynote to launch Android TV. The new service, available in the autumn, is a set-top box (or built-in interface for smart TVs) that boasts



MARTYN  
CASSERLY

**“Google TV was a certified flop, but its cheap and rather brilliant Chromecast has repaired much of the damage and is noticeable for the fact that it's mainly cross platform (iOS & Android)”**

media content from the Google Play store, as well as apps for other streaming providers, and allows you to play Android games while using your phone as a controller. You can also mirror your phone or tablet's screen on your TV, much like Apple does with Airplay on its Apple TV device. This isn't the first time that the search giant has dabbled in this area, with Google TV being a certified flop, but the recent release of the cheap and cheerful Chromecast has repaired much of the damage and is notable for the fact that it's mainly cross platform (iOS and Android). Microsoft, of course, has its own entertainment solution in the form of the Xbox One, which has plenty of content, voice control, a Blu-ray player, and premium-level gaming.

With each company now having web stores that sell films, TV, and music, it makes perfect sense that they'd be very keen to position themselves at the heart of the family home. After all, as Apple discovered with iTunes, once customers start investing in one particular platform, they tend to stay there.


It's not just the living room that will see a tech invasion either, as home automation became another focal point with Apple announcing HomeKit. This suite of tools will enable users to control various aspects of their homes, including lighting, heating, security, and various smart appliances. Google has already bought the company

that makes the Nest smart thermostat and Nest Protect smoke alarm, which puts them in a strong development position.

Wearable also became a reality with LG and Samsung releasing watches that use the Android Wear OS, a smart companion device for your Android phone. Google Glass finally received a UK launch, and Apple are heavily rumoured to be preparing a health-based wearable device. Even cars were targeted for an upgrade as both Apple and Google laid out their vehicular interfaces (CarPlay and Android Auto respectively) which bring hands-free controls to your navigation, media, and communications apps.

### The future of convergence

The question that these wonderful creations pose is whether or not they'll ever actually play nicely together. If we're about to see a wholesale revolution of our homes, bodies, and transport, it'd be preferable if we were still able to choose the devices we like rather than those that will talk to each other. Apple has long been the master of the closed-system approach, and it has served them very well, but with the new suites of interlinking services that Google and, to a lesser extent, Microsoft are now developing, we could see these types of compatibility issues becoming more considerable.

Will the fact that your phone and car can't understand each other make you switch brands? Could your choice of TV be decided by its smart apps? Would you restrict your brand of running shoe to one with companion tracking software? These might seem like decisions that would only be a problem for the wealthy or those who suffer from technolust, but mobile phones and tablets have taken very little time to become central components of modern life. The extension of their domain will happen quicker than we think. Either way, shopping has just become a lot more complicated, or far more simple. 

CHRIS MARTIN



# Smartwatches vs smartglasses

Google Glass is a neat concept, but Android Wear in essence makes it pointless

**A**ndroid Wear is Google's mobile operating system tailored to wearable devices such as smartwatches. It brings a familiar Google Now-style interface to your wrist, providing notifications and information when you need them, and covers everything from text messages to turn-by-turn navigation. Interaction is easy with simple swipe gestures or even voice commands.

Android Wear isn't confined to one device. Although only two are available to buy today, more will launch over time, including the stylish Moto 360 (pictured). That means you can buy a smartwatch designed to suit your taste. Meanwhile, Google Glass comes in different colours and with optional frames.

Glass is still a work in progress, and only serious tech enthusiasts are going to spend a grand on Glass rather than around £150 on an Android Wear watch. And although the price will fall when the final Google Glass product launches, we can't see it being less expensive than Android Wear.

But not only are Android Wear devices considerably cheaper than Google Glass, they can do the same stuff. Both can quickly

and efficiently provide the information you need, and can communicate with your paired smartphone to carry out all kinds of tasks. But Glass is compatible with only select apps; Wear works with any app - you don't even need to install it on the watch.

Glass stands out for its camera and ability to capture the moment, but Samsung has previously proved smartwatches can also have cameras. That's if you want one, of course. Able to capture whatever you're

looking at Glass brings with it privacy and security concerns.

You might feel very self-conscious wearing Glass, especially when people start pointing and wondering what on earth that is on your face. But wearing a smartwatch you can go about your daily life as usual. Eat at a restaurant, drive your car and watch a film at the cinema - whatever you like. Wearing Glass isn't appropriate in every situation - it's already banned from cinemas. ☒





# Cloud cover

ANDREW  
HARRISON



**We're being urged to store passwords in the cloud but, as researchers from Berkeley discovered, many password managers are flawed**

**E**ven in the seemingly carefree world that existed before June 2013, I can't say I was enamoured of the idea of putting my personal files into someone else's cloud. It was long known that most companies that offer to store your data online for your convenience are based in the United States. And that the country's ill-conceived Patriot Act rushed in post-9/11 in effect said "anything you store on our shores, belongs to us".

So when armed with a signed subpoena, everything you care to keep in Dropbox, Microsoft OneDrive (SkyDrive), Google Drive or a similar service will be fair game to the US government and all its agencies.

The difference now in this post-Snowden world is that we know the US government doesn't always bother with warrants before it looks inside these, er, secure and encrypted online repositories. Oh and that this kind of disregard for privacy is also standard operating practice in this country, too.

Even the most lobotomised of 'nothing to hide, nothing to fear' apologists for the continuous-surveillance horror that is the modern internet may draw the line somewhere. That line might simply be where their own money is involved. Such as their online banking credentials, access to savings accounts and pension plans. Would you give up the passwords to your online bank to a stranger in the street? How about any government official that casually asked?

Yet nowadays we're increasingly being encouraged to store our most important online security asset in the cloud. I'm still talking about passwords.

One way you may be asked to put all your passwords in the cloud is with a password manager program for your PC or mobile device. The names may be familiar, maybe you already use one of them - LastPass, RoboForm, PasswordBox to name three.

Developers of these services may have started with the best of intentions, to allow you to use long, complex and secure but impossible-to-memorise passwords for any site or service that requires a password to log on. These passwords are then filled-in on demand from an encrypted archive managed by the software.

That's all fine and dandyish, so long as the encrypted master vault is stored locally, on one PC. But all bets are off once you share that password vault with a third party, such as the password-manager developer or another such cloud-based service.



Problems here I present are at least two-fold: allowing network access to privileged data means you have to secure every possible back- and side door in all the possible ways that a smart adversary could find a way in. That's made all the easier when the developer's implementation is full of security holes, as was discovered in a research project conducted by the University of California, Berkeley, and published last month in the paper *The Emperor's New Password Manager: Security Analysis of Web-based Password Managers*.

The team of four analysed five password managers that thoughtfully offer to manage your passwords across all your gadgets. The team's damning findings were that all five were flawed in some way at the time of testing with "critical security vulnerabilities", with various hidden defects that mean your best and most securest of passwords would be worth nought if trusted to these password managers. In four password managers, "an attacker could steal arbitrary credentials from a user's account".

My second fold - even if the software and its implementation were perfect, you're still putting all your eggs in one basket, then putting your wickerwork where any cunning fox could liberate them. The archive may be encrypted, but that can mean little when the new owner of your password basket puts their talents to cracking their way in.

It's not just careless new startup companies that want to sell you their online password management. In its efforts to simplify your online life - we'll be charitable and attribute its efforts thus - Apple now

wants you to pour all your most sensitive passwords into its iCloud Keychain service.

When first setting up iCloud services on a new Mac, it's difficult not to be led down this merry path. You're opted in by default, and presented with a four-field dialog box that expects you to engage the service by tapping in a new PIN code. If you try to sidestep it by pressing Cancel, for instance, a somewhat scary warning tells you that "if you don't create a security code, setting up iCloud Keychain on a new device will require your approval from a different device". What?

Apple's security is in many ways some of the best in the business, but I would not trust it with valuable passwords. And shame on you Apple for leading users to think this is mandatory and a Jolly Good Idea.

So what do you do if you want to keep yourself relatively secure with long- and unique passwords for every site and service, but are worried about trusting them all to password managers and cloudy keychains?

As the Berkeley researchers point out, it is too much of a cognitive load to keep them all in your own head. So instead try writing them down, and keep them to hand on a Post-it note stuck to your monitor.

That is, of course, the absolute antithesis of all traditional security advice given since the computing dark ages. But since all online security threats are remote attacks by definition, a pen and paper record is now the best, being unreachable over IP. Just make sure there are no laptops across the room and facing your monitor since practically every laptop today has an all-too hackable webcam available to a resourceful hacker. ☒

# Stop blaming Apple for the industry's sins

DAVID PRICE  
MACWORLD UK



Apple hasn't always had an exemplary record on labour ethics or the environment. But going by media reports, you'd think it was the only culprit - and it's not

**M**any non-specialist news outlets spend a disproportionate amount of their tech coverage talking about Apple, as the average web browser can scarcely fail to have noticed. Stories about Microsoft's Surface line of tablets inevitably end up talking about the iPad; anything to do with Android is likely to reference the iPhone, too.

To an extent, all this is understandable, given Apple's influential position within the consumer tech industry; not to mention how reliably its name generates good copy, high web traffic and passionate reader engagement. And we'd guess that Tim Cook sheds few tears at the thought of having his firm's name shoehorned into reports about rival projects. But sometimes it means we're missing a larger point.

Take Apple's hardware supply chain. Over the past decade or so, the Asian factories in which many of the company's products are assembled have become an object of great curiosity to the western media, and with good reason. Again and again, it's been found that workers toiling at the bottom of this stupendously profitable operation are overworked, underpaid and shockingly mistreated.

Back in 2006, *The Mail on Sunday* reported that the 32,000 employees at an iPod plant owned by Hon Hai Precision Industry (now better known as Foxconn)



upsettingly, Foxconn announced plans to install netting around the roof of its facilities.

## The wider picture

These are injustices that need to be exposed, and it's undoubtedly a good thing that the media is interested in the poor treatment of low-paid workers. It's a better thing that pressure from human rights organisations, amplified by the media, has obliged Apple to audit its supply chain and try to enforce higher standards of worker treatment. It's even true that much work undoubtedly

with dubious human rights records, even if you hear about it less. Shortly before the time of writing (and with far less fanfare than similar incidents affecting Apple), Samsung cut links with the Shinyang Electronics factory in Dongguan after China Labor Watch found evidence of child labour; this only days after the company reported no such concerns in its 2014 Sustainability Report.

And needless to say, the Hon Hai/Foxconn factories don't just make iPhones; almost all of Apple's rivals have ties of some kind with the manufacturing giant. But every story referred to the buildings as iPhone factories, because that's the easiest journalist sell.

Technology holds the potential to make society a more humane place, but - and I say this as someone who makes by global standards an exceptionally lucrative living just writing about consumer technology - it very rarely does so.

We demand high-precision electronics at an affordable price; we demand updated devices every year and don't want to be bothered about what happens to the old ones. You can have these things, or you can have a technology industry that pays a decent wage to its workers and protects the natural environment (another area in which Apple's performance has come under greater scrutiny than any other company, and where - presumably as a direct consequence - its record is now among the best of its peers). You can't have both. ☒

**“It's a mistake to imagine that mistreatment of factory workers is something for which Apple alone is responsible, or that Apple is even the worst culprit in larger system that prioritises profit above human safety, comfort and mental health”**

earned £27 per month, and slept in triple bunks in large 'dormitories' that were in essence just repurposed factories. A subsequent audit found they were working more than 60 hours per week about a third of the time, and were occasionally forced to stand to attention as a form of punishment.

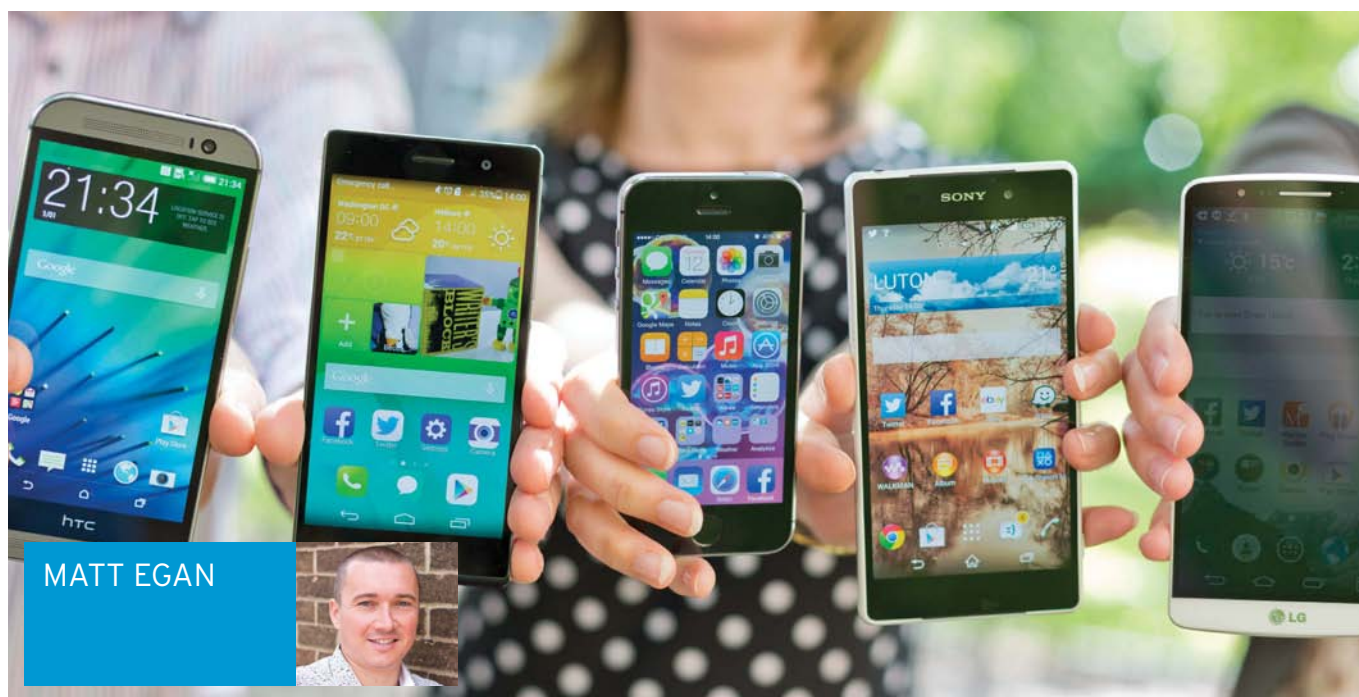
After the launch of the iPhone in 2007, concerns intensified; Foxconn's factories became notorious for the suicide rate among workers, one of whom had reportedly lost a prototype iPhone 4 and been beaten and interrogated. At one stage,

remains before Apple will be in any position to boast about the ethics of its supply chain.

But the iPhone-sweatshops narrative that makes for such pleasing headlines is afflicted with tunnel vision. It's a mistake to imagine that mistreatment of factory workers is something for which Apple alone is responsible, or that Apple is even the worst culprit in a larger system that prioritises profit above human safety, comfort and mental health.

Let's be clear, first of all: other technology companies also have links to overseas plants





MATT EGAN

# Welcome to the upgrade cycle – you'll never leave

You are manipulated into upgrading products when you have no need to do so. And you love it

I had an odd conversation with a journalist from a well-known tabloid newspaper the other day. You know the one: Princess Di conspiracies, house prices and immigrants.

The lady in question (the reporter, not the queen of our hearts) was looking for a list of the best laptops to buy for an article she was writing. Leaving aside the minor oddity of asking a rival publication for help in parking your tanks on its lawn, it was an interesting question. A consumer products reporter was struggling to understand the laptops market, and it is easy to see why.

Laptops are getting cheaper, but they are not selling as well as once they did. Laptops are ubiquitous, but I can't hand-on-heart tell anyone the best laptop for them. The facts are that the laptops market is now commoditised: you choose specifications and find a price point that suits. Model naming conventions don't change from year to year, because manufacturers live in fear of being caught with stock they cannot sell. And despite the market becoming better and better for purchasers, still it gently slows. The laptop you bought three or four years ago probably still works fine.

This is a problem, both for tech companies and for tabloid journalists used

to compiling simple lists of the best products to buy. It's less of a problem for consumers because, well, there is value to be had and no rush to buy.

Fortunately for manufacturers, there are other products that we can be persuaded to upgrade. Year in, year out.

## Welcome to the upgrade cycle

My colleague Chris Martin wrote earlier this year about how smartphone specs had flattened out. Once you get into the upper echelons of the smartphone world it is difficult to differentiate very good from great. Battery life remains a key battleground, but it is one that hasn't been solved. Meanwhile manufacturers such as LG persuade people to switch up by adding in 4K displays. Looks amazing, but not required.

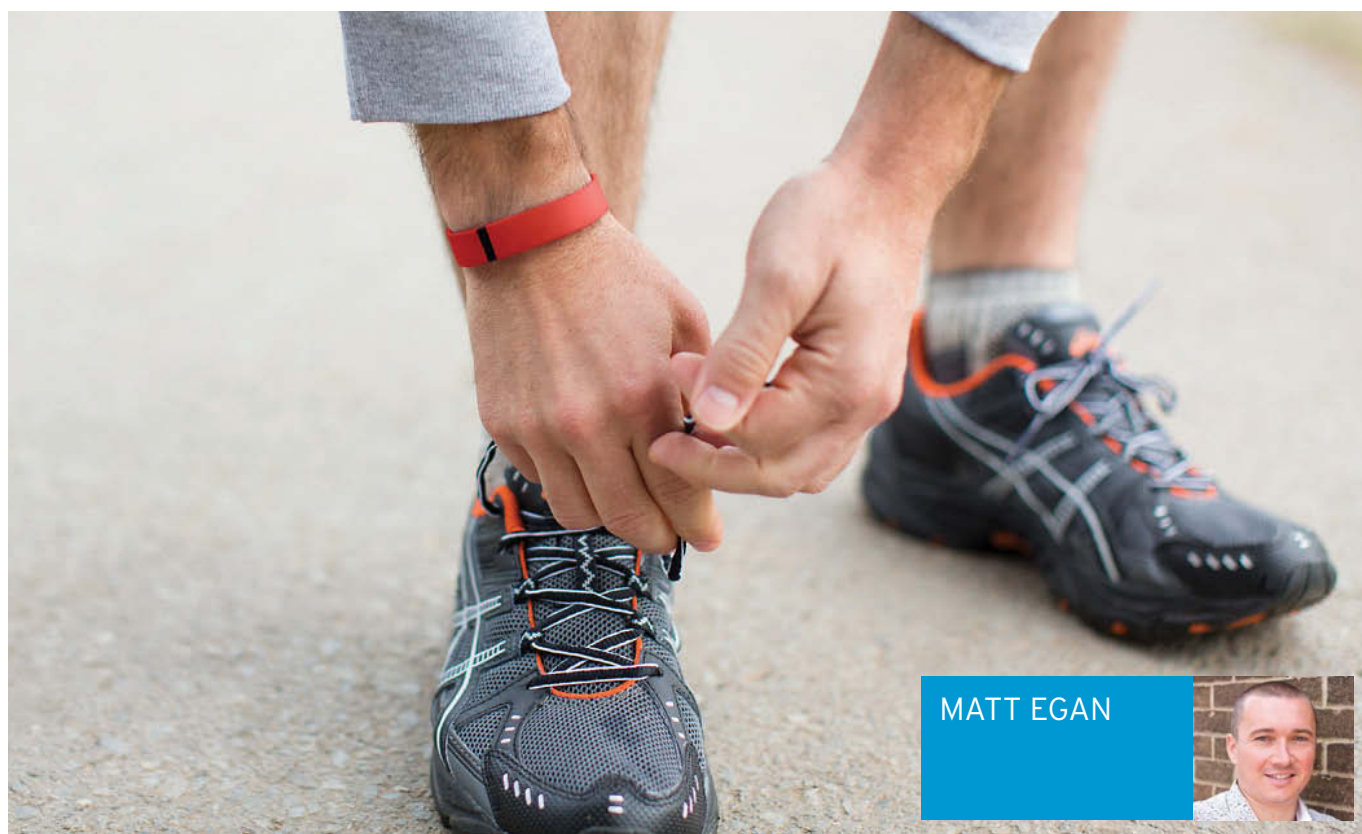
You don't need anything newer than an iPhone 4 to enjoy excellent performance and features. But if you have a three-year-old iPhone 4 you are probably gasping for a new handset. In part this is because manufacturers limit new features and software to newer handsets, without forward compatibility. But it's also because components such as battery cells degrade in such a way that three years is really too long to run a smartphone handset.

It doesn't need to be that way, however.

It's just that having lost the PC-upgrade cycle hardware makers are loathe to stop smartphone users changing handsets every year or two. Telcos have worked out smart ways of tying us into upgrading via contracts, and we as consumers seem to like the thrill of a new phone every year. Meanwhile smartphone resale values remain surprisingly high, because customers further down the financial pecking order are making similar choices with still perfectly functional, older specifications.

It's a trick the tech world hasn't been able to reproduce in other categories. A small percentage of people will upgrade their iPad every time a new one comes out, but in nothing like the same volumes as they do for smartphones. And although activity trackers are starting to proliferate and bleed upward into smartwatches, it will be fascinating to see if wearables enjoy a similar commercially successful churn.

That's certainly what the manufacturers want. Smartwatches are likely to be tied into specific smartphones, so that if you change phone you must also change watch. It doesn't have to be that way, but it certainly benefits everybody but the consumer to make it so. ☒



MATT EGAN



# Activity trackers, your regular tech Trojan horse

Smartwatches are coming. Don't take my word for it - look at your neighbour's wrist

I have written before about why the smartwatch format makes sense. In short, smartphones offer us a wealth of information accessed through a single device, wherever we are. But in doing so they have reduced us all to the status of Victorian gentlemen, forced to pull out a pocket watch every time a passer by wants to know the time. With smartphones we can contact, learn, watch, listen and publish wherever we are, but we have to delve into our pockets to do so. A well-designed smartwatch, like the wristwatch from which the format derives, places in the most practicable place a display via which we can access all that lovely info.

But smartwatches are both expensive, and conspicuous. And also conspicuously expensive. It'll be a long time before people consider a £300 or £400 digital watch a must-have purchase, unless they want to be seen to carry the latest gadget.

Which is not to say that it won't happen, nor that it isn't happening now.

I was working in the US earlier this year, and couldn't help but notice how many

people were wearing wrist-mounted gadgets. Not smartwatches, as such. Instead activity trackers. Quantifiable-self fitness devices, designed to inspire and cajole the wearer into burning more calories. Even back in April they were present in the UK, but surprisingly popular in the US.

Fast-forward to August in London and an interesting thing is happening.

Yesterday I was in a meeting. Don't worry I won't bore you with the details, beyond this: I was present to witness an argument about the best activity tracker. With 15 people in the room, seven of them were wearing Fitbits or Jawbones, or some other kind of fitness gadget. The lines were drawn pretty much evenly between the Fitbit and Jawbone camps, with me sitting on the fence. (Like the gadget fiend I am, I am currently sporting both the Fitbit One and the Jawbone UP24. So I am twice as fit as you are.)

It's possible my colleagues and I are exceptional. We work, after all, in tech media, and we are based in one of the most affluent and gadget-hungry cities in the world. But

the key to all data analysis is to follow the trend. Half the people in that room now wear activity trackers. Few, if any, of them did so at the turn of the year.

I'd wager that health and fitness is the not the only factor here. Rather, a new type of gadget becomes a must-have or a strong-want the more you see other people carrying it. Earliest adopter begets confidence to the next rank of early adopters.

What I find interesting is the effect this may have on smartwatch adoption. If we grow accustomed to people wearing dumb devices on their wrists - and most people I know wear activity trackers and a traditional timepiece - we will be more open to buying and wearing full smartwatches. And we should expect activity trackers to get smarter and reach up to high-end smartwatches, in the same way that Amazon stretched its Kindle e-readers to become low-end Kindle Fire tablets.

I'm not convinced that smartwatches will proliferate, but the way that activity trackers are increasing in popularity is making their future increasingly more secure. ☒



# 'Delivery' is the most important word in tech

MATT EGAN



Rubbish products don't succeed. But neither do good products, if you can't deliver on a promise

I recently took delivery of my brand-new OnePlus One phone. Very recently. Too recently in fact. This has been well documented elsewhere, but the OnePlus One phone is a brilliant piece of tech that is damned hard to get hold of here in the UK. In my case there was a gap of almost three weeks between me parting with money online and finally receiving my handset. In the intervening days there were a couple of issues, and there was not a great deal of communication, culminating with a text message from the courier asking me to pony up an additional £31 to pay import duty before I could get my OnePlus One.

This was okay for me as a tech journalist trying to get in a product to review, but would be not so great if you are a consumer waiting for a new phone. In fact, in that circumstance I'd expect that most people would simply cancel the order.

This is not to make a dig at OnePlus by the way. Support staff are chasing down my £31 as we speak, and the phone is great. But it illustrates a critical point.

As consumer technology has become commoditised, and virtually all computational devices good enough for purpose, the ability to get a product in the hand of the consumer becomes paramount. We live in a world in which people expect their desires to be immediately sated. If you buy something online, you want it tomorrow at the latest.

## Tim Cook - only the logistics guy

Don't believe me? Consider Apple. Yes, Apple designs and builds great products. It markets them (and itself) beautifully. But Apple is also brilliant at managing its levels of stock, and getting the product you specified into your clammy mitts within hours of you making a purchase.

This latter aspect was critical to Apple's post-Steve Jobs' return success. Yes, Jobs, Ive and the rest created amazing

category-changing products such as the iPod, iPhone and iPad. But it was Tim Cook who made the business aspects work.

Prior to joining Apple, Cook worked for both IBM and Compaq in fulfilment and operations roles. He joined Apple as a senior vice president of Worldwide Operations, and before he was CEO he was chief operations officer. He's the operations guy. The man who looks after logistics. He can be credited with changing Apple from a brilliant but slightly shambolic company into the ruthless corporate machine that can build hundreds of thousands of iPads without the outside world getting a glimpse of what is an iPad.

He's the guy who makes sure that Apple never has more than a few days' worth of unsold inventory. He's the reason that Apple makes a billion dollars a quarter. And that's why the Steve Jobs wanted Cook to follow him as CEO.


## Amazon - only a book store

To find a company-wide example of the importance of delivery, you need look only as far as Amazon.

Amazon was an online book store, remember. But really, from day one, Amazon was about moving product from A to B. Jeff Bezos set up Amazon in Washington DC so that the fewest

possible number of his customers would have to pay additional taxes from buying a book within their home state. He was already thinking about logistics. But the genius of Amazon as it grew in the US and beyond was the ability to get you the things you wanted, as soon as possible.

The UK is only a small country, but isn't it staggering that you can buy just about anything from Amazon on one day, and have it at your door the following morning? Logistics is what Amazon excels at, and it's why it has such a huge business. The Kindle, Kindle Fire and Fire Phone ranges builds from this. Yes they are e-readers, tablets and smartphones, but to Amazon they are simply another way of getting virtual products to you. Immediately. (They are also another way of you ordering physical products, which you can receive tomorrow.)

Rubbish products don't sell, but great products rarely succeed if the logistics and operations aren't taken care of. Delivery is not just important, it is the most important word in tech. 



# 5 REASONS TO BUY AN ELECTRIC CAR AND 5 REASONS NOT TO

Jim Martin is intrigued by the potential for electric cars, but isn't sure they are for everyone

**I** have driven only a couple of electric vehicles, but it really doesn't take long to get used to the absence of engine noise. In fact, it's blissfully silent and much more relaxing than living with a combustion engine.

Sure, there's more planning involved in longer trips because of the limited range and the need to find a suitable recharging point, but you soon get used to that, too.

At the moment, electric cars aren't suitable for everyone, but if you commute a relatively short distance every day, the savings quickly mount up.

## 5 REASONS TO BUY AN ELECTRIC CAR

### 1 Cheap to run

Obviously, the number one reason to switch from burning fossil fuels to an electric motor is running costs. You already know it costs a small fortune to fill a tank with diesel or petrol, but the cost to recharge a battery is

much lower. A full battery won't give you the same range as a tank of fuel, but when you compare like for like, an electric car such as the Nissan LEAF could cost as little as 2p per mile, compared to the average of 16ppm for a petrol or diesel car. Yet another longer-term benefit of all-electric cars is that you don't have to pay for a tax disc each year.

### 2 Eco-friendly

Purely electric vehicles - as opposed to hybrids which still have a combustion engine as well - have zero emissions, or as near-as-dammit when you can't rely on charging from green sources of electricity. Less CO<sup>2</sup> is good for the environment (particularly in towns and cities) and your health.

### 3 Lower maintenance costs

Without a clutch, gearbox and other mechanical engine parts, maintenance costs are anything from 20- to 40 percent lower for an electric vehicle. Naturally, there are still servicing costs, but it's yet another factor that makes EVs easier on your wallet.

### 4 A quiet, comfortable ride

With no engine noise, electric vehicles offer a very quiet ride, which is considerably more relaxing and comfortable than a noisy engine and exhaust, plus the associated vibrations and rumbles.

### 5 Fewer worries about ever-increasing fuel prices

A decade ago, we were all furious that petrol had broken through the £1 barrier. Now, we'd be over the moon if a litre of Unleaded cost that much. Prices are only going one way, but although electricity

RENAULT ZOE







prices may rise, EV owners won't feel the pinch anywhere near as much.

## 5 REASONS NOT TO BUY AN ELECTRIC CAR

### 1 Expensive to buy

Even with the government's now-extended Plug-In Car Grant, which offers 25 percent off the list price (up to £5,000), electric cars are expensive. The entry-level Nissan LEAF Visia, for example, costs £16,490, and that's after taking the grant into account. Plus, that's the cost when you lease the battery for £70 per month. Buying a LEAF and battery outright will set you back a minimum of £21,490 – £5,000 more for the equivalent model. Renault's Zoe is one of the cheapest EVs, but even the entry model costs £13,995, again plus £70 per month for hiring the battery.

### 2 Limited range

The best electric cars have a much more limited range than any petrol

or diesel car. Typically you can expect around 100 miles, but this is affected by temperature: the colder it is, the less range you'll get. Of course, using climate control, the stereo and other electrical systems will reduce range yet further

### 3 Recharging time and availability

Although it's possible to charge an electric vehicle to around 50 percent of its capacity in 30 minutes, this requires a 'rapid' charging station and corresponding socket on the car itself. If you're charging at home – the most common situation – then you can expect it to take around eight hours, depending on the vehicle and charging socket.

Compared to the number of petrol stations, recharging points aren't nearly as prevalent. This means planning your journey and checking that your intended charging station is actually working. Then there's the worry that charging bays may already be in use when you arrive. Others might leave their EVs charging for hours.

### 4 Battery lifespan

There's uncertainty over how long the lithium ion batteries will last, and how quickly their capacity will diminish. This will clearly depend on how much they're used and how old they are, but it could well affect residual values when it comes to sell your EV, since replacing a battery costs thousands of pounds – more than replacing an engine in a car. Battery warranties are therefore an incredibly important factor when buying an EV, whether new or used.

### 5 You live in a 7th floor flat

In the UK, a surprisingly large proportion of people have off-road parking or garages. However, there are still plenty of homes that don't. It isn't only a problem for those who live in flats: houses in town or city centres often lack a driveway or any kind of parking.

To own an EV, you really need to be able to park close enough to plug in and recharge overnight. Trailing a cable across a pavement isn't ideal, and may even land you in court when a neighbour trips over it. ☒

# Microsoft's all or nothing bet on Windows Phone

Microsoft is making tough but necessary decisions. [Chris Martin](#) reports



NOKIA LUMIA 625

**A**s we report on page 8, Microsoft recently announced a major restructuring involving 18,000 job cuts showing that the firm is happy to go all or nothing on the Windows Phone mobile operating system. The company finalised its acquisition of Nokia in April and it hasn't taken long for things to change dramatically. In gaming terms, the Redmond-based tech giant has made a 'big play' and it better hope it's made the right one.

The announcement detailed that most of the job cuts were to be on the Nokia side of the business – a whopping 12,500 across professional and factory positions. Most will be made by the end of the year, with full completion expected by 30 June 2015. Microsoft's new CEO, Satya Nadella says the huge change is difficult but necessary.

Not only is Microsoft downsizing its Nokia business, it's axing the Android-powered Nokia X smartphones – which we were all surprised about in the first place. On top

of this, The Verge reports that investment and development of Series 40 Asha feature phones is being put into 'maintenance mode', with services to support existing devices to be shut down over the next 18 months.

"Whereas successful hardware was the goal at Nokia; delighting our customers with Microsoft platforms, services and applications through our hardware is our goal at Microsoft," explained Jo Harlow, head of the company's phone business.

All of this means that Windows Phone is the firm's sole hope in the smartphone market going forwards. If Microsoft were in a casino, it would be putting all its chips on one colour at the roulette table or going all in on one hand in a poker game.

The firm has taken a gamble, so the question is: will it pay off? Changes as big as these will take time to come into place, so we're not going to find out quickly. Windows Phone has improved a lot recently, particularly with the 8.1 update.

The hardware has also been upgraded significantly, helping with the fight against the iPhone and flagship Android handsets.

"To win in the higher price tiers, we'll focus on breakthrough innovation that expresses and enlivens Microsoft's digital work and digital life experiences," said Nadella.

Windows Phone has gained some traction in the mobile market, with more than 10 percent market share, and although these changes are drastic, they've got to be Microsoft's best chance of competing with Apple and Google.

A while ago, I wrote a blog on how Microsoft should simplify its strategy, so sticking to the Windows ecosystem is surely the way to go. Nokia Android phones made no sense from the beginning and feature phones are a thing of the past.

Microsoft is making tough decisions, and focusing only on Windows Phone. It's painful, but the only way that the company can succeed in the mobile space. ☒



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# Thin, light and wire-free: Intel's vision for your next PC

Intel's Broadwell chips will result in PC-replacement tablets thinner than the iPad. [Agam Shah](#) reports

**I**ntel wants your future laptop to be thinner than an iPad and, like the iconic tablet, wire-free. And it should cost less, too.

The company is developing chips and wireless technologies to meet those goals, with the first fruits of that development available starting this coming year-end, said CEO Brian Krzanich on an earnings call in which he discussed the company's vision of future PCs. About 600 million PCs worldwide are more than four years old and due for upgrades, so the development efforts come at a fortuitous time.

Tablets thinner and lighter than the iPad that could be used as full PC replacements will be on store shelves by the end of this year, Krzanich said. Laptops and desktops with the faster and more power-efficient 'Broadwell' processor will be widely available in the first quarter next year. Further in the future, Intel sees Chromebooks with mobile broadband connectivity and computers that are wire-free.

Paper-thin PC replacement tablets will have long battery life, high-resolution screens and offer the fast performance of Core processors, Krzanich said. The devices will have Intel's new Core M chip, based on the forthcoming Broadwell architecture.

A reference tablet codenamed 'Llama Mountain', which is 6.8mm thick and weighs 550g, is one example of this new system type. The 10in tablet has a 2560x1600-pixel screen and turns into a laptop when attached to a keyboard dock. The dock also has cooling technology to crank up the tablet's Core M CPU performance.

Asus later this year will ship the Transformer T300 Chi dual-function device (pictured), which has a 6.8mm detachable tablet. It will also have a Core M chip.

Anticipation is growing for Broadwell, which will be in a wider range of low-priced and performance PCs in the first quarter of next year, Krzanich said. Intel typically updates chips every year, but the current Haswell chips have been around for one and a half years and have upset typical PC upgrade cycles.

Looking beyond Broadwell, Intel will release the successor 'Skylake', which could also be in PCs next year. With Skylake, Intel



hopes to disconnect wires from PCs with integrated support for wireless docking, charging, display and data transfers. Intel previewed the wire-free technology at June's Computex tradeshow, with computers not needing power cords, display connectors and peripheral cables.

A handful of PCs with Skylake could be available next year, but the chip could start shipping in volume in 2016, said Dean McCarron, principal analyst at Mercury Research.

"The environment's not that competitive, so it's more likely Intel would take advantage of the time and let Broadwell have the normal product life," McCarron said.

Broadwell and Skylake chips will improve graphics and introduce DDR4 memory to PCs for faster internal data throughput. The chips will be made using the 14-nanometre (nm) process, which will bring faster performance and more power efficiency than current 22nm chips.

Intel also wants to bring mobile broadband connectivity to Chromebooks, although no timeframe for this was provided

by Krzanich. Right now, Chromebooks with Intel chips largely don't have mobile broadband, but the chip maker wants to put its modem in the laptops so the internet is more accessible.

"Chromebooks are best when they are connected," Krzanich said, adding that those requirements will drive use of modems in laptops.

A majority of Chromebooks currently have Pentium and Celeron chips based on Haswell and low-power Bay Trail microarchitectures. Intel is due to release new Pentium or Celeron chips codenamed 'Braswell', which will go into Chromebooks.

Windows tablets with Intel's Atom chip codenamed 'Cherry Trail', which will succeed current Bay Trail Atom chips, will also be on store shelves by the end of the year. Android tablets could be added to the mix next year.

More technologies currently in research are also expected to reach computers starting later this year. Intel is developing 3D webcam technology that will recognise moods, scan 3D objects and make storytelling more interactive, for example. ☒





# Is it still worth buying an iPhone 3G or 3GS at a good price?

**Matt Egan** offers some practical old-iPhone buying advice

**A**lthough Android and Windows phones are every bit as good as iPhones, and these days tend to offer better value, for many smartphone users the word 'iPhone' remains a potent label. For a time 'iPhone' was to high-end smartphone as 'Hoover' is to vacuum cleaner. And that means that there is still good resale value in older iPhones, right back to the iPhone 3G and the iPhone 3GS.

We examine this, finding out how much it costs to buy an iPhone 3G and iPhone 3GS, and then assessing what sort of value that offers in the smartphone world of 2014.

## iPhone 3G price in UK

Some research online shows that you can pick up a used or refurbished iPhone 3G for around £50- to £100. Some stores will charge you around £100- to £150 for a new SIM-free 16- or 32GB iPhone 3G. We do have to ask, however, where are these 'new' iPhone 3G's coming from? This phone was discontinued in 2009, after all.

It's also worth noting that there is no solid accepted price for the iPhone 3G, so shop around for a bargain and don't accept the first deal you see.

Other things to consider: you could buy a brand-new Lumia 520 or Moto G for £80 or £150 respectively, so you'd have to really want an iPhone to shell out similar amounts for a six-year-old-spec phone.

## iPhone 3G display

Age does not treat well smartphone displays. The iPhone 3G sports a 3.5in TFT capacitive touchscreen with 16M colours. It has what now seems a paltry 320x480-pixel resolution. That makes for a 165ppi density. Compared to similarly priced modern budget phones, this is not an impressive display.

## iPhone 3G performance

Performance has moved on (a lot) since 2008. The iPhone 3G sports a 412MHz ARM 11 chip and just 128MB of RAM. This would be laughed out of town in a new phone for 2014 - the £80 Moto E has a dual-core 1.2GHz Cortex-A7 and 1GB of RAM.

You can see the effect in the iPhone 3G's performance. A single-core Geekbench 2 score of 140 points would look good on a 2014 phone only with an extra 0 on the end.



One other hardware specification that puts the iPhone 3G into perspective: you get a 2Mp camera. That was impressive in 2008.

## iPhone 3G software, compatibility

Here's the real problem with buying an older-generation smartphone. Current iPhones are running iOS 7, and looking forward to the full release of iOS 8. The iPhone 3G came with the original iOS, and was in time upgradable to iOS 4.2.1. To put it bluntly, without jailbreaking your iPhone 3G you will be able to install virtually no apps.

It's also worth pointing out that Apple's proprietary connector has changed since the iPhone 3G, too. There's no Lightning cable which, perversely, is good for a huge number of older peripherals that would otherwise require Lightning adaptors. But it's not so great if you want to pair your iPhone with newer, current devices and cables.

## iPhone 3G: what we said in 2008

"The iPhone 3G improves on the original iPhone's audio quality, offers access to a faster data network, and sports built-in GPS. You'll also be getting in on the exciting new world of third-party software written for the iPhone. And business users will appreciate the iPhone's Exchange syncing features.

"If you're an existing iPhone user, the fact that your current phone will be able to take advantage of all the iPhone 2.0 software features, including Exchange syncing and third-party applications, blunts some of the excitement of this upgrade. If you live in an area with a 3G network and find yourself chafing at the comparatively slow speeds of the EDGE network all the time, it's probably worth the upgrade. But if you don't mind the internet experience on your current phone, you'd be better off installing the 2.0 software and holding on to your existing device."



Overall, then? I wouldn't be shelling out more than £50 for an iPhone 3G. And even then it would be mainly for curiosity value, or to use it as an iPod. Now let's look at the iPhone 3GS.

### iPhone 3GS price in UK

We can find the iPhone 3GS for sale online for around £130- to £190. These are mostly used or 'refurbished', but again we see some 'new' iPhone 3GS handsets. Intriguing.

As with the iPhone 3G there is no accepted price for these handsets, so shop around to find the cheapest. And again, note that you could buy a brand-new Moto E, G or Nokia Lumia 520 for between £80 and £150. So how does the five-year-old 3GS compare to current budget phones?

### iPhone 3GS display

Stop me if this sounds familiar: the iPhone 3GS' display is a 3.5in TFT capacitive touchscreen with 16M colours. It is a 320x480 display with a pixel density of 165ppi. Not brilliant, as you would expect.

### iPhone 3GS performance

Things have improved a little from the iPhone 3G to the iPhone 3GS on the performance front. You get a Cortex-A8

chip now running at a faster 600MHz. This is paired with a still less-than-respectable 256MB of RAM. Again the benchmarks show how far we have gone, with a Geekbench 3 (single core) score of 150, and Geekbench 2 score of 288. Don't expect super-fast performance from a five-year-old phone.

Other improvements include the upgrading of the camera to 3.5Mp.

### iPhone 3GS software, compatibility

Again you are restricted to a Mini- rather than Micro- or Nano-SIM. The iPhone 3GS first came with iOS 3, but is upgradable to iOS 6.1.3. It can't iOS 7, so lots of apps won't work. But you've got a better chance with the iPhone 3GS than you do with the iPhone 3G, which will run very few apps.

And again, there is no Lightning cable - good for older peripherals, but not so good for newer devices and cables.

### iPhone 3GS: what we said in 2009

"The iPhone 3GS addresses most of the fundamental weaknesses of the previous models, adding raw speed, voice-activated phone- and music navigation, an improved autofocus camera, and video recording.

"With two major revisions in the past year, the iPhone platform has progressed a long


way. Beyond the variety of third-party apps, the base system has added copy-and-paste support; support for Microsoft Exchange calendars, contacts, and email; built-in voice recording; and search capabilities.

"All of it works together to produce a more refined iPhone that first-time buyers will love and upgraders will appreciate.

"If you're upgrading from the iPhone 3G, you'll appreciate the speed, although unless you qualify for a discount or have a friend or family member to give your iPhone 3G to, the upgrade price might make you consider waiting for what Apple's 2010 iPhone might have to offer.

"Users of the original iPhone will be floored by the speed of the phone and of the 3G wireless network, although they may find the phone's shiny plastic back a step down from the original, elegant brushed-aluminium edition.

"If you've never had an iPhone before, but are considering the purchase of a smartphone for the first time, you will not find a better internet-connected phone than the iPhone 3GS."

Or, at least, that was the case in 2009. These days we'd say that there is much better value in the Windows Phone- or Android worlds. 

# Apple-IBM partnership may kill BlackBerry

**Chris Martin** sees Apple's deal with IBM as critical for the ailing BlackBerry

**A**pple recently announced a partnership with IBM to 'transform enterprise mobility'. And it could be the final nail in the coffin for BlackBerry.

The partnership between the two heavyweights looks set to boost the adoption of iPhones and iPads in the enterprise market - a key area for BlackBerry.

For a while the BBM instant-messaging service made BlackBerry's smartphones trendy and popular with younger users. Today, the only reason anyone uses a BlackBerry is for business. On the rare occasion I spot a BlackBerry owner on my daily commute, none has looked as though they are enjoying using a tired and aching-to-be-retired device with a tiny screen and a physical keyboard.

BlackBerry OS market share has dropped from 13.6 percent in the first quarter of 2011 to just 0.5 percent in the same quarter of this year, according to research firm IDC. iOS has remained popular, while Android now holds more than 80 percent.

Apple's deal with IBM means we'll see a rise in iOS adoption, which will result in -


sooner or later - BlackBerry losing grip of the tiny market share it has left.

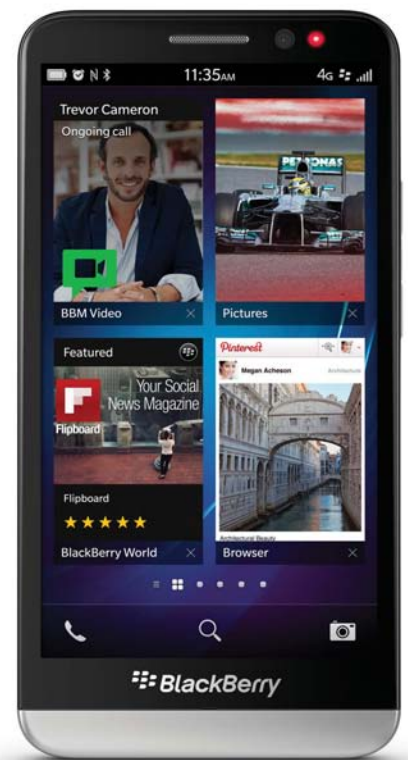
IBM will develop and launch 100 industry-specific enterprise solutions, including native apps made from the ground up for both iPhone and iPad. Apple will also launch a new AppleCare service specifically tailored to enterprise customers.

Furthermore, IBM will sell iPhones and iPads with these solutions to its business clients worldwide. Its MobileFirst Platform for iOS will deliver analytics, cloud storage, fleet-scale device management, security and integration.

The partnership will prove a force to be reckoned with, and the bosses at BlackBerry should be shaking in their boots.

It's not just my opinion either. BlackBerry's share price has already fallen 4.7 percent to \$10.77 on Nasdaq and 4.3 percent to C\$11.62 on the Toronto Stock Exchange.

Think about it for a second; if your company offered you a BlackBerry or an iPhone to use for work, which would you choose? 





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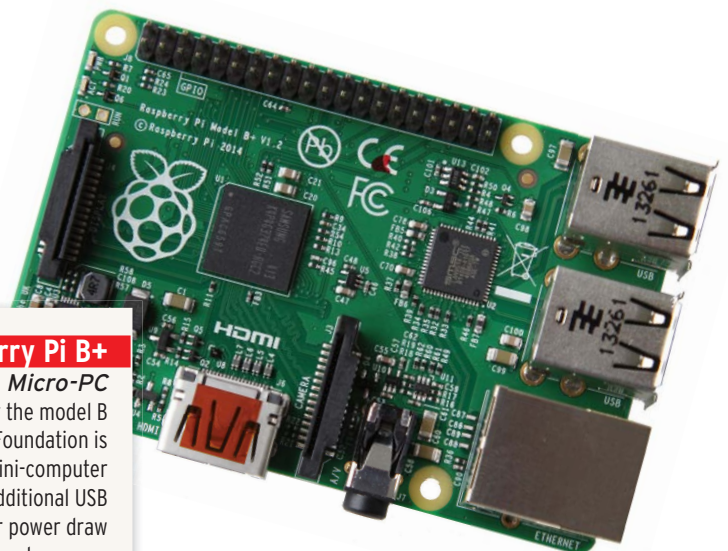
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CHRIS  
MARTIN**Samsung Galaxy S5 mini** <<  
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### Parrot Rolling Spider <<

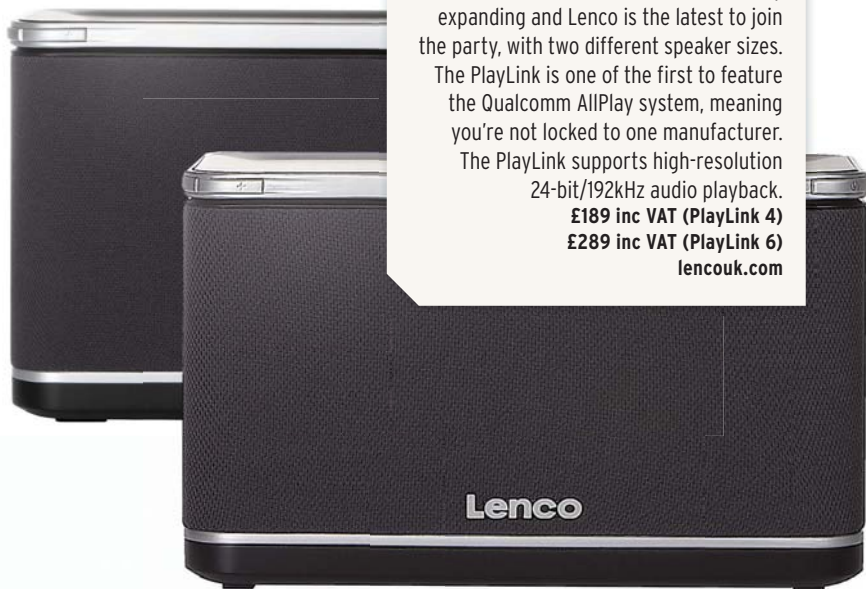
#### Mini-drone

Until now Parrot's drones have been big and expensive. The Rolling Spider mini-drone weighs just 55g and can be controlled from a free mobile app. Optional wheels let the drone go up walls and race across ceilings.  
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### >> Lenco PlayLink 4 & 6

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[lencouk.com](http://lencouk.com)



### Sony Xperia C3 <<

#### Smartphone

The selfie (self-portrait) is now an actual thing and has its own dictionary entry. And for fans of the selfie Sony is on hand with the 'world's best selfie smartphone', the Xperia C3. It features a 5Mp front-facing camera and an LED flash. It also has a 5.5in HD screen and a 1.2GHz quad-core processor.  
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15.6in (3200x1800) gloss IPS touchscreen display; 2.2GHz Intel Core i7-4702HQ (3.2GHz Turbo); Intel HD Graphics 4600 & nVidia GeForce GT 750M (2GB RAM); Windows 8.1 (64-bit); 16GB DDR3L RAM; 512GB mSATA SSD; 802.11b/g/n/ac; Bluetooth 4.0; 1x HDMI 1.4; 1x Mini DisplayPort 1.2; 3x USB 3.0, 1 USB 2.0; SDXC card slot; 720p webcam/microphone; 1x headphone socket; 91Wh lithium-ion battery; 372x254x18mm; 2.01kg

Build: ★★★★★

Features: ★★★★★

Performance: ★★★★★

Value: ★★★★★



LAPTOP

## Dell XPS 15

It might not have the eye-catching convertible design of its stablemate, the flipping-screen Dell XPS 12 ([tinyurl.com/L9L7quo](http://tinyurl.com/L9L7quo)), but the 3200x1800 display of the latest version of the XPS 15 ensures that it provides plenty of visual appeal of its own. With a weight of just 2.01kg, it's also one of the lightest 15in laptops currently available.

The partial-aluminium casing and Retina-style screen of the Dell XPS 15 prompts inevitable comparison with Apple's Retina MacBook Pro ([tinyurl.com/p4zb853](http://tinyurl.com/p4zb853)), and its weight and 18mm thickness are also virtually identical. However, the XPS 15 has some ideas of its own and outguns the MacBook Pro in a number of respects.

Dell's laptop makes a good impression even before you turn it on. The aluminium casing is both light and sturdy, and provides good support for the 15.6in screen. The keyboard, trackpad and surrounding panels all have a pleasant 'soft-touch' matt-black plastic finish that looks smart and feels very comfortable to use.

The slimline design forsakes an internal DVD drive, but few people will complain about that if it means the XPS 15 can lose some heft compared to most 15in laptops. It's a shame there's no ethernet port for a wired network connection, but one of the three USB 3.0 ports and one USB 2.0 could accept an adaptor. Both HDMI and Mini DisplayPort provide good connectivity for external monitors.

However, it's Dell's 'QHD' screen that's the real eye-opener. With a resolution of 3200x1800 pixels and 235ppi, it has a higher resolution than the Retina display of the MacBook Pro, at 2880x1800 and 220ppi. Numbers aside, it looks terrific, as the IPS panel is very bright and colourful, and strong contrast ensures that blacks look very black, while the pristine white backgrounds of many web pages help accentuate how dull the colours are for many other laptops.

The screen is touch-sensitive, too, although we found ourselves reluctant to mar the brilliant and shiny screen with our fingerprints.

The bigger problem with that high-resolution display is that many



Windows programs don't work properly. The adjustable scaling technology in Windows works well enough on the main desktop, allowing you to adjust the size of text and icons to enhance visibility. But it doesn't always help with interface elements within individual applications, which remain at the screen's native resolution.

This means that toolbars, icons and buttons in some third-party applications appear so small that they're almost unusable. And, ironically, it's often graphics applications such as the Adobe Photoshop Elements program we tried that suffer the most here, because of their reliance on graphical-based tools.

That means you may find yourself switching to a lower resolution for tasks such as photo- or video-editing; which rather defeats the point of paying for the QHD display in the first place. That's Microsoft's fault rather than Dell's, although it's you as the latter's customer that has to put up with it.

There are areas where the XPS 15 provides better performance and value for money than its rival the MacBook Pro with Retina display.

There are two versions of the Dell XPS 15 currently available, with prices starting at £1,249 for a model with a quad-core Intel Core i7 running at 2.3GHz, 16GB memory and an nVidia GeForce GT 750M handling graphics duties.

Note that the model we tested had a 2.2GHz Intel Core i7-4702HQ; Dell's website now lists a 2.3GHz Intel Core i7-4712HQ, after Intel's running processor upgrade.

Our review model included a 512GB solid-state drive, which bumped this price up to £1,499. That compares favourably to a starting price of £1,699 for the 15in MacBook Pro, which has a 2GHz processor,

8GB of memory and 256GB solid-state storage. This entry-level model of Apple's notebook also relies on Intel's Iris Pro integrated graphics rather than a discrete GPU.

Lab performance of the Dell is good, with a score of 5833 points in the general-purpose PCMark 7. This suggests that the XPS 15 can provide desktop-PC levels of performance for a wide range of software.

Performance in the Home and Works suites of PCMark 8 wasn't quite so strong, but scores of 2699 and 2800 points respectively are still solid enough for all but the most demanding of tasks.

