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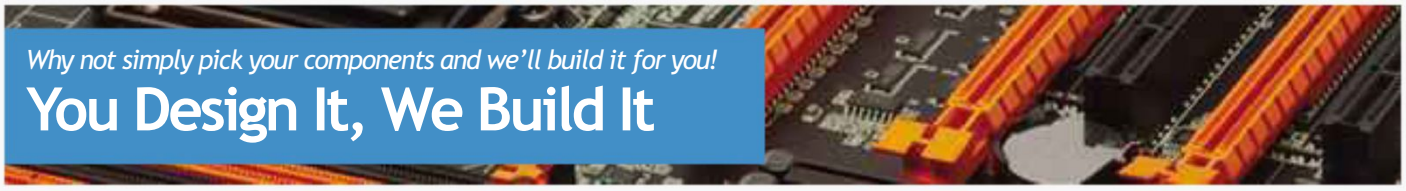

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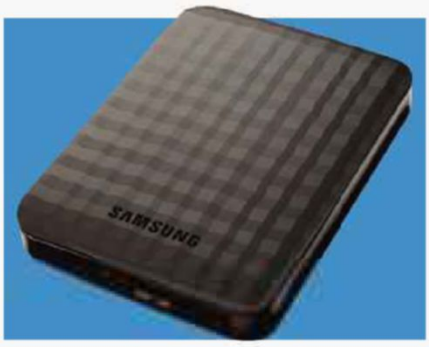

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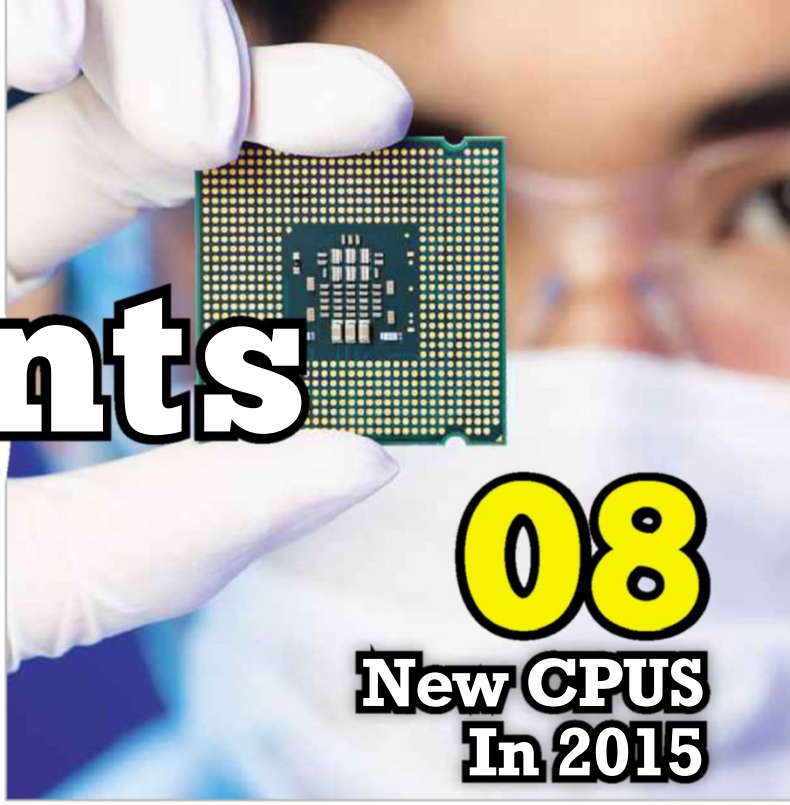
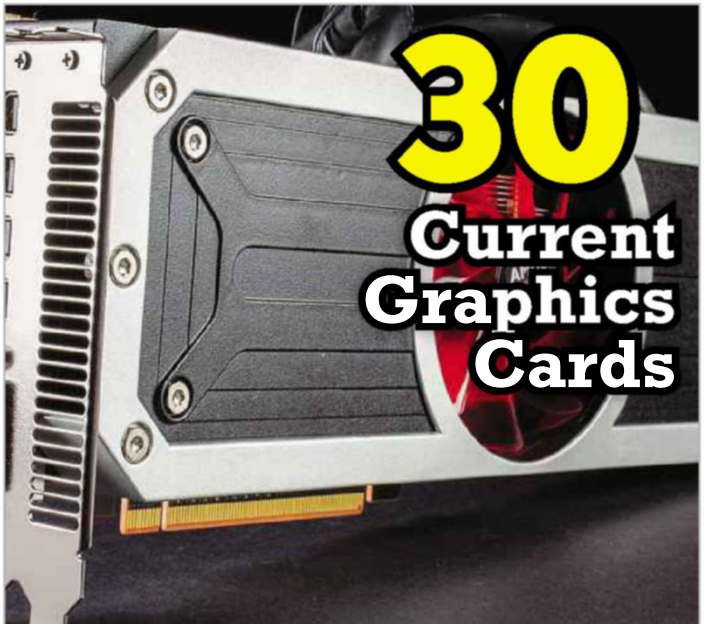
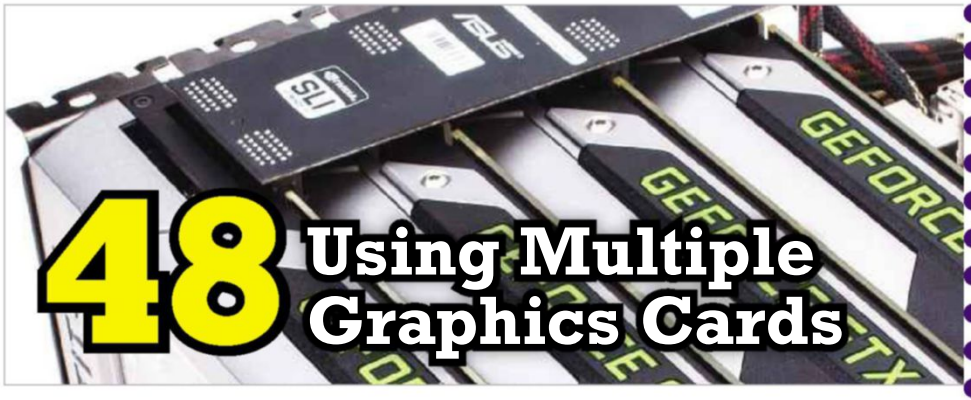
Contents