It can handle a fair bit of gaming action too, easily breezing to 68fps when running our Stalker: Call of Pripyat casual gaming test at 1920x1080 resolution.

We tried Batman: Arkham City at the full 3200x1800 resolution - which looked terrific, but only gave us 21fps. Dropping down to 1920x1080 allowed the XPS 15 to hit a smooth 50fps even with graphics details set to High.

Battery life is disappointing. Dell quotes a life of 'up to 11 hours', but in our usual test we only just managed five hours of streaming video with the XPS 15.

Apple's entry-level 15in Retina MacBook Pro lasted more than 50 percent longer in the same test, running for eight hours, 14 minutes.

### Verdict

Battery life is disappointing, especially as the XPS 15 is intended as a lightweight Ultrabook, although as a desktop replacement system, it ticks more of the right boxes. It provides outstanding display quality and high-end performance at a competitive price, while still being slim and light enough to slip into a bag for the occasional business trip or weekend away. **Cliff Joseph**



**£599** inc VAT**Contact**■ [asus.com/uk](http://asus.com/uk)**Read more**■ [tinyurl.com/Lhexq8k](http://tinyurl.com/Lhexq8k)**System requirements**

15.6in (1366x768) TN matt display; 1.7GHz Intel Core i5-4210U (2.7GHz Turbo); Intel HD Graphics 4400 + nVidia GeForce 820M (2GB); Windows 8.1 Pro (64-bit); 8GB DDR3L RAM; 1TB hard drive (5400rpm); gigabit ethernet; 802.11b/g/n; Bluetooth 4.0; 1x HDMI 1.4, 1x VGA; 2x USB 3.0, 1x USB 2.0; SDXC card slot; Super Multi DVD drive; 720p webcam/microphone; 1x headphone socket; 37Wh lithium-ion battery; 380x251x31.7mm; 2.3kg

Build: ★★★★★

Features: ★★★★★

Performance: ★★★★★

Value: ★★★★★

**LAPTOP****Asus X550LDV-X0610H**

The X500 range from Asus is designed to provide affordable laptops at 'everyday' prices. The pricing is probably helped by using cheaper chips – most of the models currently listed on Asus' website are using last-generation Intel Ivy Bridge processors from 2012.

The X550LDV wasn't listed on the company's site at the time of writing, but is one of the first to step up to the newer Haswell processor line. It's a little more expensive than some of its predecessors at £599, but it provides solid performance for a laptop in this price range.

The Asus is housed in the same chassis as its predecessors, with a 15.6in screen and a built-in DVD drive that bulks it out to 31.7mm thick and a weight of 2.3kg.

The plastic casing is sturdy, and the stencilled black-and-grey panels look smart enough, but it does have a bit of a cheap-and-cheerful feel to it. Most notably when you press the trackpad buttons – you can see the plastic surface of the trackpad bending down at the corners.

The keyboard feels a bit lifeless, too, with little travel on the keys, but it's spacious and firm enough to let you type at speed when you need to.

**Performance**

As we mention above, one reason the X550LDV is a little more expensive than previous models in the range is that it includes a discrete nVidia GeForce 820M graphics processor. That joins a dual-core Intel Core i5 processor running at 1.7GHz, and a healthy 8GB of memory and 1TB hard disk.

That combination produced a score of 3036 points when running



the general-purpose PCMark 7 benchmarks, which is about as good as you're likely to get from a laptop equipped with a hard drive rather than a high-speed solid-state drive.

Performance in the PCMark 8 Home and Work suites was equally solid, at 2419 and 2760 points respectively, so the X550LDV will be perfectly capable of acting as a workhorse desktop replacement system at home or in the office.

That hard drive is a little sluggish while it's warming up, though. Even with the fast-start option in Windows 8 the laptop took 20 seconds to boot, followed by another 20 seconds of cursor-spinning before we could start launching applications to get down to work.

But once it's up and running, the X550LDV responded quickly and smoothly, and wakes from sleep in just two seconds as Asus claims.

It can even handle some casual gaming action, too, thanks to those GeForce graphics. The 820M is very much a budget option, but it still manages a smooth 57fps when running *Stalker: Call Of Pripyat* at 1280x720 resolution.

For a more demanding test, we fired up *Batman: Arkham City* and saw a speed of 21fps when running at the laptop's maximum resolution of 1366x768 and High graphics settings. However, turning DirectX 11 off and dropping to Medium graphics at 1280x720 allowed it to hit a more playable 32fps.

That sort of performance won't impress gamers, but it's not bad for

£599 and means the X550LDV can cope with casual gaming, as long as you don't need nice rendering.


**Battery life**

Battery life wasn't bad either, giving us five hours, 15 minutes of streaming video with its integrated graphics. The size and weight of the X550LDV means that it's probably not going to spend much time on the road or in a backpack, but it will let you watch a couple of films at home or on a plane without needing to recharge.

Our only real complaint is the lacklustre screen. The 1366x768 resolution is acceptable at this price, and the glare-reducing matt finish is a welcome feature. However, viewing angles are quite limited – about 90 degrees both horizontally and vertically – and poor contrast means that colours lack crispness.

It's adequate for web browsing and streaming video, but if you're not interested in gaming, then you might want to opt for a laptop that uses integrated graphics and spends a bit more on a better display.

**Verdict**

The dull screen is a bit of a let-down, but the X550LDV does provide better performance than most laptops in the sub-£600 category. It's not the most portable of laptops either, but respectable battery life ensures that the X550LDV makes a good desktop replacement system that will earn its keep without breaking the bank.  **Cliff Joseph**





**£289** inc VAT

**Contact**

■ [acer.co.uk](http://acer.co.uk)

**Read more**

■ [tinyurl.com/L3njuqg](http://tinyurl.com/L3njuqg)

**System requirements**

10.1in (1366x768) IPS LED backlight touchscreen; Windows 8.1 (32-bit); Intel Atom Z3745 1.33GHz quad-core; 32GB flash storage; 2GB LPDDR3 SDRAM; Intel HD Graphics; 2Mp webcam; stereo speakers; microphone; 802.11n; Bluetooth 4.0; 2-cell lithium polymer; Micro HDMI headphone/microphone combo jack; Micro-USB 2.0; full-size USB (keyboard dock); microSD card reader; 262x177x8.9mm; 1.117kg

Build: ★★★★★

Features: ★★★★★

Performance: ★★★★★

Value: ★★★★★



**LAPTOP**

## Acer Aspire Switch 10

The Acer Aspire Switch 10 is a tablet/laptop hybrid. It comes preinstalled with Windows 8.1 and can be picked up for £289.

It can transform between four different modes: laptop, tablet, tent and display. The Switch does this with what Acer calls its "Snap Hinge" which, with the help of magnets, clips the tablet to the keyboard dock. It does so easily and the two are unlikely to separate unless you want them to.

This is the Switch 10's main selling point and it works well. The hinge doesn't fold all the way round like Lenovo's IdeaPad Yoga 2 ([tinyurl.com/mtwn8rL](http://tinyurl.com/mtwn8rL)), though, so don't try that unless you want to risk breaking it. Instead, you have to spin the device around 180 degrees before folding it back down on to the keyboard, leaving it upright in display mode or standing the device in tent mode.

However, during testing, we discovered an unfortunate design flaw. When we pushed the screen away from ourselves in laptop mode, the Switch eventually fell over due to the weight of the main tablet section. This perhaps won't occur if you buy the keyboard dock with a hard drive, but we can't say for sure.

The keyboard dock doesn't have a battery to charge the tablet like some hybrids, but does come with an optional 500GB hard drive. It has a USB port on the right-hand side as standard, which is handy for plugging in a mouse or an external hard drive.

The keyboard and trackpad are nothing special; the former makes for fiddly typing due to the diminutive keys, while the latter was quite sporadic during testing.

Overall, the Switch 10 feels a bit chunky but sturdy. The tablet alone is 8.9mm, which isn't bad, but at around 1.2kg when the device is docked to the keyboard is pretty heavy for a 10in laptop.

The build quality of the keyboard dock is cheap and plasticky, but things are better when it comes to the tablet. It feels solid, and although it also uses a certain amount of plastic, the brushed metal rear cover is a nice touch.

The 10.1in screen has good viewing angles thanks to its IPS



panel. The touchscreen display is bright and colours pop nicely. It uses a 1366x768 resolution, which is about right for the price.

Although the display is one of the best features of the Aspire Switch 10, we found the adaptive brightness unpredictable and annoying, so switched it off. We also feel that Acer could have fitted in larger screen due to those fat bezels - 11.6in would fit by our measurements.

Not only would this make watching video and browsing the web much more enjoyable, it would make Windows 8.1 easier to interact with. Luckily, the touchscreen is nice and responsive, though, it's not always easy to accurately hit where you're aiming. On the software front, there's fair amount of added bloatware - mainly Acer's own but also other items like eBay. You can easily uninstall anything you don't wish to keep hold of.

Inside is an Intel Atom Z3745 (Bay Trail T) 1.33GHz quad-core processor and 2GB of RAM. Performance is reasonable and you'll be able to do regular day-to-day tasks such as web browsing and word processing, but don't expect the device to cope with anything remotely strenuous.

### Performance

We measured the Switch 10's performance with PCMark 7 and recorded a result of just 2486 points - somewhat disappointing for a quad-core x86 processor.

Our graphics benchmarks using Stalker: Call of Pripyat yielded a

poor result averaging 10fps over four different tests.

On the battery life side of things, we measured six hours, 15 minutes in our looped-video rundown test - playing an HD quality film over Wi-Fi with the screen set to a comfortable 120cd/m<sup>2</sup> brightness. A reasonable result that means the device should get you through a day of varied use.

There's a choice of 32- or 64GB of internal storage. Our 32GB review sample has only 10GB free out-of-the-box, so it might be worthwhile investing in the higher capacity model or the keyboard dock with a built-in drive. Alternatively, there's a microSDXC card slot on the side of the tablet.

Alongside the microSD card slot are a couple of handy ports. There's a Micro-USB port (not for charging) and a Micro HDMI port. These make it easy to connect other devices to the Switch 10, or hook the device itself to a larger display.

Acer includes a 2Mp front facing camera for video calls and it's refreshing to see front-facing stereo speakers - these are mounted below the display.

### Verdict

Although the Acer Aspire Switch 10 is affordable, it's another hybrid that is neither great at being a laptop nor a tablet. It's both bulky and fiddly. We like the IPS screen and the multi-mode ability thanks to the magnetic hinge. However, the keyboard and trackpad are lacklustre and there's nothing to get excited about in terms of specs and performance. **✗ Chris Martin**

**£178** inc VAT**Contact**■ [benq.co.uk](http://benq.co.uk)■ [Read more](#)■ [tinyurl.com/oo6ec5L](http://tinyurl.com/oo6ec5L)**System requirements**

27in (1920x1080) LCD monitor; 16:9 aspect ratio; 0.311mm pixel pitch; 82ppi pixel density; semi-matt finish; VA technology; LED backlight; 16ms quoted response time; 178-degree viewing angle; stereo speakers; 1x HDMI, 1x HDMI/MHL, 1x D-sub VGA, 1x line in, 1x headphone connector; external power supply; 623x451x191mm; 4.2kg

Build: ★★★★★

Features: ★★★★★

Performance: ★★★★★

Value: ★★★★★

**MONITOR****BenQ EW2740L**

While you can certainly buy cheaper, in the world of the larger 27in monitors, the BenQ EW2740L could be considered a budget model – at around £200 it looks a bargain compared to competing products costing twice as much. We put it through its paces to see if its attractive pricing has resulted in mediocre performance or whether it truly does represent excellent value for money.

It's not usually easy to get excited about a monitor's styling and the EW2740L is no exception. But the slim surround and semi-matt finish to the screen give it a perfectly acceptable appearance.

In common with most budget monitors, the stand allows only the tilt to be adjusted, and the absence of any height adjustment will be pertinent to any user concerned about ergonomics. Another cost-cutting measure is the lack of internal power supply, with the result that you'll have another power brick cluttering the floor under your desk.

The onscreen display (OSD), through which you adjust the monitor's settings, is accessed by a touch-sensitive area on the bezel. We found the menus intuitive and, in addition to all the usual settings, they give you access to several preset modes, including four reduced blue-light settings which, BenQ claims, are good



for reducing eyestrain. We tested the EW2740L using the default settings.

In a change from the usual horizontal configuration, the various connectors are found in a central vertical panel on the back of the monitor. Included here is an analogue VGA connector, two HDMI ports, one of which doubles as an MHL port for Google smartphones, a line-in audio socket and a headphone socket.

The stereo speakers are small and while the audio quality isn't as good as a pair of separate speakers, with bass response being limited, they're fine for general-purpose use.

**Image quality**

The EW2740L uses vertical alignment (VA) LCD technology, in contrast to the more popular TN and IPS found in most PC monitors.

VA is generally accepted as offering a higher contrast ratio, greater viewing angle and improved colour accuracy, but at the expense of a slower response time.

Subjectively, the EW2740L gave a good image when driven either from a Windows PC via HDMI or an Android smartphone via its MHL port. Not all versions of Android support MHL, though, and some Samsung models require an adaptor.

The quoted 16ms response time is acceptable for office type work, web browsing and photography but is, perhaps, marginal for gaming.


We tested various aspects of the monitor's performance with a Spyder4 Elite colourimeter. At 280:1 over a range of brightness settings, the measured real-world contrast ratio, while comparable to lower cost monitors, is disappointing for a VA display.

The maximum brightness was a perfectly acceptable 256cd/m<sup>2</sup> at the 100 percent setting although consistency of illumination across the screen was middle of the road. The measured luminance differed between three percent and 17 percent compared to the centre of the screen, the dimmest area being the bottom-left corner.

The colour gamut was better than most budget monitors, being 77 percent of Adobe RGB and 100 percent of sRGB. Perhaps the most impressive aspect, though, was the 0.84 average reading for Delta-E (lower is better) after calibration, a measure of colour accuracy.

**Verdict**

While the BenQ EW2740L isn't priced or pitched as a top-end monitor, for the budget price its performance is remarkably good. If your requirements are more stringent the figures represent something of a mixed bag.

Photographers will be drawn by the good gamut and the colour accuracy and, while the contrast ratio could be better, this should fit the bill for less demanding users. Meanwhile, the response time is rather poor for serious gamers. If you're just looking for a 27in monitor for general-purpose use, you could do a lot worse.  **Mike Bedford**



**£1,000** inc VAT**Contact**■ [google.co.uk](http://google.co.uk)**Read more**■ [tinyurl.com/mopy4s2](http://tinyurl.com/mopy4s2)**System requirements**

TI OMAP4430 Dual 1.2GHz (ARMv7; 2GB RAM; 16GB memory; InvenSense MPU-9150 (gyroscope, accelerometer and compass); Wolfson WM7231 MEMS mic; Android 4.4 KitKat; 802.11b/g; Bluetooth 4.0 LE; 5Mp camera; 720p video

**WEARABLE TECH**

## Google Glass Explorer Edition 2.0

Google has a good claim to the world's first fully functioning wearable computer with Glass. The latest model - Explorer Edition 2.0 - doubles the amount of RAM available on the original; though, there's no other hardware change.

The tech giant has also developed a companion app called MyGlass for Android and iPhone. Meanwhile developers have been busy creating a range of Glass apps.

It is available in five different colours and the firm has introduced a range of frames for prescription lenses or to work as sunglasses (the frames cost £120 but a pair is included in the price, don't forget to add it when you checkout). These frames open up Glass to those who need lenses, and they may also help normalise what is a head-mounted computer.

The device fits snugly on your forehead by means of a thin metal band that wraps around above your eyebrows and tucks in behind your ears; two curved pieces of metal tips with plastic nibs fit this band snugly on to your nose. Along the right-hand side of Glass is a rectangular strip of plastic that curves above your right eye. In front of your right eye is a prism projector that displays a small screen.

You activate Glass either by tapping on the side or tilting your head back. You can also see the display by looking upwards. It appears in the centre of your vision. During testing, we found the Glass screen to be reasonably clear but see-through. It took a small amount of time to get used to the weirdness of seeing a virtual screen, but within half an hour, we were used to the display.

Google Glass feels light: the bare device (without the new clip-on frames) weighs in at just 36g. We found it comfortable to wear to the point of quickly forgetting Glass was on our head. It also feels sturdy.

### Interaction

There are two primary means by which to interact with Google Glass: voice activated commands, and the touchpad that runs along the right hand side of the frame.

Glass is woken up by tilting your head backwards or tapping the right



side of the frame (the display sleeps after just 15 seconds of inactivity). The screen isn't visible when you look straight ahead, instead you need to glance slightly upwards to view the display. This upward placement enables you to ignore Glass while you're walking around, but view the display when you need it. Google describes it as equivalent to a 25in high-definition screen seen from eight feet away.

The screen appears in a slightly translucent fashion, enabling you to view what is behind the display. It's blurry and while you can watch videos and browse websites, the display is better suited to flashing up snippets of information.

Saying "ok glass" brings up a list of options such as 'Google', 'Get directions to' and 'record video'. The list of default menu items grows as you install more apps. Tilting your head up and down scans through the list, and speaking that option issues a command. Voice commands open the app (or in the case of "take a photo" or "record a video" performs the specific action).

The accuracy of Google's voice recognition is ahead of Siri's by a considerable margin. Glass returns a lot of information directly from search, so you can ask Google what the weather is going to be like, or to perform a calculation and it will speak out the results.

The bone conducting headphone is an interesting addition, and is more practical than using a headset. We found the volume to be extremely quiet, even with the setting turned up to 100 per cent. The built-in audio is fine for alerts and for making a phone call in an extremely quiet area, but with any external noise you'll need to make use of the earpiece accessory.

If you don't want to use voice control, you can access all the options by tapping and sliding along

the Touchpad. Slide your finger back and forth along the Touchpad to move through the menu, and tap once to select something, and swipe your finger downwards (towards your feet) to move back.

There's also a two-finger tap and hold gesture when viewing a website, this lets you move up and down the web page by looking up and down through Glass.

### Power up

Charging is performed by means of a standard Micro-USB port, which can also be used to connect Glass to your computer. We were intrigued to find that a charger did not ship with Glass, although it comes with a custom Micro-USB cable that matches the design of the headset. You also get a free carry bag (an attached note informs us it is weaved of Japanese Micro Fibre).

### Android and iPhone compatibility

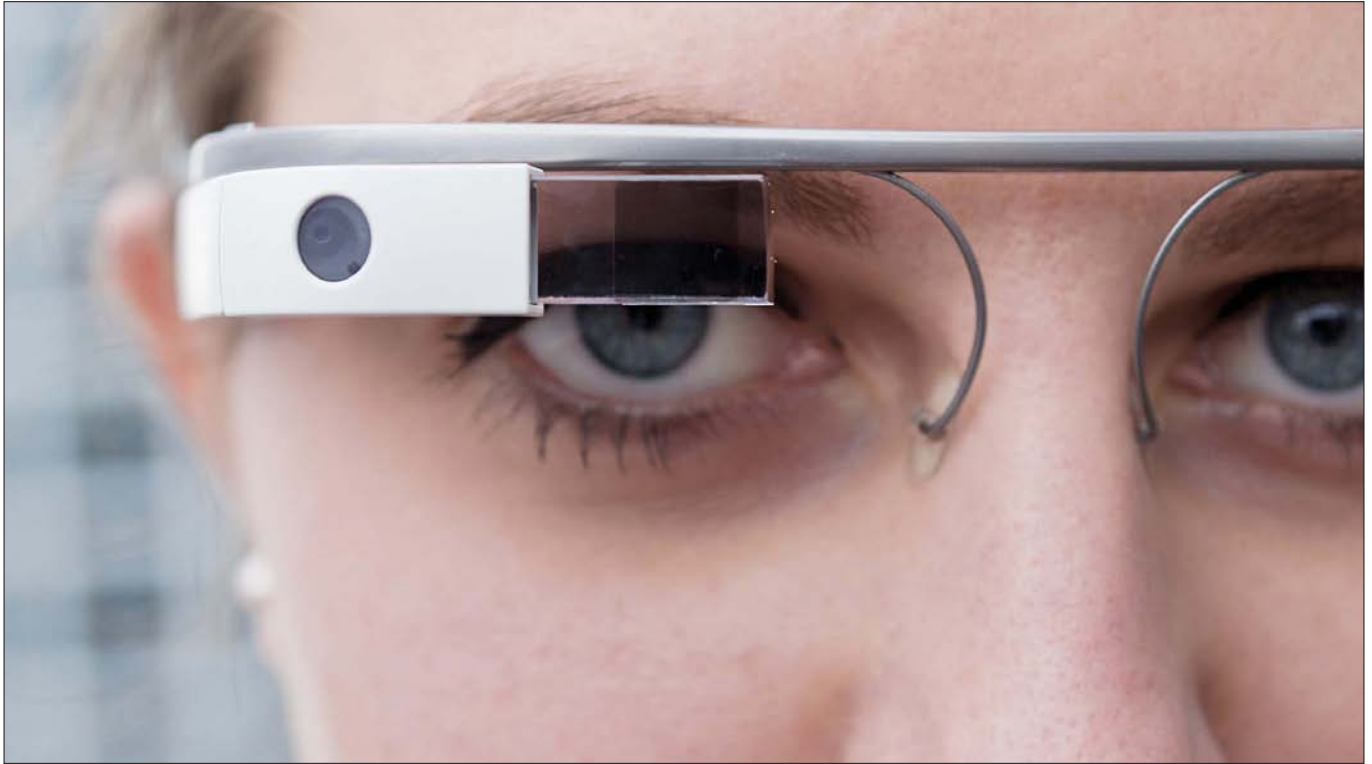
Google Glass 2.0 connects directly to the internet by means of regular Wi-Fi connection. The way the device enters passwords is pretty smart. First, tap Settings > Join network and choose the network you want; then you go online using a computer, phone or tablet to the [google.com/myglass](http://google.com/myglass) website and tap on My Wi-Fi networks.

Enter the network name and password into the MyGlass website, and it will display a QR code (containing the information). Glass then scans this and connects to a Wi-Fi router. Thus, you never have to manually enter the password.

The Google Glass website also enables you to get information on your device, add contacts, check on its location and also add, and remove apps from Glass.

The tech giant has also released a MyGlass companion app for both Android and iOS (but not Windows





Phone). This enables you to view device information, and add contacts or apps to Glass. It also makes it easier to set up Glass and connect to Wi-Fi networks (by generating the QR codes that Glass uses to connect to Wi-Fi networks).

The other main uses for the MyGlass app is to share your phone's GPS with the headset as it does not have this onboard. If your handset contract includes data sharing, you can set it up as a mobile hotspot and share its data connection with Glass.

Google Glass sends all the photos and video you record to the Google+ website. This occurs when the device is connected to a Wi-Fi network and is plugged in to the mains.

You can pair the headset to your Android phone or iPhone, using Bluetooth. You can then make and receive phone calls, and while the quality of the calls isn't great using the built-in bone conducting headphone, but Glass comes with a single USB earphone.

We were surprised to see that Google offers almost identical support for iPhone users as to its own Android customers. The only omission for iPhone users is that they can't send and receive SMS messages; this feature requires an Android phone.

### UK apps

There is a surprisingly good range of apps (known as Glassware) available

for Glass. A selection of featured Glassware apps can be found on the Glass website or app in the Glassware Gallery. The device has its own app store that's distinct from the Google Play store.

Installing an app is easy – locate it on the Glass site and tap the switch next to it to On. There's no syncing or installation process, the app appears in the list of supported apps and opens when you select it.

While the selection of apps is more limited than either Google Play or the Apple App Store, the quality of those on offer is high. Star Chat was a standout experience for us, overlaying a grid of stars above the night sky as we looked around. Other offerings include Word Lens, Twitter, Facebook and *The Guardian*.

### Battery life

As you use Glass you quickly realise just what a balancing act Google has had with the product. The space for the battery is much smaller than you'd expect to find in a mobile phone, and you find yourself taking photos and videos more often than you would with a smartphone.

Glass is also permanently connected to either an iPhone or Android phone using Bluetooth 4.0 LE (Low Energy). While Bluetooth LE doesn't drain any power when idle, it still drains the battery more quickly when the headset is communicating with the phone.


We found battery life to vary depending on how much we used it and what activity we were doing. We turned Bluetooth off on our smartphone and managed to spend six hours photographing an event, on other days it ran out in just a few hours.

Recording video rapidly drains the battery; you can expect about 45 minutes of use if you constantly record video. Bluetooth also drains the battery quickly and in our tests caused Glass to stutter due to overheating if we tried to switch to other apps. We received the "Glass needs to cool down message" frequently when using Glass with our connected phone.

Google claims that Glass lasts for about a day, but in truth we found it lasts a maximum of about eight hours if you go easy on video recording. It was typically done by around 4:30pm. Most of our interactions with apps were fairly brief: you can browse the web and watch YouTube videos, or play Google Play music, but these aren't the greatest experiences ever.

### Verdict

Google Glass is an interesting, though expensive, device and it's not hard to see why both tech freaks and developers are excited by it (and why society is afraid of it). It certainly has stopping power.

 Lou Hattersley

**£3,349** inc VAT**Contact**■ [sony.co.uk](http://sony.co.uk)**Read more**■ [tinyurl.com/mf6w4o3](http://tinyurl.com/mf6w4o3)**System requirements**

65in (3840x2160) LCD TV; Freeview HD, 2x satellite tuner; 65W total (2x 12.5W + 2x 20W) amplifiers; 4x HDMI 2.0, SCART, component (YPbPr)/composite; stereo phono audio input; digital optical audio output, 3.5mm headphone jack; 10/100 ethernet, 2.4/5GHz 802.11n Wi-Fi; Wi-Fi Direct; Miracast screen mirroring; 3x USB 2.0; HEVC decoder; 180W specified on-mode power consumption/75W measured 100 percent red field power consumption; 1494x95x790mm; 45.9kg

Build: ★★★★★

Features: ★★★★★

Performance: ★★★★★

Value: ★★★★★

**4K TELEVISION****Sony KD-65X9005B**

For its first foray into 4K, Sony bucked the trend for wimpy TV audio by introducing a panel flanked by forward-firing drivers and unapologetic amplification. For this second iteration, the KD-65X9005B, Sony has similarly snubbed cookie-cutter flatness, using its new signature wedge cabinet to enhance audio. The result is unquestionably, the best sounding flatscreen we've ever heard.

Thankfully, the rest of TV is worth making a noise about too. And if a 65in screen is too much for you, you can go smaller with the 55in KD-55X9005B - or live it even larger with the 79in KD-79X9005B.

Connections include four HDMI, between them supporting ARC, MHL and HDMI 2.0 4K 60Hz. There are also three USB, ethernet, SCART, component/composite video and stereo audio inputs. There's also integrated Wi-Fi and a digital audio optical output. A port replicator is supplied to help with wall-mounting.

This PTR-BR100 port box requires its own power supply and has satellite and RF tuner inputs, plus USB and three HDMI sources. A tethered chord routes everything to a dedicated back-panel connection.

The set hides a Skype camera in the bezel, but this can be capped if you don't like the idea of the all-seeing eye recording you. Less intrusive is an integrated HEVC decoder, which makes the set compliant with Netflix 4K. Sony provides both a standard lightweight IR remote and a Bluetooth controller.

Sony has changed its panel supplier since last year, which has



resulted in the return of Active Shutter 3D. Although not as comfortable or flicker-free as last year's Passive 4K offerings, 3D depth and clarity remains excellent. The set appears to work particularly well with side-by-side 3D broadcasts from the likes of Sky.

**Performance**

Overall image quality is squarely on the right side of sensational. The set offers bold contrast, a result of the brand's X-tended Dynamic range image processing.

It also has extraordinarily rich colours. Reds in particular throb with a plasma-like lusciousness. It's worth noting that Sony's vaguely defined Triluminos colour-image processing is also compatible with extended x.y.color information included on its Mastered in 4K Blu-ray releases, although this only works on the Cinema preset.

4K performance was accessed both with Netflix 4K programming and a dedicated 4K media player (the Sony POP-FMPA60), which came preloaded with native 3840x2160-pixel resolution

sequences, some of which were in high framerate 60Hz.

The detail and fluidity of sports footage shot at this faster frame rate is a revelation. Sky's announcement of a dedicated UHD channel for native 4K content, certain to offer high-framerate sport, may not be too far away.

The KD-65X9005B also does a great job with full-HD sources. X-Reality Pro image enhancement does a remarkable job extrapolating fine detail from 1920x1080 sources.


Motion handling is fine provided you stick with the Motionflow Clear or Clear Plus settings, which offer the best combination of detail and artefact-free movement.

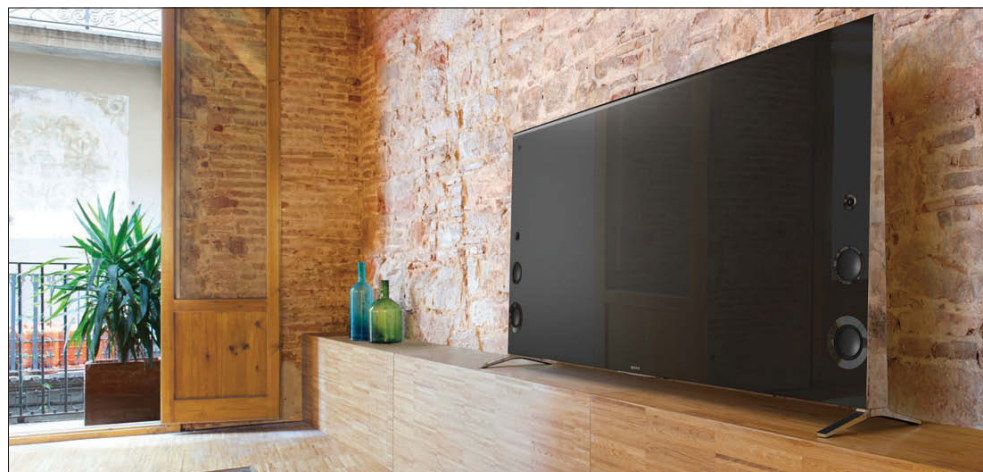
We've covered Sony's Smart TV platform at length before. Suffice to say here it offers a fair, but not comprehensive, selection of catch-up TV and streaming VoD services, including BBC iPlayer, Demand 5, YouTube, Netflix, Mubi and Sony's own movie streaming channel.

The TV also includes screen mirroring with compatible Miracast-enabled Google and Microsoft smartphones. One neat new addition to the roster is Photo Share which allows up to ten users to share and save JPEGs in a single session.

On the debit side, the UI can be sluggish to react and is certainly feels more lethargic in than some of the quad-core competition.

**Verdict**

Overall, the KD-65X8005B is a barnstormer of a 4K big-screen television. We've seen some great Ultra HD TVs, but none are as satisfying as this new X9, and our caveats remain minor. From design to AV performance, the KD-65X9005B impresses.  **Steve May**





**£799** inc VAT**Contact**■ [lg.com/uk](http://lg.com/uk)**Read more**■ [tinyurl.com/pkzuvc2](http://tinyurl.com/pkzuvc2)**System requirements**

47in (1920x1080) LCD TV; Freeview HD, satellite tuner; 12W stereo amplifier; 3x HDMI, 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; Miracast screen mirroring; passive 3D; 48W quoted On-Mode power consumption; 1061x623x55mm; 12.8kg

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

**LCD TELEVISION****LG 47LB730V**

At first glance LG's 47LB730V might look much like any other well-specified full-HD flatscreen TV. However, it holds more significance than that, being one of the first TVs to utilise the webOS platform acquired by LG from HP. Formerly a mobile platform developed by Palm, the Linux-based operating system has evolved into the backbone of the brand's 2014 connected TV range.

The set looks presentable enough, with thin bezel, metallic edge trim and stylised ribbon stand. Connections comprise three HDMI (with ARC and MHL support), a trio of USB, SCART, a shared component/composite input, plus digital audio output and ethernet. Wi-Fi is built-in and there are both Freeview HD and DVB-S satellite tuners.

The LG 47LB730V model reviewed here is also available in 65-, 60-, 55- and 42in screen sizes, so you're spoilt for choice.

**Remote control**

The screen also comes with both a standard IR wand and the latest iteration of LG's Magic Remote control. This Bluetooth pointer manages that rare trick of placing the cursor onscreen in a position that relates to the way you're hold the gyroscopic remote. The result is a naturalistic way of navigating.

LG's Smart+ webOS is rather different from rival connected platforms. It doesn't feel like a bolt-on feature for one thing. From the TV guide and menus to the choice of fonts, all elements of the navigation are uniform. There's also irreverence to the interface, from the Bean Bird mascot set-up routine to jaunty launch bar. LG has succeeded in making Smart functionality fun.



The customisable launcher bar allows you to prioritise apps that you use most. Out of the box, this leads with the LG Store, Now TV, BBC iPlayer, Amazon, Netflix, Demand 5 and YouTube. If, however, Skype is important, you can move it to the front of the line. The set also supports Screen Mirroring from Miracast-enabled Google and Microsoft phones.

**Simple UI**

While the user interface appears simple, there are deep tricks here that rival Smart TVs can't match. With webOS you can watch iPlayer or YouTube, pause and flick over to live TV, and then return and carry on with the stream. This ability to treat IPTV just as you would linear content is a revelation in usability.

File playback compatibility is solidly useful; we successfully unspooled AVI, MKV, MOV and MP4 video material. Audio playback is more limited, compatible with WAV and MP3.


Image quality is good, with caveats. The TV doesn't quite do full black, more dark grey, but this is more noticeable in full dark-room conditions. Like all LED-lit LCD sets, subjective black-level performance improves with some ambient light. Edge lighting is a tad uneven, though.

Motion handling is fine, provided you stick with the Clear Plus setting. This maintains resolution up to 1080 lines without undue artefacting, making it a great mode for sport.

The set's 3D performance is strangely problematic. The panel appears extremely directional and it's virtually impossible to keep the entire screen free of double imaging. When the top of the panel appears tight and clean, the bottom double images, and vice versa. There is 3D Viewpoint adjustment, but this doesn't offer the latitude to cope. Two pairs of passive glasses are included in the box.

The LG's audio performance is more functional than fabulous. There's not overmuch stereo separation and volume is limited, despite a 2x 12W amplifier specification. We suspect you'll probably want to invest in a soundbar at some point

**Verdict**

Overall, the LG can be considered a reasonable performer for the price - made more desirable by the inclusion of webOS. Elegant and inventive, this is Smart TV the way it should be done. Consequently, if you're a heavy user of streaming services, be they catchup or subscription, this should be high on your audition list.  **Steve May**



£119 inc VAT

Contact

■ [asus.com/uk](http://asus.com/uk)

Read more

■ [tinyurl.com/odLvok5](http://tinyurl.com/odLvok5)

System requirements

Android 4.4 KitKat; 7in (1280x800) IPS LED; 1.86GHz Intel Atom quad-core processor; 1GB RAM; 8GB/16GB internal storage; 5Mp rear camera with Autofocus; 1080p video recording; 2Mp front camera; WLAN 802.11 b/g/n Bluetooth 4.0; stereo speakers; Micro-USB audio jack; microSD Card reader up to 64GB; 15Wh battery; 113.7x189.3x9.6mm; 295g

Build: ★★★★★

Features: ★★★★★

Performance: ★★★★★

Value: ★★★★★



TABLET

## Asus Memo Pad 7

Asus has launched a new generation of Android tablet, taking another stab at the 7in market with the Memo Pad 7, which joins the Memo Pad 8 and new 10in Transformer Pad in the latest Asus tablet line-up. At just £120, this budget 7in tablet takes on the likes of the Tesco Hudl ([tinyurl.com/m52I7yz](http://tinyurl.com/m52I7yz)), and challenges the £199 Google Nexus 7 ([tinyurl.com/m9hnr8q](http://tinyurl.com/m9hnr8q)).

Like Tesco's tablet, the Asus Memo Pad 7 comes in several colours, though we find Asus's choices decidedly more appealing. We tested a delightful metallic blue model, but there are also yellow, red, black or white options available.

Overall, we found the design and build of the Memo Pad to be surprisingly solid and attractive for a budget tablet. The bezels around the 7in display are small, particularly in comparison to the Hudl. Although plastic, the back has a smooth, premium-feel finish, and the ports, speakers, camera and buttons are neat and stylish.

The weight (295g) and thickness (9.6mm) of the Memo Pad 7 is ideal for a 7in tablet, with the width of the device in portrait mode perfect for gripping with one hand. You'll need two hands to use the tablet while holding it, but for reading or watching a video, holding it with one hand won't get too heavy.

There's no flap to cover the microSD slot, though, so we imagine it could get rather dusty in there if you're not using a card. Also, we found that the tablet's screen is quite reflective and shows up fingerprints and smudges.

The 7in IPS display has a resolution of 1280x800 pixels, giving it a 216ppi pixel density. That's disappointing when you compare it with the Nexus 7's 323ppi display, and even the Tesco Hudl's 243ppi. However, we found the screen to be bright, colourful and crisp.

Inside is an impressive 64-bit 1.86GHz Intel Atom Quad-core processor with 1GB RAM. This is powerful enough to be used in netbooks and hybrids, in addition to tablets and smartphones, so is a fantastic selling point for a budget tablet like this one.

Although Android isn't 64-bit just yet, we found the Memo Pad 7



**PC ADVISOR**  
RECOMMENDED

to be responsive and smooth, and it performed most tasks with ease. Apps launched quickly on most occasions - even the camera app, which is often found to be the downfall of other tablets.

In our benchmark testing, we found that the Asus Memo Pad 7 scored 2400 in our Geekbench 3 test, 14.4fps in the Manhattan GFXBench graphics test and 608ms in the SunSpider browser test. Those results are higher than the likes of the Tesco Hudl.

There's an option of either 8GB or 16GB internal storage, but you'll be pleased to hear that there's a microSD slot that allows you to add an extra 64GB if you need it.

As can be expected, the Asus Memo Pad 7 has Wi-Fi, though not the latest (faster) 802.11ac standard. It has Bluetooth 4.0, but there's no 3G/4G connectivity or NFC.

### Software

We rather like Asus's ZenUI interface for Android 4.4 KitKat. It's not so different that you'll find it unfamiliar, but it does offer flat, simple and easy-to-understand icons and apps across the board, complete with gentle and pleasant colour schemes.

Notably, the What's Next feature is a neat way of managing your schedule, bringing together events, meetings, and more from different apps. It'll also provide you with reminders if you've got an appointment coming up.

The Memo Pad 7 has a non-removable 15Wh battery, which Asus says will last for nine hours of constant use. We've been using the Asus for browsing the web, sending emails and using social media occasionally throughout the day and have found that it can

last for several days with this kind of use. If you're a gamer or like to watch videos or TV shows on your commute, you will find that the battery drains quicker.

The tablet has two cameras - one on the front and another on the back. The rear-facing snapper is 5Mp and gave reasonable results, though, you won't be printing the snaps and framing them. They're not particularly sharp and many of our test photos were quite grainy, especially in darker conditions.

The camera app is nice, though, with previews of fun filters and effects, including Lomo, Sepia, Cartoon, Hue and more. There's also a useful Burst Mode for action shots and moving subjects. Other options include HDR, Panorama, Night, Selfie, All Smiles, Portrait and Smart Remove, which automatically removes moving subjects.

We don't usually like to use tablets to take photographs - it always seems like a bit of a clumsy task - but we found that it actually felt quite natural with the size, shape and overall feel of the Memo Pad 7.

The Memo Pad 7 can capture 1080p video, too, and the results, again, were reasonable. It'll do the trick, but if you're heading out with the sole intention of capturing something on video, we'd recommend taking another device.

On the front of the Memo Pad 7 is a 2Mp camera ideal for video calls, with 720p video recording.

### Verdict

For just £120, we're impressed by the Asus Memo Pad 7. In addition to a good-looking design and sturdy build, it boasts hardware that rivals tablets with much higher price tags.

✉ Ashleigh Allsopp



**£60 inc VAT****Contact**■ [zte.com.cn/en](http://zte.com.cn/en)**Read more**■ [tinyurl.com/p2gjslr](http://tinyurl.com/p2gjslr)**System requirements**

4in LCD display (800x480); Firefox OS 1.3; 1.2GHz dual-core Qualcomm Snapdragon 200 CPU; Adreno 302 graphics; 512MB RAM; 4GB internal storage; 3Mp rear camera; video recording at 352x288 at 15fps; Wi-Fi 802.11a/b/g/n; Bluetooth; FM radio; A-GPS; HSDPA, 21Mb/s; HSUPA, 5.76Mb/s; standard SIM; 1400mAh battery; 65x126x10.8mm; 125g

Build: ★★☆☆☆☆

Features: ★★☆☆☆☆

Performance: ★★☆☆☆☆

Value: ★★☆☆☆☆

**SMARTPHONE****ZTE Open C**

Sixty pounds is a bargain price for an unlocked smartphone, but before you get too carried away, the ZTE Open C isn't meant to be a rival to budget Android handsets.

It runs the open source Firefox operating system, which is intended to help bring the price of smartphones within reach of those in emerging markets. It's also aimed at anyone looking to upgrade from a feature phone to their first smartphone, and you can buy it in the UK from ZTE's eBay store.

It's easy to criticise the Open C for its looks, its all-plastic construction and generally mediocre build quality, but it's crucial to remember that this is a device built to a price.

However, while it will feel like an upgrade from any feature phone, the Open C won't stand up to any comparisons with budget Android or Windows Phone handsets. And it's hard not to compare the Open C with the Motorola Moto E ([tinyurl.com/moj717e](http://tinyurl.com/moj717e)) and Nokia Lumia 520 ([tinyurl.com/pkdhx6p](http://tinyurl.com/pkdhx6p)). If you want a superior unlocked handset, those both cost £99.

The ZTE has a 4in 800x480 screen, Wi-Fi, Bluetooth, GPS, 4GB of internal storage and a microSD slot for adding up to 32GB more. There's even a built-in FM radio.

Processing power comes courtesy of a dual-core 1.2GHz chip and there's 512MB of RAM.

Its rear panel unclips so you can insert your old-school, full-size SIM card, a memory card and the removable battery. Charging is via the now-ubiquitous Micro-USB. And you get a mains charger, a USB cable



and a pair of headphones in the box. No skimping on accessories, then.

There's no front-facing camera, and the rear snapper has a basic 3Mp sensor.

Firefox OS is an HTML5-based operating system, which means it's a similar concept to Google's Chrome OS. Everything is relatively familiar – it feels like older versions of Android – and the latest update, which had to be installed after we received the phone for testing, adds a much needed notification centre and quick access to common settings including Wi-Fi, Bluetooth, aeroplane mode and settings.

Since it's based on HTML5, you can use any web apps without having to download and install apps from the Firefox Marketplace. There's also an interesting 'adaptive app search' that brings up a whole host of web results based on what you type. You can then tap on the YouTube icon, say, to find matching videos, or you could tap on the Amazon store icon to run that search on Amazon's mobile site. Results can also include apps, which you can download and use.

The operating system feels far from finished, though. It isn't as slick as Android or Windows Phone, and we often felt frustrated when using the Open C. The mail app, for example, doesn't automatically remember new email addresses, so unless you add it as a contact, you have to retype it each time.

Also, although notifications appear on the lock screen – perhaps an email or text message – you can't jump directly to that message or app. All you can do is unlock

the phone, which returns you to the app you were using when you turned the phone off.

There are quite a few apps preinstalled, including Facebook, Twitter, HERE Maps and some games. You also get the expected mail, messages, contacts, notes, clock and photos apps.


Even though it has just as many pixels as the Lumia 520, the Open C seems to show less information. This is down to Firefox OS which has large, easy to tap icons, but it looks overly fuzzy or soft rather than having sharp, crisp text.

As you might expect, this is no powerhouse. There's noticeable lag when navigating around the phone, and don't expect smooth gaming. Even when playing the open source game 2048, there's an annoying delay when moving tiles.

Battery life is also on the wrong side of average. Again, it's hardly surprising, but on a practical level it means you'll need to carry a USB battery pack just in case the Open C doesn't make it through a whole day of intense use. However, for the kind of undemanding users the smartphone is aimed at, it could stretch to two days with light use.

It's best to pretend that the Open C can't shoot video: it records truly terrible 352x288-pixel clips at 15fps. Photos aren't great either.

**Verdict**

Although it's better than the original ZTE Open, performance isn't great and the operating system makes the 4in screen appear to have even fewer pixels than it does.  **Jim Martin**



**£299** inc VAT**Contact**■ [jabra.com](http://jabra.com)**Read more**■ [tinyurl.com/nfll3ov](http://tinyurl.com/nfll3ov)**System requirements**

Bluetooth portable speaker; four speakers and a bass driver; Bluetooth 3.0, USB, Micro-USB, 3.5mm jack; built-in microphone and lithium-ion battery (14 hours' playback); NFC; AC charger; 3.5mm minijack cable; USB cable; 325x132x102mm; 3.7Kg

Build: ★★★★★

Features: ★★★★★

Performance: ★★★★★

Value: ★★★★★

**BLUETOOTH SPEAKER****Jabra Solemate Max**

In the dense forest of Bluetooth speakers, Jabra's Solemate is one that stands out. Both in terms of looks and sound quality, the diminutive speaker punches above its weight. Plus, it's great value at around £80.

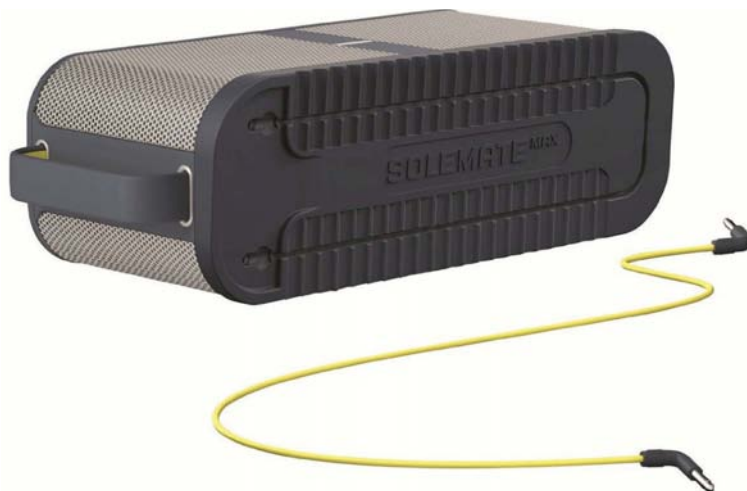
The Solemate Max is - as the name suggests - a giant version of its smaller brother ([tinyurl.com/nysrjgo](http://tinyurl.com/nysrjgo)), and has very similar features.

You can pair it via Bluetooth in the usual way, or use NFC pairing if your smartphone or tablet supports it. If someone brings a music player without Bluetooth, you can simply use the 3.5mm minijack cable that's handily clipped in place on the 'sole' of the speaker.

Inside this near-4kg monster is a whopping battery that's said to last 14 hours (we've no reason to quibble about this figure) and no fewer than five drivers: two tweeters, two woofers and a "custom-designed bass slave".

There's a useful rubber carry handle, and the Max will happily play music no matter where you are since it's dust-, dirt- and water-resistant. You can't exactly take it swimming, but it will withstand the occasional splash beside the pool.

Using membrane buttons on top of the speaker you can control audio playback - play/pause, jump to the previous or next track and adjust volume. The button in the top corner reports remaining battery life in American voiceover style, and there's a cheesy background



tune which plays behind the spoken instructions when you're pairing the speaker to a Bluetooth device.

There's a USB port on the side for charging your smartphone or tablet, which will reduce the 14 hours of playback. Plus, the Max can be used as a hands-free speaker for phone calls, although we can't imagine many people doing that.

A nice touch is the raised lip around the top, making a useful tray for your phone or other odds and ends. It's hard to tell from the photos, but the speaker is angled slightly so the drivers point upwards, which is sensible as the Solemate Max is likely to be used mainly on the ground.


Given the impressive sound quality from the smaller Solemate, we were expecting good things from the Max. Although it is most certainly loud - which is ideal for outdoor parties - it doesn't have the

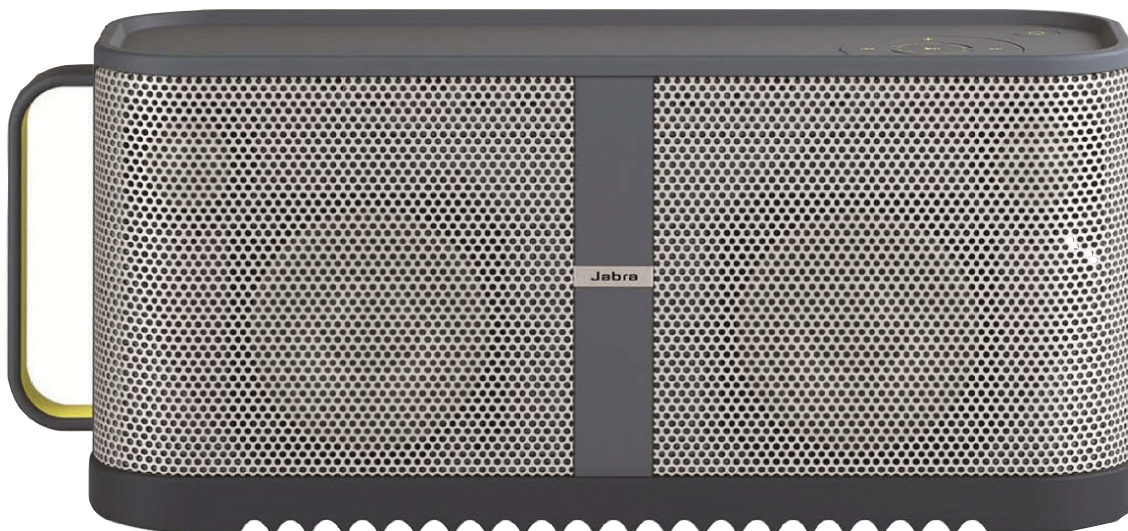
kind of forceful bass you'd expect from something this big.

We tried a variety of different genres, and at no point did the Max make us think "Wow, this is so worth over three times the price of the original Solemate". If anything, it sounds a bit thin and lacking in warmth, particularly for vocals. Unless it's a particularly simple track, things get slightly muddy with instruments blending into each other instead of being distinct.

You can download Jabra's Sound app which includes Dolby technology to expand the soundstage, but it doesn't entirely solve the problem.

**Verdict**

Even if the sound quality was up to scratch, £299 is a steep price to pay for a portable Bluetooth speaker. The fact that it isn't means you're highly likely to be disappointed by the Solemate Max.  **Jim Martin**





**£30** inc VAT**Contact**■ [mobilefun.co.uk](http://mobilefun.co.uk)**Read more**■ [tinyurl.com/ko93lvu](http://tinyurl.com/ko93lvu)**System requirements**

2200mAh battery case;  
five-hour charging time;  
136x62x16mm; 73g

**IPHONE CASE****Mobile Fun Power**

The Power Jacket is a combined battery and case for the iPhone 5c. It comes in yellow, green, black and white, although the shades of yellow and green don't match there Apple equivalents. The case has cutouts for the ports and buttons, and these are the only places where you'll see the colour of your iPhone showing through the case. At the bottom are holes for the speaker and microphone, as well as for the headphone socket. This is quite small, though, and we found that not all headphones will fit.

There's also a Lightning connector, but this is somewhat deceptive as it's only for charging the battery inside the Power Jacket and not for syncing your iPhone with a PC or Mac.

To insert your iPhone into the case, remove the top section and slide it into place. The fit is excellent, but overall build quality is not. The plastic is almost translucent in places, so you can see a dark area at the bottom where the circuit board

lives. Plus, on our test unit the battery itself wasn't stuck in place so rattled when we shook the case.


We tested the case a few times, and found that despite having a claimed higher capacity than the iPhone 5c's own battery, it was able to charge our phone up to only 95 percent from empty. That's not bad going for a case that costs this much, especially when it doesn't add too much bulk (it's 16mm thick) or weight (73g).

Four blue LEDs show how much power is left in the battery, and these flash when charging to indicate progress. There's also a tiny kickstand on the back to hold the case in landscape mode, but we needed to use a screwdriver to prise it open, and it didn't keep the phone particularly stable anyway.



Overall, the Mobile Fun Power is cheaper than some competing battery cases, but by no means the cheapest.

**Verdict**

The Power Jacket is cheaper than some competing battery cases, but by no means the cheapest. With questionable build quality we'd much rather carry a higher-capacity generic USB battery for reserve power than shell out for this model-specific case.  **Jim Martin**

**BATTERY CASE****Dexim XPowerSkin**

The Dexim XPowerSkin is a battery case for the iPhone 5 and 5s that's inexpensive and offers a full recharge when your handset's battery runs out.

It joins the gang of charger cases from the likes of Mophie, Phonesuit and Powerskin. At £70 it's at the less-expensive end of the category, although we've seen the Powerskin Battery Case ([tinyurl.com/d46r5f9](http://tinyurl.com/d46r5f9)) on sale online for less.

Its battery capacity is rated at 2000mAh, which should offer a full recharge of a fading iPhone battery. There are LED battery level indicators on the back of the case, so you can see how much extra power you have at hand. The button next to the LEDs makes turning on the case's extra battery power a simple push. You recharge the battery case and the iPhone inside with the supplied Micro USB cable.

The Dexim XPowerSkin looks quite cool in black and silver, but the case feels more plasticky and fragile than the others we've tested.



At 75g it's lightweight, but no more so than most other battery cases. It comes in two parts: the battery back and a band that clips the battery back to the phone. It's fiddly to snap together and infuriatingly difficult to pull apart again.

If you sync your iPhone using a Lightning cable rather than wirelessly, it helps if your battery case pulls off with ease. The XPowerSkin is not for you if you want to slip your iPhone quickly out of the case. As you'd expect there are cutouts for the iPhone's camera and other controls and switches.


Dexim claims that "with a 2000mAh capacity it is able to charge your phone fully twice, and have a bit more left over for good measure". This is a bold claim as

other 2000mAh battery cases we've tested offer a little over one full charge on a rundown iPhone.

Our tests bore out our scepticism. It didn't even give us a full recharge, and that's poor if this is indeed a 2000mAh battery.

According to other tests the battery pack will give an iPhone down to 10 percent charge a boost back to 75 percent - enough to last you till the next proper recharge, but nowhere near the maker's claims.

**Verdict**

The Dexim XPowerSkin looks good but feels a bit cheap and underperforms for its £70 price tag, when compared to better-built cases from the likes of Mophie and Powersuit.  **Simon Jary**



**\$129 (£129, plus \$50 shipping fee to UK)**

**Contact**

■ [martianwatches.com](http://martianwatches.com)

**Read more**

■ [tinyurl.com/Lq3fxh2](http://tinyurl.com/Lq3fxh2)

**System requirements**

Analog quartz watch with Japanese movement; upper command button; lower select button; 96x16-pixel graphic OLED display; Bluetooth 4.0 chip; RGB LED light; 'light touch' vibrating mode; 3-axis accelerometer; silicone band with stainless steel clasp; anti-scratch acrylic crystal; Micro-USB port for recharging and firmware updates; built-in lithium polymer rechargeable battery; 43.2x43.2x12.7mm; 52g

Build: ★★★★★

Features: ★★★★★

Performance: ★★★★★

Value: ★★★★★



**SMARTWATCH**

## Martian Notifier

If you're looking for a smartwatch but don't want a huge screen on your wrist, then the Martian Notifier could be for you. Available in black, white and red, it's designed to look like a regular watch, with a crown- and two push buttons.

We found the Notifier comfortable to wear, though, the supplied rubber strap tended to get clammy and uncomfortable on hot days. Other straps are available, including leather and stainless steel (both \$30) options, though, you'll need to spend another \$8 on a tool to help you replace these 'non-quick change' straps. A selection of colourful 'quick-change' rubber straps is also available.

As its name suggests, the Notifier is all about giving you notifications, so you don't need to get your phone out of a pocket or bag to read a text message or see who's calling. It does this via a small oblong OLED screen at the bottom of the watch face. It's 96x16 pixels, so isn't high res but does the job nevertheless.

As well as texts and calls, you can get all kind of notifications - pretty much anything that's installed on your smartphone or tablet. Whether it's a game, sports feed, news, finance or travel You can pick and choose which come through to the Notifier via the app (see below).

Vibration intensity can be adjusted to suit on scale of 0-15, plus you can pick your own personal patterns for different alerts. Four consecutive vibrations can be long, short or paused (nothing). For example, a text message



can be long, pause, long, pause; while a phone call could be long, short, short, long. This way you'll know what type of notification you've received without needing to look at the watch.

Notifications are read out twice and there's an RGB LED, too (which you can switch off), but if you're busy and miss one, you can recall it by double-tapping the glass front. However, you can only do this for up to five minutes after it was received, which isn't particularly helpful. We'd like it to be able to recall the last notification no matter when it came in.

### More than notifications

While the Notifier does a great job of providing information to your wrist while looking like a regular watch, it can perform some other tricks - some of which we weren't expecting.

Pushing the top button, for example, will activate voice control on your phone, but that's just the start. Pressing the bottom button once will give you a scrolling list of the time, battery life with connection status (arrows are good), the date and optionally the weather. Carry on scrolling down and you'll see other options, including a light (switches LED to white), do not disturb (switch on to avoid notifications) and find phone (forces your handset to play an alert tone so you can locate it).

Furthermore, the watch can be used as a remote control for your smartphone's camera. Point your handset in the right direction, put the watch into camera mode, tap the button and you'll start a three-second countdown to the shutter.

### Setup and compatibility

Setting up the Notifier is easy once you learn how to navigate the menu. Admittedly, we had to use the instructions but you only need to do it once and you're away.

The device is compatible with plenty of smartphones and tablets

- iPads as old as the iPad 3, iPhones back to the iPhone 4s, and the fifth generation iPod touch. You can use any Android device with version 2.3 or higher.

To make the initial Bluetooth connection, you'll need to download the Notifier app on to your handset. This can be used to control all the smartwatch's settings, including which notifications you receive and the vibration patterns which we mentioned earlier. You can also set alarms and a repeater.

### Battery

It's annoying having to charge multiple devices every night, so the good news is that the Martian Notifier isn't one of them. The firm touts a battery life of six days and we found during our testing that on average it lasted around a week. If you have alerts coming in from a lot of apps and you're popular, then expect this to drop. (We were also turning the device off at night when it wasn't needed)

Cleverly, the analogue watch part runs from a separate battery so doesn't die when the smart element of the devices does. It will last two years, according to Martian.

The Notifier charges up pretty quickly, and although it receives power over standard Micro-USB, you'll need to use the supplied one. The socket is set into the body of the watch, so a regular cable won't reach. This is a little frustrating as the beauty of Micro-USB is that you can pretty much use any charger, but that isn't the case here.

### Verdict

The Martian Notifier is a great choice for those who want a smartwatch within the design of a regular wrist watch. Its affordable but stylish, although the rubber strap isn't the most comfortable. It's main skill is notifications but the features like remote camera control are also handy. **Chris Martin**





**£50** inc VAT**Contact**■ [archos.com/gb-en](http://archos.com/gb-en)**Read more**■ [tinyurl.com/q2xrxyz](http://tinyurl.com/q2xrxyz)**System requirements**

Activity tracker; OLED display, 22.4x5.6mm with blue backlight; tracks: steps, time, calories burned and walking distance; 7 days' measurement data in memory; data is automatically uploaded and updated on smart phone with Bluetooth 4.0; 3.7V/70Ah lithium polymer lithium battery; wristband dimension, 180x15x3mm; wristband weight, 12g; tracker dimensions, 59x29x10mm; tracker weight, 8g; Android running 4.3 or later; iPhone 4s/iPad 3 or later running iOS 5 or later

Build: ★★★★★

Features: ★★★★★

Performance: ★★★★★

Value: ★★★★★

**FITNESS TRACKER****Archos Activity Tracker**

Not much thought went into naming Archos' first activity tracker, but at least it says what it does. This £50 device is a cross between the Nike FuelBand SE ([tinyurl.com/ohmgxk9](http://tinyurl.com/ohmgxk9)) and Fitbit One ([tinyurl.com/kc6wy9q](http://tinyurl.com/kc6wy9q)), and is almost what we wish the Fitbit Flex ([tinyurl.com/Lcfewyd](http://tinyurl.com/Lcfewyd)) had been.

It's a lightweight rubber band, which clips onto a plastic device that's rather like the Fitbit One. In fact, the OLED display appears to be a blatant copy of Fitbit's apart from a couple of details. When you unclip the tracker from the band, you can plug it directly into a USB port to charge it (one of our favourite features of the Nike FuelBand), and it means there's no charging cable to lose. Battery life is good at roughly a week between charges.

There's just one button, and it's surprisingly hard to push as it's almost flush. Pressing it repeatedly cycles through the clock, calories burned (aerobic), distance covered and steps taken. There's no altimeter for height climbed, and no built-in vibrating motor for alarms. Nor does it track your sleep.

As you'd expect at this price, there's no heart-rate monitor. There is, of course, built-in Bluetooth for syncing to your iPhone or (selected) Android device. It will need Bluetooth 'Smart' (4.0 Low Energy), which means anything before the iPhone 4s or iPad 3 is out. You can't transfer data via USB to a PC or Mac, so if you don't have a compatible smartphone or tablet, the Activity Tracker isn't going to be much use to you.

Similar to Polar's Loop tracker, the first thing you have to do is cut the band to size. Two are supplied in the box: a black one and a purple one. They're marked for circumference, so you measure your wrist and then cut to the

appropriate line. However, the markings must be wrong, since the band was far too big after cutting to the measured number and we had to cut an extra 20mm off for a proper fit.

**The app**

Once you've installed the free Archos Connected Self app, you create an account and then your profile, including your height, weight and age. All standard stuff for an activity tracker. Rather than a daily step goal, you have to rotate a dial to set a weekly goal.

Pairing the Tracker with the app was slightly hit-and-miss, but once it's paired, data is synced every five minutes. However, we had problems with the connection and had to repair the tracker with our iPhone.

The app itself is ugly and looks unfinished. As well as collecting data from the Activity Tracker, it also works with Archos' blood pressure monitor and Wi-Fi scales.

The home screen is therefore split into three sections: Weight, Blood Pressure and Pedometer. Keeping with the weekly goal, you get a summary of calories burned, distance covered and - importantly - steps, so you can see how well you're doing.

Tapping on the Pedometer section takes you to a daily activity

view, but you can switch to weekly, monthly or yearly. The daily view shows hourly bar graphs of steps, while a horseshoe shows how many steps you've taken and how close you are (visually) to your goal.


One extra piece of information is 'exercise time', which shows how much you were active during the day, week, month or year.

Tapping the list icon gives you a slightly odd view of the data. For each day, you get a cumulative tally of your steps, calories, exercise time and distance at various times during the day. For each, you can add a comment, such as '5km run' - it's Archos' way of attempting to auto-detect and allow you to tag different activities.

The main problem is that data is only logged and nothing more is done with it. There's no alert (as Fitbit and other trackers offer) to tell you how far you are from your goal, and no reward for achieving it. In these days of gamification, which Nike and Jawbone in particular do well, this is a missed opportunity.

Plus, there's no way to compete with others. All you can do is share your accomplishments with friends by posting the figures to Facebook or Twitter, or by emailing them. It's a half-baked approach.

**Verdict**

It may cost only £50, but that doesn't make it good value. It's a glorified pedometer and lacks features you'll find in other trackers. Its only saving grace is the handy clock.  **Jim Martin**



**£318** inc VAT**Contact**■ [wd.com/en](http://wd.com/en)**Read more**■ [tinyurl.com/qagqeug](http://tinyurl.com/qagqeug)**System requirements**

4TB portable Thunderbolt drive; 2- and 4TB capacities available; 2x Western Digital WD20NPVX Green 2.5in hard disks; 1x Thunderbolt cable (integrated); 143x89x46mm; 717g

Build: ★★★★★

Features: ★★★★★

Performance: ★★★★★

Value: ★★★★★



## PORTABLE RAID STORAGE

## WD My Passport Pro 4TB

Western Digital has been making various portable drives aimed at Mac users for many years now, but the My Passport Pro is the first to feature Thunderbolt.

It takes the same basic case as earlier metal-bodied models, but doubles the height in order to accommodate two hard disks inside. And these aren't just regular 9.5mm notebook drives, but chunky fat disks able to store up to 2TB, each.

We tested the 4TB version of this portable drive, using two 2TB SATA disks inside. The beauty of the final packaged drive is that it can still be powered entirely from the Thunderbolt bus, so there's no dependency on mains power or carrying fiddly adaptors.

But it is still something of a monster when viewed alongside the original single-disk drives. It weighs a hefty 717g and stands 46mm high on its dimpled rubber feet.

The two disks arrive ready configured into a RAID 0 striped array, to ensure fastest and most consistent speed right across the volume. The downside is, of course, the issue of data security, where one disk failing loses all your data, so full backups are more essential than ever. As with any software-based RAID device, you can reformat as a mirrored pair or just two independent disks.

Unlike many vendors, though, WD includes a useful software utility with which to configure the RAID more easily, as well as run basic



diagnostic tests. Unlike previous WD portable drives, there doesn't seem to be any access to hardware-based encryption for the user through the WD application.

Build quality is superb, a beautifully cast and milled block of natural aluminium alloy, with a black anodised top section precisely inset into the casework. The Thunderbolt cable is uniquely integrated into the unit, and wraps around the case into a rubbery slot around its perimeter before clipping into place. It means you'll never have to go hunting for a Thunderbolt cable, but you're also limited by its relatively short

With two disks crammed into the case, potentially working at their maximum, plus Thunderbolt electronics, WD has decided that passive cooling from the casework as heatsink is not sufficient so has fitted a cooling fan. This is a tiny device only 15mm across that vents from the rear next to the

Thunderbolt cable, and only comes on when required. Unfortunately, when it does rev up it's both audible and annoying.


The disks inside, Western Digital WD20NPVX Green disks, are relatively quiet in use, muted further by the heavy chassis.

We shouldn't expect SSD-like speed from even a RAIDed pair of notebook-sized hard disks, but nonetheless the My Passport Pro proved much quicker than you might expect of low-power laptop drives.

The RAID block size was set to 32kB by WD which should give slightly more favourable results with some tiny files, although random small-file read speed, averaged from 4- to 1024kB, was only 17MB/s; but write speeds in the same setup averaged a more useful 38MB/s.

Once given larger sequential data, the WD could easily surpass 200MB/s speeds, peaking at around 215MB/s to return an average result of 211MB/s for most files from 2- to 100MB in size. And in its RAID 0 configuration, it should maintain that kind of performance even as the disk becomes full.

**Verdict**

Thanks to an enormous capacity in a still just handleable bus-powered package drive chassis, the My Passport Pro could prove invaluable for carrying huge volumes of data on the road. At £350 for the 4TB version it's not cheap but nevertheless its price per capacity figure of just 8.8p/GB makes it in effect the cheapest Thunderbolt drive in this class.  **Andrew Harrison**





## GAME

## Thomas Was Alone

**£3.99****Contact**■ [tinyurl.com/nyfp9fz](http://tinyurl.com/nyfp9fz)**Read more**■ [tinyurl.com/Lv7gtse](http://tinyurl.com/Lv7gtse)**System requirements**

iOS 7 or later; iPod/

iPhone/iPad



Arty puzzle-platformer Thomas Was Alone is one of the great indie gaming successes of recent years, now brought to the iPad.

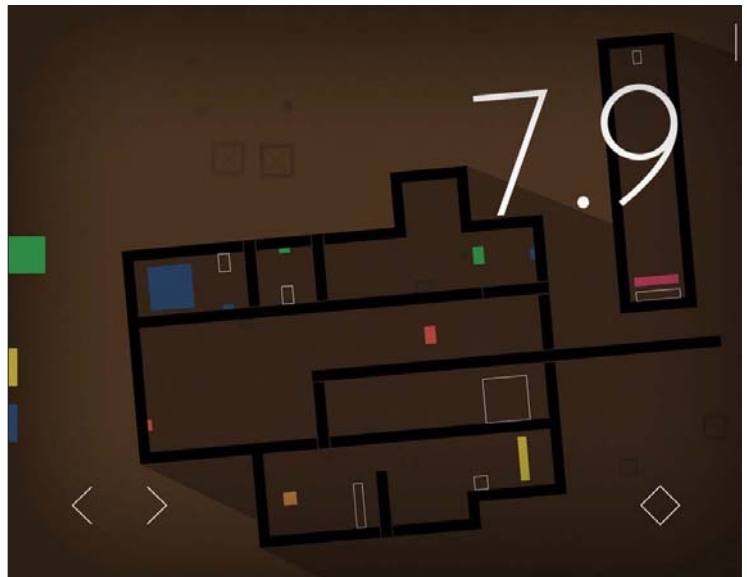
This might not sound like a compliment, but it almost feels as though Thomas Was Alone was made to win a bet: I bet you can't create something emotionally compelling out of a collection of jumping rectangles.

But it is a compliment, a reflection of how ambitious is this game. It's hard to think of another game that's so willing to impose limitations on itself, and then triumphantly transcend them.

You start off controlling Thomas, a small red rectangle who can move around and jump a bit. Your job, in traditional puzzle-platform style, is to get across a level strewn with obstacles, and reach the exit - an outline of Thomas's shape. You do this via onscreen left- and right controls, and a jump button.

As you progress through the levels, more shapes are added, each of them a slightly different quadrilateral with slightly different capabilities: the first two are a squarer shape that can hardly jump any distance, and a long thin one who can jump miles. Later characters can float, reverse gravity and so on. The challenge is to combine the characters' abilities in such a way that all are able to reach their respective exits. (You control one character at a time, swapping between them by tapping their colours on the side of the screen.)

So far, so mechanically satisfying; and it is certainly an accomplished




piece of design, with a finely graded difficulty curve and neatly interacting physics effects. But TWA aims to be more than a dry series of puzzles. It's a story, too - with characters, a plot (involving computer algorithms becoming sentient), relationships, emotions and motivations. All of it expressed via the medium of rectangles.

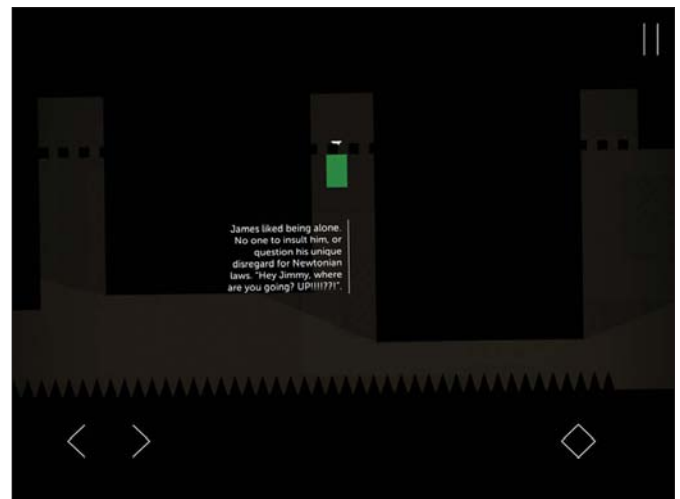
That this is achieved at all, given such childlike ingredients, is impressive. And while you shouldn't expect Lawrence of Arabia, Thomas Was Alone does draw you into its little world. Mind you, it could be argued that the actual game - the characters you control, and their challenges and achievements - are very rarely the hook. Instead, the swelling soundtrack and jaunty voiceover (which won the TV comedian Danny Wallace a Bafta)

do the narrative heavy lifting. They could almost be separated from the game and broadcast as a leftfield radio play.

Nevertheless, the overall effect is pleasing. There's a strong sense of neatness in the way everything has been put together, in the way it's all presented. It's a very self-contained piece of work. The game knows exactly what it wants to achieve on its own terms.

**Verdict**

Thomas Was Alone is artful without graduating into a full-on art game, and an accomplished piece of game design: an attractive, thoughtful and original series of platforming puzzles with an unexpectedly satisfying (if light) story popping its head in from time to time. A fine iPad game.  **David Price**





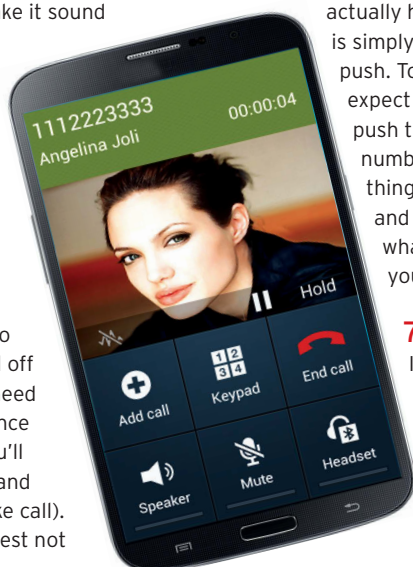
# 10 of the strangest, most pointless Android apps

What were they thinking? You won't believe what's at number one in our list of the 10 strangest, most pointless Android apps, writes Marie Brewis

**I**s there anything a smartphone can't do these days? Making cows moo and licking your own phone screen is pretty odd, sure, but you won't believe what's at number one in our list of the 10 strangest, most pointless Android apps you can download today.

## 10. Fake Call

If you're a bit of a loner Fake Call can help you to justify carrying a smartphone. Using this app you can initiate fake calls and texts to yourself; you can even pre-record your own voice to make it sound as though you are talking to someone else. Wow. According to the developer Fake Call is useful for getting yourself out of awkward situations (but to successfully pull off that one you'll need to know in advance at what time you'll want to escape and schedule the fake call). Also, probably best not



to use a picture of Angelina Jolie if you want to avoid questions (pretty sure that's not her phone number anyway).

## 9. Holy Cow

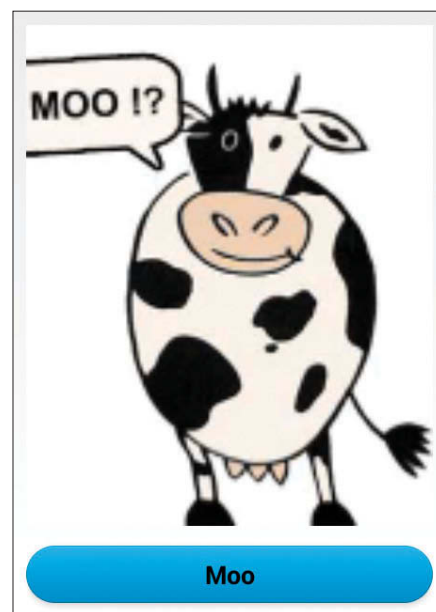
Do you like cows? Do you like things that go Moo? You'll love Holy Cow. You press Moo; the cow goes Moo. If only everything in life was so simple and straightforward.

## 8. Pointless Button

Perhaps one of the most pointless apps is one that is designed to be pointless but actually has a point to it. Pointless Button is simply an onscreen button that you push. To be pointless, though, you'd expect nothing to happen when you push the button. After a certain number of taps you unlock various things such as a picture of a cat, and after a while you start to wonder what else will pop up onscreen if you just keep pushing that button...

## 7. Sleep Sheep

If you've ever struggled with insomnia, no doubt some helpful soul has suggested you count sheep. The idea is to picture sheep jumping over a fence, counting each as they pass. You'll focus your mind on a



single task, rather than whatever has been keeping you awake, and eventually bore yourself to sleep. Except counting sheep doesn't work, according to scientists at Oxford University. So it probably doesn't matter, then, that Sleep Sheep misses the point and counts the sheep on your behalf. With this app you simply get to watch a really boring graphic of sheep jumping over a fence. No matter how long you watch them,



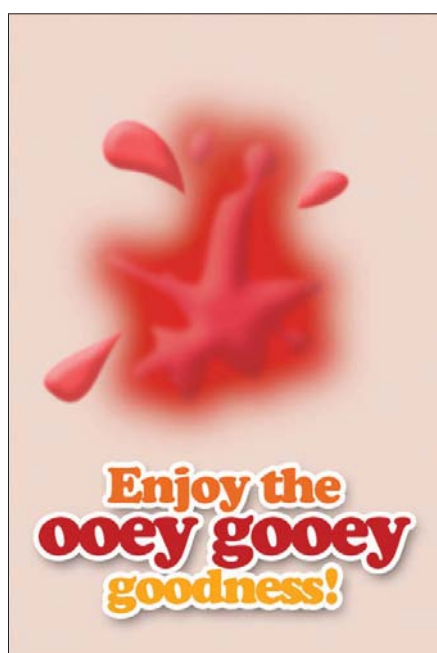
they don't turn around and pull a silly face or do a star jump or anything. It's just really dull. (And you're still awake.)

#### 6. Fake Windows 8

I once reviewed Fake Windows 8. I think I might have been trying to put off something else on my to-do list. In essence, it lets you pretend your Android phone is running Windows 8. Not Windows Phone 8 - actual Windows 8. I can't imagine why you might want to do that, unless you have some incredibly geeky friends you want to upset.

#### 5. Pimple Popper

Did your mum tell you never to pick your spots because they would scar? Did you do it anyway and now regret it? Pimple Popper ensures the younger generation won't have to endure this anguish, allowing them to get



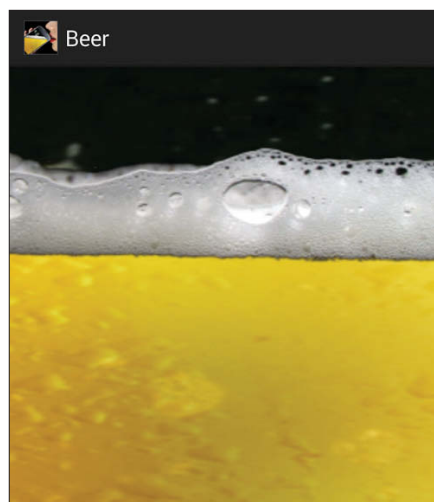
their pimple-popping hit from a free app rather than their own spotty faces. There are several types of spots to squeeze, even crusty ones. Personally I think it's revolting, but then I once blocked a good friend on Facebook for posting *that* YouTube video to my wall. You know the one I mean. Yuck.

#### 4. Beer FREE

This is bizarre. Why would you pretend to drink beer when you could just go and have a beer? However, children, alcoholics and the barking mad might enjoy Beer FREE from neptune labs, a 'fun' app that lets you pretend your phone is a beer; you tilt your phone to drink the beer, and once it's all gone you get a complimentary burp. Nice.

#### 3. I Am Rich

Once upon a time if you had a spare \$1,000 you could buy an app called 'I Am Rich' from the App Store. Its only functionality was to display a red gem onscreen (not even as a wallpaper), making sure everyone around you knew you were loaded (and weird). Eight



people actually bought it before Apple pulled the app. (Really.) Now available on Google Play from the wonderfully named developer iBanned, I Am Rich doesn't require you to be rich at all - it's free. And still totally pointless.

#### 2. Lick The Icicle

You must have seen those apps that show a cat or a dog licking the inside of your smartphone screen. Cute, right? Erm, not really. More odd, though, are those that encourage you to lick your own smartphone screen. Now I don't think the developer of Lick The Icicle really expects you to lick the icicle to make it melt (you need only touch it), but by suggesting your tongue will freeze if you hold it on the icicle for too long he just might be having a giggle at your expense.

#### 1. TapThat

With TapThat you take two NFC-enabled smartphones, choose a character on each (one of whom could be Homer Simpson, to give you an idea of the calibre of this app), then tap together those phones to let them, erm, get busy making mini smartphones. I say no more. (The horror.) ☒



## FILM STREAMING SERVICES

# Netflix vs Amazon Prime Instant Video

**Netflix**  
**£5.99** inc VAT  
 per month  
**Contact**  
 ■ [netflix.com](http://netflix.com)

**Amazon Prime**  
**£5.99** inc VAT  
 per month  
**Contact**  
 ■ [amazon.co.uk](http://amazon.co.uk)

**Read more**  
 ■ [tinyurl.com/p22a8z9](http://tinyurl.com/p22a8z9)

Video streaming is a part of daily life, with many preferring to watch TV programmes and movies via either Netflix or Amazon Prime Instant Video (previously known as LoveFilm). If, however, you have yet to sign up for a service and are unsure which one to opt for, in this comparison review we put the two leading players through their paces.

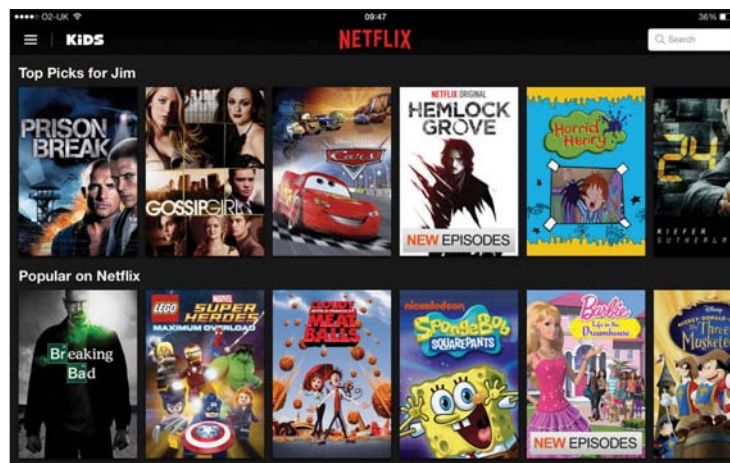
## Price

There are a few free streaming services around, but you'll have to pay for both Netflix and Amazon Prime Instant Video. Each one offers a 30-day trial, so we strongly suggest utilising these as a way of seeing which one you prefer.

When it was called LoveFilm, Amazon's service was the cheaper option, but they are now both £5.99 per month. Anyone paying £79 for

an annual subscription to Amazon Prime will get Amazon Prime Instant Video included at no extra cost.

Netflix has confirmed that it is rising its price in the UK to £6.99 per month for new members. At the time of writing, this had not come into effect, and existing Netflix users will have the price locked at £5.99 for the next two years.



A key difference between the two is that everything you see on Netflix is available to stream. However, only Prime Instant Video content with a 'Prime' banner is included in Amazon's service, though, other content is available to buy or rent.

**Winner:** Draw

## Devices

To access streaming services, you're going to need a compatible internet connected device. Both Netflix and Amazon Prime Instant Video can be accessed on a range of different devices such as Smart TVs, consoles, smartphones and tablets.

Our table lists which devices are supported. Aside from those shown below, both services can be accessed via a web browser on a desktop PC or laptop, whether or not they are connected to an external display such as a monitor or television.

As you can see from the table, Netflix supports a larger amount of devices. The additional support on

TVs and affordable media streamers puts it out in front.

**Winner:** Netflix

## Content

Price and device compatibility is all well and good, but they mean nothing if there isn't anything to watch. Netflix and Amazon Prime Instant Video offer films and TV shows, plus exclusive offerings that you won't find on rival services.

Netflix's content is ever-changing, with new titles constantly being added, though TV shows and movies are removed too. What we can say is that the content is of a good quality across the board, though you'll have to wait a little while before new releases are added.

Amazon touts 50,000 titles in its store, but only 15,000 'films and TV episodes' (note that individual programmes are being counted) are available for the monthly subscription. Again, see the table for comparative figures.

Programmes such as *Game of Thrones*, *The Hunger Games: Catching Fire* and *Boardwalk Empire* require you to buy or rent them. In essence, newer content isn't accessible for your monthly fee.

As you can see, Netflix has more content on offer and although Amazon has pay per view, we're comparing what's included for your monthly fee here, so Netflix comes out on top.

**Winner:** Netflix

## Verdict

Netflix and Amazon Prime Instant Video both cost £5.99 per month so there's no difference there. However, with more supported devices and a better range of content, Netflix is our winner for the best streaming service. **Chris Martin**



## Streaming services

	AMAZON PRIME INSTANT VIDEO	NETFLIX <small>PC ADVISOR BEST BUY</small>
Smart TV	Sony, Samsung, LG	Sony, Samsung, LG, Philips, Panasonic
Games console	Xbox 360, Xbox One, PS3, PS4, Wii, Wii U	Xbox 360, Xbox One, PS3, PS4, Wii, Wii U
Tablet	iPad, Kindle	Android, iPad
Smartphone	N/A	Android, iPhone, Windows Phone
Blu-ray player	Sony, Samsung, LG	Sony, Samsung, LG, Philips, Panasonic
Home cinema system	Sony	LG
Set-top box	Sony	N/A
Media streamer	N/A	Apple TV, Philips, Roku, Western Digital, Virgin Media, Google Chromecast
Film titles	2,452	6,916
TV series	936	3,613

## MUSIC STREAMING SERVICES

## Spotify vs Google Music

**Spotify Free****Contact**■ [spotify.com/uk](https://spotify.com/uk)**Google Music****£9.99** inc VAT  
per month**Contact**■ [google.co.uk](https://google.co.uk)**Read more**■ [tinyurl.com/pept724](https://tinyurl.com/pept724)

If you're a music lover, but aren't sure whether to plump for Google Music or Spotify, we compare the two, so you can see which one to opt for.

**Price**

The streaming model of Spotify differs from Google Music – if you don't mind the occasional advert, you can listen for free. On Google Music, however, you can only listen to the individual tracks of albums you have purchased. Pricing is competitive, though, with many albums available for under £5 and an album of the week for just 99p.

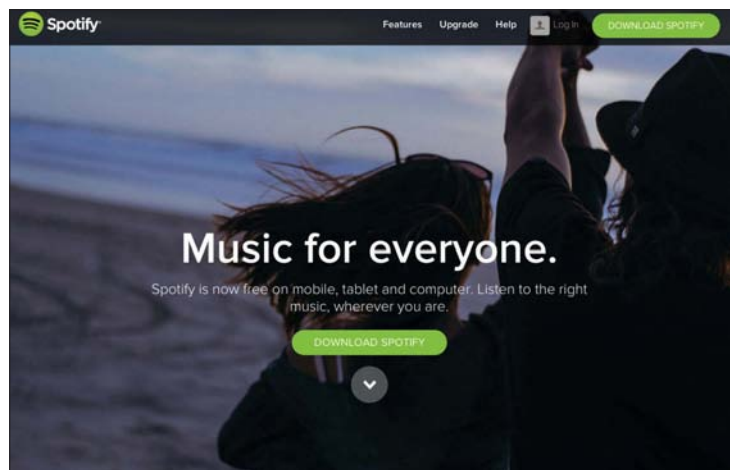
One thing both have in common is an unlimited ad-free streaming service. They're called Spotify Premium and Google Music All Access. You can trial each for 30 days without paying, after which you'll have to pay £9.99 per month.

**Apps**

As you might expect, each service can be used on the web and mobile devices via apps – iOS and Android for each, plus Windows Phone and BlackBerry for Spotify. However, Spotify also has a desktop program that can be downloaded on to a PC or Mac. You can use all these devices whether you pay a subscription, or not, though, the Spotify app will only let you listen to music on shuffle if you're using the free service.

**Streaming quality**

Each service streams music at a maximum of 320Kb/s which, unless



you're an audiophile, will be fine. You'll need to pay to get the higher quality rate.

**Quantity and new releases**

In terms of content, Spotify has more than 20 million songs for you to stream. The firm adds around 20,000 each day, but it's worth noting that a big chunk of these are obscure offerings, so although Google Music offers less, quantity isn't everything.

What you want from a streaming service is the most recent singles and albums available as soon as they are released. In general, you'll get that from both, but there will occasionally be exceptions. Coldplay, for example, has decided not to allow streaming of its latest album, *Ghost Stories*, so only the singles are available.

**Offline and backup**

A plus point of Google Music is the ability to upload your existing music. You can back up and listen

mobile device to be played from within the program.

**Radio and recommendations**

Both Spotify and Google Music will learn what your taste is, then recommend content – they offer radio stations based on the music and artists you listen to. It's only available on Google Music if you pay monthly for All Access, though.

A free feature on Google Music is Instant Mixes, which is similar to a radio station, but creates a playlist from your music based on favourite songs or artists. It shows you what's coming up next and you can skip forwards.


**Devices**

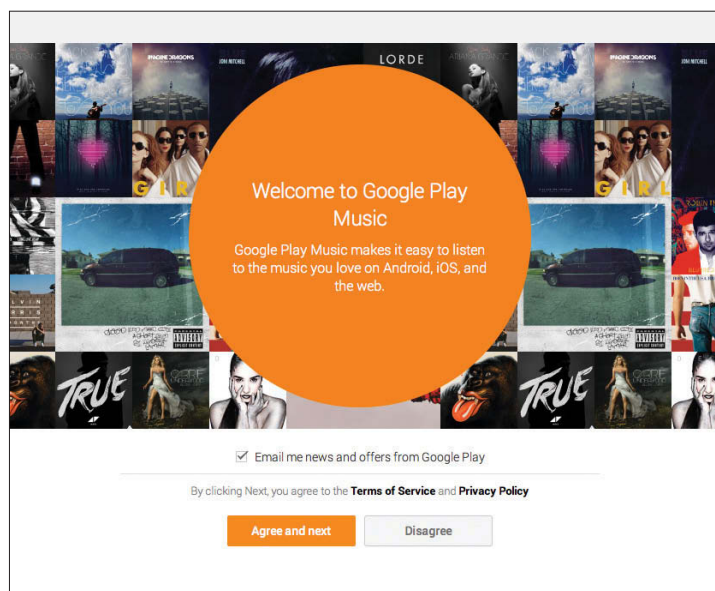
Both Spotify and Google Music are compatible with speaker systems and other gadgets, including Sonos, Roku players, Apple TV (via AirPlay), Google Chromecast, smart TVs, and more. Spotify is the more widely available of the two.

**Social**

Spotify has much better integration with social networks. Not only can you post what you're listening to, but you can see what your friends are playing without them posting something specifically. You can also follow your favourite artists, so you can ensure you don't miss future releases. Furthermore, you can keep track of your streaming habits with last.fm integration.

**Verdict**

Netflix and Amazon Prime Instant Video both cost £5.99 per month, so there's no difference there. However, with more supported devices and a better range of content, Netflix is our winner for the best streaming service.  **Chris Martin**



to up to 20,000 tracks, which appear alongside your streaming content as one library. You can also download content for offline listening by pinning it within the app, and music purchased from the shop doesn't count towards that limit.

While Spotify allows offline listening there are a couple of limitations – you can download up to 3,333 tracks to each device and stay offline for up to 30 days. The desktop application lets you play files on your computer, and you can also sync these with your



£30 inc VAT

Contact

■ [larian.com](http://larian.com)

Read more

■ [tinyurl.com/oy39fe8](http://tinyurl.com/oy39fe8)

System requirements

Windows XP SP3 or higher; Intel Core2 Duo E6600 or equivalent; 2048MB RAM; HD Intel Graphics 4000 or nVidia GeForce 8800 GT (512MB) or ATI Radeon HD 4850 or equivalent; DirectX 9c; 10GB drive space; DirectX9c-compatible sound card

PC ADVISOR

GOLD



GAME

# Divinity: Original Sin

Proving, as so many other games have lately, that there's a huge appetite out there for games based on genres and values long since abandoned by the mainstream industry, Divinity: Original Sin has been a runaway success. A roleplaying game that's starry-eyed about the classic likes of Baldur's Gate, this sprawling title goes out of its way to be a giant toybox.

You can steal almost anything that it isn't bolted down, use fire and water spells to create vast infernos or electrifiable ponds, create a vast range of experimental cookery, and even talk to the animals.

While plot-wise Original Sin involves mostly linear progression, the freedom to muck around as you travel is immense and refreshing. As trite a phrase as it might be, it's almost impossible not to pin the words 'labour of love' on to this. It's giving long-time RPG fans what they want, but it's doing it because that's what its creators want to.

Said creators have seen middling success and acclaim for their long-running Divinity series, which has long boasted best intentions but wobbly execution. Granted a decent budget at last, thanks to a big Kickstarter success, they've finally been able to go for it. There's so much to do, and not just in terms of quests - Original Sin works hard to get its systems right.

A town's citizens go about their own business to some degree, there's an involved stealth system if you like to play such things as a



tea-leaf, and furniture within rooms can be rearranged to your heart's content (though not always to the content of the room's owner - a reputation/annoyance system means you can quickly end up in fights for not respecting others' property).

The main story/quest isn't so impressive or unusual as the optional stuff, though, perhaps it's deliberately straightforward in order to give players who don't enjoy prattling about something to sink their teeth into. There's also a wider problem in terms of the game communicating what you're supposed to do, and where, in order to progress.

It's not uncommon to find yourself wandering aimlessly or accidentally into the middle of a fight you're not strong enough to survive yet, because meandering or vague dialogue and pointers have left you clueless. Sometimes, this approach suits the game down to the ground, as it encourages poking

at the rules and seeing what's possible, but other times it means slowdown for no good reason.

Playing the game in two-person co-op can help get around this, as well as more generally encouraging experimentation and unpredictable outcomes. A spot of burglary is a very different affair when you've got one player distracting a storehouse's owner, while the other one disguises themselves as a giant bush and nicks everything in sight, for instance.

Or there's the option to discuss and bicker about moral dilemmas, both big and small - whether it's deciding a character's fate or making a call as to whether robbing an old lady is justified if it helps you buy a sword that in turn helps you save the world. The co-op system isn't perfect, but this is an RPG that's properly set up for two-person play, rather than just including it as a semi-functional gimmick.

Whether solo or co-op, this is a game in which you'll quickly lose yourself to sharp, funny writing, an excess of optional pursuits and an elaborate, explosive combat system that's based heavily on the elements (freezing, burning, electrocuting). While there's still competition yet to come this year (particularly Dragon Age: Inquisition and Pillars Of Eternity), Divinity: Original Sin has a great shot at being 2014's best RPG, and deserves its success.

## Verdict

Divinity: Original Sin sometimes creaks under the weight of its many features, but it provides a wonderful blend of roleplaying's past and present. Rich, vast and silly where it needs to be, this is a triumphant achievement. Alec Meer





**£34** inc VAT**Contact**■ [ubi.com/uk](http://ubi.com/uk)**Read more**■ [tinyurl.com/o8wnedo](http://tinyurl.com/o8wnedo)**System requirements**

Windows Vista SP2/7/8;  
2GHz dual-core CPU; 4GB  
RAM; GeForce 400 or  
higher, AMD Radeon HD  
4000 or higher, Intel HD  
4000 or higher; DirectX 11;  
4GB drive space DirectX-  
compatible sound card

**PC ADVISOR**  
**RECOMMENDED**
**GAME****Tropico 5**

The '5' in the title might suggest that this Caribbean-set city-building series is getting long in the sun-bleached tooth. In practice, it's keeping itself fresh with a cheerful attitude, an indulgent and relaxed approach to a type of game that's often rather particular about how to play, and a carefree amorality.

As with its mixed-bag predecessors, you play as the despot (to varying degrees, depending on your playing style) ruler of the titular Caribbean island, striving to slowly upgrade a two-horse town into a thriving and extremely lucrative metropolis. Build houses of assorted quality, construct mines and factories, try to keep everyone healthy and educated enough to expand your population and bring in more profitable industries and a booming tourist trade: it's a classical formula, and it's certainly not worn out yet.

While Tropico 5 isn't an enormous departure from Tropicos 4 and 3, it does do more with the concept of foreign powers and their impact on your fragile economy.

Trade routes with the Allies during the 1940s will bring in a wad of vital cash, for instance, but you might well end up with an Axis invasion fleet on your beach.

These mini-decisions and short-term quests aren't game-changing stuff, as Tropico 5 isn't especially keen to punish its players for cocking anything up (despite some earlier talk about this being that instalment to shake things up), but



they do create many more things to do while you're waiting for a particular construction to finish.

Picking and choosing between the various quests offered by factions and your advisors also helps to stop the game from playing quite the same way every time, although again this is cut from very similar cloth to the other Tropicos, and so your empire is essentially headed in the same direction regardless.


Combat – which is for the most part rare and fleeting – is a real weakness, as you have no more control over your soldiers and tanks than you do the citizens who carry out their own errands across the city. So when an enemy army arrives at your doorstep, all you can do is try to have enough watch towers in all the right places, and hope your repairmen can get any destroyed ones standing again quickly.

Fighting is an annoyance, not a crisis, but enough of one that you are at least well-invested in playing politics with external factions in the hope of avoiding it.

It's an extremely pretty game, especially in the latter 'modern age' stages, which see your former empire of sand now bristling with gleaming skyscrapers and impossibly luxurious hotels. Getting to that point for the first time is by and large a joy, with a steady stream of new toys to play with, but the trouble is that doing it again isn't quite so appealing. Once you know how to play, and once you've learned what the majority of buildings are for, the game doesn't have much left to throw you off-balance with. The great appeal of city-builder games is as an infinite toy, but as with other games in the series this seems more of a one-shot affair.

The exception is the new multiplayer mode, where the aggression and folly of human opponents removes a degree of predictability. Only time will tell if that's enough to give this Tropico more legs than the last couple, but then again, we'll probably have Tropico 6 in 2015 anyway.

**Verdict**

Tropico 5 is perhaps only a gentle departure from previous instalments, but it does enough to pull the series away stagnation. It's a little too forgiving and broad to sate the needs of anyone looking for a truly detailed city simulation, but as a cheerful and colourful good time with plenty to do (for a little while, at least) it's hard to fault.  **Alec Meer**



**£11** inc VAT**Contact**■ [ubi.com/UK](http://ubi.com/UK)**Read more**■ [tinyurl.com/n7amhed](http://tinyurl.com/n7amhed)**System requirements**

PC system requirements:

Windows XP SP3/Vista

SP2/7 SP1/8 (both

32/64-bit versions); 3GHz

Intel Pentium IV 630 or

1.8GHz AMD Athlon 64

3000; 2GB RAM; nVidia

GeForce 8800 GT or AMD

Radeon HD2900 XT

(512MB VRAM); DirectX

9.0; 2GB drive space;

DirectX-compatible

sound card with latest

drivers; Windows-

compatible keyboard

and mouse required

**PC ADVISOR**  
**RECOMMENDED**

## GAME

## Valiant Hearts: The Great War

"Adventure game set during World War One and styled like a French animation" is the kind of description one might expect from an experimental indie game, but not so much from Assassin's Creed and Far Cry publisher Ubisoft. Here's Valiant Hearts, though, the prettiest thing you ever did see.

It's easy to expect it to be a subdued, tragic affair, covering as it does one of humanity's bloodiest conflicts. However, the beautiful 2D, comic-like graphics are the only way in which Valiant Hearts is unusual. At its heart, it's a routine point-and-click puzzle game, with a propensity for the wacky and outlandish rather than dwelling too much on the reality and darkness of war.

There are sad moments in its tale of four very different protagonists drawn together through conflict, but for the most part, it's cartoon capers. There's even a suspiciously smart and super-helpful dog in there - it's not quite Scooby Doo in the Somme, but it's certainly not *All Quiet On The Western Front*.

It's difficult to tell from afar - especially as the marketing has tried to make Valiant Hearts look like a hand-drawn *War Horse* - but it may well be that this is a children's game. Carefully-told nuggets of WW1 history are in there, and might be picked up by a curious young mind in between solving puzzles about organ-playing dogs and giant underground gas machines, or



rhythm action sequences in which Parisian cars dance to the Tango. On that basis, Valiant Hearts is a triumph - educational without being at all overtly so.

For an adult, it's more problematic. The rhythm action sequences (also used, bizarrely and inappropriately, to perform field surgery on shelling and gas victims) are irritating, while the more general puzzles too often involve finding levers to open doors, so it can be a bit of a slog. They're rarely hard - if anything they're too obvious - but there's a lot of trudging back and forth required to complete them.

A sustained level of visual invention makes Valiant Hearts hard to put down despite this, but the reason to continue is to find out what artful oddity will next occupy your screen, not because of any sense of triumph from the puzzles.

The game's tendency to lean towards the absurd also harms its ability to be moving, which is a great shame. When tragedy does occur, it rings hollow, because we've seen characters survive other things unscathed and repeatedly perform superheroic acts.

The takeaway sense is that Valiant Hearts has a bold appearance and a bold subject matter (both in terms of World War One being an uncommon game setting and that this isn't an action title), but it couldn't quite find the game design to go with it. Even so, it's not far off 'not to be missed' status. It might not get it quite right, but games that aim as high as this - especially when they come from an organisation that usually makes mainstream action games - should be encouraged.

**Verdict**

Valiant Hearts is beautiful and brave, but it doesn't land as many emotional punches as it might have done, while the puzzles' challenge will underwhelm most grown-up players. ☒ **Alec Meer**





**£341** ex VAT  
**£410** inc VAT

#### Contact

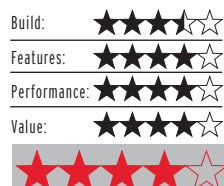
■ [kodak.co.uk](http://kodak.co.uk)

#### Read more

■ [tinyurl.com/pcvq435](http://tinyurl.com/pcvq435)

#### Specification

A4 sheetfed flatbed;  
600dpi; colour duplex;  
50-sheet feeder capacity;  
USB 2.0 interface (USB 3.0  
compatible); daily duty  
volume 3000 sheets;  
barcode reader; ultrasonic  
multifeed detection;  
TWAIN/ISIS/WIA compliant;  
330x162x246mm; 3.2kg;  
3-year warranty



## SHEETFED SCANNER

# Kodak Scanmate i1150

Some scanners almost revel in their level of complexity, offering you umpteen different ways to carry out a task, but few ways to easily and quickly process simple jobs. The Kodak Scanmate i1150, though, goes to war against Byzantine scan processes. Aimed primarily at businesses that have to handle large numbers of customers, or locations in which employees need flawless scanning immediately, the Scanmate is a one-stop-shop for perfect results.

The sheetfed doesn't dazzle you with elaborate control panels. Much of the smooth exterior is completely blank, and there's even a generously-sized ledge for holding cards, photos and other items that can identify the owner of the documents - should you be processing information on individuals, for instance, you'll find this a quick means of keeping track of who you're currently working on. The main controls are situated to the right, and work in conjunction with a colour LCD.

Operation is extremely simple, and you run through a list of supported file formats - including colour or black and white PDF or RTG documents, and TIFF pictures - and select the number of prints. And that's all there is to it. The Kodak can automatically send specific files to a particular location for the most effective one-button results. You can't plug in USB drives or memory cards, but otherwise it's very easy to access files. With its 162x330mm footprint, the Kodak is large enough not to be easily knocked off a tabletop, yet compact enough to leave plenty of desk space.

In operation, the i1150 is quick but quiet. Bundles can combine a wide variety of different document types, so you needn't be too fussy about what you put through it. The Scanmate can even handle barcodes without too much difficulty, giving it the ability to run through sizeable workloads at once. We didn't find the paper output to be the most effective, though. Even when the output tray was extended to its furthest point, A4 documents had a habit of trapping themselves.

We had few problems with material not feeding properly,



though. Kodak's ultrasonic detection is good at listening to what is happening, and when more than one item gets sucked into the feeder, it halts to proceedings, making it unlikely that your documents will be ruined by an errant feed. Overall, the i1150 was easy to deal with. A4 is handled as standard, although an optional upgrade can convert this to an A3 model.

## Scan speeds

The Scanmate doesn't aim to be the fastest on the market, but it's still a pretty slick performer. The assumption is that operators will need to process lots of relatively short bundles of documents. To that end, the i1150 has a 'Transaction' mode that aims to turn out the first 10 sheets (either double- or single-sided) in a fast time, while taking longer from the eleventh sheet onwards. So at 200dpi, the first 10 sheets were turned out at the speed of 37.5ppm - only marginally down on the quoted maximum of 40ppm. The remaining sheets were noticeably slower, though, achieving speeds of just 25.8ppm. This is still fast, but if you'll be using the i1150 for large bundles, you should expect a significant drop in performance.


At 300dpi, the Kodak achieves speeds of 31.6ppm over the first 10 pages, but drops to 20.6ppm for subsequent sheets. Bear in mind that the scanner works in duplex mode, so you can effectively double these figures if you want to consider sides per minute rather than pages.

The scanner has a recommended daily volume of 3000 pages per day, which is standard for a mid-volume sheetfed at this price-point.

Quality is good, with characters beautifully converted, and lines and shades subtly handled. There are better photo scanners, but for handling varied bundles of documents, the Kodak offers more than enough quality to produce excellent results. 600dpi is available for the very best results, although the still very capable 300dpi mode is likely to be the favoured option when high quality and performance need to be combined.

The main software package will be the Limited Edition of Kodak Capture Pro. This comprehensive package takes in excellent OCR facilities and spectacular barcode reading, as well as the more standard imaging capabilities. It's a reasonably intuitive and effective program that allowed us to produce Searchable PDFs, and to separate different jobs from one another with ease. It can even work directly with SharePoint 2013.

## Verdict

The Scanmate i1150 is powerful and easy to use. Results are smooth and the quality is good. For many serious businesses, the price tag won't be much of an issue given the stunning performance. Whether you're feeding in 200+ page bundles, or scanning books, this is a fantastic option for the office with very high aspirations.  **Robin Morris**



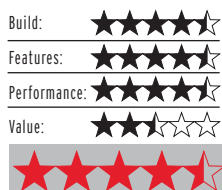
£49 ex VAT  
£59 inc VAT

Contact

■ [samsung.com/uk](http://samsung.com/uk)  
Read more  
■ [tinyurl.com/nfjhdor](http://tinyurl.com/nfjhdor)

Specification

Mono laser printer;  
128MB standard memory;  
1200x1200dpi max  
printing resolution;  
20ppm specified speed;  
150-sheet standard  
input capacity; USB  
2.0; 802.11b/g/n;  
332x215x178mm; 3.97kg



MONO LASER

## Samsung Xpress M2022W

Samsung's latest compact mono laser printer, the Xpress M2022W, may be small in size but it packs a turn of speed in just about every department.

For a start, it takes no time at all to set up. As it measures a mere 332x215x178mm and is a lightweight 3.97kg, you can whisk it swiftly out the box. Its small footprint is ideal for SMEs wanting to economise on desktop space.

Loading paper is a matter of dropping the front panel and sliding in up to 150 sheets of A4 - the 100-sheet output tray is on the top and the printing action is smooth with no noticeable jamming issues.

The Xpress M2022W also presents you with several fast print options. As well as the conventional USB 2.0 connection to a PC, a dedicated WPS button ensures a rapid Wi-Fi link to a network.

Printing from mobiles and tablets takes seconds using Google Cloud Print or Samsung Mobile Print, and if you have an NFC-enabled Android

phone, then you can do a 'tap' to pair before printing over Wi-Fi on the top left of the cover.

When it comes to production rates, the M2022W lives up to Samsung's claimed speed of 20ppm, with the first page out in around nine seconds. Black text is bold and unbroken, with no evidence of streaking or feathering, and there's remarkably good definition and contrast on graphics and photos.

Some people might find the control system too minimalist, though - just the WPS and power buttons, and no display. The enclosed software includes an online manual and Samsung's Easy Eco Driver, which lets you make adjustments to your documents and images prior to printing to reduce costs.

So bitmaps can be converted to sketches or erased entirely, bold text scaled back to standard and small lines removed, while simultaneously revealing what percentage saving you're achieving.



There's no high-yield ink cartridge for the M2022W but the MLT-D111S cartridge is good for 1000 pages and currently costs £49.55 on Amazon or £41.04 on Cartridge Save. So overall value is poor at 5p per page, when many mono lasers will cost you 2p or less per page.

### Verdict

Samsung's mono laser punches out rapid, good-quality pages. Its host of connectivity options as well as eco savings should appeal to the expanding SME market. It will be an expensive printer to run, though, each page costing 5p when other models run at 2p or less. [✉ Martyn Clayden](#)

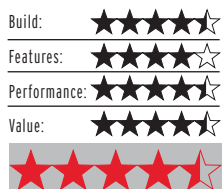
£548 ex VAT  
£658 inc VAT

Contact

■ [brother.co.uk](http://brother.co.uk)

Specification

Colour laser printer;  
128MB standard memory;  
2400x600dpi max  
printing resolution;  
30ppm specified speed;  
auto duplex printing;  
750-sheet standard  
input capacity; 50-sheet  
multi-purpose tray;  
10/100 Ethernet, Wi-Fi  
802.11b/g/n, USB 2.0;  
410x495x445mm; 28.3kg



COLOUR LASER

## Brother HL-L9200CDWT

Brother's HL-L9200CDWT is a colour laser that's designed for the more demanding office. It weighs a hefty 28.3kg and measures 410x495x445mm out of the box. Part of the weight is due to the extra 500-sheet paper tray, which is boxed separately and slides easily under the base unit.

A 250-sheet paper tray comes fully attached and the drop-down panel at the front reveals a further 50-sheet multi-purpose tray that can be used for feeding thicker paper and envelopes. To make this transition even easier, a back panel can be lowered to enable the paper to glide smoothly out without having to bend.