This week...





44 Do You Need DDR4?



48 Using Multiple Graphics Cards

40 Are You Missing Out?

You might think you PC has all the latest technology standards, so you don't need to upgrade. But progress moves so fast, it doesn't always stop to tell you it's taken another leap forward, leaving you behind. With that in mind, James Hunt considers what new tech you might be missing and to go about adding it to you system

44 Do You Need DDR4?

DDR4 is, of course, the newest form of PC RAM, following on from DDR3. As you'd expect it's faster and also much more expensive. Is it really necessary, though? We've been looking at just what it offers and if you really need it

46 Motherboard Upgrades

Changing a motherboard is a big deal. It often means you'll need to get new components to fit the new standards it's built on. Considering that, it's important to know what to look for, so we've go some essential advice for you

48 Using Multiple Graphics Cards

SLI and CrossFire, as you probably know, allow you to use more than one graphics card for improved performance. So, is it worth the the hassle and cost. James Hunt clears up any confusion in this short guide

52 Custom Firmware

Got old gadgets lying around that have seen better days and are no longer supported by their manufacturers? Well, fret not, because you might find you can unlock new features with custom firmware, so join us as we look at what's around

Also In This Issue...

52 Intel Compute Stick
Intel is looking to try something new with an intriguing mini PC

64 PC Simulations
David Hayward lists some his favourite sim titles

64 Artificial Intelligence
How did it get started and where is it heading?

92 Download Directory
James looks at what new software the web has to offer

98 Retro Round-up
Dave Edwards returns with another selection of news

100 What Happened To RealPlayer
At one point, it was everywhere, but what became of it?

104 iOS Puzzle Games
Keri Thomas puts his grey matter to the test