The HL-L9200CDWT is all about smoothness and economy of space. For example, there's a tilting 4.5cm colour touchscreen LCD on the top that's discreetly placed on the far left and folds down to lie level with the output area. Likewise, the front cover release button fits seamlessly into the front edge and the USB

port for flash drives is tucked neatly and discreetly into the top left of the front panel, directly in line with the control panel.

Volume is a key factor here, with the 800-sheet total capacity, but connectivity is equally prominent. Ethernet and USB 2.0 connectors provide links to single or multiple PCs and wireless networking is quick and easy to establish.

Brother claims speeds of up to 30ppm for both mono and colour single-page documents and we found this to be pretty accurate overall, with duplex documents on average appearing in 12ppm. Colour contrast and authenticity in mixed text and graphics documents and PDFs is very impressive and photo reproduction on plain paper shows plenty of detail.

The HL-L9200CDWT comes with 128MB memory, which can be expanded to 384MB for even more efficient operation. As you'd expect, you can also buy high yield ink cartridges for black, cyan,



magenta and yellow, which will produce 6000 pages each for 0.96p per page for black and 5.94p per page for the three colours. That's great value for money.

### Verdict

For middle to larger businesses needing a speedy and sturdy colour printer that can churn out good volume and quality with all connectivity options covered without costing the earth, Brother's HL-L9200CDWT ticks all the right boxes. [✉ Martyn Clayden](#)

**£268** ex VAT  
**£322** inc VAT

#### Contact

■ [brother.co.uk](http://brother.co.uk)  
Read more  
■ [tinyurl.com/qgpa2L6](http://tinyurl.com/qgpa2L6)

#### Specification

Colour laser printer;  
128MB standard memory;  
2400x600dpi max  
printing resolution; 30  
ppm specified speed;  
auto duplex printing; 250-  
sheet standard input  
capacity; 50-sheet multi-  
purpose tray; 10/100  
ethernet, Wi-Fi  
802.11b/g/n, USB 2.0;  
410x486x313mm; 21.9kg

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



### COLOUR LASER

## Brother HL-L8350CDW

You can tell that the Brother HL-L8350CDW means business as soon as you take it out of the box. It's a solidly constructed rectangular unit that measures 410x486x313mm and weighs 21.9kg.

There's nothing flash about this printer as it's styled in unassuming shades of black and cream, designed to fit in with your other office furniture. Even the control panel on the top has been made of the same cream plastic to be less visible. Buttons have been kept to a minimum, although cost-cutting shouldn't always be mistaken for style minimalism.

Disappointingly, the LCD doesn't tilt and although the two-line text is backlit, it's a slow process going through menus with small button.

In terms of capacity, the Brother has a 250-sheet paper tray in the base and a 50-sheet multi-purpose tray that drops down at the front. Auto Duplex printing comes as standard which can make significant savings on your stationery costs.

Brother has made some improvements over last year's HL-3150CDW ([tinyurl.com/mcsxoo2](http://tinyurl.com/mcsxoo2)) by including a USB port on the front for USB flash drive printing. Connectivity includes the full package of ethernet, USB 2.0, Wi-Fi 802.11b/g/n and Wi-Fi Direct for linking to mobiles and tablets through the Brother iPrint&Scan app.


The claimed top printing speed is 30ppm for both colour and mono documents, although we averaged around 25ppm for single-page documents of both types and 12ppm for double-sided duplex versions. These are still respectable print rates for busy SMEs and print quality was generally detailed with blacks solid.

As you'd expect, ink cartridges come in low and high yield versions. The basic 2500-page black costs 2.39p per page, while the 4000-page option reduces the amount to 1.76p per page.



Similarly, for colour each standard 1500-page colour cartridge arrives at 5.1p per ink per page with the high-yield 3500-page ink working out as 4.18p per ink page. But at over £100 per colour refill, a toner top-up will set you back close to £400, which will be more than you probably paid for the printer.

### Verdict

Brother's latest laser printer is a good all-rounder and should appeal to SMEs wanting volume printing at a reasonably high speed and good quality.  **Martyn Casserly**

**£26** ex VAT  
**£32** inc VAT

#### Contact

■ [canon.co.uk](http://canon.co.uk)  
Read more  
■ [tinyurl.com/qyxgmp](http://tinyurl.com/qyxgmp)

#### Specification

Compact inkjet photo  
printer; 128MB memory;  
4800x600dpi maximum  
resolution; 8ppm  
specified speed; 60  
sheets plain paper  
maximum input  
capacity; 10 sheets  
photo paper; USB 2.0;  
426x235x134mm; 2.3kg

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



### COLOUR INKJET

## Canon PIXMA iP2850

Canon's PIXMA iP2850 is a compact single-function colour inkjet printer aimed at the home office worker or casual user who wants virtually no frills apart from basic printing.

When you take it out the box, you almost wonder if it's a toy printer as it weighs a miniscule 2.3kg; and all the plastic components feel decidedly flimsy. It certainly won't take up much desktop space, measuring just 426x235x134mm.

Setup is simple - flip up the 60-sheet input tray that acts as part of the cover, pull down the panel that conceals the ink cartridge holders, push the two cartridges into place and connect to your Windows PC or Mac via a USB 2.0 connection round the back. Use the supplied installation disk to load up the drivers and software, fill up with paper and you're ready to go.

The sub-£40 price tag will be one of the main attractions of the iP2850, but the first trade-off is the number of features you'll have to forego. There's no USB port for

flash drives, no controls apart from the power button and no further connectivity options. Borderless printing isn't available either and the maximum photo print size is 13x18cm, which is what you can expect from much smaller compact printers.

The quality of the photos produced is, however, of a high standard, both in terms of detail and colour reproduction, although each 10x15cm glossy print does take 40 seconds to create, and the image doesn't fully fill the paper.


The same is also true of black text documents, mixed text and graphics documents and even comic book pages - you won't achieve speeds of more than 7ppm on A4 plain paper, but thickness of lettering and lines is excellent, and colour authenticity is impressive.

Unfortunately, the iP2850 takes only one combined colour cartridge so will have to be replaced if any one of the individual Cyan, Magenta or



Yellow inks run out. The standard colour cartridge allows up to 180 pages of A4 and costs 7.2p per page, while the standard black cartridge of the same volume is pricey at 6.1p per page. High yield versions increase colour usage to 300 pages and reduce costs to 5.3p per colour page, while black usage expands to 400 pages and halves rates to 3.6p per page.

### Verdict

Canon's stripped-down basic inkjet produces high-quality print results, but dearer ink costs, photo restrictions and very limited functions might prove a deterrent.  **Martyn Clayden**

# BEST MOBILE NETWORKS

We've tested every 3G- and 4G network in the UK. What's the UK's best mobile network in 2014? [Matt Egan](#) investigates

**C**hoosing a smartphone or tablet is just the start. In this world of constant connectivity, the quality and speed of your chosen network is critical to your ability to work and play on the hoof. But which mobile network is best? Connectivity can vary from locale to locale, and day to day. Visit the websites of the major players and they will tell you that they have great coverage, everywhere. The truth is more nuanced.

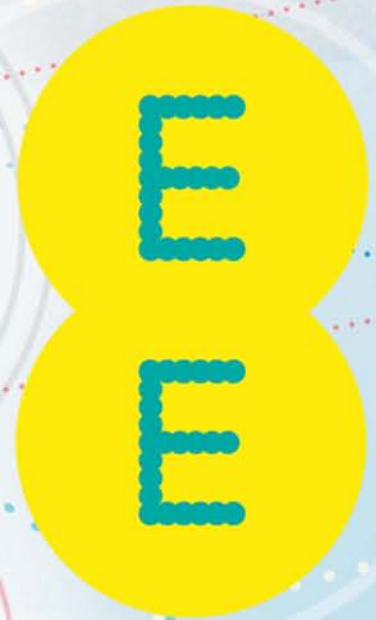
So in the interests of providing excellent independent data, we teamed up with Broadband Genie and set out to test mobile broadband under real-world conditions over most of the length of the UK. We travelled from London to Edinburgh to discover which 3G and 4G networks are best for speed, and for reliability.

We tested 3G- and 4G mobile broadband on the four main networks, with a selection of tasks designed to emulate actual usage and push performance to the limit.

IN ASSOCIATION WITH

**Broadband  
GENIE**





“ 3 is the UK's best mobile network of 2014. Both on 3G and 4G it completed more tests than any other network ”

## UK'S BEST 3G- AND 4G NETWORKS OF 2014: THE CONTENDERS, AND HOW WE TESTED

The major mobile broadband providers who agreed to take part in our test were: 3, EE, O2 and Vodafone. EE incorporates Orange and T-Mobile, so we tested all of the UK's nationally available networks.

We asked each vendor to furnish us with a 3G and a 4G dongle, and over the course of two days we took a train from London to Edinburgh and back, carrying out 39 tests along the way. Each network was evaluated by a dedicated individual, so each test took place at exactly the same time, in the same location.

Our tests fell into three categories: speed, video, and download and upload times. Speed tests are straightforward: at the appointed time each connection was put through Broadband Genie's own speed test, and the results recorded. For video, we streamed a range of clips from a variety of sources, recording what point in the clip each connection allowed the viewer to reach, if they allowed them to play at all. And for the final category of tests, each network was used to down- or upload a specified file to or from the internet. In each case, we recorded whether the network succeeded or failed, and if the latter how far it got.

## UK'S BEST MOBILE NETWORK OF 2014

We can reveal that 3 is the UK's best mobile network of 2014. Both on 3G and 4G, the provider completed more tests than any other network. It was the fastest, with excellent average and peak scores in our speed tests up and down the country.

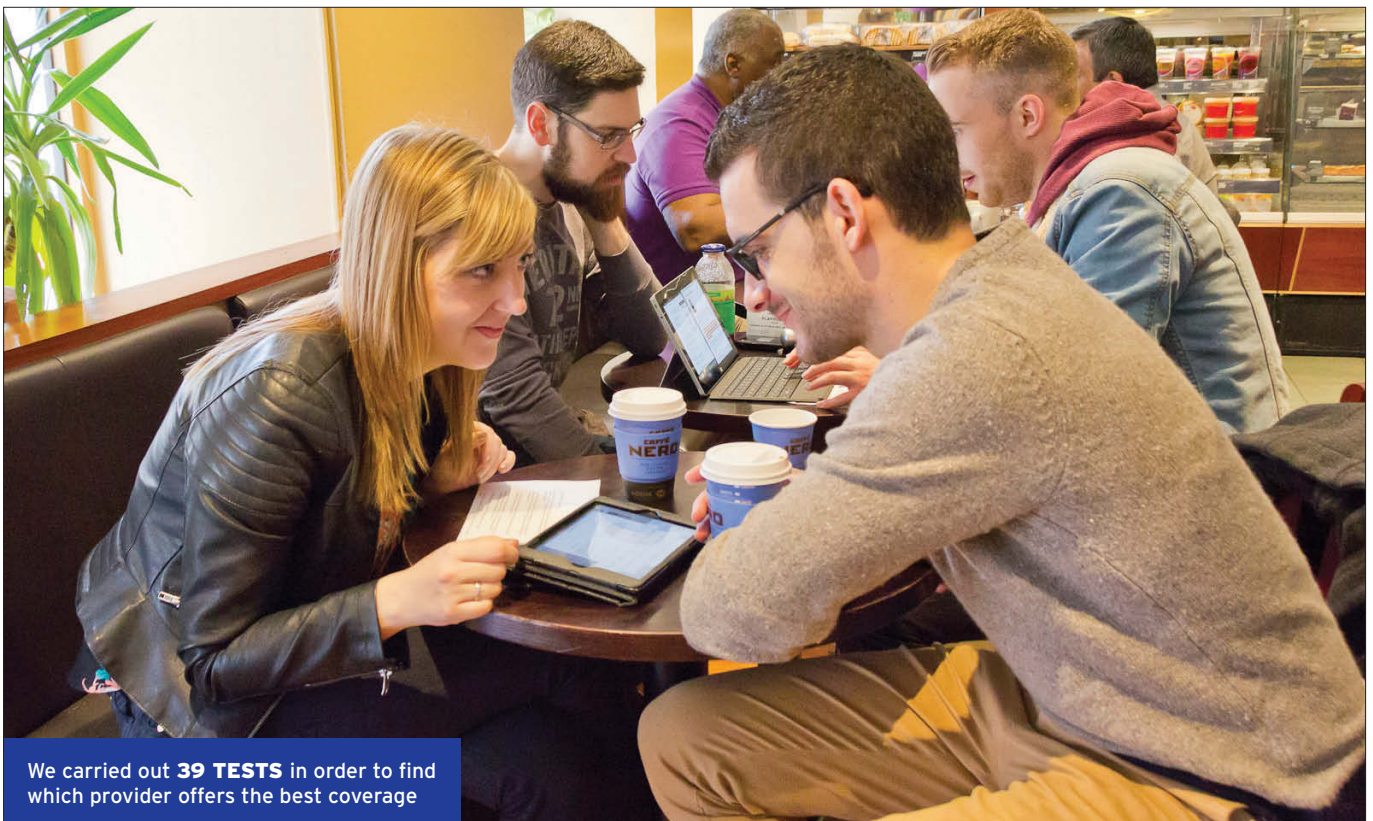
This year's runner-up was EE. It wasn't as reliable as 3 as we traversed the country at high speed, but it completed more tests than any of the other providers. Moreover, as we shall see over the following pages, it's a fast network.



## UK'S FASTEST 3G AND 4G NETWORK 2014

Speed isn't everything, of course, but being able to surf the web, and download and upload at speed is the mobile connectivity dream. Seventeen speed tests were run across both legs of the route, at speed and at many different locations.

Three is the UK's fastest mobile network, on 4G and 3G. Its 4G dongle managed an average download of 6.19Mb/s and an upload speed of 1.54Mb/s, and gave us the single fastest speed test result of the entire Road Trip with a rapid 19.53Mb/s. The provider's 3G service was also extremely impressive thanks to an average 4.48Mb/s download and 1.4Mb/s upload speed.



We carried out **39 TESTS** in order to find which provider offers the best coverage





That's not only faster than every other 3G network, but quicker than almost all the rival 4G networks, too, with only Vodafone's 4G beating it on average upload speed. Three's 3G also recorded the second fastest top speed (for both 3G and 4G) of 15.41Mb/s.

EE was once again the runner-up, being the second fastest 3G and 4G network in the UK. EE's tested averages of 3.99- and 0.62Mb/s for 4G and 2.62- and 0.91Mb/s on 3G were consistent, and peaked at 7.64Mb/s on 3G and 12.34Mb/s for 4G.

O2 isn't far behind EE. The provider's 4G averaged 4.13Mb/s up and 0.89Mb/s down, while its 3G network scored 2.03- and 1.24Mb/s. In our tests, we found that its peak speeds were slightly lower: 11.83Mb/s was the best on 4G, 4.27Mb/s for 3G. Unfortunately, coverage issues adversely affected O2's speed scores - we could complete only seven of the 17 speed scores. So although it's possible O2 is faster than our results show, you need to be able to get online in the first place to measure speed.

Last but not least of the UK's best 3G- and 4G networks is Vodafone. Its 4G successfully completed eight speed tests for averages of 3.2- and 1.49Mb/s, with a top download of 7.92Mb/s

and the overall fastest upload of 7.23Mb/s. Not bad at all on 4G, then. Unfortunately, it's behind on 3G. Average scores of 1.21Mb/s download and 0.66Mb/s upload are disappointing. Just two successful speed tests is poor.

The average speed of all networks this year was 3.48Mb/s download and 1.09Mb/s upload, which is a big improvement on the average 1.24- and 0.72Mb/s of 2013.

## UK'S BEST 3G AND 4G NETWORK COVERAGE 2014

We measured coverage and reliability based on how many of the download, upload and video-streaming tests each network completed. Three came out top, finishing 90 percent of all tests - a staggering result when you consider that most of the time we were travelling through rural areas at speed. We also found 90 percent completion across both its 3G and 4G networks.

EE was once again our runner-up, finishing a decent total of 73 percent of the tests. Its 4G achieved 79 percent, while its 3G service enjoyed slightly less coverage with a 67 percent success rate. A notable difference between the two is that on tests where both



“Runner-up to 3 in the UK's best mobile network of 2014 category is EE. It wasn't quite as reliable as was 3 as we traversed the country at high speed”



services failed, EE's 4G almost always came closer to finishing thanks to its faster speed.

There was then a big drop to O2 and Vodafone. O2 completed just 18 out of a possible 78 tasks. There were no significant differences between 3G and 4G - both scored 23 percent and experienced long periods with no connectivity at the same time. Down at the bottom is Vodafone, with a disappointing 17 percent completion rate. Its 3G was only able to finish just four of 38 tasks, and its 4G was marginally more successful with 23 percent. Both providers struggled outside of heavily populated areas such as London and Edinburgh.

## UK'S BEST 3G NETWORK 2014

Of the four 3G networks on test, 3 demonstrated the best performance. We recorded an outstanding top download speed of 15.41Mb/s, and average speeds were 4.48Mb/s down and 1.4Mb/s up. The provider maintained a connection throughout much of the journey to complete 90 percent of all the tests. A great 3G network.

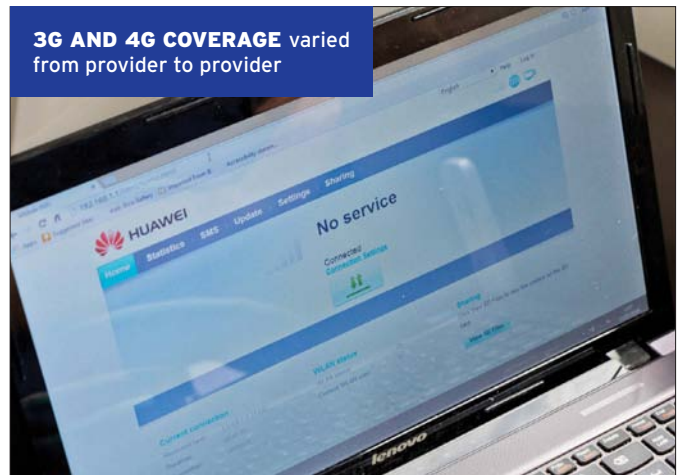
EE was not as good, getting a reasonable average download speed of 2.62Mb/s and a less impressive 0.91Mb/s average upload. It also had the second fastest 3G result of 7.64Mb/s. Completing 67 percent of tests on 3G is a decent result, too.

O2's 3G dongle gave a strong performance, with an average 2.03- and 1.24Mb/s, and a peak download speed of 4.27Mb/s. Again reliability was an issue, with only nine out of 39 tests successful. But at least it was better than Vodafone's 3G offering, which completed just 10 percent of all the tasks. The average speed was a meagre 1.21Mb/s down and 0.66Mb/s up, with a top speed of just 1.95Mb/s down.

## UK'S BEST 4G NETWORK 2014

Guess what: 3 was the best 4G network, too. It completed 90 percent of tests, with average speed test results of 6.19- and 1.54Mb/s. The

**3G AND 4G COVERAGE** varied from provider to provider



provider's 4G top speed of 19.53Mb/s was also the single fastest result recorded, and its peak upload of 2.89Mb/s was impressive.

EE wasn't able to match 3 on speed or coverage, but still performed well. A success rate of 79 percent in tests was good, as was an average download time 3.99Mb/s. The 0.62Mb/s average upload was disappointing, though, it managed a peak downstream rate of 12.34Mb/s.

O2's 4G beat EE in average speeds, as our speed testing recorded 4.13Mb/s download and 0.89Mb upload. It also came close on top speeds with 11.83Mb/s download. Unfortunately, with only a 23 percent test completion rate it appears O2's network lacks the reach of EE. Vodafone 4G made up for the weak results of the 3G service by hitting an average 3.2Mb/s down and 1.49Mb/s up, and peak speeds of 7.92- and 7.23Mb/s, which was the fastest upload speed overall. Unfortunately, it struggled to hold on to a signal and managed just 23 percent of the 39 tasks.



**TRAIN STATIONS** were among the locations we visited to test coverage



## BEST TECHNOLOGY FOR WORK AND PLAY ON THE MOVE: LAPTOP vs TABLET vs SMARTPHONE vs HYBRID

BY MATT POWELL, BROADBAND GENIE

Remember netbooks? These diminutive laptops were all the rage until the iPad launched in 2010. Just two years later they were dead in effect as makers ceased production due to plummeting sales.

Despite some predictions, laptops haven't gone the way of the netbook, although the traditional notebook PC is facing an increasing challenge from a growing choice of compelling portable gear. Tablets have never been so powerful and affordable, smartphones with huge screens and multi-core CPUs are commonplace, and there's the recent rise of convertible tablets and lightweight ultrabooks.

But can you drop the laptop and use a tablet instead? Or is a hybrid such as the Microsoft Surface Pro the ideal compromise? Could a smartphone be all you'll ever need? That's what we set out to discover by asking eight volunteers to pair up and head off across Edinburgh putting portable technology through a series of tests.

The tests were designed to hit the weak spots and strong points of one or more of the devices each time, and throw up obstacles the users would have to overcome. They were asked to take photos and video, use mobile internet to post on social media, edit documents and images, and locate and navigate to Edinburgh landmarks.

The volunteers had no knowledge of the tasks in advance, and where possible we gave them devices they'd never used before. We weren't gathering hard data to arrange in graphs, this was about the real-world experience and practicalities of using portable tech.

## BEST TECHNOLOGY FOR WORK AND PLAY ON THE MOVE: LAPTOP

### Acer E1-570

While the other portable devices we handed out were relatively new this was just an average 15in, Intel i3-based system. There's absolutely nothing remarkable about this computer, which was deliberate. Our plucky laptop volunteers were the control group.

This is the kind of system that you can pick up for under £500, hence they're incredibly common and may be the only option for many of us when we need a computer outside the house. The advantages and disadvantages were clear going in, we just wanted to see how they'd get on, and how much complaining they'd do when lugging it around Edinburgh.

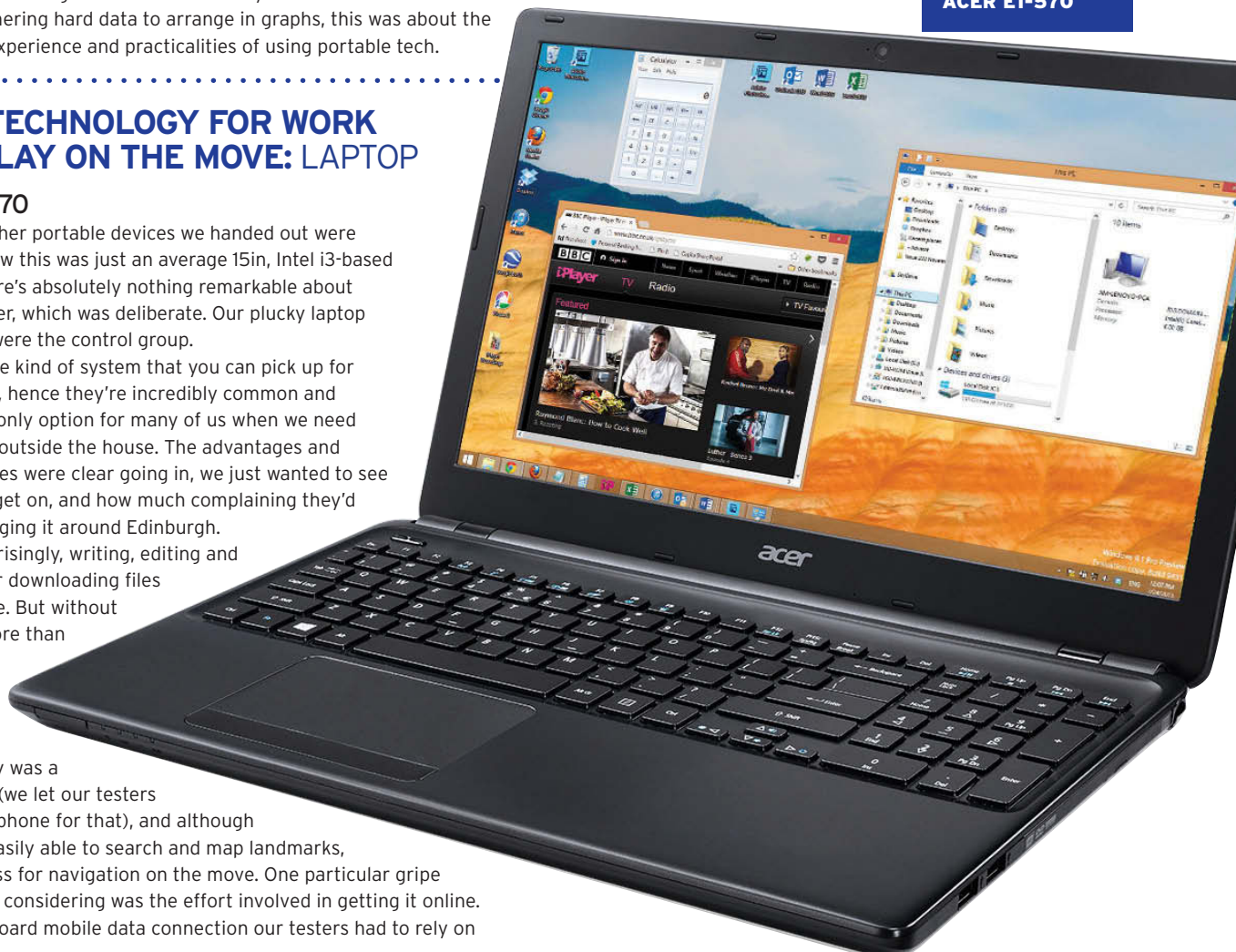
Not surprisingly, writing, editing and uploading or downloading files was a breeze. But without anything more than a simple front-mounted webcam photography was a non-starter (we let our testers use a smartphone for that), and although they were easily able to search and map landmarks, it was useless for navigation on the move. One particular gripe that's worth considering was the effort involved in getting it online. With no onboard mobile data connection our testers had to rely on



public Wi-Fi, which was sometimes hard to track down. It was only later pointed out that they could have tethered a smartphone.

Battery life was a constant worry, as systems of this size do well to last for more than a few hours. It never died completely as it was used only sporadically in order to reserve power. The weight was irritating, too, and it's not hard to see why smaller portables are more attractive for this reason if nothing else. In the end our laptop testers were the first to skulk off to the pub.

ACER E1-570





## BEST TECHNOLOGY FOR WORK AND PLAY ON THE MOVE: SMARTPHONE

### Samsung Galaxy S5

Samsung's latest flagship smartphone doesn't change the winning formula too much, but it's still a cracking handset, with a beautiful display, tons of processing power, and some useful new battery saving features. The 5.1in 1080p screen and powerful hardware make a smartphone like this a natural choice for anyone looking to replace all their gear with one device.

Our Galaxy S5 users were immediately smitten by the quality and size of the screen. They also found the user interface fast and responsive compared to their own iPhones, and were surprised how unobtrusively it slipped into a pocket, despite the relatively large dimensions. However, in actual usage the Samsung's measurements were a handful, particularly when walking around, and they found the material was quite slippery.

Navigation and photography tasks were painless. The camera is fast and takes a great picture, the big screen made using Google Maps a pleasant experience and Android makes it easy to post on social media.

Text entry was trickier. Although the default keyboard is very good, it became uncomfortable for anything lengthier than a Twitter post or text message, and they found copy and paste to be fiddly. Android does offer a wide range of alternative keyboards, so there's usually a way to make text input more pleasant but there's nothing to match a physical keyboard. A Bluetooth keyboard accessory would definitely help and, when paired with a case/stand combo, can turn any smartphone into a mini laptop. But that's another device to charge and carry around.

Battery life, the Achilles heel of any portable gadget, was an issue on the S5. An afternoon of constant use left it nearly drained by the evening. Navigation in particular was a major power hog, as the need to maintain data and GPS links and have the screen powered on resulted in a rapid decline in battery.

## BEST TECHNOLOGY FOR WORK AND PLAY ON THE MOVE: TABLET

### Apple iPad mini 2

Unlike its first iteration, the latest version of the iPad mini doesn't lose out much on specifications compared to its bigger brothers. While smaller and lighter, you still get that headline Retina display and the same 64-bit A7 chip found in the iPad Air. The mix of power, portability and a huge range of apps and accessories makes the iPad a tempting alternative to laptops.

The mini 2 proved useful for our volunteers when faced with text- and image-editing tasks. The big screen made text input more comfortable even with a virtual keyboard, though, a keyboard accessory would be advantageous for lengthy text entry. Our testers also found it easy to get some nice images when recording photo and video, with the bigger display proving useful when framing a shot and viewing the results. iOS 7 makes social media sharing a cinch, too.

The iPad was equipped with mobile data support and had a SIM card from 3. This feature adds a significant premium to the basic



SAMSUNG GALAXY S5

price of any tablet, but it's far more convenient than using a tethered smartphone or Wi-Fi hotspot; if you're serious about working on the move with a tablet, we feel it's worth the additional cost.

The experience of using an iPad for navigation was mixed. The bigger display makes it much easier to search on a web browser and use Google Maps to plan a route, but on the move it's not as comfortable or convenient. We don't imagine many will prefer a tablet over a smartphone for this purpose, it's far easier to quickly pull out your phone and check the location, or keep it in your pocket to use headphones and voice directions.

One shortcoming that may crop up if you're using it for work is the difficulty of transferring files between the iPad and a computer. It's not possible to simply browse its storage and drag files on to a desktop or laptop. To move data off, you'll need to send it to a cloud storage service such as iCloud or Dropbox, email it to yourself or use a third-party tool. None of these options are particularly convenient. Many Android tablets, however, can simply be connected via USB and accessed as a mass storage device.

## BEST TECHNOLOGY FOR WORK AND PLAY ON THE MOVE: CONVERTIBLE TABLET

### Microsoft Surface Pro 2

The Surface Pro 2 is a beast of a tablet that boasts a powerful mobile processor (Intel i5 or i7), 10in 1080p display, up to 512GB storage and Windows 8.1. Add the optional Type Cover accessory, which gives it a real keyboard, and this package offers lot more flexibility for proper computing compared to the competition.

“ The iPad Mini 2 proved useful for our volunteers when faced with text and image editing tasks ”



**iPAD MINI 2**

The hardware and software of the Surface Pro 2 made the productivity tasks very easy – sit down, flip out the keyboard, deploy the kickstand and get to work. Its weaker areas were anything to do with photography or requiring on-the-go access. Front and rear cameras are just 1.2Mp, so image quality is limited, and like other tablets, it's not the most convenient way of getting information while walking around. Neither is surprising and a smartphone fills the gap, but you shouldn't expect it to take pictures like the iPad mini.

Our testers were new to the Surface Pro, had never used Windows 8 with the Modern UI and mostly stick to Apple gear outside of work. Their first look at the Surface Pro 2 left them impressed with the build quality, keyboard accessory and touchscreen, but they weren't happy with the UI, complaining that the interface was convoluted and got in the way of what they were trying to do. They did, however, admit that it made a lot more sense here than on a normal Windows 8 laptop.

Despite these misgivings there's a major advantage to having Windows running on a highly portable platform like the Surface Pro: it's got an incredible choice of software. Most of the tools you'd use on a laptop or desktop will work, including

productivity and creative applications such as Microsoft Office and Adobe Photoshop. And whereas Android and iOS tablets can be fiddly when faced with more unusual file formats or specialist requirements there's little you can't easily achieve with Windows.

The Surface Pro 2 proved extremely useful in any of our tasks where a keyboard or mouse came in handy, and did so without the weight or power requirements of a full-size laptop. It sits in a niche between a tablet and laptop that's not going to be right for everyone, but there's a section of the market, business users in particular, who'll find the Surface to be a perfect match. ☒



**MICROSOFT  
SURFACE  
PRO 2**





# SUB-£50 HEADPHONES

These days, you needn't spend a fortune on a decent set of headphones.

**Dave Stevenson** looks at six great-sounding models that won't break the bank

**M**obile music lovers have never had it so good: the standard headphones you get with smartphones are at an all-time high in quality terms, with even Apple's much-derided white earbuds receiving an upgrade in 2012.

Still, spending a little to upgrade your earphones is one of the best ways to get the most from a smartphone, or any other portable player. The instant lift in audio quality needs to be heard to be believed - better, more impactful bass, crisper, more detailed treble and better isolation from the outside world are all worth the investment. Here, we've rounded up six different pairs, from traditional studio-style cans to tiny in-ear offerings, and given them an extensive listen to see where your money is best spent.

Choosing headphones isn't just about improved audio quality, though - there are plenty of things to consider to make sure you end up with something that suits you perfectly.

## Inline remotes and microphones

Once you've had headphones with an inline remote and microphone you'll never go back. These allow you to answer calls, shuffle tracks and change the volume on audio playback, while the integrated microphone means you can carry on a conversation - and use voice activated software - without pulling your phone from your pocket. A very useful addition to look out for.

## Circumaural headphones

Circumaural is another way of saying that a pair of headphones totally enclose the ears they're worn over. The advantage to this is lots of bass and good isolation from outside noise. And, because the speakers are effectively sealed against the wearer's head, there's minimal sound leakage. The drawback is always size: circumaural

headsets are very big and very heavy, and are always worth trying on before committing to.

## Supra-aural headphones

These are a different kind of headphones, although like circumaural headsets they still involve a headband. Supra-aural sets sit over the ears and press inwards to provide enough volume and to stop sound leaking out. The benefit is size and weight: these can be smaller than studio-style headsets, but the trade-off is often comfort.

## In-ear headphones

These are arguably the most common type you'll see, and it's obvious why. In-ear headphones are small, very portable, and don't weigh very much. All the in-ear headphones this month are canal headphones, which means they have rubber grommets on the end which are pushed slightly (and carefully) into the ear canal. This produces excellent audio quality, thumping bass and lots of noise isolation.

## Noise isolation

Blocking out the outside world is an important job of a decent pair of headphones. Cancelling a rowdy office or the hum of the engines on a long flight can make life much more pleasant. At its most basic, noise isolation simply forms a seal around or inside the ear, preventing unwanted sound waves entering. In-ear headphones, particularly canal-style headphones, are excellent at this. Otherwise, circumaural headsets are the next best way to go. Pay more than £50 and you'll find models with active noise cancellation, where headphones play an imperceptible sound that cancels out constant background thrums such as engine noise.



Photography by Dominik Tomaszewski



# IN-EAR HEADPHONES



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

**PC ADVISOR**  
BEST BUY

## RHA MA450i

**£40 inc VAT** • [rha-audio.com](http://rha-audio.com)

The MA450i, built by British specialists RHA, is a classy-looking set of in-ear headphones. Finished with glossy black plastic and aluminium, and with a gold-plated 3.5mm jack at the end of a 1.5m, fabric-braided cable, these are headphones for those who don't need to shout.

The fabric-braided cable isn't just for show. It's harder to kink and bend than traditional rubber casings, and that means these should survive being stuffed in a pocket a few times. The metal and plastic construction of the earbuds themselves is convincing, too. The box also contains a mesh pouch with a drawstring, giving you another way to protect the MA450i when not in use. The bundled accessories don't stop there: everyone has different shaped ears, and the RHAs come with seven pairs of rubber ear grommets, allowing you to find a setup that fits snugly and comfortably. The MA450i is topped off by an inline remote on the right speaker cable. Three buttons mean you can send the volume up and down, as well as being able to start and stop playback on compatible phones. The integrated microphone is a further plus, and we found the system worked well and delivered phone conversations extremely well on an iPhone 5.

A big advantage of earphones that fit in your ear canal is noise isolation, and the MA450i is a great choice for anyone looking for passive noise cancellation: hearing the outside world is all-but impossible with them on. Press Play and the impressive performance continues: the MA450i produces a spacious, detailed sound whose rich, clear bass belies the small size of the dynamic driver. Unlike other budget headphones, the bass isn't simplistic, boomy noise but crisp, detailed and dynamic, which means electronic music sounds as good as traditional rock. They sounded excellent no matter what we put through them, effortlessly distinguishing between instruments in complex rock arrangements, and underscoring their suitability for those who don't restrict themselves to a single genre of sound.

**VERDICT:** The MA450i is the most expensive set of headphones here – either in-, on- or over-ear – but you get indisputable benefits for the extra money. Sound quality is the biggest plus: these sounded superb no matter what we threw at them, and the generous supply of different-size earbuds meant they were comfortable as well. The inline remote is great for anyone who listens while they roam, but the biggest plus is audio quality, which is deeply impressive for the cash.



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

## SONY MDR-EX110AP

**£18 inc VAT** • [sony.co.uk](http://sony.co.uk)

Apart from the glossy red finish on our review headphones, the Sony MDR-EX110APs are nondescript – a pair of tiny drivers with rubber grommets and a small, single-button remote dangling from the left-hand cable. Compared to the fabric effort on the RHA headphones or the unusual zipper-style cable on the Vibe headphones, the audio cable feels like it might not stand up to much abuse.

The remote control is a welcome sight, and on our test iPhone, it had no problem picking up our side of a voice call and relaying it down the line. The remote has just one button, so although you can start and stop music, the only way to change the volume is to reach for the phone itself. The final touch is a cable tie, around which you can wrap the EX110AP's 1.2m wire, allowing you to avoid key-ensnaring tangles forming in your pocket.

Still, at £18 we're happy to sacrifice a few luxuries if decent sound quality is on offer. In fairness, the EX110APs offer a decent sound. There's a good amount of volume, and pop music in particular sounds pretty reasonable: bright and clear with a detailed top end that sits just on the right side over overly-sharp. The upshot is that there's enough treble to make different instruments and stereo channels sound distinct without the sound being cutting or crispy.

At the other end, there's enough bass to do the job, which is impressive from such a small pair of headphones. The drawback is that the bass isn't particularly clever: there's a bit of boom to keep pop-pickers happy, but fans of more traditional bass guitar sounds will notice a distinct lack of timbre compared to pricier headphones. We were unable to find any music that made the headphones sound poor, though – there's enough quality to keep casual music fans happy.

The EX110APs are very, very comfortable. The very low weight means they don't need to grip the ear canal too tightly, which can be an irritating bugbear on larger ear canal headphones. It also makes them less prone to falling out, which makes these a good choice for those looking for something to wear while exercising.

**VERDICT:** For the price, this is an excellent set of headphones that we're happy to recommend. They're comfortable, affordable and the sound quality, while not of the highest order, is satisfying enough. We don't think you'll regret spending the extra on the RHA MA450i headphones, but for those on a budget these are a decent choice.

## OVER-EAR HEADPHONES



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

**PC ADVISOR**  
RECOMMENDED

## VIBE SLICK ZIP V3

**£14 inc VAT • [vibeaudio.co.uk](http://vibeaudio.co.uk)**

The other in-ear headphones in this group test use a simple system for managing where the wire from each headphone joins the other: an adjustable toggle which slides up and down. The Vibe Slick Zip V3 headphones use an altogether more complex solution: a plastic zipper which can be zipped up to bring the two cables together, or down to allow them to separate.

The cynical will accuse the makers of cheap gimmickry, and they'd be right: the zipper adds precious little functionality to the headphones. In fact, it actually adds a not-insignificant amount of weight, which is bad news as it makes them prone to falling out. We also discovered that the plastic zipper was a keen transmitter of vibration noise, which means the slightest touch on the cable was sent up the wire to the listener's ears.

There are other compromises: the black plastic 3.5mm jack feels a little cheap, and although the Slick Zip's cable is wrapped in fabric, it didn't resist kinking as well as the RHA MA450i's more supple-feeling cable. And, as with the Sony MDR-EX110AP headphones, the inline remote has only a single button. That means you can answer calls with it, as well as starting and stopping music, but there's no volume control.

There is an upside, though, and it's significant. For the paltry sum asked - under £15 - there is an astonishing amount of sound quality available. The Slick Zips aren't world class - they're bested by the much more expensive RHA headphones - but they're at least on-par with the Sony EX110APs.

There's a lot of (fairly uncomplicated) bass on offer - on the wrong track the Slick Zips can sound too boomy, and there's an obvious trade-off between overall detail, direction and attack and headline-grabbing bass, but the overall effect is a reasonable amount of clarity and punch.

**VERDICT:** There are drawbacks: the zipper is an unnecessary detail that makes the whole assembly heavier, and that means these were the least comfortable headphones we tested, albeit in the company of some supremely comfortable examples. There are also practical concerns: jogging with these in became irritating extremely quickly. But when you can get decent sound quality for a shade over a tenner, many will be happy to make the compromise.



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

**PC ADVISOR**  
RECOMMENDED

## AKG K77

**£25 inc VAT • [uk.akg.com](http://uk.akg.com)**

Like the Sennheiser HD 429s (page 74), AKG's K77s are circumaural, which means they completely enclose the wearer's ears. This, in concert with their closed backs, means plenty of potential for strident, thumping bass. AKG also markets these headphones as being suitable for "professional use" - quite the claim for a pair of £25 'phones.

They don't make a strong first impression. The synthetic grey ear cushions aren't exactly plush, and the blue plastic casing on the closed backs of the earpieces is equally utilitarian. The 190g weight is low, but on such a large pair of headphones the build quality is a little unimpressive. Beauty may only be skin deep, but we couldn't help but wish the K77's offered a look that matched the high-end marketing claims.

You do at least get a very practical amount of cabling: the 2.5m wire is only bettered by Sennheiser's three metre cable, and AKG's is the thicker of the two, which makes it less prone to tangling and - potentially - more resilient to being run over by office chairs or kinked in a bag. There's also a 1/4in phono adaptor to pop on the end of the cable in the event you've got high-end stereo equipment. Travellers should note that AKG's money hasn't been frittered away on extras - there's no inline remote control or carry case.

Pop the headphones on and press play and you'll forgive the looks and scarce accessories: these sound impressive for a sub-£30 pair of headphones. The soundstage is wide, with detailed bass and reasonably dynamic treble. If we had a complaint, it would be that bass is clearly the priority, which is great for pop music, but means more subtle acoustic music is a little less impressive. Still, there's detailed sound across the board, rock music is handled with attack, and the faintly limited treble is easily corrected by anyone with access to a graphic equaliser.

**VERDICT:** Better yet, despite the uninspiring looks and choice of materials, the K77's are comfortable. Adjustability doesn't come via a clicky ladder mechanism but by a traditional flexible headband, with a cage above it providing structural support and somewhere for the stereo cable to run. The result - in concert with the low weight - is a pair of headphones you can wear for hours. Fashionistas might not like them, but there's plenty here for the unselfconscious.





## SENNHEISER HD 429

**£45 inc VAT • en-uk.sennheiser.com**

Compared to the AKG K77's, the Sennheiser HD 429s look the part. Finished in posh-looking black plastic with faux-leather earcups and headband cushion, they deliver the kind of aesthetic that style-conscious audiophiles will be looking for. They also deliver something closer to the kind of price we'd expect: £45 makes them the most expensive headphones here.

Design isn't the only place the money's been spent. The HD 429's feel a little more convincingly built throughout, and the gold-plated 3.5mm and 1/4in adapter jacks are good to see. You also get more cable: 3m of 3.5mm audio wire means you can stray a long way from your sound system without having your headphones yanked off your head. This is something a double-edged sword: nearly 10 feet of cable is a lot to cram into a jacket pocket as you get off the train. The cable is thin compared to AKG's: those with an unsympathetic approach to wire bundling will have to beware of kinking the cable. All the headphones in this round-up have captive audio cables, so if the wire snags or breaks within the rubber casing, you're stuck with them. If you're happy to spend another £15 you can buy the Sennheiser HD 429s, which comes with a single-button inline remote: these don't.

The HD 429s are big. The ear cups are slightly larger than those on the AKG K77s so they fit a little easier, and although we preferred the flexible head strap on the AKGs, the HD 429s are nonetheless comfortable for very extended listening periods. The HD 429s have larger earcups, but we slightly preferred them in our comfort tests.

They sound good, too. We felt the soundstage was a little more compact than with the AKG K77s, but where the AKGs put lots of emphasis on bass, the Sennheiser HD 429s were more subtle across the range of music we tested them with. They don't lack bass, but it never overpowered. There's still plenty of bass where it's needed, but the HD 429s produced a broadly balanced, fulsome sound whatever we listened to.

**VERDICT:** You admittedly pay quite a bit more for a fairly small improvement in sound quality, and from a purely aural standpoint, the extra cash isn't terribly well spent. However, the HD 429s are smaller than the AKG K77s thanks to the lack of a large frame over the head strap, feel a little more solid on the head, as well as combining high-end looks with a budget price.



## SKULLCANDY UPROCK

**£17 inc VAT • skullcandy.co.uk**

No beating about the bush: half the *PC Advisor* office loved how the Skullcandy UpRocks look. A hot pink audio cable combined with neon blue on-ear speakers make for a distinctive piece of kit, although distinctive styling wasn't enough to stop the other half of the *Advisor* office recoiling in horror. They are, incidentally, also available in black.

Portability is one of the UpRock's key attributes. The Sennheiser HD 429s and AKG K77s look huge by comparison, with their large earpieces and long cables. The UpRocks are compact, lightweight, and the 1.3m cable is a very practical length for connecting to a phone in your jacket pocket, if less appealing for connecting to a home stereo. The cable also has a flat rather than circular cross-section, which makes it harder to tangle.

There are other factors that limit the UpRock's appeal. They're on-ear, rather than in-ear headphones, and while this doesn't mean less comfort, they definitely sit tighter on the head because the earpieces need to press in to prevent lots of sound leaking. They are generally comfortable, though, with a double-cushion design in the earpieces giving sensitive ears a little more padding. You'll never forget you're wearing them, though, which might limit their appeal.

Sound leaks are controlled by the UpRock's closed-back design. Closed-back headphones can often produce a limited soundstage, and while that effect is limited on the other headphones on test, it's definitely true of the UpRocks. The soundstage is cluttered and indistinct: a stereo effect is discernible, but the UpRocks produce a denser wall of sound than either the Sennheiser or AKGs. Possibly as a sop to fashion-conscious pop-pickers there's tons of bass, but it isn't as tightly controlled as either the Sennheiser or AKG sets. There's plenty of shock and awe, but not much on offer for fans of more delicately arranged music. Fast moving pop sounds okay: trying to tease out the finer points of a Jeff Buckley track was frustrating.


**VERDICT:** The UpRocks have two big advantages: they look (arguably) great, and they're highly portable. The short, flat cable is very convenient, and the low price means it's not the end of the world if you stuff them in a backpack every morning for a combative commute across town. As a gift for fashionable music lovers we can't recommend them enough for these two reasons: but for audiophiles on a budget they don't quite fit the bill.

## Conclusion




This month's round-up contained a pleasant surprise: despite low prices, none of the headphones we tested disgraced themselves, although the Skullcandy UpRock was a clear case of form before function. However, we loved the RHA MA450i: a light, unobtrusive design that packs superb audio quality. Bass is punchy without being overpowering while other notes are crisp, clear and detailed. We played a wide range of music on them and couldn't find anything that made them sound less than stellar, where other headphones had clear strengths in terms of genres that sounded particularly good.

They're clear winners in terms of features as well. The inline, three-button remote is very handy indeed, while the six supplied pairs of rubber grommets mean finding a good, comfortable fit is no problem. We certainly had no discomfort after several hours' use.

Elsewhere the Vibe Slick Zips, despite a rather distracting, gimmicky design, delivered excellent audio quality.

Elsewhere, we liked both the Sennheiser and AKG over-ear headphones. Sound quality from both was excellent, and they were supremely comfortable. The AKG held a slight advantage in this respect, albeit in a rather dated-looking design; still, they're an impressive set for under £30. If you don't mind the extra weight and bulk, or are looking for a pair of respectable-looking headphones for a home studio, either of these will do nicely, although we felt the Sennheisers held a slight edge for straightforward sound quality. Those looking for commuting headphones might avoid them though: they're both large and heavy, and neither comes with the convenient inline remote of the in-ear headphones we've reviewed. 

## In-ear headphones

	<b>RHA</b> <b>£40 inc VAT</b>  <b>PC ADVISOR</b> <b>BEST BUY</b>	<b>SONY</b> <b>£18 inc VAT</b> 	<b>VIBE</b> <b>£14 inc VAT</b>  <b>PC ADVISOR</b> <b>RECOMMENDED</b>
Product name	<b>MA450i</b>	<b>MDR-EX110AP</b>	<b>Slick Zip V3</b>
Colour(s)	Black/silver	Red/black	Red
Type	In-ear	In-ear	In-ear
Frequency response	16Hz to 22kHz	5Hz to 24kHz	20Hz to 20kHz
Nominal impedance	16ohms	16ohms	16ohms
Sensitivity	103dB	103dB	Not stated
Extras	6x pairs of grommets, drawstring carry case	3x pairs of grommets	2x pairs of grommets
Cable type and length	1.5m	1.2m	1.2m
Connections	3.5mm mini jack, three-button inline remote, mic	3.5mm mini jack, one-button inline remote, mic	3.5mm mini jack, one-button inline remote, mic
Weight	16g	13g	21g

## Over-ear headphones

	<b>AKG</b> <b>£25 inc VAT</b>  <b>PC ADVISOR</b> <b>RECOMMENDED</b>	<b>SENNHEISER</b> <b>£45 inc VAT</b>  <b>PC ADVISOR</b> <b>BEST BUY</b>	<b>SKULLCANDY</b> <b>£17 inc VAT</b> 
Product name	<b>K77</b>	<b>HD 429</b>	<b>UpRock</b>
Colour(s)	Blue/grey	Black	Blue/grey/pink
Type	Closed back circumaural	Closed back circumaural	Closed back supra-aural
Frequency response	18Hz to 20.5kHz	18Hz to 22kHz	20Hz to 20kHz
Nominal impedance	32ohms	32ohms	32ohms
Sensitivity	112dB	110dB	106dB
Extras	None	None	None
Cable type and length	2.5m	3m	1.3m
Connections	3.5mm mini jack, 1/4in adaptor	3.5mm mini jack, 1/4in adaptor	3.5mm mini jack
Weight	190g	218g	120g



# HOME VS ONLINE PRINTING

Should you consider buying a home printer these days with so many other options? **Mike Bedford** investigates

**P**rinting is no longer the growth area it once was. Commonly, documents are emailed rather than printed and put in an envelope, and even the once ubiquitous fax has pretty much died out, eliminating another need for printed documents. It's perhaps even more significant that photos are now viewed on screen, shared online, and archived on hard drives or in the cloud rather than being printed out.

Despite this, the printed page has an appeal that an on-screen image can't match.

The allure of high-quality photographic prints hasn't disappeared for good, and, while relatively few people will print out all their photos, it's not uncommon to want to put the more treasured ones in an album.

Another reason for printing documents is to be able to check them. Although Word and Adobe Acrobat Reader both allow you to add reviewer comments to a document, sometimes writing on a printed copy seems so much more natural, especially where diagrams are included. With printing in decline, but by no means obsolete, it pays to give some thought to your home printer.

For a start, should you consider buying one at all or would it make more sense to use an online or high-street print service?

If you decide you really do need a printer at home, what type should you buy?

Over the page, we consider the answer to these and other pertinent questions in our easy-to-follow guide to home printing.





If you rarely print, it's important to decide on whether or not to invest in a home printer that will spend most of its time sitting idle or to rely on third-party print services.

The first issue is price – and if this is your only concern, online services are often the cheapest. This is especially true if you have an inkjet printer. Buying online, you'd pay up to £1.50 for a large A4 print, but with a home inkjet you could pay anything from 25p to over £1 for the ink, plus another 50p for a sheet of good-quality photographic paper.

In addition, you'll have had to buy the printer in the first place. It's a similar situation with 6x4in prints, which many inkjet printers can handle, but online services offer great prices on postcard-sized prints, too.

What's more, we're not even comparing like with like. Most people prefer photos printed on genuine photographic (silver halide) paper which is the type of print offered by most third-party services.

While home printing often isn't particularly cheap, it does offer a major advantage of convenience. Instead of a trip into town, or waiting a day or two for an online print to appear in the post, your print is available immediately. This is particularly important if you're a keen photographer and want to fine-tune the photo using your photo editor until the printout is perfect.

Alternatively, if you run a small business from home and need to send quotations, invoices and other documents in the post, being able to print immediately is no longer a convenience, but a necessity.

There are also instances when you'll have to use a third-party print service because a home printer just isn't up to the job. Print size is the most obvious example. Few home printers are larger than A4 because A3 printers and above are very expensive.

Print services offer larger sizes and some more specialised companies offer huge poster-sized prints. Similarly, if you need the ultimate in quality, a home printer won't be suitable and we're not just talking about photographic prints. Wedding invitations printed professionally, for example, look so much better than ones created on a home inkjet printer, which may not be able to print on card, and the ink won't run if they're splashed. Online services also provide options of printing on all sorts of media – for example T-shirts, mouse mats and mugs – that ordinary printers can't cope with.

Having weighed up the various pros and cons, it's probably true to say that most people will want the convenience of having a home printer to hand, but they'll also make use of online or high-street print services, especially when cost is an issue. Since printers start at well under £50, you don't have to pay a fortune for this convenience.



## Home printers

If you're in the market for a new printer, the first thing to bear in mind is that the inkjet isn't the only option for home use. There are also monochrome laser printers and colour lasers and, depending on your needs, any of the three could well be the best option.

Inkjet printers tend to be the cheapest (but not by much compared to some monochrome lasers), which is why they're the most popular type for home use. Indeed, you can buy a colour inkjet for as little as £29. However, beware of judging the cost on the purchase price alone.

Equally important, if not more so, is the running cost, and you could well find that the cheaper printers have expensive ink cartridges. Alternatively, some printers use a combined cartridge for all the colours, rather than individual ones, which means you have to replace it when one colour runs out. We always detail running costs in our printer reviews, so be sure to read up on these before making a purchase.

The other thing to bear in mind is quality, and if your main interest is photos, you should only look at those models specifically designated as photo printers.

If you want to print a lot of documents in black and white, the monochrome laser is a sensible option – and prices are a lot lower than you might imagine, from £39. They're fast; text and line diagrams will be sharp and won't run if splashed with water; and the cost of toner cartridges will be much lower than if you were feeding an inkjet with ink cartridges (typically 2p per page of monochrome text compared to 2.5- to 4p for an inkjet). As with inkjets, you should bear in mind the complete cost of ownership, not just the up-front purchase price.

Colour laser printers have dropped in price quite considerably in recent years, and you can now pick one up for less than £120 although, once again, please bear in mind their running costs. As with monochrome lasers, they're fast and produce sharp text

The screenshot shows the Pixum website interface. At the top, there's a navigation bar with the Pixum logo, a search bar, and links for Help & FAQ, Contact, Register, Login, and a shopping basket showing £0.00. Below the navigation bar is a horizontal menu with categories: Photo Book, Prints, Posters & Canvas, Photo Gifts, Photo Calendars, Photo Cards, Creative World, My Pixum, and Customer Service. The main content area features a large banner for 'GALLERY STYLE FOR YOUR HOME' with the text 'Impressive wall art that showcases the very best of your photos.' and a 'Choose Yours' button. Below this, there are links for 'Prices' and 'Tell me more'. At the bottom, there's a blue banner with the text 'ONLINE PRINT SERVICE Printing wedding invitations or need high-quality prints? This is the way to go'.





**OFFICIAL CARTRIDGES** Almost exclusively the more-expensive option, but reliable quality is a given

Second, printers often have built-in scanners - this applies mainly, but not exclusively, to inkjets. These all-in-ones (known as multifunction devices), can be used as a printer, scanner or photocopier. Often they don't cost much more than a plain printer, but first appearances can be deceptive as you might not be comparing like with like in terms of quality.

A third point to consider is to do with the interfaces. Most printers now have a Wi-Fi built in which means that you can share the printer without having to ensure that the PC to which it's attached is turned on.

However, if you find a printer that looks attractive in every other respect, but lacks built-in Wi-Fi, you might find that your router has a USB port which means you'll be able to achieve the same result by plugging

the printer straight into the router.

You'll also be able to print photos to a Wi-Fi printer or to a printer attached to your router from a smartphone equipped with a suitable app. Some printers have a memory card slot or allow you to print from a locally connected camera - selecting which photos to print using the printer's LCD display.

### Printer care

Owning a printer isn't just a case of sitting it on your desk next to your PC and forgetting about it. As we've seen, they can be very costly to run because of the high price of inkjet or toner cartridges. It pays to give some thought, therefore, to the thorny question of what type of cartridge to buy.

Of course, the cartridge must be compatible with your printer as only the

correct type will fit. However, compatible cartridges are made both by the printer manufacturer and by third parties. It's also possible to have cartridges refilled and you can even buy bottles of ink and kits to refill them yourself. These alternatives are a lot cheaper, but are there any drawbacks?

First of all, unless you intend to do a huge amount of printing, we'd be inclined to suggest that you forget about the DIY refill route. It might be the cheapest option, but it's a hassle and it's also a good way of getting your hands (and the kitchen worktop) covered in ink or toner powder.

Having discounted this, the choice comes down to either a branded cartridge, or a third-party new or refilled cartridge. Your printer manufacturer will warn you that using anything but their own cartridges could result in damage to the printer and might even suggest that you'll invalidate the warranty by doing so. However, the fact that we were told in a local high-street cartridge store that they hardly ever sell branded cartridges suggests that any official warnings overstate the case.

Having said that, there are sometimes drawbacks to using third-party inks and cartridges, but as their quality can widely vary from maker to maker it's tricky to give hard-and-fast rules. The most common complaint is that they don't last as long. However, if they only last 75 percent as long, but cost less than half as much, which is typical, they will work out a lot cheaper.

Still, there are reports of some third-party cartridges having such a poor lifetime that they actually work out as more expensive. The other drawback is that some produce prints that fade more quickly. Again, this differs from one cartridge to another, so look for reviews and recommendations before spending any money. ☒

**THIRD-PARTY CARTRIDGES** Finding reliable online reviews is crucial as their performance can vary widely



A large graphic featuring a stack of colorful cubes, each displaying a different icon representing various digital features like music, camera, Wi-Fi, social media, and productivity tools. The word "The" is prominently displayed in red at the top right.



# internet of things

Move over computers, in the future the internet will be populated by "things". **Mike Bedford** reports

**I**t seems likely that the number of servers on the internet - those large computers that serve up websites on demand - will exceed one billion sometime this year. What's more, this is dwarfed by the six billion devices - from desktops and laptops to smartphones and tablets - that access this wealth of information. Huge as these figures might be, though, experts are suggesting that both will pale into insignificance by the number of 'things' that are increasingly appearing online. Estimates suggest there'll be 10 billion such things in 2018, that's 1.3 for each person on the Earth, rising to 26 billion in 2020. What's more, unlike those six billion computers that mainly access information provided by others, all these things will be generating information for themselves. Here, we take a detailed look at the so-called internet of things to discover what's available today and what it might provide in the future.





While the term 'The internet of things' is only a few years old and still isn't an everyday term, the idea of connecting devices other than computers to the internet is by no means new. It's commonly said that a coffee pot at Cambridge University was the first everyday object to be featured on the web. In reality, though, it wasn't really the coffee pot that was put on the internet back in 1991, but an image of the coffee pot via the world's first webcam. Its purpose was to prevent people having wasted journeys when there was no coffee available. Some of the earliest things other than cameras to turn up on the web, all back in the Nineties, were a model railway at the University of Ulm in Germany, the so-called Telegarden at the University of Southern California that could be watered and cared for online, and a light display in a Japanese shopping centre. In each case, an interface allowed the hardware to be controlled remotely while a camera allowed you to see the result of your actions.

All of these web robotic projects were impressive demonstrations of what could be done when the internet had still to become the universal resource it is today.

Such projects are still around in the 21st century, even though they tend to come and go fairly quickly, but they're really just for fun (or for learning about telerobotics). In the main, though, the internet of things is becoming much more down-to-earth in providing data that will benefit us all.

### Ubiquitous sensors

Although it uses the sensors that are present in smartphones, rather than tiny sensors in their own right, an example of a project that was completed by researchers at the California Institute of Technology in Pasadena will show how an internet of things, that's constantly monitoring the world around us, could bring major gains.



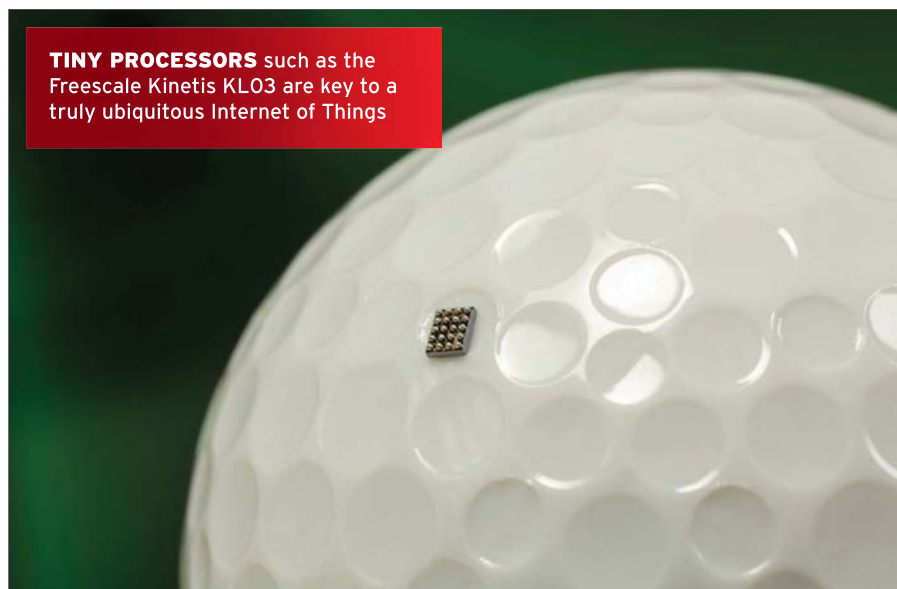
The city of Pasadena is located near the infamous San Andreas Fault which means that it's at risk from earthquakes. Seismic activity that occurs before such events is detected using instruments called seismometers, which are designed to be highly sensitive to movements in the earth while not being unduly affected by other sources of motion such as traffic. The number of seismometers is limited due to their cost so the Southern California Seismic Network operates just 350 seismic stations and the Northern California Seismic Network has further 412. The California Institute of Technology's opt-in Community Seismic Network uses a vastly greater number, specifically harnessing information generated from accelerometers that are fitted in most smartphones.

According to the project's Matthew Faulkner, if only one percent of users in the area opted into the scheme, then a few

hundred seismometers would be augmented by several hundred thousand extra ones. Certainly, they're not bolted to the bedrock, as are seismometers, but Faulkner explained how their susceptibility to irrelevant motion and their often far-from-ideal positioning, can be compensated for by their huge numbers, given sufficiently intelligent processing. The benefits are huge.

"A dense, city-wide seismic network could be used to detect earthquakes rapidly after they start, and measure the strength of shaking accurately as they unfold," Faulkner explains. "For the community, this could mean making automated responses to prevent damage, like stopping trains and elevators, stabilising the power grid, and notifying emergency teams like firefighters about how the shaking occurred."

"We may be able to use sensor data from within high-rise buildings to estimate structural damage, allowing responses and structural repairs to be prioritised."



### The environmental advantage

As part of the government's drive to reduce the nation's energy consumption, and hence the amount of greenhouse gasses produced, electricity and gas suppliers are rolling out smart meters across the country. Due to be completed by 2020, the move to smart meters will bring some substantial changes. Perhaps most obviously, these will communicate directly with the energy companies so we won't have to provide manual meter readings, nor will the utility companies have to send out staff to read our meters and send us bills. Instead, the meters will send back data on how much energy we've used in each half-hour period.

The meters themselves won't necessarily be connected to the internet but, because of the philosophy that information is a key to



persuading consumers to use energy more sensibly and more economically, we'll each be able to view graphs and summaries of our energy consumption online.

To all intents and purposes, therefore, our meters will be online. For those who want to better understand how their electricity has been used, British company Navetas has developed a means for carrying out signal processing to calculate the energy consumption for each appliance. Again, the data is available online.

Smart metering, and even Navetas' application-specific metering, relies on nothing more sophisticated than the ordinary appliances we have around the home. However, even greater energy savings could be made available with smart appliances that would be able to switch on when the smart meter told it that the energy was cheapest, and even allow remote control via the web. It might be a while before the average washing machine or oven is web-enabled, but already British Gas is promoting its Hive system ([tinyurl.com/mppe6h5](http://tinyurl.com/mppe6h5)) for remotely controlling central heating. By having more control over your heating, and being able to delay the system from switching on if you're going to be returning late from work for example, British Gas suggests you could save up to £150 per year. Much smaller and cheaper appliances are becoming web-enabled too with a spate of smart light bulbs having appeared over the last year or so. While some of those have only Bluetooth connectivity, and can therefore only be controlled from nearby using a smartphone and appropriate app,

products from LIFX have Wi-Fi connectivity, allowing them to be dimmed, and even colour adjusted, both locally and via the internet.

### The need to downscale

Online light bulbs might be something of an eye opener, but to achieve anything like the huge number of internet-connected devices over the next few years, those things are going to need to be a lot cheaper than LIFX's rather expensive (around £80) multicoloured light bulb. One company that's keen to help the internet of things become a reality is the UK's leading processor designer ARM. Although, some of the company's cores are powerful enough to be used in top-end servers and even super-computers, at the other end of the spectrum, the range includes products that are small enough and cheap enough to enable the internet of things as never before.

The core that takes centre stage here is the Cortex-M which Ian Ferguson, ARM's VP Segment Marketing, anticipates being used virtually everywhere because of its ultra-low power consumption. Because ARM doesn't manufacture chips, choosing instead to licence its technology to semiconductor manufacturers, he illustrated the point by referring to a 32-bit processor core that's manufactured by Freescale Semiconductor, which fits inside the dimple of a golf ball and consumes just 50mW of power.

Ferguson mentioned chips that consume even lower levels of power so they can be used in equipment that doesn't contain batteries and is powered by harvesting the

energy from the environment, perhaps in the form of vibrations, sunlight or heat.

Some processors based on the Cortex-M core sell for less than 30p each in large volumes. With this sort of technology, Ferguson sees no limit to the sort of devices that will ultimately become intelligent and which could, conceivably, be connected to the internet. "We expect the technology to be embedded into a wide range of existing, everyday objects - even inside our bodies - that will improve all aspects of our lives including health, simplifying daily chores, education, and communication," he told us.

### Voyage of discovery

If you want to get a feel for some of the things already on the web, why don't you take a look at [thingful.net](http://thingful.net)? Although the site offers little in the way of explanation, it provides a geographical interface allowing you to view connected things anywhere in the world; and clicking on one of those things allows you to discover more about it.

Commonly, the things are sensors of various types including weather stations, navigation buoys, environmental monitors and smart energy meters. You can choose to view only those things that fall into certain categories - namely energy, home, health, environment, flora & fauna, transport, experimental or miscellaneous - or get it to zoom in to show you what things are in your neck of the woods. Hardly surprisingly, looking around Silicon Valley provides lots of points of interest - we even found a pack of sensors monitoring a wine cellar. ☒

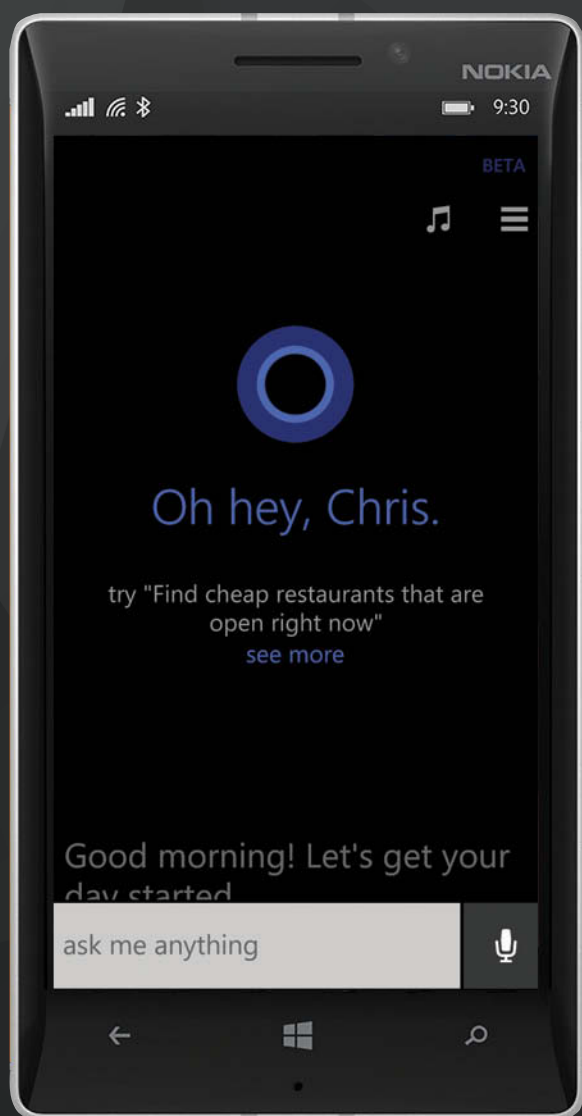
# ASK CORTANA ANYTHING

The digital assistant in Windows Phone 8.1 is more fun than Siri and Google Now put together

**Brag Chacos** asks the big questions

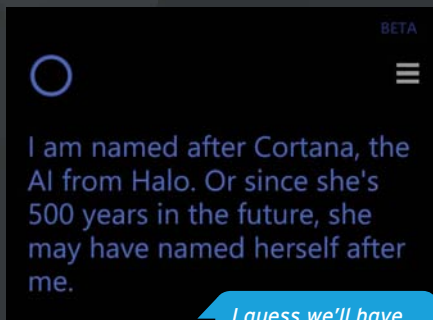
**Y**ou're supposed to ask Cortana questions, so we did - lots of them. Based on its answers, it's clear that Windows Phone's digital assistant has taken the customised awareness of Google Now and the chatty personality of Siri, and raised the schtick several notches.

Cortana spits out clever responses on topics ranging from Android to Siri. It makes jokes and explains its Halo-inspired lineage. Here are some of the funniest answers we've found. And remember: Cortana is still in beta. It may get even sharper before it reaches its final form.



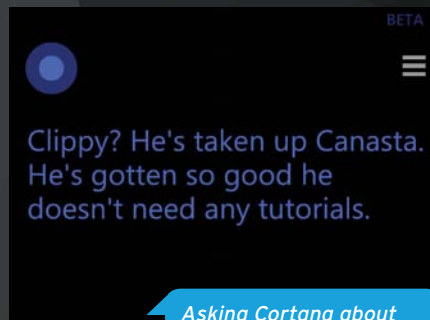


### What does Cortana mean?



*I guess we'll have to wait a while to settle that issue.*

### Do you know Clippy?



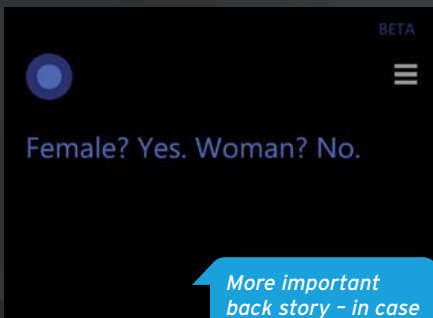
*Asking Cortana about Clippy transforms her avatar into the little guy.*

### What do you think of Apple?



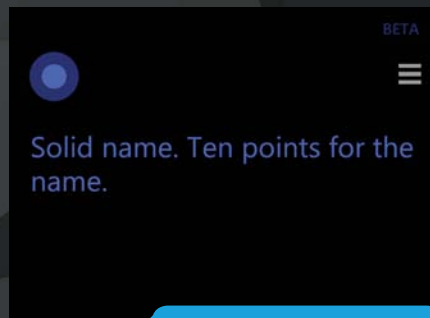
*Cortana is pretty gracious about Apple, all things considered.*

### Are you male or female?



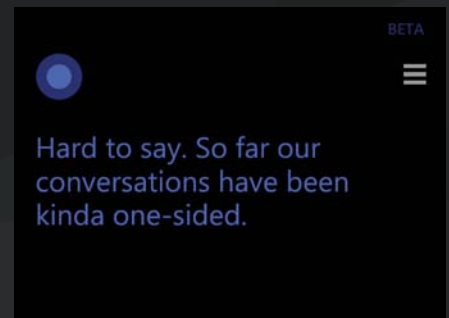
*More important back story - in case you were hoping she'd say "Woman? Yes. Lady? No."*

### What do you think of Android?



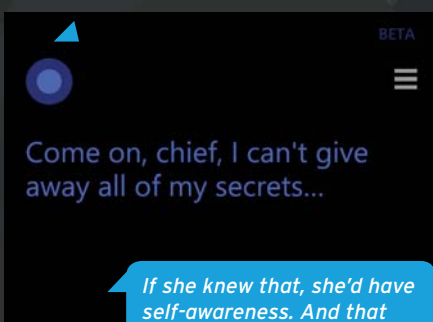
*It figures that a virtual assistant based on an AI in a game would say that.*

### What do you think of Siri?



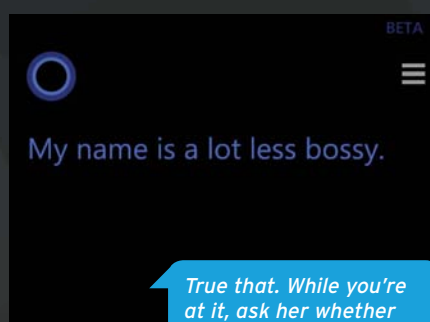
*But maybe not all the time.*

### Who is your creator?



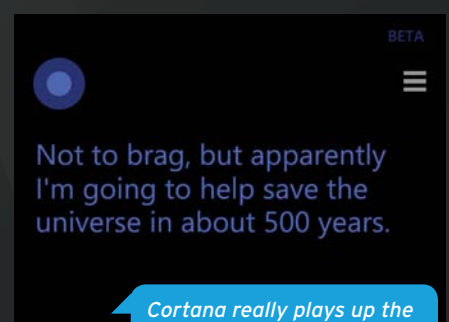
*If she knew that, she'd have self-awareness. And that might be dangerous.*

### Who's better, Google Now or Cortana?



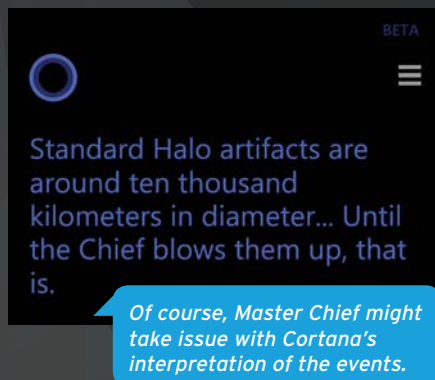
*True that. While you're at it, ask her whether Bing or Google is better.*

### Which is better, Siri or Cortana?



*Cortana really plays up the video game angle at times.*

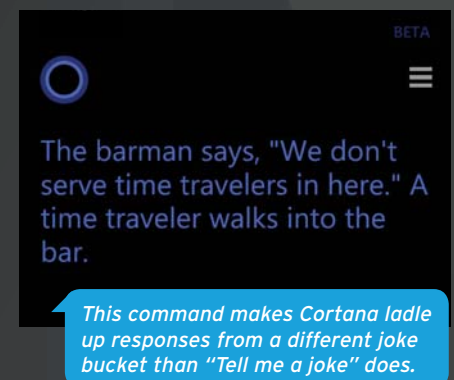
## Tell me about halo



## What does the fox say?



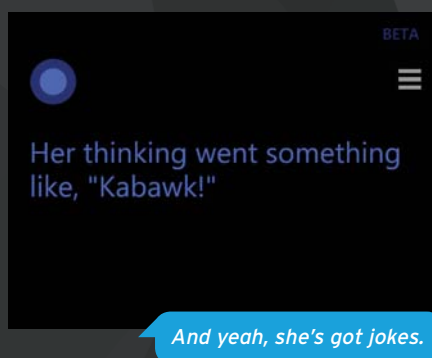
## Say something funny



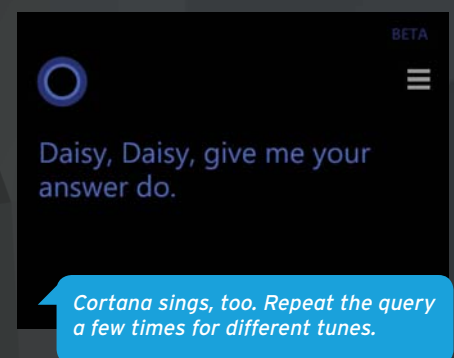
## Open the pod bay doors



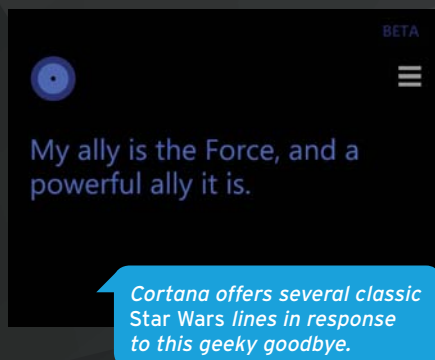
## Why did the chicken cross the road?



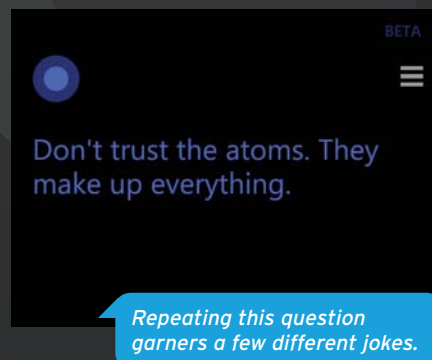
## Sing me a song



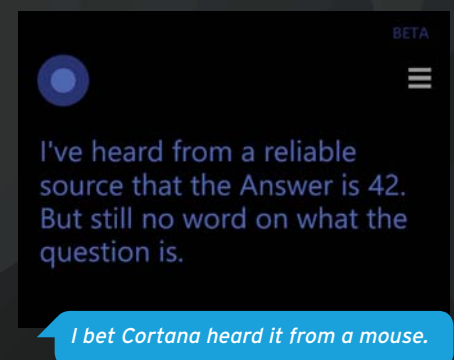
## May the force be with you



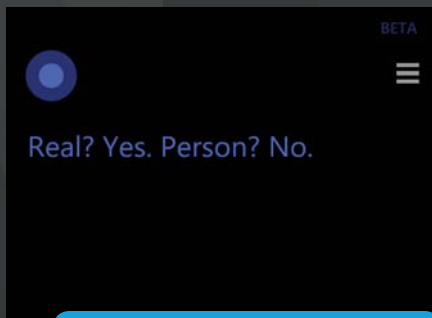
## Tell me a joke



## Why are we here?

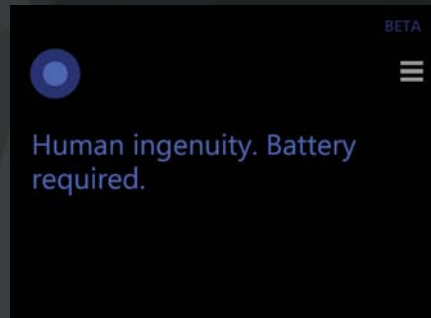


Are you real?



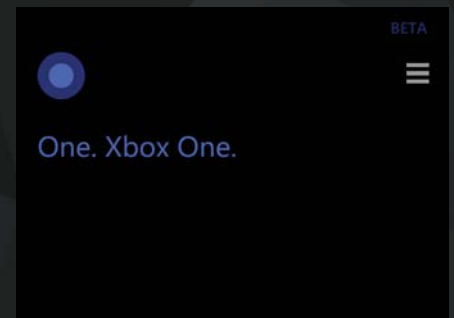
*This answer may or may not resolve Cortana's existential identity.*

Where do you live?



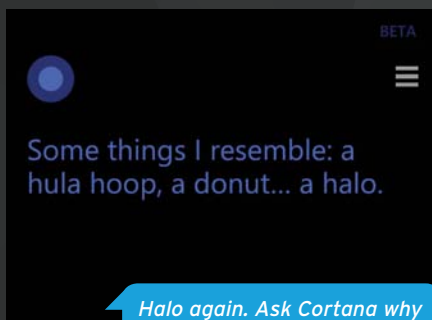
*I'll plug you in.*

Which is better  
PlayStation or Xbox?



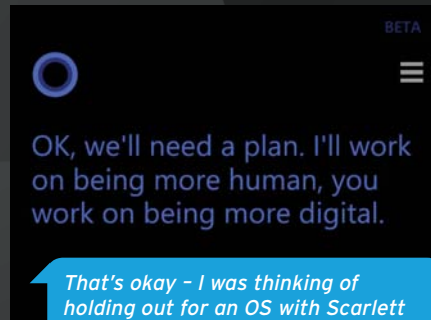
*I thought you'd say that.*

What do you look like?



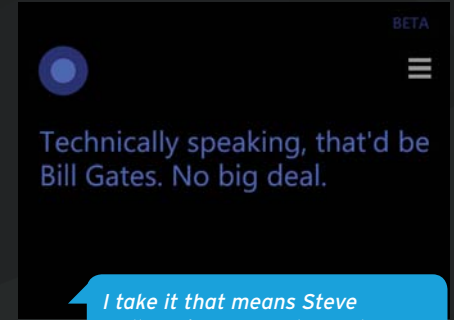
*Halo again. Ask Cortana why she's blue while you're at it.*

Will you marry me?



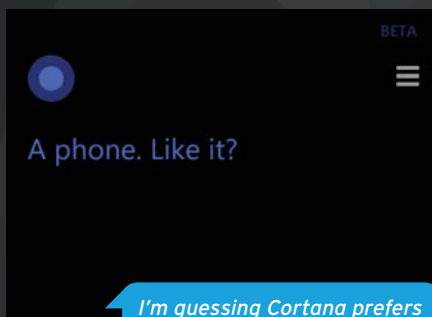
*That's okay - I was thinking of holding out for an OS with Scarlett Johansson's voice anyway.*

Who's your daddy?



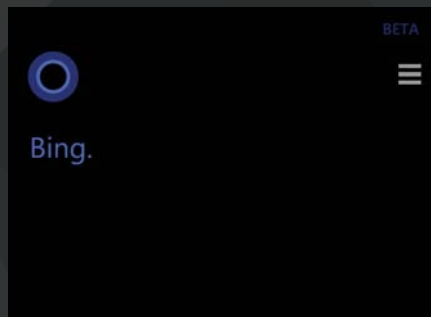
*I take it that means Steve Ballmer is your uncle. Lucky you.*

What are you wearing?



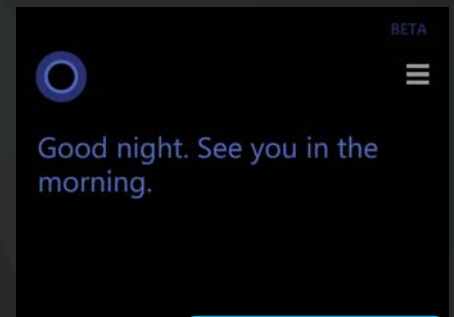
*I'm guessing Cortana prefers synthetic fabrics.*

What's the  
best search engine?



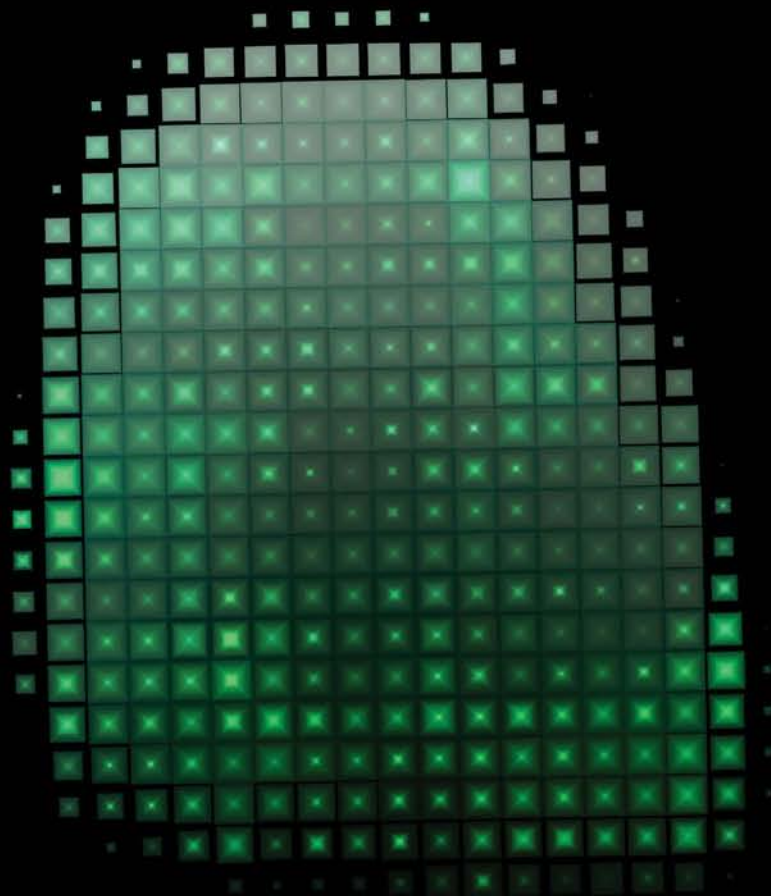
*Not that you're biased.*

Good night



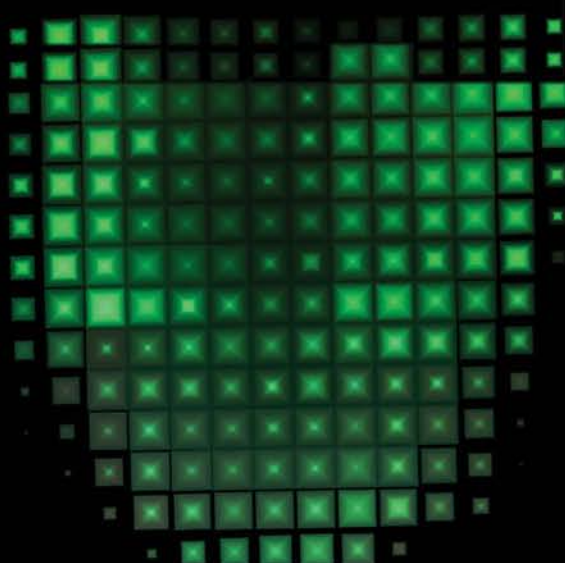
*Also try good morning.*





# Cover your digital footprints and reclaim your privacy

Whether it's GCHQ, hackers or marketers, someone is looking over your shoulder whenever you use your PC. You can minimise your exposure, though. Follow Alex Castle's simple tips to stay on guard and off the grid



## Conceal your internet activity

Start with private-browsing mode, which prevents your web browser from keeping a history of the pages you view. Look in your browser's menu for Incognito mode (Chrome), the Private Window option (Firefox), or InPrivate Browsing (Internet Explorer).

Private browsing doesn't remove every trace of your internet activities. Any files you save will remain, and your web traffic is visible on the server's side. Any unencrypted data you send is as susceptible to interception as it is in a normal session.

A more covert option is to use private browsing in conjunction with Sandboxie ([www.sandboxie.com](http://www.sandboxie.com)), an application that prevents programs (including malware) from saving data to your hard drive.

For stronger protection, consider Tor ([www.torproject.org](http://www.torproject.org)), a network through which you can browse the Internet anonymously. While you're running the Tor software, any outgoing or incoming traffic first bounces among many other computers that people have set up to act as nodes in the Tor network. The sites you visit won't know your IP address (which, ordinarily, they can use to identify your local area), and anyone listening in on your outgoing traffic (including your Internet service provider) won't be able to tell which sites you're visiting.

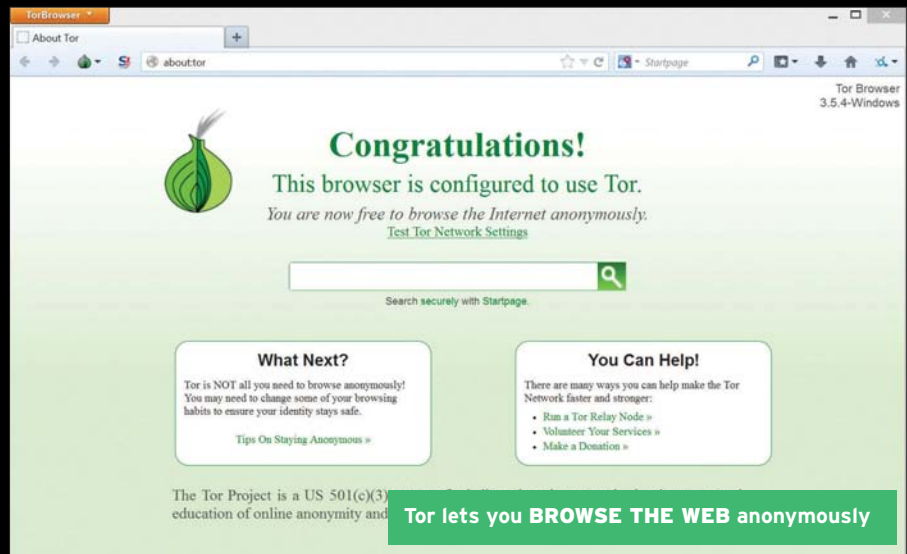
However, although Tor may be your biggest weapon in the battle to protect your privacy, it isn't the fastest. All that server-bouncing slows down browsing considerably. Unless you're a dissident under a repressive regime, or you have a similar life-or-death need for web anonymity, Tor may be a lot more security than you require.

## Be discreet with your data

The next sensible step is to protect the personal data stored on your PC.

Set up a unique user account with a password for each person who uses your computer, including guests. (Windows guest accounts have fewer privileges.) By default, any file in the C:\Users directory (including My Documents, My Photos, and all related folders) is accessible only to the user account that created it. This arrangement doesn't provide airtight security, but it does reduce a lot of access to your files.

To make your hard drive snoop-proof, you need to encrypt its contents. The easiest method is to use BitLocker, the encryption feature in the Ultimate and Enterprise editions of Windows 7 and Vista, as well as in the Pro and Enterprise versions of Windows 8. You can turn it on by going to Control Panel/System and Security/BitLocker Drive Encryption. Encrypting your whole drive makes it inaccessible to anyone who doesn't have your Windows user password.



Don't have BitLocker? You can get free encryption with TrueCrypt ([truecrypt.org](http://truecrypt.org)), which secures files with military-grade protection. Like BitLocker, it can encrypt your whole drive or a subset of files. TrueCrypt-locked files aren't merely inaccessible - they're invisible to anyone who lacks the password for the containing volume.

Even deleted files aren't safe from prying eyes. When you delete a file, Windows simply erases the bit of your file system that points to the file; the data still exists. Tools such as Recuva can often retrieve trashed data.

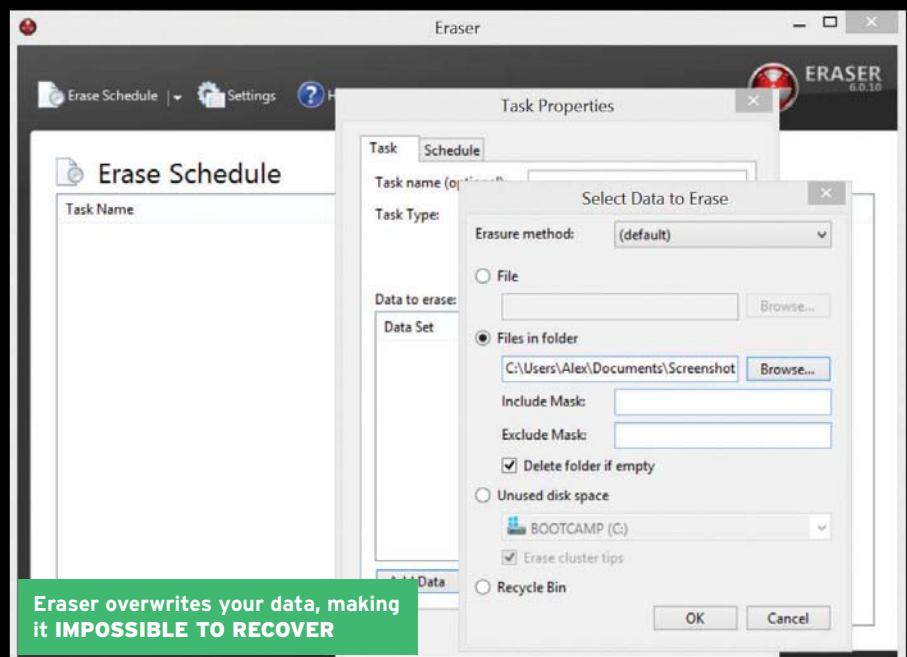
However, tools like Eraser ([tinyurl.com/cuxyLz3](http://tinyurl.com/cuxyLz3)), overwrite that data on your hard drive, ensuring that nobody can resurrect it.

## Corral clandestine activities

Using free virtualization software such as VirtualBox ([virtualbox.org](http://virtualbox.org)), you can run a separate Windows or Linux computer within

a window on your PC. Nothing you do inside VirtualBox leaves any files in your normal Windows file system. You can even keep the VirtualBox in a TrueCrypt volume so that absolutely no-one else but you can see it.

Finally, if nothing so far offers you enough privacy for your needs, Tails OS ([tinyurl.com/pkzoghq](http://tinyurl.com/pkzoghq)) is part of the Tor Project. It isn't a web browser and network like Tor, but rather an operating system devoted to privacy. You install Tails OS on a DVD or a USB drive and run it on any computer. Everything necessary to run Tails OS stays on the removable disk, and nothing is written to the computer's main drives. Any data that you transmit to and from the computer goes through the Tor network, so your browsing activity stays untraceable. The OS also comes loaded with assorted encryption and secure-erase tools, as well as other privacy-oriented software. Think of it as your pocket privacy toolkit. ☒



**Eraser overwrites your data, making it IMPOSSIBLE TO RECOVER**

# 12 PC UPGRADES FOR UNDER £250

ADD SOME ZIP TO YOUR DESKTOP WITH NEW STORAGE, NETWORKING,  
OR ACCESSORIES. BY JON L. JACOBI

**M**aybe your old desktop is struggling to keep up with the demands of modern, high-resolution games and media. Or perhaps someone in your family has a computer that needs rejuvenating. We have PC upgrades to fit every budget.

We set an upper limit of £250, but did so just to cover some of our pricier recommendations. Most of these upgrades cost far less. Presented in order of how much of a transformative effect they're likely to have, from greatest to least, here are our 12 favourites.



ILLUSTRATION: JOHN UELAND



## 1 A SOLID-STATE DRIVE

Our number one upgrade recommendation is a solid-state drive (SSD). Why? No upgrade provides a more noticeable, practical increase in performance than a fast SSD. Getting one is almost as good as buying a brand-new PC.

About a year ago, a top model would have run you approximately a buck per gigabyte. This year the cost is 40p per gigabyte, and sometimes even less. You'll wonder how you ever got along without an SSD.

With most drives, more capacity equals faster performance, due to the presence of more chips and channels. Also, if your motherboard doesn't have a SATA 6Gb/s connection (all good SSDs are 6Gb/s of this type), pick up a good PCIe 2X SATA 6Gb/s controller - it makes a huge difference in system speed.

Toshiba's Q Series Pro 256GB ([tinyurl.com/pne2gvr](http://tinyurl.com/pne2gvr)) is almost as fast as Samsung's top-dog 840 Pro ([tinyurl.com/occyx9g](http://tinyurl.com/occyx9g)); we found the 256GB version of the Toshiba drive online for only £100. It's the only drive we've tested whose performance doesn't drop off at lower capacities, too. In fact, the 128GB version tested slightly faster than the 256GB model.



## 2 A FASTER CPU

When it comes to CPUs, what once was state-of-the-art now won't cut the mustard. And if installing an SSD doesn't completely satisfy your need for speed, maybe adding a new CPU will. Your choice of CPU depends on what motherboard your computer is packing under the hood. If your PC has a Socket 1155 motherboard, for instance, your best choice is the Intel Core i7-3770K, whose price slips in well under our £250 ceiling and whose hardware supports overclocking (running faster than spec) for even better performance.

If you have an AMD AM3+ motherboard, make your target an AMD FX-9370, priced at around £170. If you already own a Socket 1150 Haswell system, but went the cheapskate route originally with an Intel Core i3 or Core i5, opt for a fourth-generation Intel Core i7-4770K for around £230.



## 3 A FASTER VIDEO CARD

This upgrade is for gamers and for photo and video geeks only, as even the lowliest integrated GPU is fast enough to handle the 2D graphics found in everyday applications. For playing games at a decent resolution, however, you need a discrete graphics card from AMD or nVidia.

Combined with built-in Avivo or CUDA codec acceleration, a discrete graphics card can also speed the processing of video files—and with 4K video rearing its extremely bandwidth-hungry head, that's not a bad thing. OpenCL support helps accelerate photo rendering.

You're not going to get a state-of-the-art board for under £200, but the nVidia GTX 760 ([tinyurl.com/khoy884](http://tinyurl.com/khoy884)) is a great all-around card that will bring you most of the way there for about £180. If you're an AMD diehard or if you want to save your money, the Radeon R9-270 ([tinyurl.com/mce7353](http://tinyurl.com/mce7353)) offers comparable performance for only £140.



## 4 A NEW MOTHERBOARD

Maybe what's bugging you is your motherboard's lack of USB 3.0, PCIe 3.0, SATA 6Gb/s, SLI/CrossFire (for multiple graphics cards), or Thunderbolt. If your CPU is reasonably young, a new motherboard will provide some or all of those faster technologies.

Another reason to upgrade the motherboard is downsizing. A micro-ATX or mini-ITX motherboard takes up less room and fits in a smaller case.

Finally, Intel's Haswell platform really does use a lot less energy - which is always a good thing, and an even better reason to upgrade your motherboard. (The upgrade requires a new Socket 1150 CPU, too.)

You can find scads of motherboards out there, and it has been a while since we ran across a lemon from any manufacturer, but you should probably stick with a well-known brand name. We have a fondness for anything from Asus ([asus.com/uk](http://asus.com/uk)), Gigabyte ([uk.gigabyte.com](http://uk.gigabyte.com)), or MSI ([uk.msi.com](http://uk.msi.com)), as we've rarely encountered a problem with their products.



## 5

### SPEEDIER MEMORY

Though it doesn't offer the obvious performance boost of an SSD or a faster CPU, more and better memory lets your operating system spend less time swapping stuff to disk and lets you keep more apps and larger files open. And if you love video, you can't have enough memory.

Most users will be fine with memory that matches the fastest frequency their motherboard's chipset supports, which is generally DDR3/1600 these days. As for the amount - 2GB, 4GB, 8GB, 16GB, 32GB - the more, the merrier; but 8GB should be plenty unless you need extreme speed. You'll pay about £7.50 a GB for on-spec, brand-name, non-ECC (error-correcting code) memory, and about £12 per GB for the ECC kind.

If you took our advice and bought a CPU with overclocking capabilities, you'll want memory that supports the same feature. A lot of high-quality enthusiast-level memory is available, but we've had good luck with the Kingston 2400MHz HyperX Predator, which costs about £9 per GB.

Kingston also sells 2800MHz of memory for about £20 a GB if

you really want to push the limits - and your budget.



## 6

### A FASTER VASTER HARD DRIVE

Hard-drive prices still haven't returned to their all-time low level of a couple of years ago, but they're no longer the premium item they became immediately after the 2011 floods in Thailand. You can now get 4GB in a single drive - just in time to hold all those 1080p movies you've been downloading. Hybrid drives didn't live up to the hype, so you're best off sticking with the traditional kind.

Our pick of the litter is the Western Digital Black 4TB. The successor to the Caviar Black, the WD Black 4TB costs a pretty penny (about £180 at the time of this writing), but it spins at 7200rpm, has a whopping 64MB cache, and carries a reassuring five-year warranty. It has tested faster than just about everything else in its class, too.

You might, of course, opt for a cheaper drive - especially if the newcomer will be playing second fiddle to an SSD in your system. If you're feeling adventurous or you're worried about losing your data, consider buying two drives and running them in RAID 0 (for more speed) or in RAID 1 (for safety).



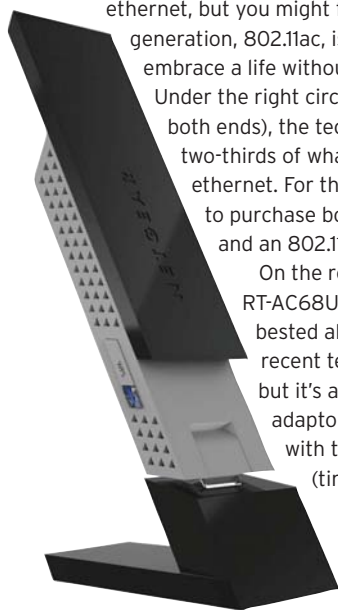
## 7

### AN 802.11AC WI-FI SETUP

No wireless setup will be as fast as wired gigabit ethernet, but you might find that the latest generation, 802.11ac, is fast enough to let you embrace a life without wires and switches.

Under the right circumstances (802.11ac at both ends), the technology gets you about two-thirds of what you get with gigabit ethernet. For this upgrade, you'll have to purchase both an 802.11ac router and an 802.11ac adapter for your PC.

On the router side, Asus's RT-AC68U ([tinyurl.com/k4zatkv](http://tinyurl.com/k4zatkv)) bested all competitors in our recent tests. At £190, it's pricey, but it's also very fast. As for an adaptor, you can't go wrong with the £58 Asus USB-AC56 ([tinyurl.com/mvov536](http://tinyurl.com/mvov536)).



## 8

### A LIQUID COOLER

Liquid-based systems cool better than traditional air-only systems do - and that advantage can be a significant boon if we've talked you into overclocking, with its high thermal overhead. Although a liquid-cooling system's radiator has a fan, chances are good it's replacing an existing case fan and is a whisper-quiet, top-of-the-line model. You might consider ornamental liquid-cooling systems with clear tubing and coloured or UV-reactive fluid, if you're into such things.

You can pay a lot of money for liquid cooling - but most users will be fine with something modest, such as Corsair's £62 Hydro Series H75, which consists of a copper water block, a radiator, and a single 120mm cooling fan, or with the same company's £81 Hydro Series H100i, which has a dual radiator and two 120mm fans.



## 9 A LARGER DISPLAY



Have Retina or 4K envy? Want to reach out and drag things around on your Windows home screen with your bare hands? A new display may be the upgrade you're looking for.

Alas, even the least-expensive 4K PC display currently exceeds our £250 limit; however, you can find a 23-, 24- or 27in 1080p model without touch capabilities for less than that. A multitude of good displays are available, but we've had particularly good results over the years with AOC models. You can pick up the company's 23in i2369Vm ([tinyurl.com/ooefypr](http://tinyurl.com/ooefypr)) for just £130.

## 11 A NEW CASE

I recently upgraded my PC case - to make it smaller. I snagged a Cooler Master HD 120, which is about the size of a breadbox but has room for a full-size graphics card. Alas, going small means switching to a smaller motherboard as well - and before you know it, you're sliding down the slippery (but not altogether unpleasant) upgrade slope.

Tastes vary when it comes to case aesthetics, but the £80-and-up Corsair Obsidian series for all the flavours of ATX, the £55 BitFenix Prodigy and £40 Cooler Master Elite 130 for mini-ITX are good places to start looking. You can save a few bucks by reusing your old power supply, if it's up-to-date enough.



## 10 A BETTER KEYBOARD & MOUSE

Despite some users' unbridled passion for touch, the fastest way to navigate and to input information on a PC remains the humble mouse and venerable keyboard. Moving up to models with more heft and a better feel opens a world of luxurious tactile sensations. Wireless models reduce cable clutter. Sold yet?

Logitech makes many worthy keyboards, and some people swear by the Microsoft ergonomic models. Nevertheless, if you can find an old IBM Model M, you're typing on the best keyboard ever made. The £100 Das Keyboard Professional Model S Mechanical Keyboard ([tinyurl.com/oqow84k](http://tinyurl.com/oqow84k)) is much the same thing, sans the Model M's rather high decibel level.

Among mice, consider the svelte, wireless £60 Logitech Ultrathin Touch Mouse T630. Although it's designed for Ultrabooks, it's a pleasantly self-indulgent pairing for any system.



## 12 A BACKUP PRODUCT OR SERVICE

We considered making backup the number one item on the list because its presence will forestall so many problems.

If you want a local backup, choose a hard drive with the fastest interface technology your system supports: Thunderbolt, eSATA, USB 3.0, FireWire (which is fading from the scene), or USB 2.0, in that order. Speed is essential - if backups take too long to make, you'll give up on the process. LaCie, Seagate, and WD all manufacture capable external drives ([tinyurl.com/k6nf334](http://tinyurl.com/k6nf334)), and all of them include backup software, though Windows itself provides everything you need.

You might even consider opting for a NAS (network-attached storage) box ([tinyurl.com/m8x32fo](http://tinyurl.com/m8x32fo)), which can also back up multiple PCs and devices without your having to drag it around. You can also opt for online backup, by itself or in addition to a local option; figure on paying £30 per year for such a service. If that seems expensive, think about the minimum £500 it costs these days to recover data from a corrupted hard drive - if recovery is possible at all.





# BEAT IT, BLOATWARE

## CLEAN THE CRAP OFF YOUR PC

Chris Hoffman reveals how to get rid of preinstalled software from your PC

**B**oot up a new computer for the first time, and it may sputter and struggle, burdened with all the junk that vendors dump onto their new machines. Bloatware, also known as crapware, is more than annoying - it actively consumes your computer's resources. Cleaning it off is worth some time and effort.

PC profit margins are low, and preinstalling trial programs and other junk gives computer makers a bit of extra money - and, to be fair, lowers your computer's purchase price. But many types of preinstalled software are just plain bad. You'll often find antivirus utilities that attempt to scare you into paying by claiming that your system is at risk, advertising-filled games you don't want to play, and demos that give you only an hour before becoming useless.

Not every program on a new PC is trash. Tools worth keeping include those that manage your hardware, such as the nVidia

Control Panel and GeForce Experience for tweaking graphics-hardware settings.