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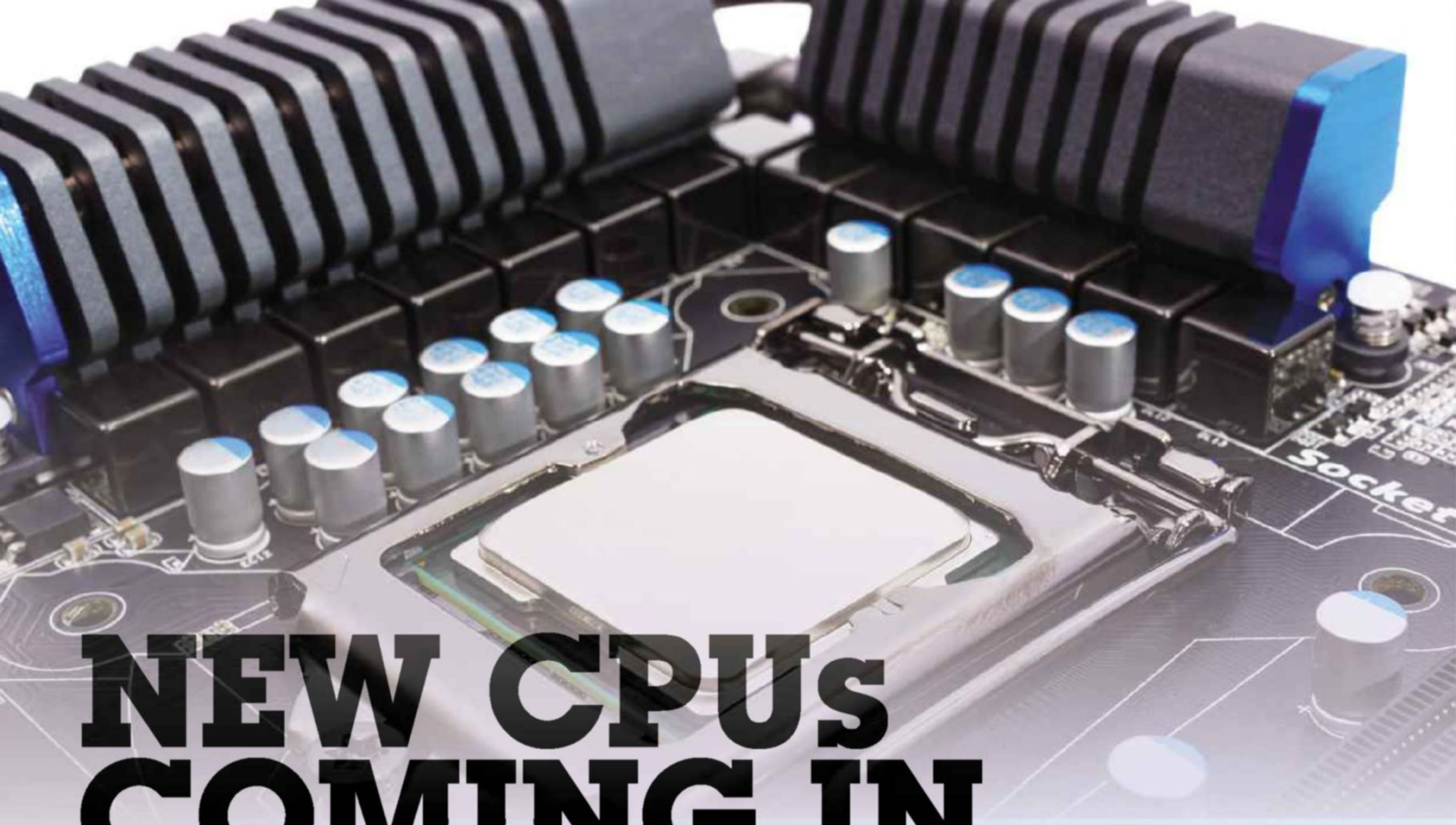

NEW CPUs COMING IN 2015

(And Should You Wait For Them?)

Considering a system overhaul? Here's what this year has to offer...

Whether and when to upgrade your system are always hard decisions to make, especially when there are new platform refreshes due at as-yet-undetermined points in the relatively near future. Commit too early and you can end up paying a premium for hardware that becomes obsolete within weeks, but wait too long and you might discover you've been holding on for a refresh that isn't really worth spending the money on.

Of all hardware options, trying to decide on a new CPU is possibly the hardest decision – and Intel isn't making that any easier this year, with plans to bring new Haswell, Broadwell and Skylake processors to market in a single 12 month period. Even AMD's getting in on the act, though, with its new Carrizo hardware apparently just a matter of weeks away.

Fear not, though, if you're thinking of buying a new CPU now – or if you're planning to do so at any point this year – we have all the information you need to help you decide when to pull the trigger.

Haswell-EX

As a platform, Haswell has been around a while, having had its initial release in 2013. It's no surprise, then, that 2015 has only one scheduled release that goes anywhere near the architecture, and that's the Haswell-EX, a variant of 2014's Haswell-E platform, which is aimed at installation in mission-critical servers. Due to be formalised any day now (maybe even by the

> **"Trying to decide on a new CPU is possibly the hardest decision – and Intel isn't making that any easier this year"**

“The smart money says that Pentium and Celeron chips won’t be replaced by Broadwell releases, while Intel Core i3 upwards will”

time you read this) Haswell-EX is expected to be the most complex CPU ever made by Intel and will push the boundaries in terms of its server platforms.