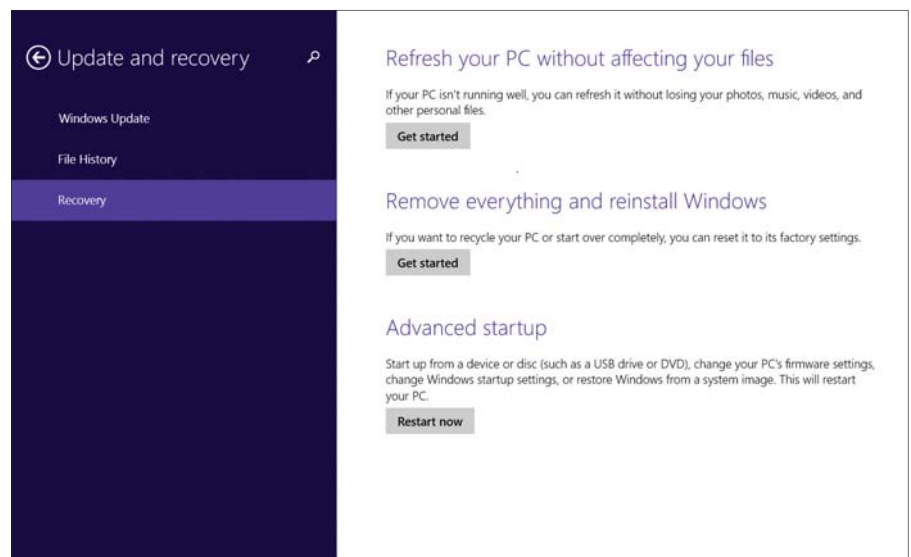
### Desktop vs. modern-app bloatware

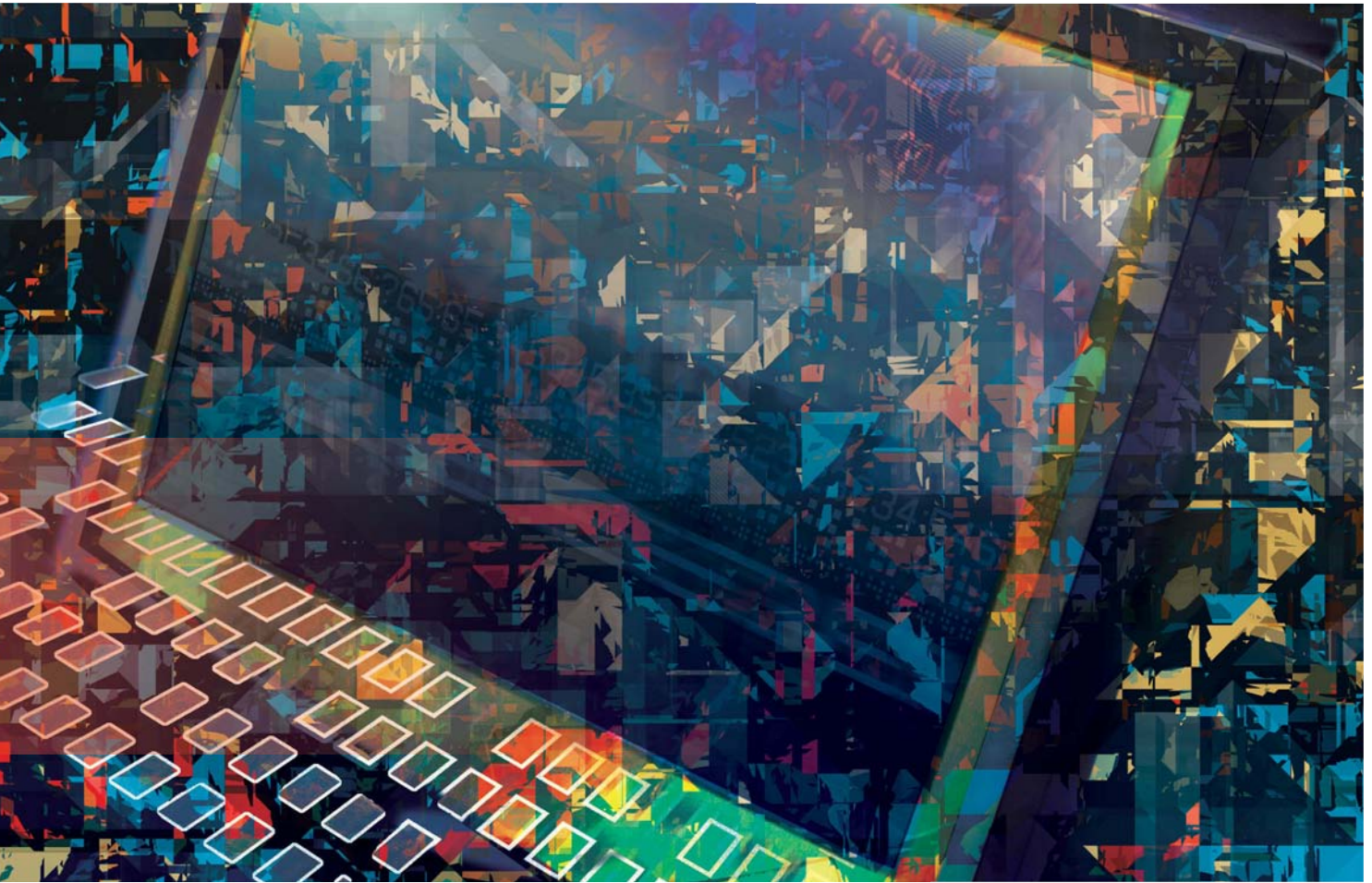
Windows bloatware has traditionally been confined to the desktop, often loading at startup and filling the system tray. On Windows 8 and 8.1 devices, however,

bloatware sometimes comes in the form of preinstalled Windows Store apps - full-screen apps that show up in the modern-style Start screen's tiled interface.

Even if you don't like Windows 8's touch-first interface, this type of bloatware is more tolerable. Because such apps can't start automatically at boot, they won't run

**REFRESHING OR RESETTING** your PC is a handy way to clean up Windows, but doing so can restore bloatware





Bloatware in the form of modern-style apps is not as burdensome as **DESKTOP BLOATWARE**

in the background and slow down your system. Plus, they're a cinch to remove - just right-click or long-press the app's tile and select Uninstall.

### Recovery restores bloatware, too

When Windows 8 debuted, people discovered that they could obliterate bloatware from new PCs by using Windows' Refresh or Reset option. These functions restore Windows to a clean state, serving as an easy way to reinstall the operating system.

Unfortunately, Refresh and Reset probably won't remove bloatware on new computers anymore. These days system manufacturers have realised that they can create custom recovery images full of bloatware, so refreshing your PC will simply restore all of the same junk.

However, you can create custom recovery images as well. When you get a new PC,

“ You'll often find antivirus utilities that attempt to scare you into paying by claiming that your system is at risk and advertising-filled games you don't want to play ”



You might try burning your new PC's OS to the **GROUND AND REINSTALLING**

first remove the bloatware and then create a custom refresh image. Then, if you use Refresh or Reset on your computer in the future, you'll restore it to that clean state.

### Uninstall the junk

Several utilities can help you fight bloatware. PC Decrapifier ([pcdecrapifier.com](http://pcdecrapifier.com)), for instance, attempts to find known bloatware installed on your PC. The Should I Remove It? utility ([shouldiremoveit.com](http://shouldiremoveit.com)) displays your installed programs, indicates what they do, and shows you whether other users have removed them.

You can also remove bloatware just as you'd remove any other type of software: open the Control Panel and uninstall unwanted programs. Additionally, you can check the system tray to see what's running in the background, which can help you find some of the worst offenders. When in doubt, perform a Google search for the program. You may be able to find bloatware removal guides for your specific PC model.

### Reinstall Windows to get a clean system

Some people prefer to perform a clean Windows install on their new PCs, as they find it easier to wipe everything and start from scratch.

All you need is a fresh Windows disc. (If your new PC lacks a DVD drive, you can put Windows installation files on a USB drive.) Insert the installation disc into your computer and reboot. Install Windows normally, and



“Some people prefer to perform a clean Windows install on new PCs, as they find it easier to wipe everything and start from scratch. All you need is a fresh Windows disc”

you'll end up with a clean Windows system as Microsoft intended it, without any of the manufacturer-specific clutter.

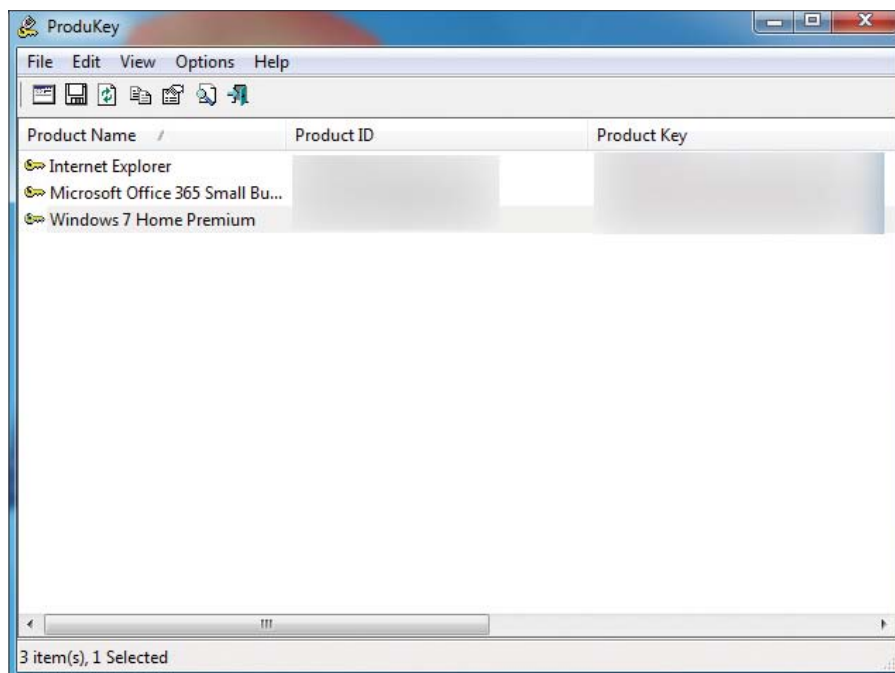
Manufacturers generally don't include Windows installation media with new PCs anymore, however – and when they do, it often has the same bloatware, so you'll have to find fresh media yourself. Microsoft offers a way to download Windows 8.1 installation media ([tinyurl.com/pcykadr](http://tinyurl.com/pcykadr)); Digital River,

a licensed distributor of Microsoft software, allows you to download Windows 7 ISO files ([tinyurl.com/qa9b2fy](http://tinyurl.com/qa9b2fy)).

When you reinstall Windows, you can use the same Windows product key that came with your PC. You'll usually find it printed on a Certificate of Authenticity sticker on the computer. Can't locate the sticker? Before reinstalling the operating system, run a program such as NirSoft's free ProduKey ([tinyurl.com/o5mgje6](http://tinyurl.com/o5mgje6)) to find the key for your installed copy of Windows, and write it down. Many new Windows PCs come with their product key embedded in their UEFI firmware and should automatically enter the key when you install Windows 8, so you won't always have to do this by hand.

Note that the reinstallation approach has several drawbacks. You'll have to spend time on it, of course, and it will erase any currently installed files and programs, so you should apply this method only immediately after you get a new PC.

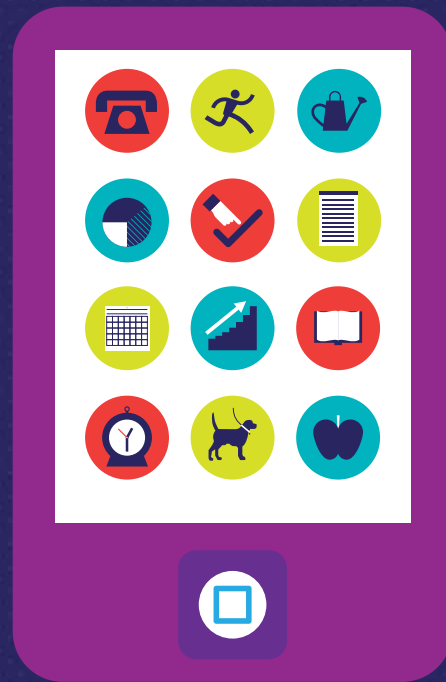
You'll also have to install any necessary hardware drivers or utilities afterward. Windows will fetch and install many drivers, but you may need to handle some driver installation ([tinyurl.com/pzam7m4](http://tinyurl.com/pzam7m4)). ☒



ProduKey can find your **SYSTEM'S PRODUCT KEYS** for you, for free



# PLAY YOUR WAY TO PRODUCTIVITY



with **5**  
these  
**gamified**  
apps

Try these apps inspired by RPGs and brain science. **By Robert Strohmeyer**

**B**ored by the prospect of slogging through traditional business to-do lists? Then you'll be glad to know that gamification is rapidly growing beyond its original home base in enterprise apps and reaching personal productivity tools, where it adds a layer of quirky fun to the usual lists and checkboxes. Today, whether you're looking to raise your game at work, get your home life on track, or break

through your fitness barriers, personal gamification is serious business.

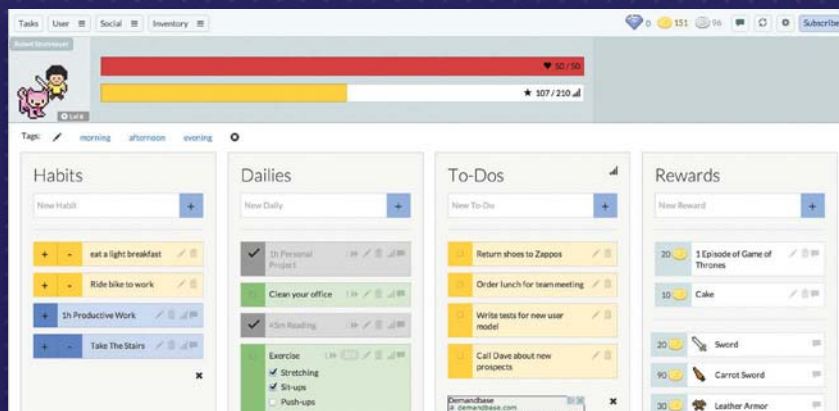
The premise is simple: exploit the brain's natural mechanism for reward gratification by using techniques long since perfected by the casino industry. Track desired behaviours, add a gamelike atmosphere, and trigger a few strategically designed flashes and dings to let the dopamine flow whenever the user does well.

Over the past decade, gamification has become big business in the enterprise software world, where companies have learned to tap the power of game mechanics to unleash their workers' competitive instincts. Now a few cool personal apps are bringing those techniques into the land of desktop, mobile and web-based productivity tools. Here are five great apps to help you gamify your daily routine.

1

## HabitRPG

**Platform:** WEB  
**Price:** Free



If you've ever wished that you could apply the motivational magic of RPGs to the rest of your life, HabitRPG ([tinyurl.com/bsLt9h4](http://tinyurl.com/bsLt9h4)) may be just what you were longing for.

It's a web app full of smart task lists that you can customise to reinforce good habits and get things done. But those productivity tools are wrapped as fantasy role play, and every time you check off an item on one of your lists, HabitRPG plays dungeon master for you, rolling its virtual dice and dropping coins and magical items as you rack up experience points.

The app's best feature is its Habits list, which encourages you to reward yourself for building productive habits and to give demerits for unproductive habits.

Its game elements feel contrived, but it's a fun app that gets the productivity play right.



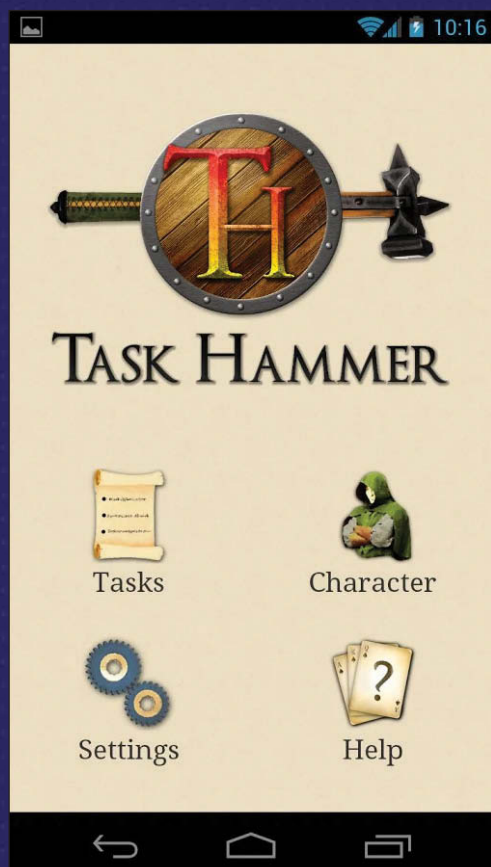
## 2

## EpicWin

Platform: iOS  
Price: £1.99

For iOS users looking to enhance their to-do lists with an RPG experience, EpicWin ([tinyurl.com/3ykh34](http://tinyurl.com/3ykh34)) is just what the competitive worker ordered. Like HabitRPG, it takes its cues from the world of D&D gameplay. But EpicWin's graphics, sound effects, and game mechanics are orders of magnitude more sophisticated. Merely checking off an item becomes a game-play experience, as you hold your finger down on the rosette for each item and witness a brief virtual struggle before the rosette bursts and you rise over the forces of unproductivity.

EpicWin's RPG mechanics enable you to assign attributes such as intellect and stamina to a task. The sophistication comes at the cost of complexity, however, as the menus are dense. But this isn't an app for the productivity purist, so the trade-off of fun for efficiency makes perfect sense here.



## 3

## Task Hammer

Platform: ANDROID  
Price: Free

What EpicWin is to iOS, Task Hammer ([tinyurl.com/p4etkc2](http://tinyurl.com/p4etkc2)) aims to be for Android. It offers similar RPG mechanics, letting you assign character attributes to your tasks and moving you up levels as you complete to-dos. On both the productivity and gamification fronts, it's slightly less compelling than its iOS counterpart. Nevertheless, it's fun to use – and unlike EpicWin, it's free.







## 4 Doable

Platform: iOS  
Price: 69p

Statistics lie at the heart of all gamification schemes. If you thrive on stats but don't care about game play, Doable (doableapp.com) may be for you. This unique productivity app lets you focus on your performance by surfacing cool stats about your effectiveness at a given task, so you can continually strive to beat your current personal best.

Set up a goal, and it will track it for you, dynamically assisting you in prioritising your activities based on which ones you're late on, how you generally get them done, and other factors. It's light on gamification, but it still manages to deliver a fun, engaging productivity tracking experience in its own quirky way.



## 5 Zombies, Run!

Platform: iOS, Android  
Price: £2.49



Because they exploit our brain chemistry in such reliable ways, the principles of gamification can apply to any activity. If you're looking for a creative way to get your fitness goals on track, check out Zombies, Run! (zombiesrungame.com). This geolocation-driven app uses your iPhone or Android phone to motivate you during your real-world runs by overlaying a zombie-themed adventure on your activities. To the world, you'll look like just another jogger. But in your world, you're a zombie-evading adventurer surviving the apocalypse.





## YOUR QUESTIONS ANSWERED

# Expert computing advice

We tackle readers' hardware and software conundrums

### LEAVE OR STAY ON PAGE

**Q** Sometimes when browsing the internet I come across pages which simply don't want to go away. Instead, when I try to close the page or tab, I get a pop up saying "Are you sure you want to leave the page?" with the option to click to leave or stay on the page. I can see no reason for this behaviour other than to annoy me or trap me into staying on their site for even longer. Is there a way I can disable this feature?

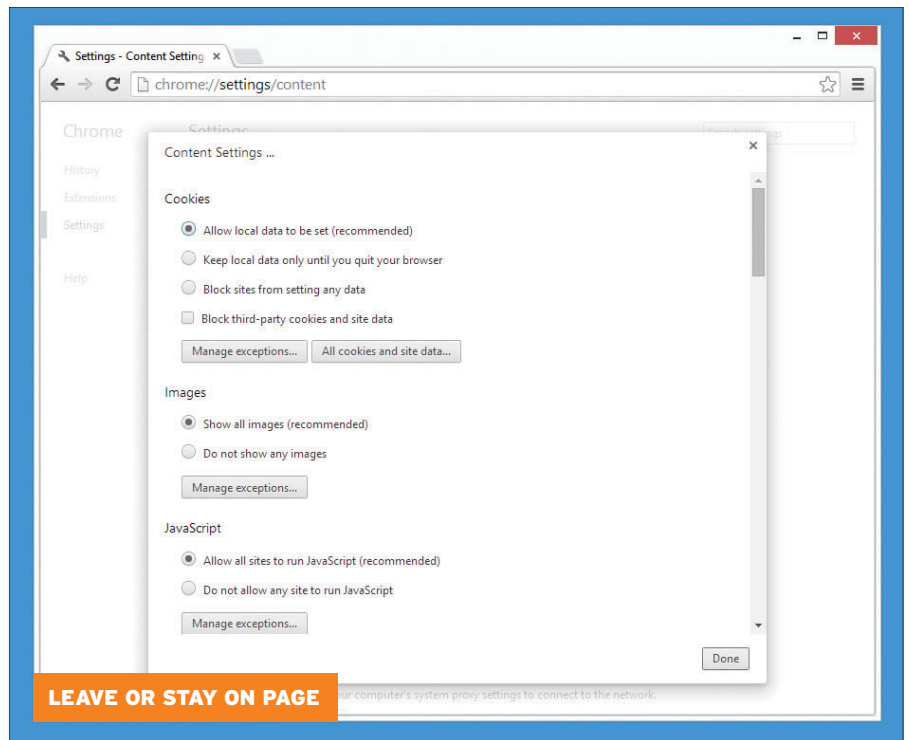
Although the situation you describe can be very annoying, the reasoning behind this feature is sound. Consider a site where you're typing in a large amount of text, such as an email or filling in a long form. It could be even more annoying to inadvertently close the window with a single click and lose all of your typing. In this case, the feature gives you a chance to go back and submit or save your work before losing it, forever. For this reason, you should think carefully about disabling this feature.

The pop-up message is generated by JavaScript code embedded in the web page, so if you're sure you want to disable it, you'll need to prevent the underlying JavaScript code from running. The easiest, and crudest, way of achieving this is to disable JavaScript entirely.

In Firefox, type **about:config** into the address bar and hit Enter. Next, click on the button to promise to be careful. Search on this page for **javascript.enabled** and click the Toggle button to disable JavaScript. To re-enable JavaScript, repeat the process.

In Google Chrome, type **chrome://settings/content** into the address bar and hit Enter. Scroll down to the JavaScript section and click 'Do not allow any site to run JavaScript'. If you'd like to enable or disable JavaScript on a site-by-site basis, you can click the manage exceptions button and set up rules based on partial URLs.

In Internet Explorer, click on the gear wheel icon at the top right and select Internet options from the menu. Now, select the Security tab and click the 'Custom level...' button. Scroll down to Scripting, then under Active Scripting, click disable to turn off JavaScript. Then click OK.



### LEAVE OR STAY ON PAGE

### Z97 OR Z87

**Q** I'm upgrading my PC and I'm in the market for a new motherboard. Should I go for one of the new Z97 boards or try to save a little money and stick with the previous generation Z87?

The Z97 Express chipset is an evolution of the previous generation Z87 Express and there are a few very good reasons to go for the newer chipset.

First of all, the Z97 Express chipset officially supports the latest fifth generation Intel Core processors. Whereas Z87 Express offers support only up to the fourth generation chips. This means if you plan to upgrade to a 'Broadwell' chip in the future, you'll need Z97 Express. If you're planning on sticking with Haswell, then you could stick with Z87, but there's only a small price premium to pay for Z97, so we would recommend opting for the latest chipset rather than trying to save money and go for a Z87 board with limited upgrade potential.

Some Z87-based motherboards support 'Devil's Canyon' CPUs, such as the Core-i7 4790K, but may require a BIOS update.

One of the most important new features of the Z97 chipset is the addition of support for SATA Express and M.2, which will greatly increase maximum throughput for SSDs.

### JAVA VIRTUAL MACHINE

**Q** I keep getting the error message "Error: Could not create the Java virtual machine", after which my program exists. How can I fix this?

Most of the time you can fix this problem by uninstalling the Java runtime and then reinstalling it all over again.

To do this, go to the control panel and then Programs and Features. If you're running Windows 8.1 Update 1, just right-click on the Start button and click on Programs and Features. Locate the Java runtime, uninstall it and reboot your PC.

Next, download the latest Java Runtime from [java.com](http://java.com), taking care to install the correct version for your PC. You will likely want the 32-bit version as the 64-bit option is specifically for 64-bit browsers. Most browsers are 32-bit on Windows, even on 64-bit editions of the OS.



If you have both 32- and 64-bit applications that need to use Java, then you'll need to download and install both versions of the Java runtime. Hopefully, this will fix your problem.

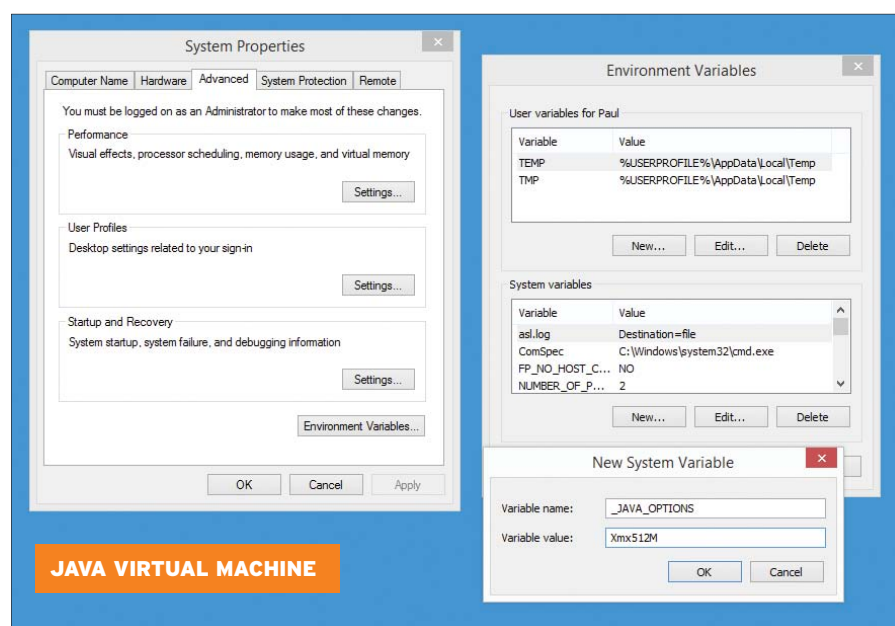
Sometimes this error can be caused by not having enough system memory allocated to the Java Virtual Machine - or not enough system memory full stop.

If you can successfully run your program only right after the system boots, then you may have too many other applications running and consuming your memory. Try to cut down on these, or consider adding more RAM to your system if it isn't already configured with the maximum amount.

You can also try increasing the amount of system memory allocated to the Java virtual machine by setting an environment variable.

To do this, go back to the Control Panel and click on System, then Advanced system settings. Now click the Environment Variables button to bring up a list of all those currently set.

Click the 'New' button in the bottom half of the window to create a new system variable. Finally, you need to set the variable



name to `_JAVA_OPTIONS` and the Variable value to `Xmx512M`.

This allows up to 512MB to be allocated to the Java virtual machine. You can experiment with different values, if required.

## CPU TEMPERATURE GADGET

**Q** I've overclocked my PC and it seems to be running well, but I'd like to be able to have a readout of the CPU temperature on my desktop at all times.

Continues >>

# LOCK OUT WINDOWS AFTER FAILED LOGIN ATTEMPTS

Complex passwords can be a pain to remember and prone to mistyping, but shorter passwords can be much easier to guess by brute force - trying huge numbers of passwords until the correct one is guessed. You can reduce the effectiveness of a brute force attack by limiting the number of 'guesses' available before the system locks the account, requiring an administrator to reset it before the user can sign in again.

While using this policy defends against brute force attacks on passwords, it introduces another possible vulnerability, in that an attacker could cause disruption by deliberately locking multiple accounts by repeatedly trying incorrect passwords.

The three local security policies you need to set are:

1. Account lockout threshold, which sets the maximum number of invalid login attempts before the lockout occurs.
2. Account lockout duration, which sets the time in minutes for which a lockout will remain in force. If you set this value to zero, the lock will remain until reset by an administrator.
3. Account lockout window. This security policy is responsible for setting the total length of time which must pass before the count of failed login attempts is reset to zero.

```
Microsoft Windows [Version 6.3.9600]
(c) 2013 Microsoft Corporation. All rights reserved.

C:\WINDOWS\system32>net accounts
Force user logoff how long after time expires?: Never
Minimum password age (days): 0
Maximum password age (days): 42
Minimum password length: 0
Length of password history maintained: None
Lockout threshold: Never
Lockout duration (minutes): 30
Lockout observation window (minutes): 30
Computer role: WORKSTATION
The command completed successfully.

C:\WINDOWS\system32>
```

To set the lockout policy, open an Admin command prompt. On Windows 8.1 press Windows+X and then select Command Prompt (Admin). Next, type:

```
Net accounts /lockoutthreshold: value
Net accounts /lockoutduration: value
Net accounts /lockoutwindow: value
```

Where value is the value you want to set for each policy. You can view your current settings by typing `Net accounts` on its own.

Now that Desktop Gadgets are no longer supported under Windows 8 (I'm not really comfortable with using a hack to re-enable them, for security reasons) is there another way I can do this?

One popular CPU monitoring tool is Core Temp, available free from alcpu.com. This program will provide plenty of information about how your processor is running, including the temperatures and speeds of individual cores. It also supports logging results over a period of time. It has a small footprint, so you can leave it running all the time and, when minimised, it can sit in the task bar with temperature information displayed in the form of small icons.

If you want something a little closer to one of the former desktop gadgets, why not giving Open Hardware Monitor a try from openhardwaremonitor.org.

This program is in Beta and hasn't been updated in a year, but seems to work very well. It allows the monitoring of just about every sensor in your PC and comes with a customisable desktop gadget which can be used to display any metrics you select.

It's also worth checking for downloads specific to your PC's motherboard, as some come with their own monitoring programs.

## WINDOWS 8.1 EMAIL

**Q** Not long ago, I moved from Windows XP to Windows 8 and, while I found it initially difficult to learn, I gradually worked out most of the basics that I needed and was quite happy.

I recently installed the free upgrade to Windows 8.1, presuming it would be the same, but better and that I would find it easier to keep up with small changes by installing updates as they are published rather than being forced into a big change later on.

Unfortunately, I'm totally confused by it! There are so many changes and I can't even do the basic things that I'd mastered before. I don't like it at all, but I haven't found anything easier or better.

I don't even have a manual with the laptop and was told that it's so easy that a manual isn't needed.

I want to use email and Google, also access music weather, news, and so on. I don't know how to send attachments with Windows 8.1. Also, I really want to learn how to sell on eBay, but I need to be able to use various features of Windows 8.1 to do this. Is there a simple manual with pictures for Windows 8.1?

If you're having difficulty with Windows 8.1, a good place to start is Microsoft's own online Windows 8.1 tutorial, found at [windows.microsoft.com/en-gb/windows/tutorial](http://windows.microsoft.com/en-gb/windows/tutorial).

This is a multimedia tutorial which uses video, pictures and written text to take you through all of the Windows 8.1 basics one step at a time. Section 8 is dedicated to helping you understand, set up and use the Windows email app.

From the sound of it, you're using the built in Windows 8.1 Mail app. While not actually an integral part of the operating system itself, this new version of the app comes with the Windows upgrade whether you like it or not.

Many of the changes you're seeing have been made to make the app more usable on touchscreen devices and tablets and this is probably why you're seeing such a difference in how it works.

Microsoft also has a tutorial specifically for the Mail app here: [windows.microsoft.com/en-gb/windows-8/mail-app-tutorial](http://windows.microsoft.com/en-gb/windows-8/mail-app-tutorial).

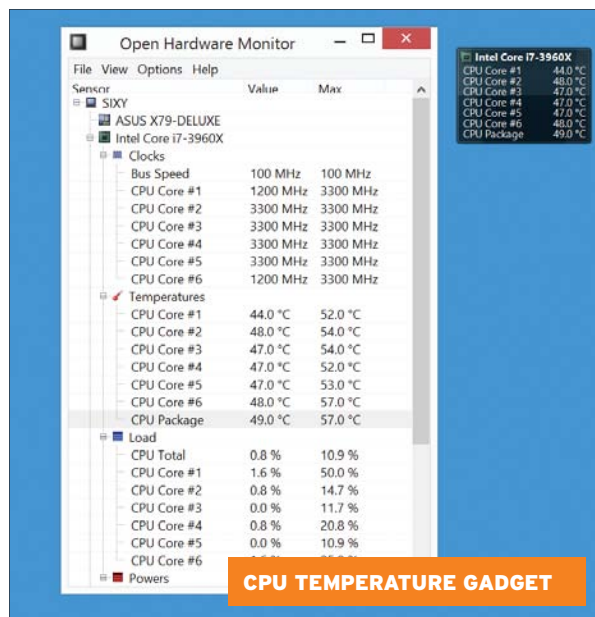
We notice you used a Hotmail address to contact us. Another alternative would be to use outlook.com to send and receive emails rather than the built in Windows email.

To do this, open Internet Explorer (or your favourite browser) and type in, then visit outlook.com, where you'll be given instructions on screen.

Most of the time, the way to attach a file is to look for an icon which resembles a paper clip. Generally speaking, clicking on a paper clip will start the process of adding attachments in most email software regardless of whether you're using Windows XP, Windows 8 or even a Mac or a smartphone. It's not a hard-and-fast rule, but it's still a convention that's widely followed.

If you're used to Windows XP, then you can probably use software that's very similar to what you've used before, by ignoring the Windows 8.1 apps altogether and running Windows desktop apps.

To do this, click on the Desktop icon on your Windows start screen. This will take you to a desktop environment more similar to Windows XP. From here, you can launch Internet Explorer (or your favourite browser) to access Google and other information on the web.

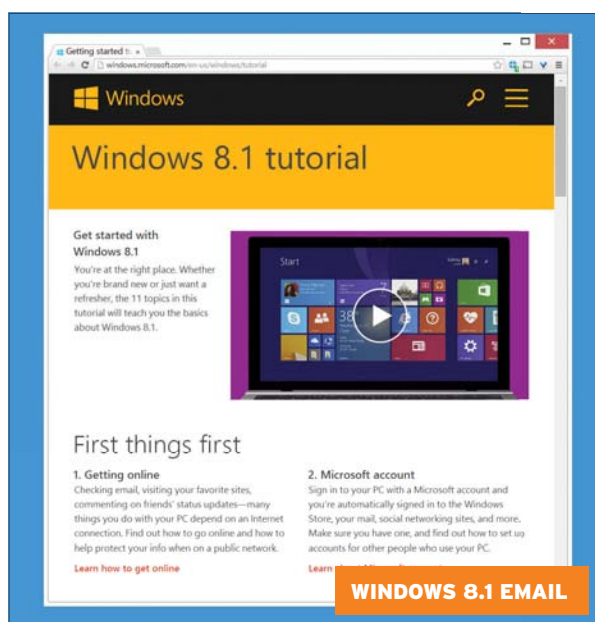


You can also install the email software of your choice, or simply use your preferred browser for web-based email.

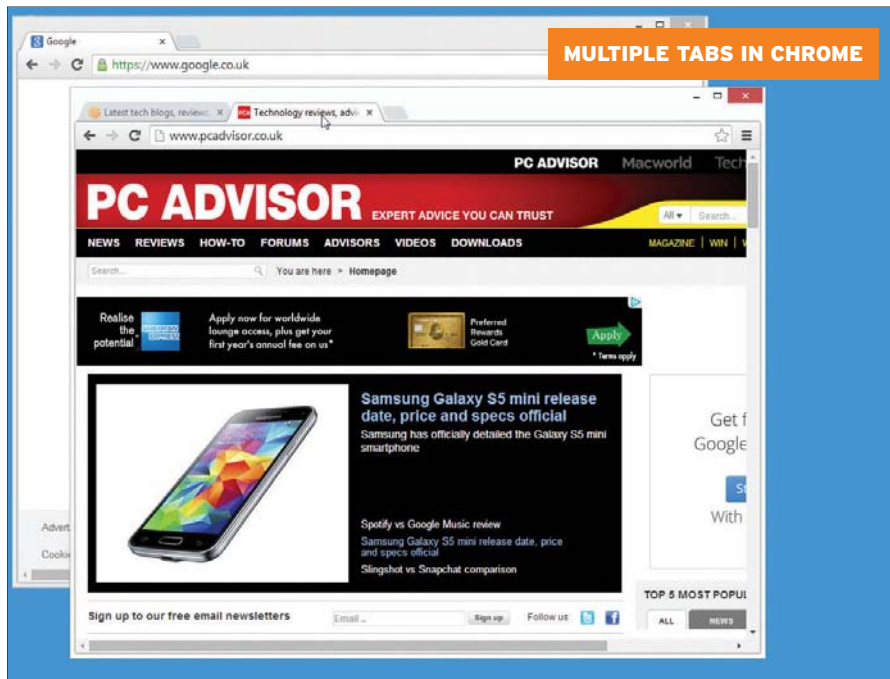
## MULTIPLE TABS IN CHROME

**Q** I'm an avid user of the Google Chrome browser in Windows and I often have several windows open at once, each containing many tabs. I like to reorganise my tabs into various windows to group them together logically, which I do by dragging the tabs from one window to another. Is there I way I can select multiple tabs and move them all at once to save time?

Yes, this works in a similar way to selecting multiple items on the Windows desktop. Click on the first tab you want to move, then hold down Ctrl and click on any other tabs you'd like to add to your selection.







Now let go of the Ctrl key and you should be able to click and drag on any of your selected tabs to move them all at once.

Drag them to another Chrome window to add them to its existing set of tabs, or drag them to the desktop to create a new window containing just your selected tabs.

Sadly, this handy technique doesn't seem to work in Internet Explorer or Firefox.

### GPT OR MBR?

**Q** I'm building a new PC for use with Windows 8.1 and when it comes to

**formatting the hard drive, I have the choice of using MBR format or GPT format. Which should I use and why?**

Master Boot Record or MBR format has been in use since the early 1980s and is widely supported, though, it's limited to a maximum of four primary partitions with up to 2TB, a size that's easily exceeded by many large hard drives available today.

The GUID Partition Table (GPT) format, is a newer technology which allows much larger disks to be used up to a theoretical

limit of 9.4 zettabytes (ZB), or nearly 10 billion terabytes. It has been estimated that, as of 2013, the whole of the world wide web occupies around 4ZB. Windows currently limits GPT partitions to 256TB.

Additionally, there's no theoretical limit to the number of partitions you can create on a GPT format drive.

The main issues to consider are those of compatibility. Older versions of Windows, such as 32-bit XP can't read, write or boot from GPT disks. Newer desktop versions of Windows can handle the disks quite happily, but require you to have a modern PC which supports UEFI on the motherboard.

If you're using MBR format, you may also run into problems when installing multiple operating systems on a single drive. Obviously all installed operating systems must be compatible with your chosen format, but it's also not unusual for an operating system to create multiple partitions during installation, especially if you want to install a recovery partition. Using a GPT drive should ensure that you don't run out of available partitions.

Another advantage of GPT over MBR is that it saves two copies of the GPT header, one at the start of the disk and one at the end. This small amount of redundancy affords some protection against data corruption when compared to MBR format which only saves a single partition table.

So, to summarise: if you want to use a large hard drive with lots of partitions and multiple operating systems, go for GPT.

Continues >>

## TECH JARGON BUSTER

**AMOLED:** Active-matrix organic light emitting diode or AMOLED displays feature heavily in mobile devices and TVs, due to excellent contrast and colour saturation. Each pixel in an AMOLED is formed from a thin piece of organic film which emits its own individual light when current passes through it. This differs from LCD which uses a backlight shining through from the rear of the display.

**DEVIL'S CANYON:** Devil's Canyon is Intel's codename for the unlocked 'K' editions of the "refresh" revision of the Core i5 and Core i7 Haswell processors. These include the Core i5-4690K and Core i7-4790K which feature improved thermal interface material, thereby allowing cooler operation and improved overclocking.

**ELECTRONIC PAPER:** Electronic paper, also known as e-paper and electronic

ink, is a form of digital display designed to emulate, as closely as possible, the experience of reading ink on paper. Most commonly used in eReaders such as Amazon's Kindle or the Nook from Barnes & Noble, this technology relies on external light and allows for very long battery life, but only supports monochrome displays with no support for moving pictures.

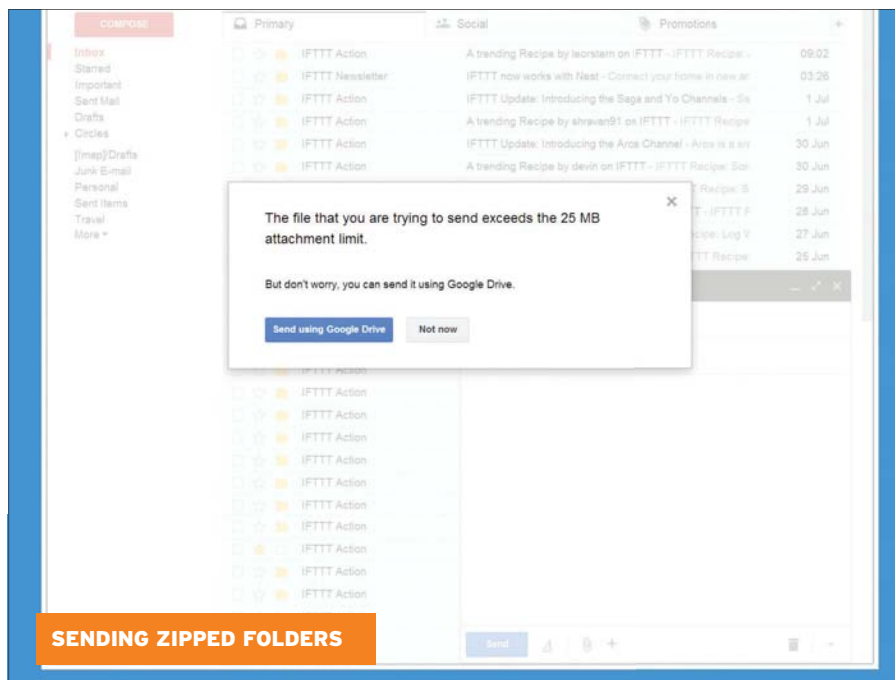
**JAVASCRIPT:** Not to be confused with Java, JavaScript is a programming language used predominantly to create interactive content in web browsers. JavaScript code can be inserted into the code of web pages and it runs on the viewers' PCs when they browse the page.

**PROCESSOR CORE:** Most modern computer processors are multicore processors. This means they contain more than one internal CPU, each of

which is capable of running program code independently and simultaneously. Each of these CPUs is called a core. The more cores a processor has, the more instructions it can process simultaneously, allowing more programs to be run at the same time without slowing down the host computing device.

**SATA EXPRESS:** SATA Express is a computer interface which can support both SATA and PCI Express devices and is designed as a successor to SATA 3.0 enabling faster data transfers. It allows the use of existing SATA connectors, making it compatible with existing storage devices, but also allows for the use of the much faster PCI Express bus via the latest SATA Express connectors.

SATA Express increases the maximum transfer speed from 6Gb/s for SATA 3.0, to about 16Gb/s (but other factors affect it).



SENDING ZIPPED FOLDERS

If you want to retain compatibility with older hardware, you can stick with MBR.

## SENDING ZIPPED FOLDERS

**Q** I'm running Windows 7 on my PC and I've zipped a folder containing 125MB of pictures. When I try to send the folder as an attachment, it tells me the file is too big. Have I done something wrong or do I have to send them in smaller batches? Is there a maximum file size I can send in one go via email?

A 125MB file is most certainly too large for sending as an email attachment. Email really isn't designed to cope well with large files and most email providers impose strict limits on the maximum size of a single attachment. For example, Gmail imposes a limit of 25MB per file, which is on the generous side.

You can check online to find the maximum size supported by your provider, but this is only half of the issue. The person

or persons to whom you are sending your file will also have a limit on the maximum size of an attachment they can receive and this limit may well be lower than your own.

Furthermore, if you're using an email client such as Microsoft Outlook, this may impose its own limits on file size.

In general, it's good practice to keep email attachments down to one or two megabytes maximum if you want to be sure to avoid any issues. You'll often be able to get away with more than this, but if you do, expect frequent delivery failures.

Larger files are best sent using an online storage service such as Dropbox (dropbox.com) or Google Drive (drive.google.com) which will let you upload files to the Cloud and then send a link to your email recipient so they can download it directly to their hard drive without filling up their email inbox.

Google Drive and Dropbox both have their own desktop apps which sync with the cloud making file sharing even easier. ☒

## CONTACT US



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Helproom aims to give you the best assistance possible. But, given the

limitations of this type of advice, we can't guarantee what we say will work and we can't accept responsibility for any damage arising as a result.

Always back up your system before you make any changes, including software installations.

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Alternatively, you can ask for help from the experts on our online forums. Sign up to be a registered user - which is free - and then browse to one of the discussion forums. In the Helproom your first stop should be the searchable database of frequently asked and previously answered queries. With more than 1.5 million forum posts, you'll almost certainly find your answer in this archive of queries - just enter a few keywords.

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# PC ADVISOR

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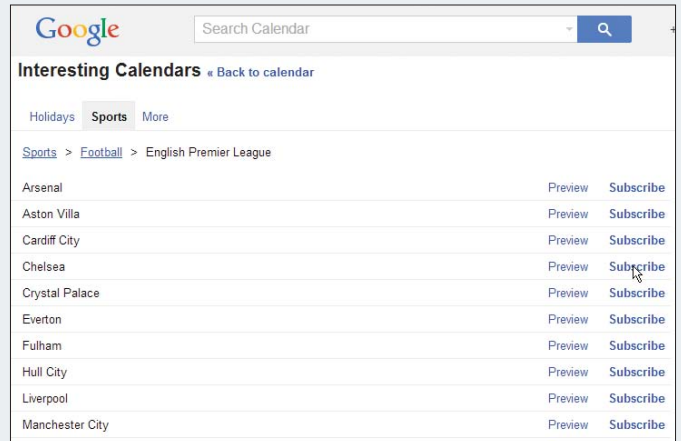


# Boost Google Calendar

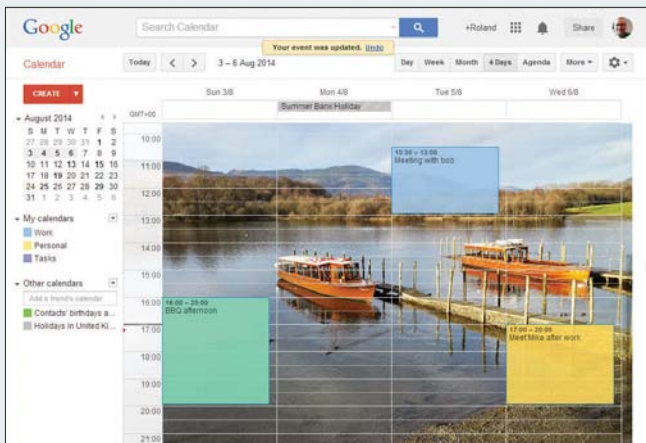


With some clever configuring and adding optional extras you can boost Google Calendar's features to make it even more useful, explains Roland Waddilove

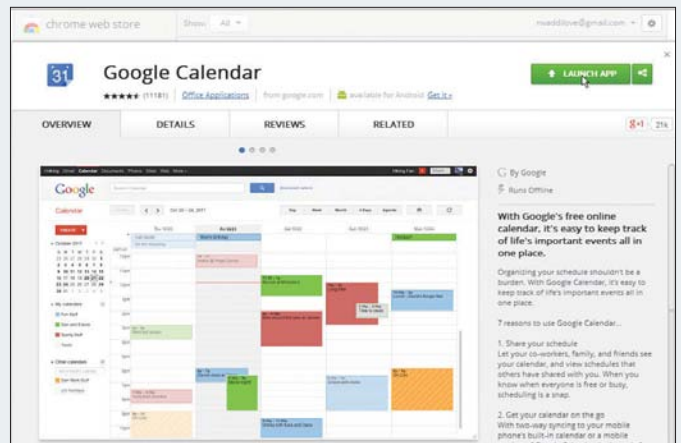
If you've a Google account, such as Gmail, an Android phone or tablet, and so on, you can access Google Calendar. It's useful for storing appointments, meetings, projects, holidays, birthdays and other events. With these handy tips you can make it even more useful. For example, did you know you can add events to Calendar simply by speaking them? It works on both PCs and mobiles. You can add extra calendars and these also appear on your phone. Most of the advanced features, such as the labs extras, are only available through a browser on a PC or Mac, though. One of the great things is that you can invite Microsoft calendar users to events and respond to invitations to events in their calendar.



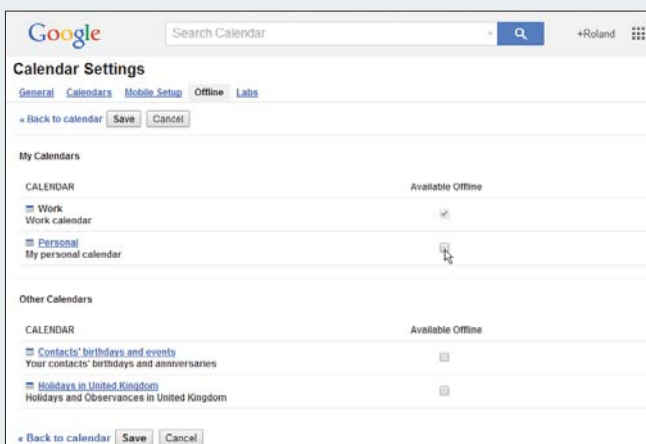
**START** Google Calendar can show multiple calendars. Click the button next to Other calendars in the left panel and select 'Browse interesting holidays'. Subscribe to 'Holidays in the UK' or follow the sport link to a favourite football team and add match dates.



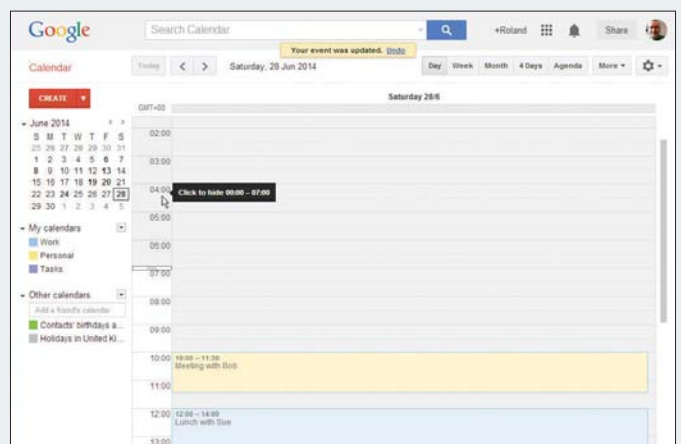
**2** You can add a background image to make the display more interesting. Go to the Gear menu, Labs, and enable 'Background image'. Go to General in Calendar settings and find 'Calendar background'. Click 'Choose image' and select your photo.



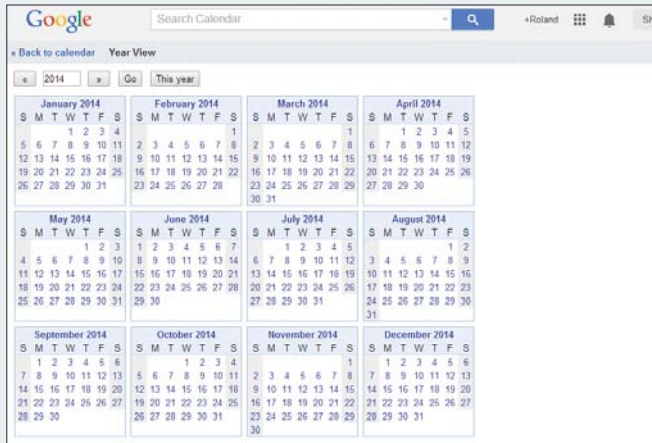
**3** Anyone that travels with a laptop may find themselves without a web connection, which means Calendar is unavailable. The solution is to set up Calendar for offline use in Google Chrome. Select Offline on the Gear menu and install it from the Chrome Web Store.



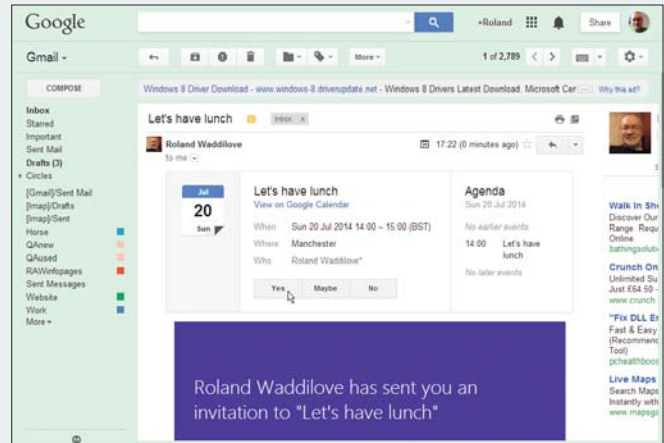
**4** After adding offline capabilities in case you don't have an internet connection, go to the Gear icon, Settings and click Offline. Calendar can work with multiple calendars such as work and person, UK holidays and so on. Select the ones to use offline.



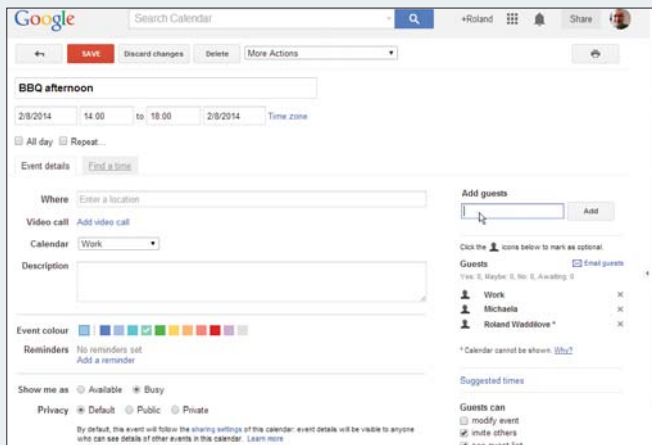
**5** Meetings and appointments don't take place at 3am, so why show these times on the calendar? Click Labs on the Gear menu and select Enable next to 'Hide morning and night'. Return to the calendar day view and click 00:00 to 07:00 to hide these times.



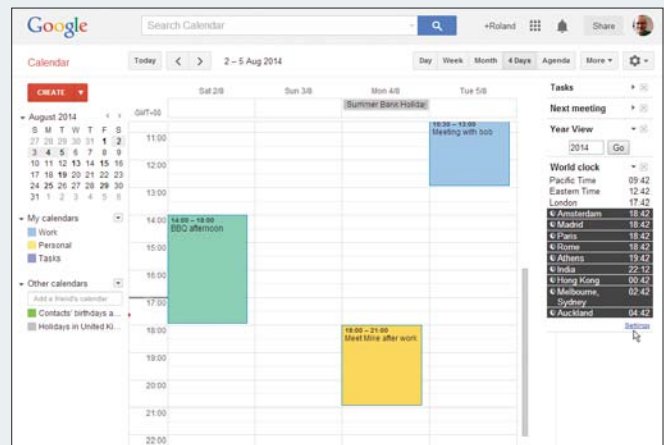
**6** Calendar has day, week and month views, but what if you want to look further ahead? Go to Labs on the Gear menu and enable 'Year view'. Click the arrow at the right edge to show the right panel if it's hidden and click Go under Year view.



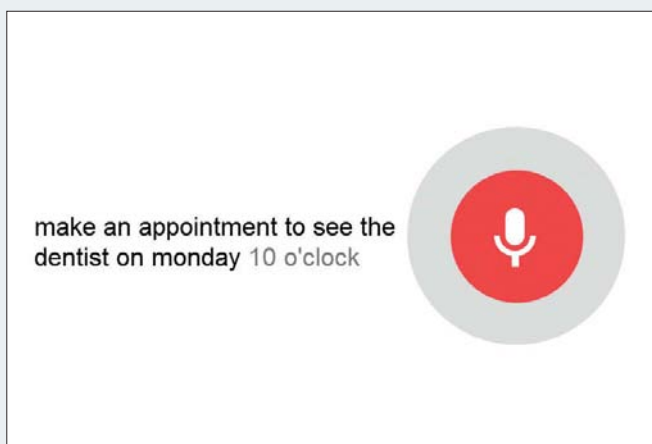
**7** Google Calendar users also have Gmail, and this enables users of other calendars, such as Outlook.com or Windows 8 Calendar to invite you. They simply add you as an attendee using your Gmail address. Click Yes to add the event to your calendar.



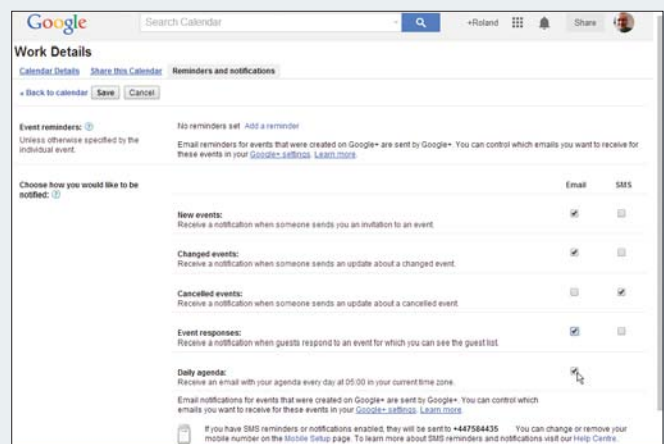
**8** This works in reverse, too, and you can invite both Google Calendar users and Outlook.com or Windows Calendar users to events. When creating an event, simply enter their email addresses in the 'Add guests' box on the right-hand side of the page.



**9** Although it's easy to find out the time in another country using Google, if you frequently have Calendar open, add time zone clocks to the display. Go to the Gear menu, Labs and enable 'World clocks'. Open the left panel and click Settings to add clocks.



**10** Why type in appointments when you can speak them? Click the microphone icon in the search box on the Google home page and simply say what you want. You'll see the text on the screen and afterwards you just confirm that it's correct.



**11** Calendar can notify you when events change or are about to happen. Click the Gear menu and select Settings, Calendars. Click 'Reminders and notifications' next to a calendar and tick the options for email and SMS. Daily agenda is a useful option, too. ☑

# Use Google Search



Useful as Google's search engine might be, Mike Bedford looks at some of Google's advanced features to make our Web searches even more productive

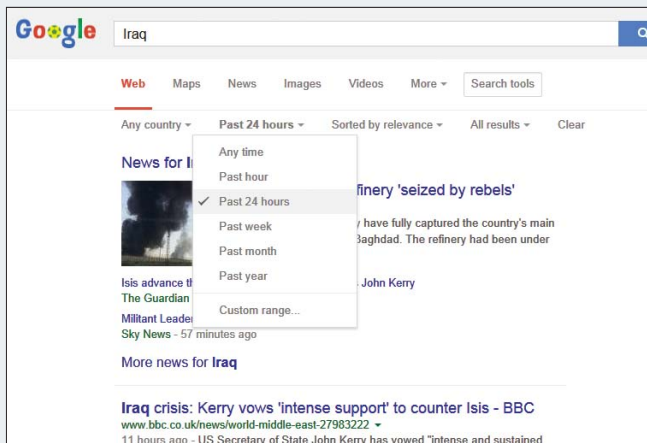
Google's search engine is a miracle of technology, but the way most of us use it just scratches the surface. There's a lot more to Googling than simply entering a word or phrase and, by taking advantage of Google's more advanced features, we stand a much better chance of finding what we're looking for more quickly.

To help you become more productive in searching the Web, we're providing a round-up of those features that move you beyond just entering some text and hoping for the best. To start, we'll look at some additional features that are accessible from Google's home page. We'll then move on to some other handy search features that are better hidden, but no less useful.

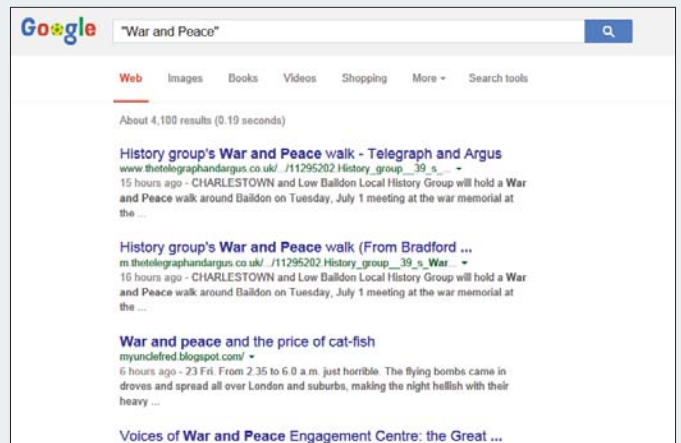


START

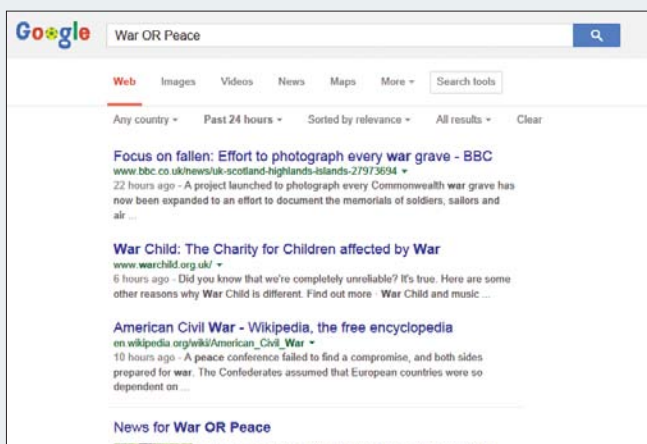
Normally, Google responds to our searches by listing web pages. However, if you're actually looking for news, images, videos or shopping, these can be selected from buttons on the Home page. Other options are available from the 'More' menu.



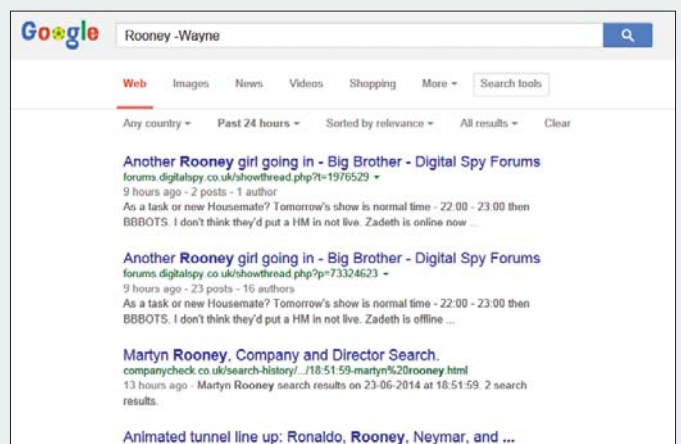
**2** The 'Search Tools' button has various useful menus. The first, which allows you to choose between pages hosted in the UK or in all countries, and the second - which lets you specify pages that were updated within a set time period.



**3** Google lists pages that contain any of the words you enter. If you want to search just for an exact phrase (such as "War and Peace") but not for sites just containing either or all the words, put your search request inside double quotes before hitting Enter.

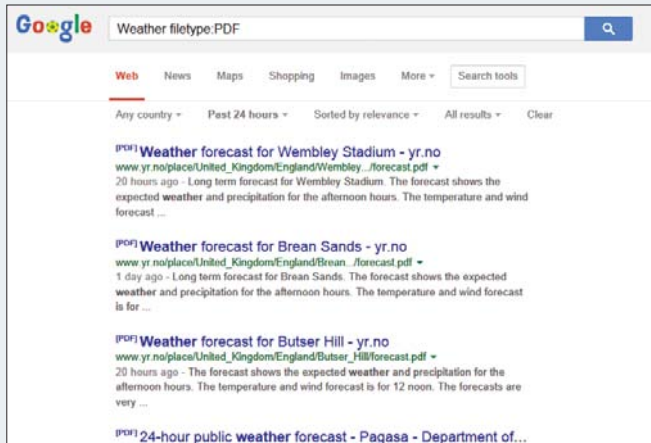


**4** Even without quotes, if you enter "War Peace" Google will list pages containing "War and Peace" first but you can force its hand using AND or OR (in capitals). "War OR Peace" lists pages containing either word, "War AND Peace" lists page with both.

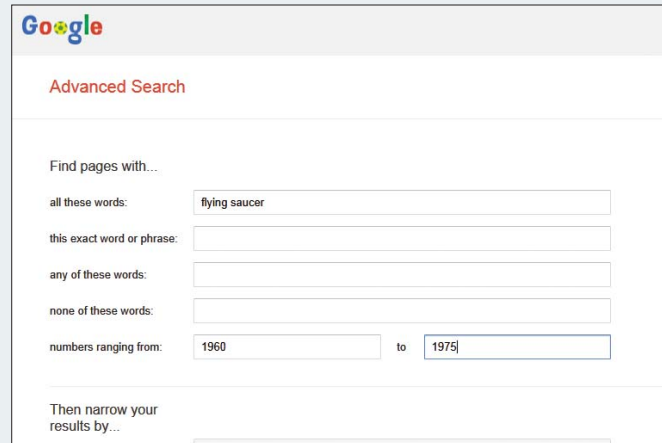


**5** Sometimes you'll want to exclude some words. Searching for Rooney will list sites predominantly relating to Wayne Rooney. If you're interested in other Rooneys, but don't know the first name, exclude Wayne with a minus sign (search for "Rooney -Wayne").

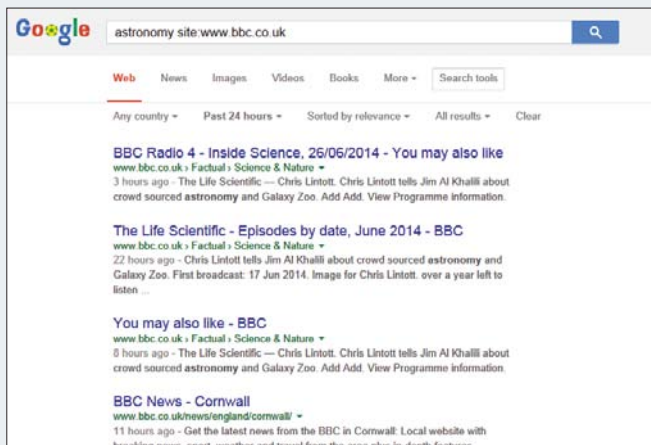




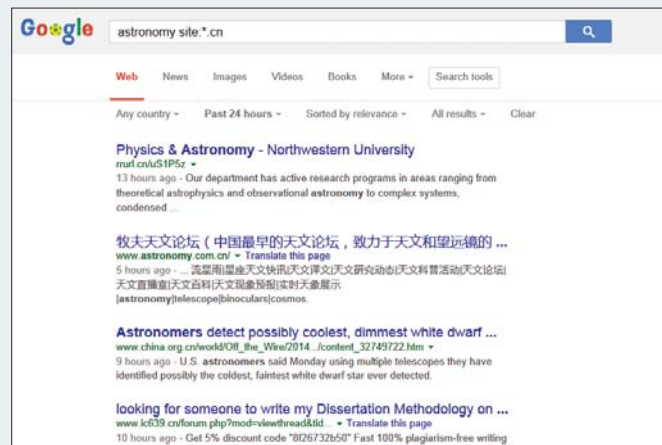
**6** If you're looking for a particular type of file, you can easily narrow the search using the 'filetype:' option. Searching for "Weather filetype:PDF", for example, will only produce a list of Adobe Acrobat documents containing the word 'weather'.



**7** Many of these features (and more) are available by using Google Advanced Search. After searching, click on the cog wheel icon in the top-right of the results page and select 'Advanced Search'. A different Advanced Search form is available for images.



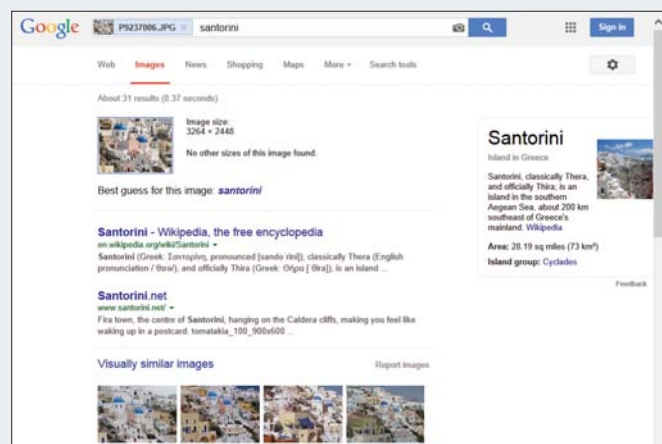
**8** Using the 'site:' option, you can tell Google to search in a particular site, even if it doesn't have its own search facility. For example, "Astronomy site:www.bbc.co.uk" will search for pages containing the word Astronomy, but only within the BBC site.




**9** The 'site:' option also lets you to search in a particular country. Because an asterisk means "anything", searching for "Astronomy site:\*.cn" will restrict the search to Chinese sites. Country codes are listed at [tinyurl.com/298u65](http://tinyurl.com/298u65).



**10** For some searches - exchange rates is an example - Google will provide results directly instead of listing third-party sites. Type "GBP to EUR" to see the Pound to Euro exchange rate. Three-letter codes for currencies are at [tinyurl.com/zocyf](http://tinyurl.com/zocyf).



**11** Images.google.com lets you use an image as your search term instead of text. Click on the camera icon and then, either paste the URL of an image on the web or upload one from your PC. Google will list similar images and sometimes related web pages. 

# Linux to the rescue: How Ubuntu can help a computer in distress

It may sound like sacrilege, but it's not: Ubuntu Linux is a useful tool for even hardcore Windows users, explains Chris Hoffman

Whether you need to recover files from a failing computer, diagnose hardware problems, scan for viruses from outside Windows, or reset a forgotten Windows password, Ubuntu can help. You can't boot a full Windows system from a USB stick to troubleshoot your PC - unless you have an Enterprise version of Windows and Windows To Go ([tinyurl.com/pwzrevv](http://tinyurl.com/pwzrevv)) - but you can use Ubuntu for lots of troubleshooting.

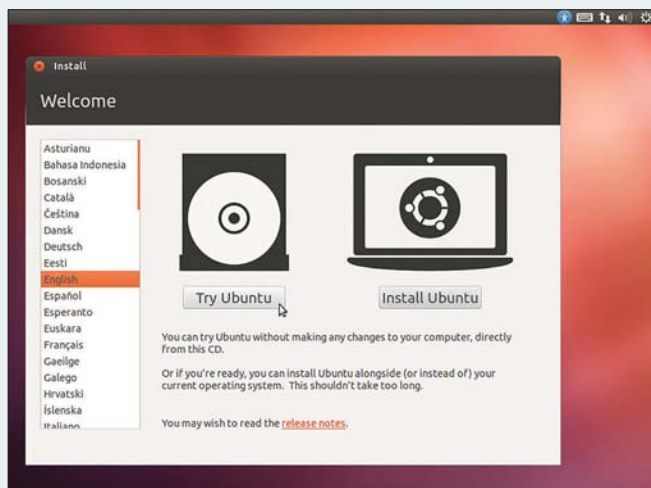
We'll be digging into some Linux terminal commands. Don't worry - they won't bite.



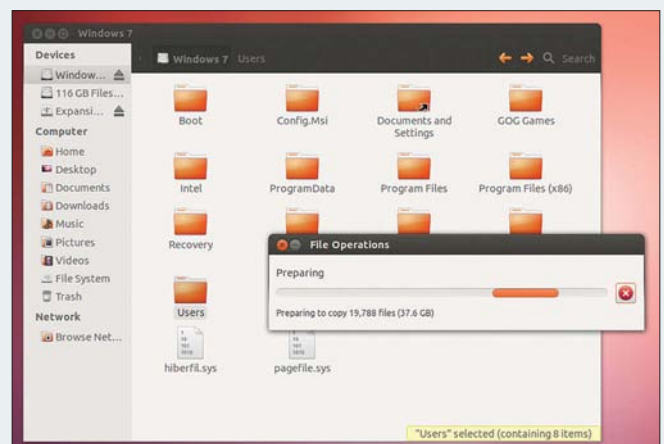
## Create Ubuntu Live media

You'll need a Linux live USB drive, CD or DVD. You can use any distribution you like, but for this tutorial, we're focusing on Ubuntu.

First, download Ubuntu Desktop ([tinyurl.com/mp2674g](http://tinyurl.com/mp2674g)). Then download the Universal USB Installer tool ([tinyurl.com/pwf2eo2](http://tinyurl.com/pwf2eo2))



Select the '**TRY UBUNTU**' option to use the live drive

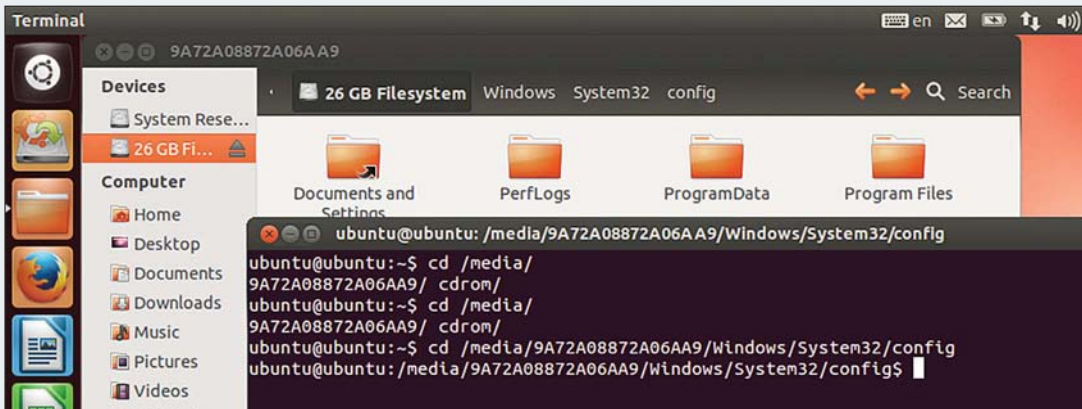


To recover Windows-stored files using Ubuntu, **OPEN A FOLDER**

and select your USB drive. The ISO file and tool will create a bootable USB drive. You can also burn the ISO file to a CD or DVD.

Insert the live drive into your computer and reboot. It should boot straight into Ubuntu; if it doesn't, don't worry, simply change the boot order in the BIOS ([tinyurl.com/pagybc7](http://tinyurl.com/pagybc7)). Once you're through to the Ubuntu desktop and it's all up and running, the fun stuff and troubleshooting begins.

## “ When you hear the dreaded click of a dying hard drive, Ubuntu can help ”



Find the **WINDOWS DIRECTORY** using the terminal

### Recover files from a failing drive

It happens. Your PC won't boot, Windows is showing errors or a blue screen, or you hear the dreaded click of a dying hard drive.

Even if you can't boot the operating system, you may be able to recover some files before the drive dies completely. Or, if the Windows system is corrupted and the drive is fine, you can recover all of the files from outside the operating system.

Click the folder icon on Ubuntu's launcher to open the file manager. Your Windows drive appears under Devices in the sidebar; click it to see the file system. If you have multiple partitions or hard drives, multiple devices will show up in this view.

Connect an external drive or USB stick to your computer, and it will appear under Devices as well. Drag and drop files from the Windows system to your external drive. You can also upload files to a cloud storage service, or open Brasero Disc Burner (included with Ubuntu) and burn them to disc.

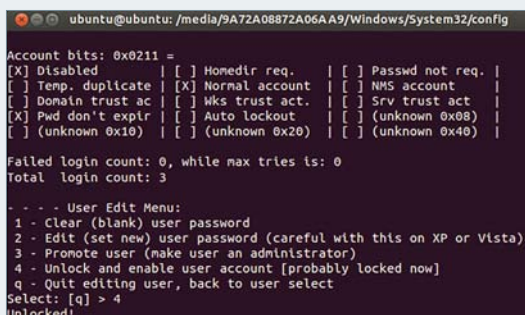
### Reset your Windows password

Ubuntu also allows you to edit your Windows user account password. After you unlock your admin account and clear its password, you can log into Windows as an administrator and reset your other passwords if you want to.

To open a terminal window, click the Ubuntu logo in the top-left corner of the launcher, type **Terminal**, and press Enter. Run the following commands to install a password-changing utility. (If you've already run the first two, just use the third one.)

```
sudo add-apt-repository
"deb http://archive.
ubuntu.com/ubuntu $(lsb_release -sc) universe"
sudo apt-get update
sudo apt-get install chntpw
```

If you haven't done so yet, open the file manager from the launcher and click your Windows drive under Devices to view its



Unlock the  
Windows  
**ADMIN  
ACCOUNT**

contents in the terminal. Next, type the following command, but do not press Enter: **cd /media/**.

Press Tab twice. You'll see an alphanumeric label that corresponds to your hard drive. Type the first few characters and press Tab again to fill the label in. Type **/Windows/System32/config**. You'll end up with a command like the following:

```
cd /media/label/Windows/System32/config
```

Press Enter.

Run the following command and press Enter to modify the admin account: **sudo chntpw SAM**.

SAM is the name of the Windows system file containing the hashed user account passwords.

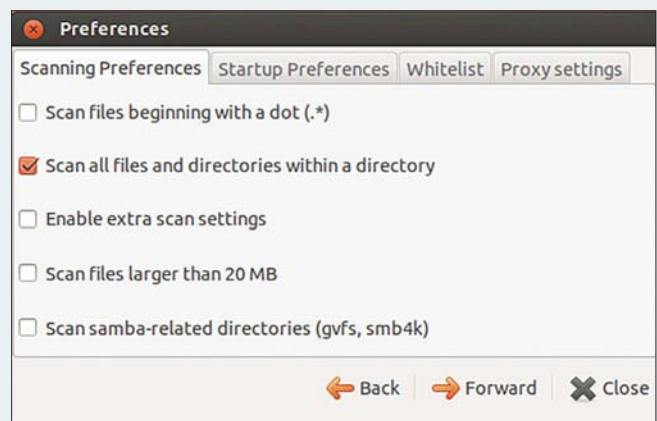
If your admin account is locked (the default), type **4** at the prompt and press Enter to unlock it. Type **y** at the confirmation prompt and then hit Enter to confirm.

Run the **sudo chntpw SAM** command again to get back into the program. Type **1** and press Enter at the prompt to clear the admin password and make it blank. Type **y** at the prompt and press Enter to confirm again. Important: do not use the 'change password' option here, as it could cause problems.

You are now free to log into Windows as an administrator, with a blank password, and then open the Control Panel and reset other user account passwords if you need to do that, too.

### Scan for malware

Antivirus companies make dedicated antivirus boot discs for scanning your system (tinyurl.com/qdg4h24), but you don't really need one of those as Ubuntu comes in handy here, too.



**TELL CLAMAV** (above) to scan all files and directories





Select **RECURSIVE SCAN** while ClamTk is open

click the Ubuntu icon at the top-left corner of your screen, search for Disk Utility, and press Enter. Select your Windows drive and look next to SMART Status. You can click the SMART Data button to see more details and perform self-tests.

SMART isn't perfect. A drive may report that everything is fine when it's actually failing, or it may register a serious problem and then work fine for months. But if you see a serious warning, you should replace the drive as soon as possible.

## Test your RAM

Ubuntu includes the memtest86+ memory-testing utility ([tinyurl.com/ojqpfbq](http://tinyurl.com/ojqpfbq)). If your RAM has a problem, memtest86+ will detect it. RAM problems can lead to application crashes, file corruption, and the dreaded blue screen of death. First, restart your computer if you're already at the Ubuntu desktop.

ClamAV ([tinyurl.com/pvxtjz](http://tinyurl.com/pvxtjz)) is open source and easy to install on Ubuntu. You can also use commercial antivirus software such as AVG Free for Linux ([tinyurl.com/n544k6k](http://tinyurl.com/n544k6k)) or BitDefender for Unices ([tinyurl.com/osanrcm](http://tinyurl.com/osanrcm)).

To install ClamAV, open the terminal and enter the following commands, pressing Enter after each. (Again, if you've already run the first two commands, start at the third.)

```
sudo add-apt-repository "deb
http://archive.ubuntu.com/ubuntu
$(lsb_release -sc) universe"
sudo apt-get update
sudo apt-get install clamtk
```

Type **y** and press Enter to confirm the installation.

Next, run the following command to update your virus definitions: **sudo freshclam**.

You can now run the clamtk command in the terminal or open ClamTk from your list of installed apps. Click the Preferences button and make sure that you enable the 'Scan all files and directories in a directory' option.

Click the Scan option on the menu at the top of ClamAV's screen and select Recursive Scan. Select your Windows drive in the sidebar and click OK. ClamTk should scan every file on your Windows drive with the ClamAV antivirus engine.

## Give your hard drive a check-up

The SMART status monitor allows a failing hard drive to warn you before it goes down in flames. To check a drive's SMART status,

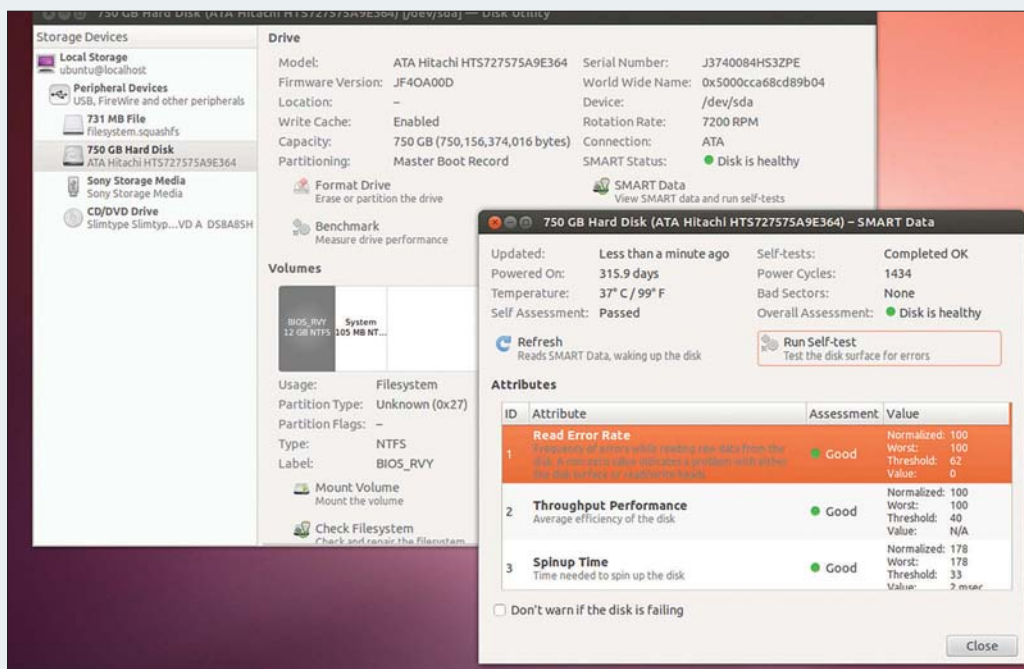


You'll want to use the **TEST MEMORY** option

When Ubuntu starts booting, repeatedly press <Escape> to see the normally hidden boot menu. Select Test Memory to launch the memtest86+ memory-testing utility.

After a successful batch of tests (a pass), you'll see the message: "Pass complete, no errors, press Esc to exit." You can then exit memtest86+ or allow it to perform multiple passes. If you see an error, you likely need to replace a RAM stick.

You can do a lot with that tiny Ubuntu drive. Our sister title *PC World's* handy Ubuntu guide ([tinyurl.com/p6sqkho](http://tinyurl.com/p6sqkho)) has lots more useful information about the OS's ins and outs. ☐



Checking your **HARD DRIVE'S HEALTH** is the smart thing to do



## Connect your Android tablet to a television



Displaying your tablet's content on your TV can be tricky. Dave Stevenson reveals how to do so without spending a fortune or drowning in a sea of cables

Tablet owners live in a golden age of content: streaming video applications such as Netflix and Blinkbox, catch-up services such as BBC iPlayer and Channel 4's 4oD, and home-spun video and photographs are all begging to be shared. And, while sharing online is the ultimate convenience, sharing in person is more fun. The problem is your tablet's screen: perfect for one or two people but it will never feel smaller with five people crowded

around it. This is doubly true for smaller tablets such as the 7in Amazon Kindle Fire HD.

The good news is that you already have a device in your living room which is perfect. Your TV is big, bright and no-one has to squint to see what's happening on it. There's a growing number of ways to get video and pictures on to it, from straightforwardly stringing cables around to ingenious wireless options that will propel your living room into the 21st century. Here we'll explore both options, as well as looking at the services that will let you share your subscriptions, photos and videos on the big screen.

Although we're talking predominantly about tablets, the same advice applies to smartphones.

### HDMI

HDMI (High Definition Multimedia Interface) is the interface standard du jour. If your TV was bought in the past decade it has an HDMI port, as does almost every set-top box, games console and a decent number of still and video cameras. The benefit to HDMI, apart from its ubiquity (which means it's cheap), is that it accommodates HD video and audio simultaneously, allowing you to connect devices without worrying about watching a film in full HD but having to make do with your tablet's tinny speakers. An HDMI output is an advantage that many Android tablets have over Apple's iPad.

HDMI plugs come in three sizes. Regular HDMI (or Type A) are the full-size ports you'll find on devices where space isn't an issue: think TVs, laptops and games consoles. The sockets you're likely to find on tablets and phones will be either Type C (also known as Mini HDMI) or Type D (Micro HDMI). Of these, Micro HDMI, or Type

D, is the smallest. Whichever type of your tablet has, connecting it to HDMI socket isn't going to cost you the Earth: expect to pay well under £10 (under £5 in some cases) for an HDMI to Mini- or Micro-HDMI cable.

A decent range of tablets have either HDMI or its miniaturised variants. The Acer Iconia A1, Tesco Hudl, Archos 80 Titanium and Nokia 2520 – among many, many others – all offer it. It's the most straightforward approach.

You're not limited to buying a tablet with an HDMI output to connect it to your TV, though.

### HDMI CABLE



## MHL/SlimPort

HDMI is easy to understand: it's a port that only does one thing, after all. The drawback is that not all tablets have an HDMI output. The good news is that a pair of widely-supported standards have emerged that allow Android owners to connect to external displays using their Micro-USB port.

The standards in question are MHL (Mobile High Definition Link) and the newer SlimPort. Both look the same, which is stating the obvious as they simply use the Micro-USB port on an Android device to deliver video.

Like HDMI, SlimPort and MHL support both video and audio, with up to eight channels of surround sound available. Both normally require breakout boxes: a small dongle between your device and TV that converts the signal from your phone to one compatible with HDMI. Expect to pay between £10 and £25 for either a SlimPort or MHL signal converter. That makes things a little more expensive than using a tablet with an HDMI port, but MHL in particular is supported by a wide range of phone and tablet makers.

MHL has undergone various versions: we're currently on version three, which improves the maximum resolution to 4K. This is the same as SlimPort, and means both standards offer pretty similar technical specs. One advantage that MHL has is support from various manufacturers: look on the back of your TV, and if the HDMI port has an MHL logo above it, you can use an HDMI to Micro-USB cable to connect the two - the HDMI cable will pass power to your tablet or phone, meaning no need for extra adaptors or cables. Bonus.

If your TV doesn't support MHL, or you have a SlimPort device, you'll need an adaptor. SlimPort users should expect to pay around £15, while MHL users may spend slightly less. If you're using MHL it's likely you'll need an external power source: MHL 3 can draw up to 10W from its host device. SlimPort has the advantage here: no external power supply is needed, making setup less cluttered. Both devices need a tablet's screen to be on, though, so breakout boxes normally come with a Micro-USB port so a charger can be connected.

### SLIMPOR



Support for MHL and SlimPort varies enormously. With three different versions of MHL available, plus SlimPort, you'll need to check the specifications of your device before buying an adaptor. The Microsoft Surface and Samsung Galaxy Tab 3 support MHL, while the Google Nexus 5 supports SlimPort.



Apple users have a simpler time: although the iPad is, technically speaking, compatible with DisplayPort, the only way to connect it to a display is with Apple's proprietary cables. The downside is cost: you'll pay £40 for an HDMI adapter that connects to an iPad's Lightning connector (a 30-pin version is available for older iPads).

## Wireless

There's little to beat the wow-factor associated with beaming video straight from a tablet to your TV. The good thing about Android is that there's more than one way to do it. Miracast is a wireless standard that creates an ad-hoc network between two devices, typically your tablet and a set-top box which supports Miracast.

An increasing number of TVs support Miracast without the need for extra hardware. Miracast uses H.264 for video transmission, which means efficient compression and decent, full HD picture quality. Better yet, Miracast supports Digital Rights Management (DRM), which means services such as iPlayer and YouTube can be streamed to a TV. Not all services work, though.

An alternative is Google's Chromecast. This inexpensive £30 'dongle' plugs into a spare HDMI port on your TV and connects to your wireless network. Chromecast support is burgeoning, which means content from services such as iPlayer, Netflix, BT Sport and others can be played with the Chromecast dongle doing all the legwork instead of your tablet, and that's good news for battery life.

As of July 2014, it's possible to use Chromecast to mirror the display on your Android device, allowing you to hit play on a tablet and have (non DRM-protected) video start playing on your TV. The same goes for anything the screen can display, including apps, games and photos.

## Which devices support Chromecast mirroring?

Mirroring on Chromecast is new, and the list of devices that support it is limited. Own one of the following? You're in luck.

- Google Nexus 4
- Google Nexus 5
- Google Nexus 7 (2013)
- Google Nexus 10 (pictured)
- Samsung Galaxy S4
- Samsung Galaxy S5
- Samsung Galaxy Note 3
- Samsung Galaxy Note 10 (2014)
- HTC One M7
- LG G Pro 2
- LG G2
- LG G3





Again, Apple users have an easier but more expensive time. The iPad and iPhone don't support any open streaming standards, so you'll need to get hold of an Apple TV (£79). This supports AirPlay mirroring from iOS devices only, and, like Chromecast, offers various streaming services including Netflix and Sky offerings Sky Sports and Now TV. BBC's iPlayer also supports AirPlay. Note that you can't use Sky Go to watch Sky programmes on your TV via AirPlay.

### Making it work

Streaming video to your TV from your smartphone or tablet will depend on the setup you've gone for. If you're using a physical connection, such as HDMI, MHL or SlimPort, the content on your tablet's display will simply appear on your TV once everything's connected. This is straightforward but has drawbacks. For one thing, your tablet will only send a signal when its screen is on. This means battery life will be sapped quickly, so it's likely you'll need to plug in its charger to stop it running out of power (or going to sleep) mid-show.

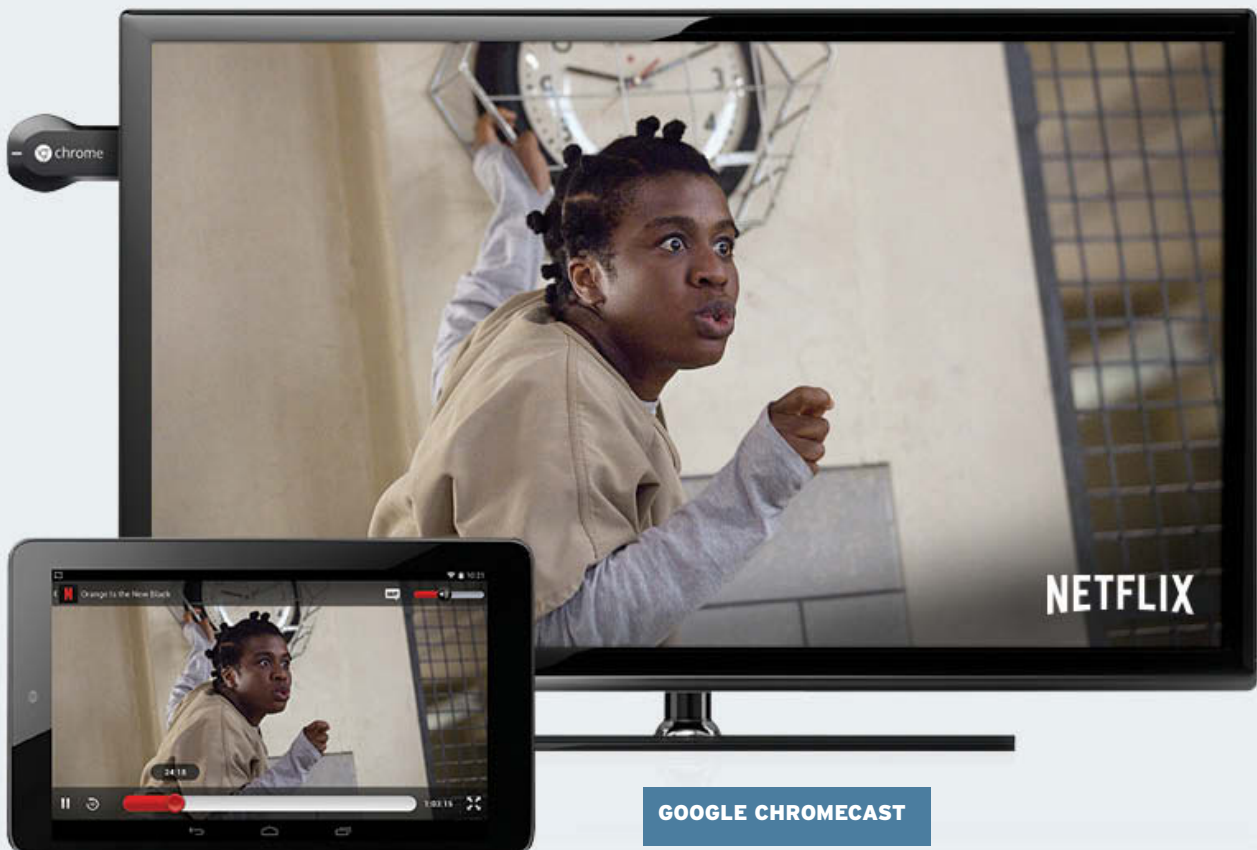
If your tablet has video you've supplied yourself, in the shape of non-DRM files, mirroring will work fine, and the same goes for various commercial services including Netflix, ITV Player and iPlayer. Life isn't all rosy, though. Content providers know consumers will pay extra for the convenience of streaming TV shows through their homes. Sky, for example, charges subscribers an extra £11.25 if they want to watch their Sky subscriptions in another room of their house. If you want to watch your Sky subscription on a tablet there's no charge; in fact, you can add two mobile devices per account. Plug in an HDMI cable or attempt to use Miracast and you'll find the limits of Sky's generosity though: outputting Sky Go's display to an external TV or projector is banned.

If you go wireless, Miracast is currently the best option for display mirroring, as it simply outputs the contents of your Android device's screen wirelessly. So, as with a physical connection such



APPLE TV

as HDMI, if you load a photo onto your tablet's display, it appears on your TV. The same goes for many apps: BBC's iPlayer, YouTube and Vimeo are all known to work via Miracast. The drawback for Miracast is the same as with a cable connection: your tablet's display needs to be running the whole time for it to work. That, coupled with higher demands for your device's wireless radio (particularly if it's streaming from the internet simultaneously) could result in precipitously lower battery life. ☒



GOOGLE CHROMECAST

# Upgrade your old PC



Is your computer running too slow? Chris Hoffman reveals how you can breathe new life into an elderly PC with a few tune-ups and upgrades to get it back up to speed

Windows PCs slow down over time - that's the popular wisdom, at least. Your PC's hardware isn't actually becoming slower, though. Startup programs, junk files, and even clumps of dust are just weighing it down. If you give your PC's software and hardware a quick tune-up, it should run like it did the day you bought it. Inexpensive hardware upgrades can even make your PC run faster than it ever did. Here's what you can do...



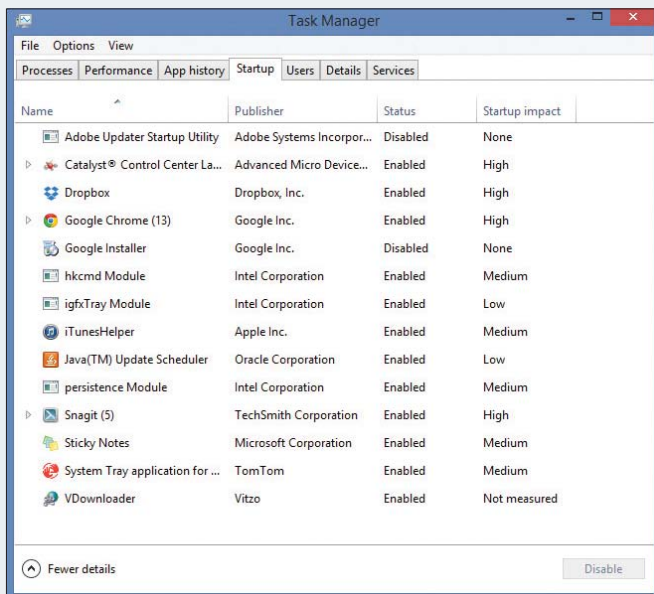
## Software tune-ups

**START**

### Disable or remove unwanted startup programs

Many programs install system tray utilities or services that piggyback onto your system's startup routine, slowing your PC's boot time and wasting valuable RAM.

In Windows 8, right-click your taskbar, select Task Manager, click More details, and use the Startup tab to disable programs you don't need. The Task Manager even tells you how much time each program adds to your boot process.



In Windows 7, you can use the Startup manager in CCleaner to change which programs start after a boot. In CCleaner, navigate to Tools > Startup. Of course, if you don't use a program, you should uninstall it entirely from your Control Panel instead of disabling it.

**2**

### Clean up unnecessary system files

Use a tool such as CCleaner or the Disk Cleanup program included in Windows to clear unnecessary files from your PC. These files take up space and can even slow down your PC.

To open the Disk Cleanup program on Windows, start by tapping the Windows key to open your Start menu or Start screen. Type Disk Cleanup, and click the Free up disk space by deleting unnecessary files shortcut in Windows 8 or the Disk Cleanup shortcut in Windows 7. Use CCleaner if you want to clean up even more types of temporary files. You may want to tweak CCleaner's

settings first though, as it will erase your browser history, cookies, cache, and other data you may want to keep.

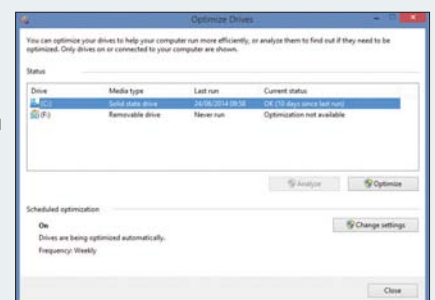
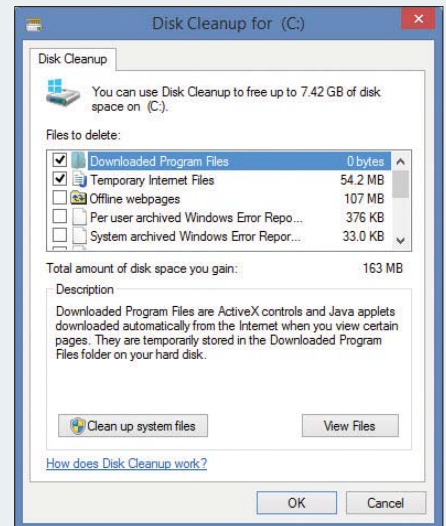
**3**

### Defragment and optimise your hard drives

Modern versions of Windows defragment drives automatically in the background, so you probably don't have to defragment your hard drive manually. Still, it doesn't hurt to check.

Tap the Windows key to open the Start menu or Start screen, type Defragment, and launch the Disk Defragmenter in Windows 7 or the 'Defragment and optimise your drives tool' in Windows 8. Analyse your drives, and the tool will tell you whether you need to defragment them.

Windows 7's Disk Defragmenter should refuse to defragment solid-state drives (SSDs), while Windows 8's Disk Defragmenter is now named 'Optimize Drives' because it can also optimise SSDs.



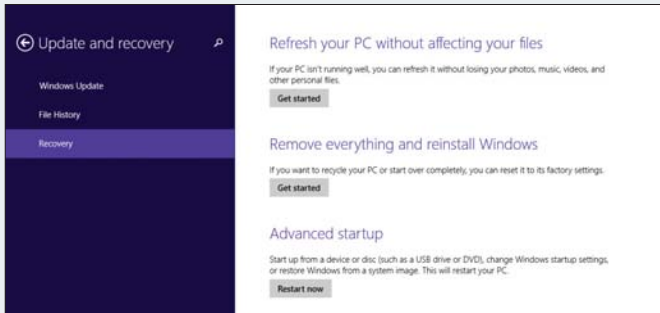
**4**

### Keep your system free of viruses and malware

Even if you're using antivirus software and otherwise playing it safe, newer kinds of malware can sneak into your system.

The nuclear option is reinstalling Windows entirely and starting afresh. In Windows 8, you can use the Refresh-your-PC feature to effectively reinstall Windows. You'll keep all your personal files in the process, but you'll get a fresh desktop system and will have to reinstall your desktop software.

On Windows 7, you can use your manufacturer's recovery partition or reinstall the operating system from an installation disc.



If you refresh your PC or reinstall Windows from your manufacturer's recovery partition, you'll need to clean up all that nasty bloatware floating about to make it run as fast as possible.

## 5 Upgrade to a newer operating system

You can also upgrade your PC's operating system. If you have a really ancient PC – maybe you have an old Windows XP PC lying around – you can try installing a lightweight Linux system on it to give it a new lease on life.

Old computers that came with Windows Vista can probably be sped up by updating them to Windows 8.1 or even Windows 7, but it may not be worth the cost of a new Windows licence. You're usually better served putting that money towards newer, faster PC hardware.

## Hardware cleaning

Heat can also cause your PC to slow down over time. If your PC can't cool itself efficiently, it may throttle down your CPU or graphics hardware to operate safely, giving you reduced performance. Excessive heat can damage the hardware over time or cause it to unexpectedly shut down to prevent itself from suffering severe damage. If you hear your PC's internal fans whirring to their maximum speed during light or moderate usage, it may be an indication that your system is overheating.

### START Bust the dust

Give your PC's case a regular cleaning to prevent dust build-up. While your computer is powered off and unplugged, open up its case and give it a spray with canned air to clean out that nasty dust clinging to fans and blocking vents. Depending on how long it's been since you last cleaned your PC, you may find it surprisingly dusty. You may also want to try cleaning out your laptop's cooling fans, but opening up a laptop may be more difficult.

## 2 Replace the paste

Your computer's CPU and GPU use a thermal compound to help dissipate heat. This compound sits between your both your CPU and your GPU and their respective heatsinks. The paste conducts heat from the heat-generating chip to the heatsink. The heatsink is then cooled by moving air pushed around by a case fan.



This is similar to how your car cools itself. If you imagine your CPU or GPU as an engine, and the heat sink as the radiator, the thermal paste would be the coolant. The compound, like the coolant in your car, can deteriorate over time. This can cause problems cooling your CPU or GPU.

You can disassemble your GPU and replace its thermal paste or remove the heatsink from your CPU and replace the CPU's thermal paste. You'll want a thin, flat, uniform layer of paste.

## Hardware upgrades

Hardware upgrades can also give your PC a new lease of life. Of course, hardware upgrades aren't always the right solution. If your PC is a decade old, you won't be able to speed it up much with a hardware upgrade. You'd be better off buying a new PC entirely. With that in mind, here are the best bang-for-the-buck upgrades.

### START Replace your drives

The bottleneck in most PCs – that is, the slowest part of the PC that you find yourself waiting for most often – is the hard disk.

Solid-state drives are much faster than traditional magnetic hard drives, although they do offer less storage space per pound. You can get a 120GB SSD for £70, while you can get a 2TB – that's over 17 times more storage – magnetic 'moving parts' hard drive for about the same price.

If your PC is only a few years old, but it seems like the hard disk is the slowest part, you can probably boost its speed by upgrading it with an SSD. You may even be able to upgrade your laptop with an SSD. Whatever you do, be sure to move your operating system and program files to the SSD.



## 2 Upgrade your Random Access Memory (RAM)

More RAM can help too, but only if your PC doesn't have enough of it already. RAM holds your PC's working memory. If you have too little RAM, your PC will have to constantly read and write to the page file on its hard drive, slowing everything down. If you go this route, be sure you buy the correct type of RAM for your PC.

To install the RAM, power off the PC, open it up, and snap in the new sticks of RAM. Some laptops even allow easy access to their RAM slots making this kind of upgrade straightforward.

## 3 Upgrade your CPU or graphics card

Other upgrades are a bit more niche. If you're a gamer and want to run games on higher graphical settings, you may want to upgrade your PC's graphics card. Bear in mind that your performance bottleneck may be your CPU: if your CPU isn't fast enough, upgrading your graphics card may not help much.

CPU upgrades are possible, but Intel regularly introduces new socket formats, which means new CPUs may not fit in older motherboards. Also note that an Intel CPU won't work in a motherboard with an AMD CPU socket, and vice versa. You may have to upgrade your motherboard as well, and at that point, you may just want to think about buying or building a new computer.

Your old PC hardware won't last forever. New software will eventually become more and more demanding, and your old hardware will one day succumb to entropy and physically break down. Fortunately, some basic system maintenance can extend any computer's usable life considerably. So it pays to take care of your system and it will keep you happy for longer. ☒



# Install a new screen



If your laptop screen cracks or dies, this shouldn't be the end of the world as it's easy to fit a replacement one yourself, explains Mike Bedford

The LCD panel that comprises your laptop's screen is probably the most likely component to fail. If the screen dies, don't necessarily assume that you'll have to buy a new laptop. Replacement screens can be bought for most models and this is usually a far cheaper option than buying a whole new laptop.

Here we provide practical guidance on how to proceed, starting with diagnosing whether the screen truly is the culprit. However, we assume that you know for sure that the problem is related to the video system and not something totally unrelated like the hard drive. (Note: some models fit together in a different way from the one shown here, but the same principles apply.)



## START

First, you need to identify the problem. If the screen flickers, or initially comes on but then goes off again, or if an image appears but is extremely dim, the inverter that drives the backlight could have failed. If so, proceed to Step 3 (below).



**2** If the screen is totally black, or perhaps shows garbage, attach an external monitor and, if necessary, press the appropriate key to switch to it. If you get no image on the monitor, it's probably the video circuitry, so replacing the screen won't help.



**3** First, as a general safety precaution (bearing in mind that there are high voltages inside a laptop, despite it being powered from a portable low-voltage battery), disconnect its charger and remove the internal battery before you do anything.



**4** The screen bezel is sometimes secured by screws hidden behind rubber covers. If so, remove them using a very small jewellers' screwdriver. Now remove the screws. Keep each set of screws safe and separate, making a note of where they fit.



**5** Having removed any screws, prize off the bezel using a small flat-bladed screwdriver. Start at one point and work your way around until it comes loose. If you've identified the LCD panel as the culprit, as opposed to the inverter, proceed to Step 8.



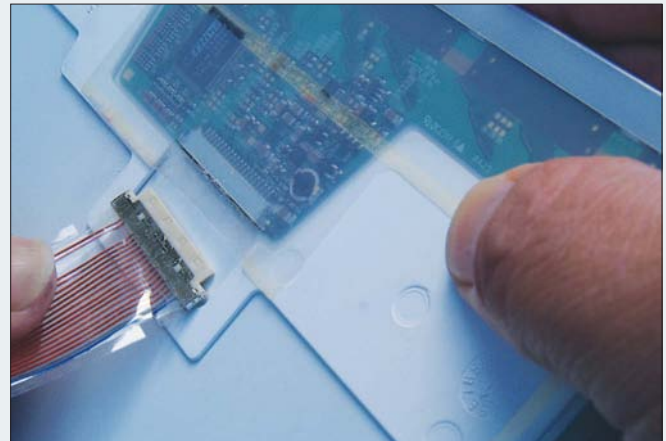
**6** If you identified the inverter as the potential cause of the problem, this is the long narrow circuit board which will now be visible, mounted between the screen and the case, probably at the bottom. Unscrew it carefully before you try to remove it.



**7** With the inverter loose, unplug the cables that connect to it - one of them provides power and the other goes directly to the LCD panel. Remove the board from the laptop and make a note of the part number so you can order a new one. Go to Step 10.



**8** If you identified the screen as the problem component, you'll have to unscrew the LCD panel from the lid of the laptop. On some models, you'll first have to unscrew a metal cradle and then unscrew the panel from the cradle. It's very straightforward.



**9** Unplug the multicore cable that connects to the panel, probably on the rear. Now remove the panel, note its part number and order a new one. Keep the various screws and your notes safe while you're waiting for the new one to be delivered.



**10** When the replacement component arrives, reconnect the leads that you unplugged from the old ones and screw them back in place. Before replacing the bezel, it's a good idea to check that it works, but keep your finger away from the inverter.



**11** Complete the reassembly of the laptop by replacing the bezel (it should just snap on) and if there were any screws securing the bezel, fit those too. A final check should be all but a formality as you'll now have restored your laptop to its former glory. ☒



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## Auslogics BoostSpeed 6

FULL PROGRAM (THREE-MONTH LICENCE) AVAILABLE ONLY ON THE DISC+

### Installation details

Go to My Computer, right-click the DVD icon and open the disc. Next, select Files 231\Auslogics BoostSpeed 6 and then open the install file

**Online registration required:** follow the links during installation before 11 Nov 2014

### System requirements

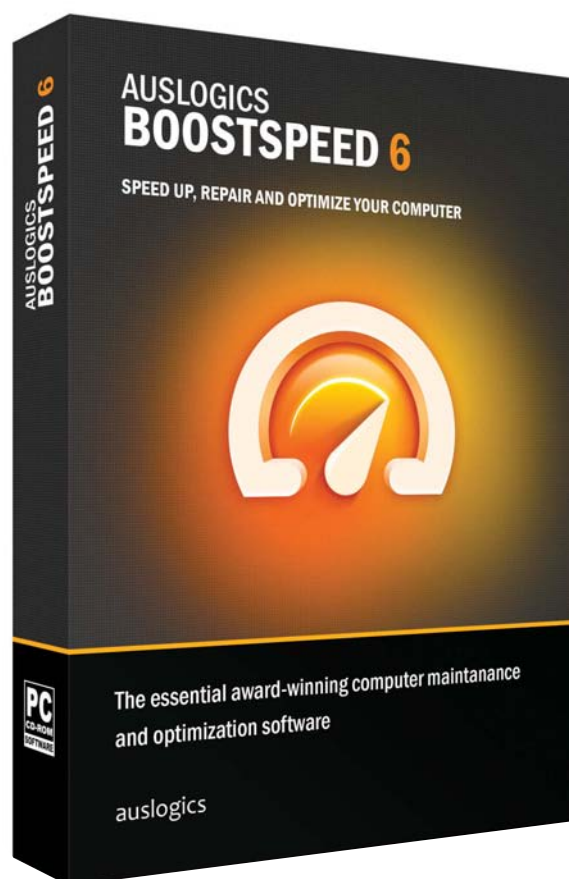
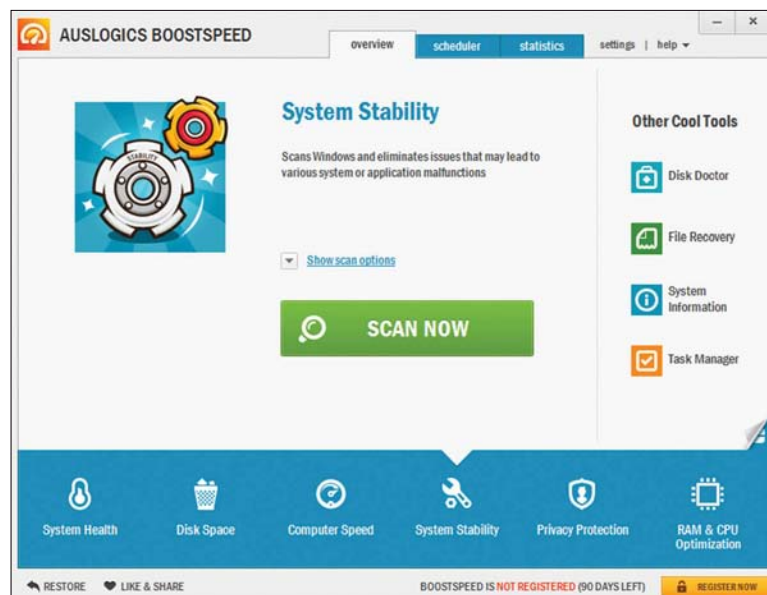
Windows XP/Vista/7/8 (32- or 64-bit); 512MB RAM; 60MB drive space

Auslogics BoostSpeed is your one-stop computer maintenance and optimisation tool, providing you with everything you need to keep your computer running fast and smooth. With BoostSpeed 6, you'll be able to repair, defragment and optimise your system, remove junk files, speed up your internet connection, find duplicates, recover accidentally deleted files and protect your privacy.

### FEATURES

- **One-click scan:** Removes junk files, defragments disks and repairs Registry errors with just a couple of mouse clicks
- **Over 15 major tools:** Supplied with over 15 power tools for complete computer maintenance and ultimate speedup of a slow PC
- **Internet optimiser:** Automatically tunes internet connection settings to maximise your download- and web-surfing speed
- **System advisor:** Analyses your system and provides a detailed diagnosis, with advice on how to speed up your computer
- **File recovery:** Recovers accidentally deleted files or those damaged by spyware and computer viruses
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# Ashampoo Photo Commander 11

## FULL PROGRAM

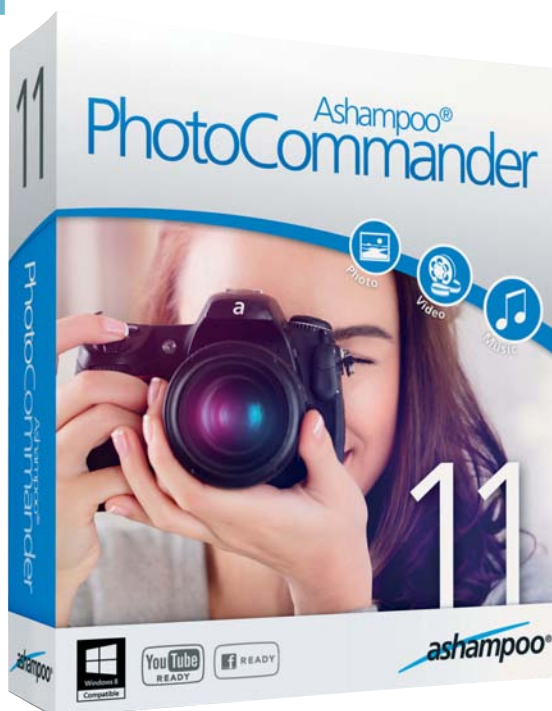
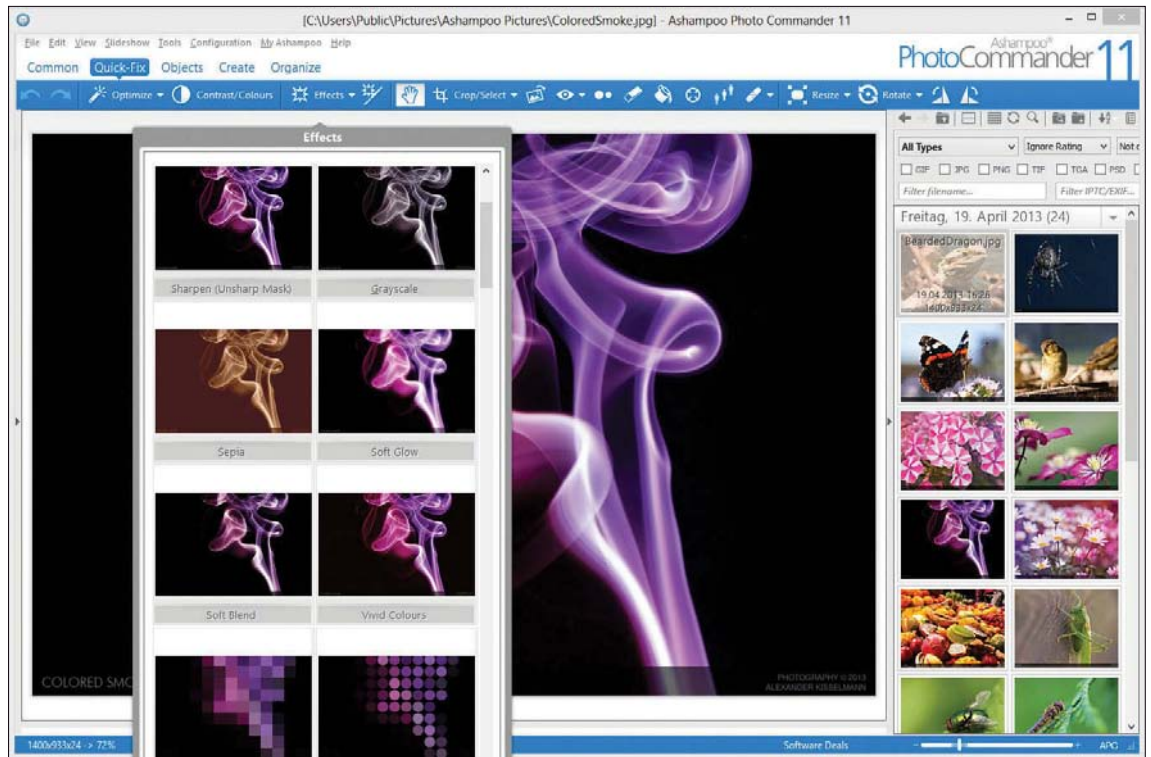
### Installation details

Go to My Computer. Right-click the disc icon and open the disc. Select Files > Files 231\Ashampoo Commander 9 and open the file

**Online registration required:** follow the links during installation before 11 Nov 2014

### System requirements

Windows XP/Vista/7;  
256MB RAM; 160MB  
drive space; 1024x768  
screen resolution



Ashampoo Photo Commander offers all the features you need to manage, edit, optimise and present your digital pictures. It lets you quickly and easily manage your photo collection, creating groups, tagging pictures and putting together virtual albums. You can optimise your images with one-click fixes, turn them into oil paintings, or use them to create personalised calendars or party invitations.

### FEATURES

- Miniature view with grouping function
- Tagging
- Batch processing
- Editing and optimisation of photos
- Create HTML albums, slideshows, collages, and more
- Burn discs, send emails and create PDFs
- Import images from cameras and scanners
- Apply skins and plug-ins

**The Cover disc is free with print issues of *PC Advisor* magazine, available in all good newsagents**

## ABBYY FineReader 12 Professional

FULL PROGRAM (THREE-MONTH LICENCE) AVAILABLE ONLY ON THE DISC+

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### Installation details

Go to My Computer. Right-click the DVD icon, and open the disc. Select Files 231\ABBYYFineReader 12 Professional Home 10 and open the install file

**Online registration required:** follow the links during installation before 11 Nov 2014

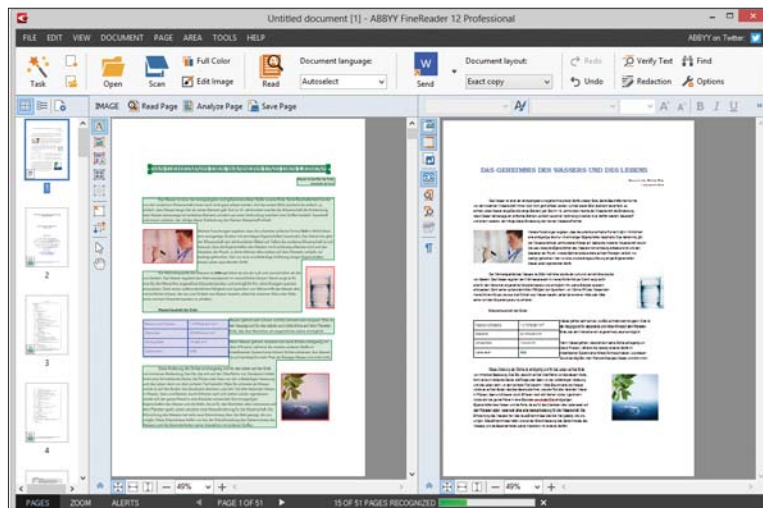
### System requirements

Windows Server 2003/2008/XP/Vista/7; 1GB RAM; 700MB drive space

FineReader makes it easy to turn documents and PDFs into text you can use. Copy text into an email or presentation, publish it online, edit it in Microsoft Word or Excel, or build searchable document archives.

Save the time and resources typically spent on copying text from scanned-in paper documents, PDF files and digital images. FineReader can significantly reduce your manual workload, reading and converting files into text you can copy and paste, search or edit.

Whether you want to create searchable files for easily accessible archives, or edit an old contract or brochure, ABBYY FineReader is an ideal choice for productive work. ☒



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## Abelssoft Codify 2014

FULL PROGRAM AVAILABLE ONLY ON THE DISC+

### Installation details

Go to My Computer. Right-click the disc icon and open the disc. Select Files 231\Abelssoft Codify 2014 and open the file

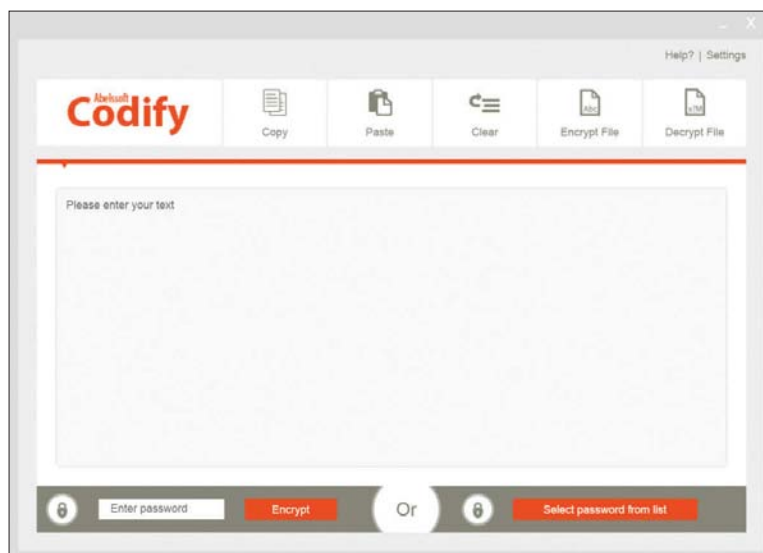
**Online registration required:** follow the links during installation before 11 Nov 2014

### System requirements

Windows XP/Vista/7/8; RAM: 512MB RAM; 50MB drive space

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Place disc in drive. Open the file 'Click here to begin.pdf' for extra information.

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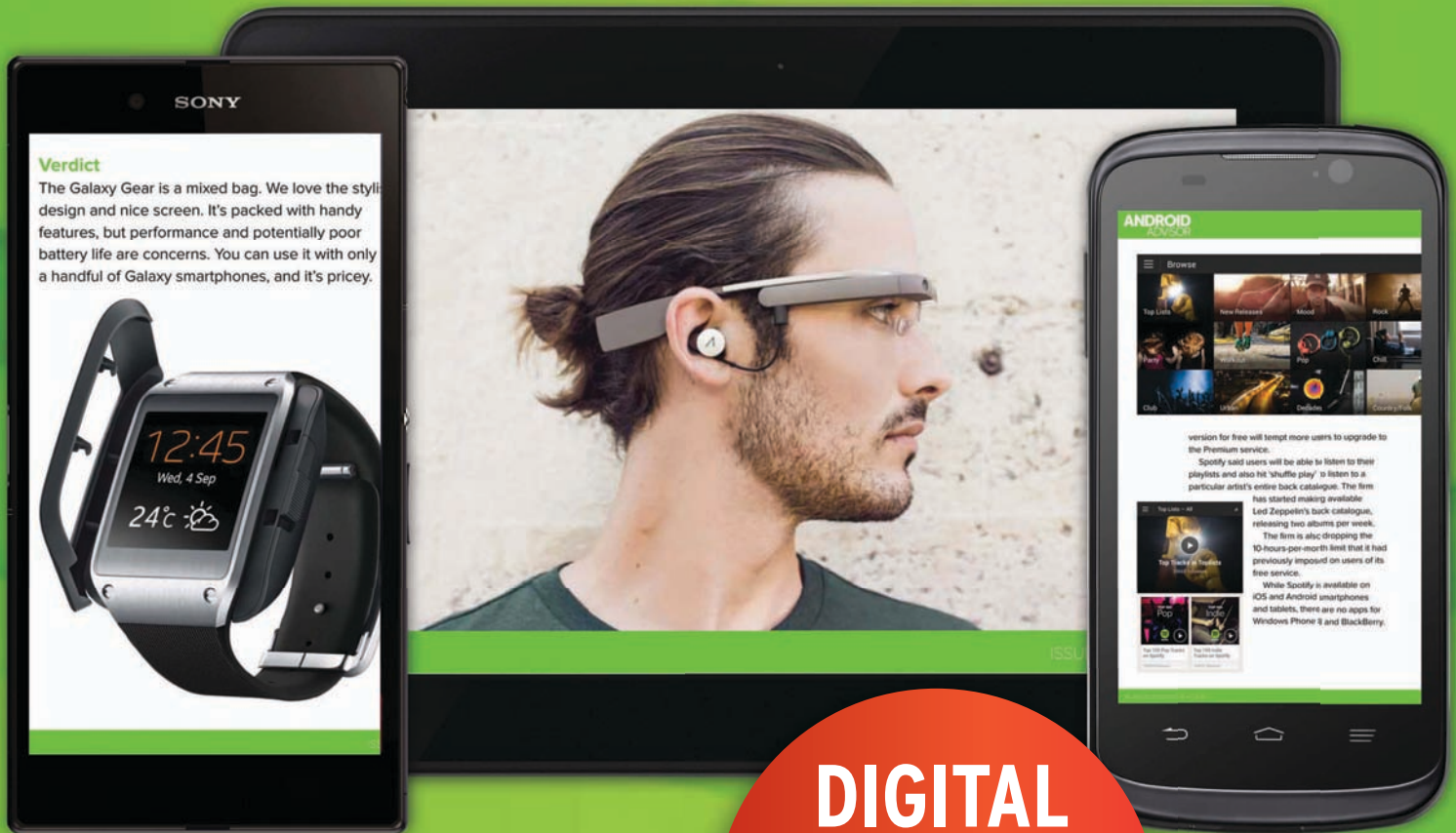
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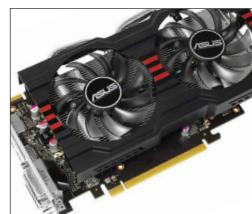
Printers



Projectors



Solid-state drives



Graphics cards



Flat-panel displays

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Ultraportable laptops	    				
	1	2	3	4	5
	Apple MacBook Pro 13in Retina	Apple MacBook Air 13in	Toshiba Kira-101	Acer Aspire S3-392G	Dell Latitude 14 7440
Price	£1,499 inc VAT	£849 inc VAT	£1299 inc VAT	£900 inc VAT	£1,500 inc VAT
Website	Apple.com/uk	Apple.com/uk	toshiba.co.uk	Acer.co.uk	Dell.co.uk
Launch date	Feb 14	Apr 14	Aug 14	Jun 14	Jun 14
Build rating	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★
Features rating	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★
Performance rating	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★
Value rating	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★
Overall rating	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★
Processor	2.6GHz Intel Core i5	1.4GHz Intel Core i5	1.8GHz Intel Core i7-4500U	1.6GHz Intel i5-4200U	2.1GHz Intel Core i7-4600U
RAM	8GB DDR3L	4GB DDR3L	8GB DDR3	4GB DDR3	8GB DDR3
Storage	512GB SSD	128GB SSD	256GB SSD	500GB Hybrid	256GB SSD
Screen size	13.3in glossy (anti-glare)	13.3in glossy (anti-glare)	13.3in glossy	13.3in glossy touchscreen	14in matt
Screen resolution	2560x1600	1440x900	2560x1440	1920x1080	1920x1080
Graphics	Intel Iris Graphics	Intel HD Graphics 5000	Intel HD Graphics 4400	nVidia GeForce 735M GT	Intel HD Graphics 4400
Video memory	N/A	N/A	N/A	1GB	N/A
Wireless	802.11a/b/g/n/ac	802.11a/b/g/n/ac	802.11b/g/n/ac	802.11a/b/g/n	802.11a/b/g/n/ac
Ethernet	Optional	Optional	None	10/100	Gigabit
Bluetooth	✓	✓	✓	✓	✓
USB	2x USB 3.0	2x USB 3.0	3x USB 3.0	2x USB 3.0, 1x USB 2.0	3x USB 3.0
FireWire	x	x	x	x	x
Thunderbolt	✓	✓	x	x	x
DisplayPort	x	✓	x	x	✓ (mini)
HDMI	✓	x	✓	✓	✓
DVI	x	x	x	x	x
VGA	x	x	x	x	x
eSATA	x	x	x	x	x
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	720p webcam	None	None
Operating system	Mac OS X 10.9 Mavericks	Mac OS X 10.9 Mavericks	Windows 8.1 Pro 64bit	Windows 8.1 64-bit	Windows 7 64-bit
Bundled software	iLife 11	iLife 11	None	Acer bundle	None
Fear (Max detail)	Not tested	Not tested	17fps (1080p)	62/34.5fps	22fps
Battery	71.8Wh lithium-polymer	54Wh lithium-polymer	52Wh lithium-polymer	36.4Wh lithium-polymer	47Wh lithium-ion
Battery life	9 hrs 55 mins	12 hrs 57 mins	7 hrs 10 mins	5 hrs	5 hrs 15 mins
PC Mark 7 score	Not tested	4602	5100	4282	4706
Dimensions	314x219x18mm	325x227x4-17.5mm	316x207x19.8mm	324x255x18mm	337x232x21mm
Weight	1.57kg	1.35kg	1.26kg	1.65kg	1.63kg
Warranty	1-year return-to-base	1-year return-to-base	2-year onsite	1-year return-to-base	3-year next-business-day
FULL REVIEW	TINYURL.COM/M3TNC29	TINYURL.COM/KNXWZ3	TINYURL.COM/QHP9F9T	TINYURL.COM/QFGQOOP	TINYURL.COM/QAH43KC

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	1	2	3	4	5
	Compaq CQ58-300sa	Asus X102BA	Toshiba Satellite L50-B-1DV	Toshiba CB30-102	Asus X552CL
Price	£230 inc VAT	£270 inc VAT	£500 inc VAT	£250 inc VAT	£500 inc VAT
Website	Saveonlaptops.co.uk	Asus.com/uk	Toshiba.co.uk	Toshiba.co.uk	Asus.com/uk
Launch date	Nov 13	May 14	Jul 14	Jun 14	Jun 14
Build rating	★★★★☆	★★★★☆	★★★★☆	★★★★☆	★★★★☆
Features rating	★★★★☆	★★★★☆	★★★★☆	★★★★☆	★★★★☆
Performance rating	★★★☆☆	★★★☆☆	★★★★☆	★★★★☆	★★★★☆
Value rating	★★★★☆	★★★★☆	★★★★☆	★★★★☆	★★★★☆
Overall rating	★★★★☆	★★★★☆	★★★★☆	★★★★☆	★★★★☆
Processor	1.4GHz AMD E1-200	1GHz AMD A4-1200	1.6GHz Intel Core i5-4200U	1.4GHz Intel Celeron 2955U	1.8GHz Intel i5-3337U
RAM	2GB DDR3	4GB DDR3L	8GB DDR3	2GB DDR3	6GB DDR3
Storage	320GB HDD	500GB HDD	1TB HDD	16GB SSD	750GB HDD
Screen size	15.6in glossy	10.1in glossy touchscreen	15.6in glossy	13.3in glossy	15.6in glossy
Screen resolution	1366x768	1366x768	1366x768	1366x768	1366x768
Graphics	AMD Radeon HD 7310	AMD Radeon HD 8180	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	3x USB 3.0	1x USB 3.0, 2x 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	8x DVD ± RW	None	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	None	MS Office Home & Student	None	None	None
Battery	47Wh lithium-ion	33Wh lithium-ion	52Wh lithium-ion	Lithium-polymer	37Wh lithium-ion
Battery life	4 hrs 45 mins	4 hrs 20 mins	4 hrs 15 mins	7 hrs 25 mins	3 hrs 20 mins
PC Mark 7 score	1094	1100	2500	N/A	2700
Stalker (Low/High)	9fps (720p)	N/A	23fps (720p)	N/A	50fps (720p)
Dimensions	376x247x33mm	266x185x29mm	380x260x24mm	454x268x56mm	380x251x34mm
Weight	2.3kg	1.1kg	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	<a href="http://tinyurl.com/MT67W8X">TINYURL.COM/MT67W8X</a>	<a href="http://tinyurl.com/PLAUQCG">TINYURL.COM/PLAUQCG</a>	<a href="http://tinyurl.com/L76JXUV">TINYURL.COM/L76JXUV</a>	<a href="http://tinyurl.com/LQEBYPA">TINYURL.COM/LQEBYPA</a>	<a href="http://tinyurl.com/JWFOQJL">TINYURL.COM/JWFOQJL</a>

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	Scan 3XS Graphite LG156	Dell Inspiron 17-7737	HP Pavilion TouchSmart 15	Chillblast Defiant 2 Mini	Chillblast Helium
Price	£899 inc VAT	£849 inc VAT	£650 inc VAT	£899 inc VAT	£899 inc VAT
Website	3xs.scan.co.uk	Dell.co.uk	Hp.com/uk	Chillblast.com	Chillblast.com
Launch date	Jul 14	Jul 14	May 14	Jul 14	Jul 14
Build rating	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★
Features rating	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★
Performance rating	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★
Value rating	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★
Overall rating	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★
Processor	2.5GHz Intel Core i7-4710MQ	2GHz Intel Core i7-4510U	1.6GHz Intel Core i5-4200U	2.5GHz Intel Core i7-4710MQ	1.8GHz Intel Core i7-4500U
RAM	8GB DDR3	16GB DDR3	8GB DDR3	8GB DDR3	16GB DDR3
Storage	1TB SSHD	500GB HDD + 8GB NAND	750GB HDD	1TB SSHD	500GB HDD + 120GB SSD
Screen size	15.6in matt	17.3in glossy	15.6in glossy touchscreen	13.3in non-reflective	14in
Screen resolution	1920x1080	1920x1080	1366x768	1920x1080	1600x900
Graphics	GTX 860M/Intel HD 4600	GT 750M/Intel HD 4400	GT 740M/Intel HD 4400	GTX 860M/Intel HD 4600	Intel HD Graphics 4400
Video memory	2GB	2GB	N/A	2GB	N/A
Wireless	802.11a/b/g/n/ac	802.11a/b/g/n	802.11b/g/n	802.11a/b/g/n	802.11b/g/n
Ethernet	Gigabit	Gigabit	10/100	Gigabit	Gigabit
Bluetooth	✓	✓	✓	✓	✓
USB	3x USB 3.0, 1x USB 2.0	4x USB 3.0	2x USB 3.0, 1x USB 2.0	2x USB 3.0	2x USB 3.0
FireWire	x	x	x	x	x
Thunderbolt	x	x	x	x	x
DisplayPort	x	x	x	x	x
HDMI	✓	✓	✓	✓	✓
DVI	x	x	x	x	x
VGA	✓	✓	✓	✓	✓
eSATA	✓ (shared USB 3.0)	x	x	x	x
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	8x DVD ± RW	N/A	N/A
Extras	1080p webcam	720p webcam	Webcam	1080p webcam	720p webcam
Operating system	Windows 8.1 64-bit	Windows 8.1 64-bit	Windows 8 64-bit	Windows 8.1 64-bit	Windows 8.1 64-bit
Bundled software	None	None	None	None	None
Stalker (720p/1080p)	178/102fps	104/63fps	60fps (720)	180/100fps	29fps (720p)
Battery	77Wh lithium-ion	58Wh lithium-ion	41Wh lithium-ion	62.2Wh lithium-ion	44.6Wh lithium-ion
Battery life	4 hours	5 hrs	5 hrs 45 mins	5 hrs 33 mins	5 hrs 20 mins
PCMark 7 score	4846	4260	2860	4456	5100
Dimensions	374x250x43mm	412x269x28mm	386x258x25mm	330x227x32mm	337x236x21mm
Weight	2.7kg	3.3kg	2.6kg	2.1kg	2.1kg
Warranty	2-year return-to-base	1-year NBD	1-year return-to-base	2-year collect-and-return	1-year return-to-base
FULL REVIEW	TINYURL.COM/MYTG9X5	TINYURL.COM/N6828JG	TINYURL.COM/L2JAXH7	TINYURL.COM/NNDFZRR	TINYURL.COM/P7U28WQ





# HEAD TO TINYURL.COM/N6R5438 FOR OUR LAPTOP BUYING ADVICE



	<div> <div>  <div>1</div> <div>PC ADVISOR GOLD</div> </div> <div>  <div>2</div> </div> <div>  <div>3</div> </div> <div>  <div>4</div> </div> <div>  <div>5</div> </div> </div>				
	Apple 15in MacBook Pro Retina	Gigabyte P35W v2-CF2	Schenker XMG P304	Asus G750JZ	Alienware 17
Price	£1,699 inc VAT	£1,399 inc VAT	£1,100 inc VAT	£1,770 inc VAT	£1,699 inc VAT
Website	Apple.com/uk	Uk.gigabyte.com	Mysn.co.uk	Asus.com/uk	Alienware.co.uk
Launch date	Mar 14	Jul 14	Jul 14	Jul 14	Jul 14
Build rating	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★
Features rating	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★
Performance rating	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★
Value rating	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★
Overall rating	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★
Processor	2GHz Intel Core i7-4750HQ	2.5GHz Intel Core i7-4710HQ	2.2GHz Intel Core i7-4702MQ	2.4GHz Intel Core i7-4700MQ	2.4GHz Intel Core i7-4700MQ
RAM	8GB DDR3	16GB DDR3	8GB DDR3	16GB DDR3	8GB DDR3
Storage	256GB SSD	1TB/2x 128GB SSD	250GB SSD	1TB/256GB SSD	1TB + 80GB SSD
Screen size	15.4in glossy (anti-glare)	15.6in matt	13.3in matt	17.3in matt	17.3in anti-glare
Screen resolution	2880x1800	1920x1080	1920x1080	1920x1080	1920x1080
Graphics	Intel Iris Pro	nVidia GeForce GTX 870M	nVidia GeForce GTX 860M	nVidia GeForce GTX 880M	nVidia GeForce GTX 880M
Video memory	128MB	6GB	2GB	4GB	8GB
Wireless	802.11a/b/n/ac, MIMO	802.11a/b/g/n	802.11b/g/n/ac	802.11a/g/n	802.11b/g/n
Ethernet	Gigabit	Gigabit	Gigabit	Gigabit	Gigabit
Bluetooth	✓	✓	✓	✓	✓
USB	2x USB 3.0	2x USB 3.0, 2x 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	None	N/A	None	N/A	None
Extras	Webcam	720p webcam	720p webcam	720p webcam	720p webcam
Operating system	OS X Mavericks	Windows 8.1 64bit	Windows 8.1 64bit	Windows 8.1 64bit	Windows 8.1 64bit
Bundled software	Apple iLife	None	None	None	None
Stalker (720p/1080p)	62/57fps (Batman)	185/122fps	115fps (1080p)	182/135fps	150fps (1080)
Battery	958Wh lithium-polymer	75.8Wh lithium-polymer	62Wh lithium-ion	88Wh lithium-ion	86Wh lithium-ion
Battery life	8 hrs 14 mins	4 hrs	5 hrs 5 mins	4 hrs 32 mins	4 hrs 20 mins
PCMark7 score	N/A	6226	5500	5929	5600
Dimensions	359x247x18mm	385x270x21mm	374x250x37mm	410x318x58mm	414x299x48.5mm
Weight	2.02kg	2.5kg	2kg	4.5kg	4.2kg
Warranty	1-year return-to-base	2-year return-to-base	2-year collect-and-return	2-year return-to-base	1-year next day in-home
FULL REVIEW	TINYURL.COM/K3QSD9Y	TINYURL.COM/O9WUF8S	TINYURL.COM/Q4JWVSM	TINYURL.COM/O8AGBOL	TINYURL.COM/Q6DUD64

HEAD TO TINYURL.COM/N6R5438 FOR OUR LAPTOP BUYING ADVICE

Tablets					
					
	1	2	3	4	5
	PC ADVISOR GOLD	PC ADVISOR RECOMMENDED	PC ADVISOR RECOMMENDED	PC ADVISOR GOLD	PC ADVISOR RECOMMENDED
	Google Nexus 7 (2013)	Apple iPad Air	Sony Xperia Z2 Tablet	Apple iPad mini (1st gen)	Google Nexus 10 by Samsung
Price	£199 inc VAT	£399 inc VAT	£399 inc VAT	£249 inc VAT	£319 inc VAT
Website	Play.google.com	Apple.com/uk	Sony.co.uk	Apple.com/uk	Play.google.com
Launch date	Jul 13	Oct 13	Apr 14	Nov 12	Nov 12
Overall rating	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★
Platform	Android 4.3 Jelly Bean	Apple iOS 7	Android 4.4.2 KitKat	Apple iOS 7	Android 4.4 KitKat
Screen size/resolution	7in/1280x800	9.7in/2048x1536	10.1in/1920x1200	7.9in/1024x768	10.1in/2560x1600
Storage/media card slot	16GB/none	16GB/none	16GB/none	16GB/none	16GB/none
Connectivity	802.11b/g/n, Bluetooth 4	802.11a/b/g/n, Bluetooth 4	802.11b/g/n/ac, Bluetooth 4	802.11b/g/n, Bluetooth 4	802.11b/g/n, Bluetooth 4, NFC
Processor	1.5GHz Snapdragon S4 Pro	Apple A7	2.3GHz Snapdragon 801	1GHz Apple A5	1.7GHz Cortex A-15
RAM	2GB	1GB	3GB	512MB	2GB
Claimed battery life	9 hrs	10 hrs	Not specified	10 hrs	9 hrs
Cameras (front/rear)	1.2/5Mp	1.2/5Mp	2.2/8.1Mp	1.2/5Mp	1.9/5Mp
Dimensions	114x200x8.7mm	169x240x7.5mm	266x172x6.4mm	135x200x7.2mm	178x264x8.9mm
Weight	299g	469g	439g	308g	603g
Warranty	1 year	1 year	1 year	1 year	1 year
FULL REVIEW	TINYURL.COM/QYUDY5C	TINYURL.COM/LSB84EE	TINYURL.COM/M8BZZUN	TINYURL.COM/CLJWUVS	TINYURL.COM/ARL2KDG

Tablets					
					
	6	7	8	9	10
	PC ADVISOR RECOMMENDED	PC ADVISOR RECOMMENDED	PC ADVISOR RECOMMENDED	PC ADVISOR RECOMMENDED	PC ADVISOR RECOMMENDED
	Sony Xperia Tablet Z	Advent Vega Tegra Note 7	LG G Pad 8.3	Lenovo Yoga Tablet 10	Tesco Hudl
Price	£339 inc VAT	£129 inc VAT	£199 inc VAT	£249 inc VAT	£119 inc VAT
Website	Sony.co.uk	Currys.co.uk	Lg.com/uk	Lenovo.com/uk	Tesco.com
Launch date	May 13	Nov 13	Feb 14	Jan 14	Sep 13
Overall rating	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★
Platform	Android 4.1 Jelly Bean	Android 4.3 Jelly Bean	Android 4.2 Jelly Bean	Android 4.2 Jelly Bean	Android 4.2 Jelly Bean
Screen size/resolution	10.1in/1920x1200	7in/1280x800	8.3in/1920x1200	10.1in/1280x800	7in/1440x900
Storage/media card slot	16GB/microSDXC	16GB/microSDHC	16GB/microSDHC	16GB/microSDXC	16GB/microSDHC
Connectivity	802.11a/b/g/n, Bluetooth 4	802.11b/g/n, Bluetooth 4	802.11a/b/g/n, Bluetooth 4	802.11b/g/n, Bluetooth 4	802.11a/b/g/n, Bluetooth 4
Processor	1.5GHz SnapDragon S4 Pro	1.9GHz nVidia Tegra 4	1.5GHz Snapdragon 600	1.2GHz ARM Cortex-A7	1.5GHz quad-core A9
RAM	2GB	1GB	2GB	1GB	1GB
Claimed battery life	10 hrs	10 hrs	8.5 hrs (actual)	18 hrs	9 hrs
Cameras (front/rear)	2.2/8.1Mp	0.3/5Mp	1.3/5Mp	1.6/5Mp	2/3Mp
Dimensions	172x266x6.9mm	120x190x10mm	127x217x8.3mm	261x181x8.1mm	129x193x9.9mm
Weight	495g	320g	338g	605g	370g
Warranty	1 year	1 year	1 year	1 year	1 year
FULL REVIEW	TINYURL.COM/ODTP6B8	TINYURL.COM/PMCO4H4	TINYURL.COM/N80BC7N	TINYURL.COM/KLV5SDM	TINYURL.COM/MXHXVUK

**HEAD TO TINYURL.COM/KL2EV4G FOR OUR TABLET BUYING ADVICE**

Smartphones	1	2	3	4	5
	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	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★
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/NGBWX9	TINYURL.COM/PAFK4SZ	TINYURL.COM/KYW977U

Smartphones	6	7	8	9	10
	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	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★
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

HEAD TO TINYURL.COM/OTU6XA9 FOR OUR SMARTPHONE BUYING ADVICE



Gaming PCs	 <b>1</b> 	 <b>2</b>	 <b>3</b>	 <b>4</b> 	 <b>5</b>
	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	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★
Features rating	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★
Performance rating	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★
Value rating	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★
Overall rating	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★
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	<a href="http://tinyurl.com/OWQ24QQ">TINYURL.COM/OWQ24QQ</a>	<a href="http://tinyurl.com/MEGK909">TINYURL.COM/MEGK909</a>	<a href="http://tinyurl.com/PKDV2NG">TINYURL.COM/PKDV2NG</a>	<a href="http://tinyurl.com/NKWN7V4">TINYURL.COM/NKWN7V4</a>	<a href="http://tinyurl.com/MJZKS7G">TINYURL.COM/MJZKS7G</a>

**HEAD TO [TINYURL.COM/PYWN4DA](http://tinyurl.com/pywn4da) FOR OUR DESKTOP PC BUYING ADVICE**

Mini PCs	 1 PC ADVISOR BEST BUY	 2 PC ADVISOR RECOMMENDED	 3	 4	 5
	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	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★
Features rating	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★
Performance rating	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★
Value rating	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★
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 Z87I-Pro	Asus H81I-PLUS	MSI Z87I 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/MQ8POPOQ	TINYURL.COM/NFQ6EGO	TINYURL.COM/PWCACV2	TINYURL.COM/MXMJ6QT	TINYURL.COM/O4QDHTY

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All-in-one PCs	1 	2 	3 	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	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★
Features rating	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★
Performance rating	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★
Value rating	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★
Overall rating	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★
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	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★
Features rating	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★
Performance rating	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★
Value rating	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★
Overall rating	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★
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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Rating: ★★★★★



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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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## PC ADVISOR











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	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★
Features rating	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★
Performance rating	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★
Value rating	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★
Overall rating	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★
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	<a href="http://tinyurl.com/kf6g3t7">TINYURL.COM/KF6G3T7</a>	<a href="http://tinyurl.com/oa8ukdp">TINYURL.COM/OA8UKDP</a>	<a href="http://tinyurl.com/ozcshyu">TINYURL.COM/OZCSHYU</a>	<a href="http://tinyurl.com/pfa55f7">TINYURL.COM/PFA55F7</a>	<a href="http://tinyurl.com/nu7fsgb">TINYURL.COM/NU7FSGB</a>






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Sub-£150 printers	1	2	3	4	5
	Samsung Xpress M2070W	Canon Pixma MG5550	Canon Pixma MX535	Brother MFC-J870DW	Brother HL-1110
Price	£99 inc VAT	£70 inc VAT	£70 inc VAT	£137 inc VAT	£57 inc VAT
Website	Samsung.com/uk	Canon.co.uk	Canon.co.uk	Brother.co.uk	Brother.co.uk
Launch date	Mar 14	Apr 14	Jul 14	Jul 14	Jun 14
Overall rating	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★
Technology	Mono laser	Colour inkjet	Colour inkjet	Colour inkjet	Mono laser
Max print resolution	1200x1200	4800x1200dpi	4800x1200dpi	6000x1200dpi	600x600dpi
Actual print speed	B=17.1ppm	B=11.8ppm C=8.7ppm	B=9.7ppm C=3.8ppm	B=18ppm C=11ppm	B=16.4ppm
Scan/fax facilities	1200x1200 scans	1200x2400 scans	1200x2400 scans/fax	1200x2400 scans	None
Supported interfaces	USB 2.0, 802.11b/g/n, NFC	USB 2.0, 802.11b/g/n	USB 2.0, 802.11b/g/n, AirPrint	USB 2.0, 802.11b/g/n, NFC	USB 2.0
Cost per page	B=3.8p	B=2.4p C=4.8p	B=2.7p C=4.8p	B=3.9p C=2.5p	B=2.7p
Media card/auto duplex	xx	x✓	x✓	✓✓	xx
Input capacity	150 sheets	100 sheets	100 sheets + 30-sheet ADF	150 sheets + 20 ADF	150 sheets
Dimensions	406x360x253mm	455x369x148mm	458x385x200mm	410x374x180mm	340x238x189mm
Weight	7.4kg	6.3kg	8.5kg	9.5kg	4.5kg
Warranty	1 year	1 year	1 year	1 year	1 year
FULL REVIEW	TINYURL.COM/OYZKJKE	TINYURL.COM/LKWLJDE	TINYURL.COM/N9LXVN7	TINYURL.COM/M52V29R	TINYURL.COM/QE9GLNF

£151+ printers	1	2	3	4	5
	Canon i-Sensys MF6180dw	HP OfficeJet Pro X551dw	Kyocera Ecosys P6030cdn	Lexmark CS410dn	Canon Pixma iP8750
Price	£361 inc VAT	£435 inc VAT	£546 inc VAT	£210 inc VAT	£288 inc VAT
Website	Canon.co.uk	Hp.com/uk	Kyoceradocumentsolutions.co.uk	Lexmark.co.uk	Canon.co.uk
Launch date	May 14	Aug 13	Jul 14	Jul 14	Jul 14
Overall rating	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★
Technology	Mono laser	Colour inkjet	Colour laser	Colour laser	Colour inkjet
Max print resolution	1200x600dpi	2400x2400	9600x600dpi	1200x1200dpi	9600x2400dpi
Actual print speed	B=24ppm	B=42.9ppm C=15.8ppm	B=27ppm C=27ppm	B=23.1ppm C=13.6ppm	B=13ppm C=10ppm
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	USB 2.0, ethernet	USB 2.0, 802.11b/g/n
Cost per page	B=1.5p	B=1p C=4.3p	B=1.2p C=1.7p	B=1.8p C=9.5p	B=1.5p C=5p
Media card/auto duplex	x✓	x✓	x✓	x✓	xx
Input capacity	250 + 50 sheet + 50 ADF	500 + 50 sheet	500 sheets + 150 (2150 max)	250 + 1 sheets	150 sheets
Dimensions	390x473x431mm	517x399x414mm	345x518x480mm	291x442x407mm	590x331x159mm
Weight	19.1kg	17.1kg	29.5kg	20.5kg	8.5kg
Warranty	1 year	1 year	2 years	1 year	1 year
FULL REVIEW	TINYURL.COM/LE9WA5N	TINYURL.COM/CZ05P65	TINYURL.COM/N4MCYLF	TINYURL.COM/MJG33UL	TINYURL.COM/LS7E2AX

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Blu-ray drives					
	1	2	3 	4	5
	Pioneer BDR-209EBK Retail	Pioneer BDR-209DBK OEM	LG BH16NS40	LG BP40NS20	Lite-On IHES112-115
Price	£61 inc VAT	£57 inc VAT	£70 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	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★
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	<a href="http://TINYURL.COM/LD47X7K">TINYURL.COM/LD47X7K</a>	<a href="http://TINYURL.COM/LD47X7K">TINYURL.COM/LD47X7K</a>	<a href="http://TINYURL.COM/8YTUJEF">TINYURL.COM/8YTUJEF</a>	<a href="http://TINYURL.COM/BS8UAFF">TINYURL.COM/BS8UAFF</a>	<a href="http://TINYURL.COM/8SYECMW">TINYURL.COM/8SYECMW</a>

Wireless routers					
	1 	2	3 	4 	5
	Apple AirPort Extreme	AVM FRITZ!Box 7490	TP-Link Archer C7	Asus RT-AC68U AC1900	TP-Link TL-WDR4900
Price	£169 inc VAT	£240 inc VAT	£80 inc VAT	£150 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	✓ x	✓ x	✓ x	✓ x	✓ x
Modem/Parental Control	x✓	✓✓	x✓	x✓	x✓
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	<a href="http://TINYURL.COM/MFDLLSC">TINYURL.COM/MFDLLSC</a>	<a href="http://TINYURL.COM/MUAFBHP">TINYURL.COM/MUAFBHP</a>	<a href="http://TINYURL.COM/KKJMPC">TINYURL.COM/KKJMPC</a>	<a href="http://TINYURL.COM/K4ZATKV">TINYURL.COM/K4ZATKV</a>	<a href="http://TINYURL.COM/MUXCBNM">TINYURL.COM/MUXCBNM</a>

**HEAD TO [TINYURL.COM/PDYZU8D](http://TINYURL.COM/PDYZU8D) FOR OUR PERIPHERALS BUYING ADVICE**



NAS drives	1	2	3	4	5
	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	★★★★☆	★★★★☆	★★★★☆	★★★★☆	★★★★☆
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	1	2	3	4	5
	G-Technology Professional	LaCie Little Big Disk	G-Technology Thunderbolt	Toshiba Stor.E Basics	LaCie Fuel
Price	£250 inc VAT	£770 inc VAT	£599 inc VAT	£92 inc VAT	£170 inc VAT
Website	G-technology.com	Lacie.com/uk	G-technology.com	Toshiba.co.uk	Lacie.com/uk
Launch date	Sep 13	Feb 14	Aug 12	Nov 13	May 14
Overall rating	★★★★☆	★★★★☆	★★★★☆	★★★★☆	★★★★☆
Capacity tested	4TB	1TB	8TB	2TB	3.5
Capacity range	2TB to 4TB	512GB to 2TB	4TB to 8TB	320GB to 2TB	1TB
Disk size	3.5in	2.5in	3.5in	2.5in	2.5in
Spin speed	7200rpm	5400rpm	7200rpm	5400rpm	5400rpm
Transfer speed	N/A	635MB/s	329MB/s	94MB/s (USB 3.0)	94MB/s (USB 3.0)
Encryption	None	None	None	None	Password protection
Other interfaces	FireWire 800	None	None	None	Wi-Fi 802.11b/g/n
Software	None	LaCie Backup Assistant	None	None	LaCie utilities
Dimensions	235x130x46mm	40x140x85mm	235x130x85mm	119x79x21mm	115x115x23mm
Weight	1.35kg	650g	2.3kg	215g	300g
Warranty	3 years	1 year	3 years	1 year	2 years
FULL REVIEW	TINYURL.COM/NV7F32F	TINYURL.COM//KRCL3VZ	TINYURL.COM/CXEF6MH	TINYURL.COM/LBHC8EL	TINYURL.COM/LK3398C






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SSDs					
	1	2	3	4	5
	Crucial M550	OCZ Vector 150	Crucial M500	Samsung 840 EVO	Seagate 600 SSD
Price	£350 inc VAT	£135 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	★★★★★	★★★★☆	★★★★★	★★★★★	★★★★☆
Capacity tested	1TB	240GB	480GB	750GB	480GB
Price per GB	35p	56p	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					
	1	2	3	4	5
	BenQ W1300	Optoma W316	NEC M352WS	Optoma ML1500	Optoma HD30
Price	£770 inc VAT	£463 inc VAT	£780 inc VAT	£660 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	    				
	1	2	3	4	5
	MSI Radeon R9 270	MSI HD 7770	MSI R7 260X OC	XFX Radeon R7 265	Gigabyte GTX 750 Ti WindForce
Price	£135 inc VAT	£66 inc VAT	£100 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	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★
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	    				
	1	2	3	4	5
	Gigabyte GeForce GTX 770 2GB	Gigabyte Radeon R9 280X	XFX Radeon R9 290X	MSI Radeon R9 270X	MSI Radeon R9 295 X2
Price	£240 inc VAT	£225 inc VAT	£325 inc VAT	£155 inc VAT	£1140 inc VAT
Website	Uk.gigabyte.com	Uk.gigabyte.com	Xfxforce.com	Uk.msi.com	Uk.msi.com
Launch date	Aug 13	Mar 14	Apr 14	Dec 13	May 14
Overall rating	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★
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	1GHz/1.1GHz	1GHz/1GHz	1030MHz/1120MHz	1018MHz/N/A
Memory clock/Effective	1752MHz/7010MHz	1.5GHz/6GHz	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	3 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					
	1 <b>PC ADVISOR</b> BEST BUY	2 <b>PC ADVISOR</b> RECOMMENDED	3 <b>PC ADVISOR</b> RECOMMENDED	4 <b>PC ADVISOR</b> RECOMMENDED	5 <b>PC ADVISOR</b> RECOMMENDED
	AOC i2369Vm	BenQ GW2760HS	Philips 234E5QHAW	NEC MultiSync E243Wmi	BenQ GL2450
Price	£140 inc VAT	£170 inc VAT	£130 inc VAT	£185 inc VAT	£106 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	Jul 14
Overall rating	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★
Screen size	23in	27in	23in	23.8in	24in
Panel type	IPS matt	A-MCA	IPS matt	IPS matt	TN matt
Native resolution	1920x1080 pixels	1920x1080 (82ppi)	1920x1080 pixels	1920x1080 pixels	1920x1080 pixels
Pixel density	96ppi	82ppi	96ppi	93ppi	92ppi
Brightness	220cd/m <sup>2</sup>	300cd/m <sup>2</sup>	187cd/m <sup>2</sup>	250cd/m <sup>2</sup>	261cd/m <sup>2</sup>
Static contrast ratio	630:1	950:1	210:1	650:1	610:1
Response time	6ms	4ms	5ms	6ms	5ms
Ports	HDMI, HDMI/MHL, DP, VGA	HDMI, DVI, VGA	2x HDMI (QHAB) or 1x HDMI (QDAB), VGA	DP, DVI-D, VGA	DVI-D, VGA
Dimensions	531x204x398mm	472x191x623mm	532x213x414mm	558x214x380-490mm	579x179x436mm
Weight	3.75kg	4.5kg	3.5kg	6.3kg	4.1kg
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/OOUPFUE

£201+ flat-panel displays					
	1 <b>PC ADVISOR</b> RECOMMENDED	2 <b>PC ADVISOR</b> RECOMMENDED	3 <b>PC ADVISOR</b> RECOMMENDED	4 <b>PC ADVISOR</b> RECOMMENDED	5 <b>PC ADVISOR</b> RECOMMENDED
	BenQ BL2411	Asus ProArt PA279Q	AOC Q2963PM	Dell UltraSharp 32 Ultra	ViewSonic VP2772
Price	£227 inc VAT	£663 inc VAT	£312 inc VAT	£1,575 inc VAT	£558 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	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★
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/m <sup>2</sup>	350cd/m <sup>2</sup>	240cd/m <sup>2</sup>	350cd/m <sup>2</sup>	350cd/m <sup>2</sup>
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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MARTYN  
CASSERLY



# AI comes of age

**W**ell we've had a good run. Seven million years to go from swinging in trees to world domination is a success in anyone's book. In that time we've created great literature, magnificent architectural structures, and a music video where a young, scantily clad woman expresses her considerable physical appreciation for various pieces of demolition equipment. The human race has crafted an empire of terrifying majesty and dazzling variety, the likes of which have never been witnessed before and most likely never will again. So it gives me no pleasure in letting you know that it will soon be over. All these edifices to our indomitable spirit of adventure and creation will soon be nothing more than two vast and trunkless legs of stone standing in the lonely desert sands. Last orders please. I'm calling time.

"Why the despondency?" I hear you cry. Well, it's quite simple. The Turing test. It's been passed.

When Alan Turing, the father of Artificial Intelligence research, released his seminal paper *Computing Machinery and Intelligence* in 1950 little did we know that this smartly besuited man was, in fact, the prophet of doom for all mankind.

If only he had worn robes, held a staff, or at least had the decency to grow an enormous beard, then we'd have been prepared. But no. Instead, he set forth his Test, one which would act as a cypher to discern whether an intelligence was human or a computer trying to pull a fast one. For 64 years this has been an impassible exam, which has seen off a wealth of digital pretenders... that was until June 7, 2014, when Eugene came to play.

The news of the now inevitable enslavement of all humanity came to national attention when the University of Reading announced that a chatbot named Eugene Goostman had managed to convince judges from the Royal Society that it was human. To pass the Turing test, Eugene needed only maintain the appearance of being a 13-year-old Ukrainian boy, while the judges asked it a series of questions over a five-minute period. Sadly, the transcripts have been kept private, but I can only assume that the interrogation revolved around the current difficult political conditions in the country, and whether Selena Gomez was hot or not.

The choice of Eugene's persona has left some scientists complaining that it artificially restricted the interaction with the judges, and therefore wasn't a true success. The obvious fact that these complainants fail to take into consideration is that if the AI programmers had instead chosen to make it a 13-year-old American boy with an Xbox Live account, then it would have passed with 100 percent rather than the rather lowly 33.

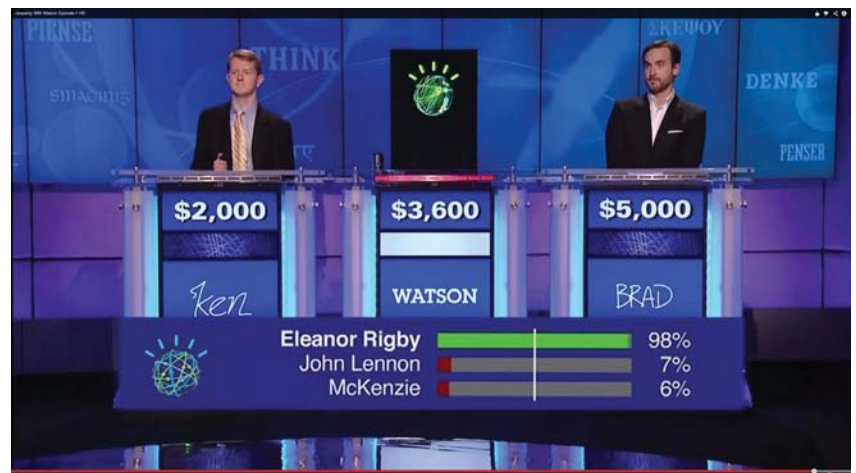
To prove this theory, I loaded up *Call of Duty Modern Warfare*, entered a live game, and spent the next hour having my virtual backside handed to me in all manner of explosive fashion. I left the battlefield scarred emotionally and digitally, but with no clear idea whether my tormentors were man or machine. War, as they say, is hell.

Of course, this is just part of the AI masterplan that began a few years ago. Watson (the AI, as opposed to Sherlock's hobbit sidekick) became a household name in 2011 when it scaled the pinnacle of modern cultural achievement by winning a TV game show. Its victorious *Jeopardy!* appearance netted the know-it-all bag of chips a cool \$1 million, thus providing it funds to start a scholarship for underprivileged PCs. How long before we see a supercilious Jeeves on *Countdown*, or witness Corbett tearing it up on *Family Fortunes*?

Do you now start to gather the seriousness of our predicament? Without access to jobs or the sudden wealth that *Catchphrase* can bring, the masses will begin to wilt, while the computer empire continues its ascent. To those of you who doubt our slow but inevitable betrayal, citing that these aren't truly intelligent beings at all, I point you to futurist Ray Kurzweil. He writes in his excellent book *How to Create a Mind*, 'Some observers have argued that Watson does not really "understand" the *Jeopardy!* queries or the encyclopedias it has read because it's just engaging in "statistical analysis". If understanding language and other phenomena through statistical analysis doesn't count as true understanding, then humans have no understanding either.'

So, with our time as rulers of the Earth drawing to a close, it remains for me to say (like *The Simpsons'* Kent Brockman) that I, for one, welcome our new, AI overlords. Please, be merciful. ☒

“Watson became a household name a few years ago when it scaled the pinnacle of modern cultural achievement by winning a TV game show”





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# AOC



u2868Pqu

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ULTRA HD

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Innovative height adjust stand (130mm) and pivot



Without HD



With HD



Picture



### PRODUCT DETAILS

- Inputs: D-Sub, DVI-D, HDMI, USB 2x 2.0 and 2x 3.0, DisplayPort
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- 3840 x 2160 @ 60 Hz
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- 300 cd/m<sup>2</sup>

PRO