Released as the Intel Xeon E7 v3, Haswell-EX chips will run in configurations up to eight sockets, integrating as many as 18 cores with hyper-threading and an absolutely huge 45MB of last-level cache. New memory controllers (Jordan Creek 2) will also aim to provide improved performance, though at present it’s unclear whether that’ll specifically mean support for DDR4 RAM or a faster scalable interface for DDR3.

As with other Haswell chips, the Xeon E7 v3 will use a 22nm tri-gate process with up to 5.56 billion transistors. Notably, it will support the TSX instruction set (Transactional Synchronisation Extensions), which speeds up the execution of multi-threaded software, but was disabled on current Haswell (and early Broadwell) chips because of a bug in the implementation.

Admittedly, none of that’s exactly riveting and has little to do with what CPUs you’ll find in your home system in the next year or two – though it’s interesting that 18-core processing is already technically, if not financially feasible. Nonetheless, Haswell-EX is due to be released in Q2 this year, and will likely be the final iteration of the platform, with successive chips being based on Broadwell-E platform.

Should You Wait?

The short version? No. Not unless you’re running a server farm out of your basement. Haswell-EX has some exciting features, but it’s definitely not aimed at home users. Even if it were, 2015 is already starting to look pretty crowded for Intel and Haswell’s got a lot of competition bringing up the rear, so we’d recommend extreme caution!

Broadwell

Following the 2013 ‘tock’ release of the 22nm Haswell CPUs, 2015 sees the ‘tick’ release: a 14nm die shrink of the Haswell microarchitecture, with all the benefits that entails. In previous years, that’s meant a triple threat of cooler running, lower voltages and around a 10% speed increase at the same price as the previous generation chips, and there’s no reason to suggest that will be any different when Haswell replaces Broadwell.

However, one thing that will be different is that Broadwell isn’t expected to be a full refresh of the Intel desktop line. Unlike previous tick releases, the low-end chips will be omitted from the update and remain available in their Haswell incarnations until Broadwell’s successor is released. This is likely because the Broadwell desktop line has been delayed from its original release, and Intel doesn’t appear to be shuffling its successors back to account for that; a decision that has left limited space in its release calendar (not to mention putting strain on consumer buying habits).

It hasn’t been officially defined where the cut-off point will be, but the smart money says that Pentium and Celeron chips will not be replaced by Broadwell releases, while Intel Core i3 upwards will – although there’s a small chance that the Core i3 will also get skipped. Ultimately, it all depends on what Intel feels are its ‘low end’ chips.

Broadwell CPUs will only be compatible with Intel 9 Series chipsets (H97 and Z97) so, although it uses the same LGA1150 socket, they will not be compatible with Intel 8 Series motherboards. If you have a Series 8 board, though, there isn’t

necessarily cause to despair: some manufacturers are able to update motherboard firmware to provide compatibility, so check that out and see whether you're able to upgrade your hardware to add Broadwell support.

The desktop version of the chip – Broadwell-K – is expected to be quad core with a GT3e/Iris graphics processing unit on-board. Notably, GT3e has 128MB of its own RAM and supports Direct3D 11.1, OpenGL 4.3 and OpenCL 2.0. They benchmark in the range of NVIDIA's GeForce GT 650M. The TDP of the chips will be in the range of 65 watts, around 20 watts slower than their Haswell equivalents. Although it's already possible to buy mobile version of Broadwell CPUs in retail systems, Broadwell-K is expected to land on shelves late in Q2 2015, probably around May.

Beyond that, Intel will also release Broadwell-E chips that will use the same socket as Haswell-E – LGA2011v3. You probably won't see these until early 2016, though, and (as with the Haswell-EX earlier) these chips will be marketed under the Xeon name and will be be aimed at high-end systems and servers rather than home use.

Should You Wait?

If you're looking to perform a major upgrade on your system sooner rather than later, and were aiming for a Haswell board and chip, then definitely wait. Broadwell is coming very soon and is likely to provide a far superior option in both financial and performance terms. That said, if you can wait until the end of the year, you might be in luck…

Skylake And Cannonlake

Already previewing, Skylake is the 'tock' release due to follow Broadwell, and is currently expected to launch at the end of 2015. Although this would put it unusually close to the release of the delayed Broadwell, some analysts predict that Intel will seek to maintain momentum by choosing not to push back Broadwell's successors. That said, it's possible that even if mobile Skylake chips are out by the end of the year, it'll be the following year before the desktop versions are ready to sell.

Skylake will be manufactured using a 14nm process before being shrunk to 10nm for the Cannonlake 'tick' release in 2017. Both will use a new socket, LGA1151, and be compatible with Intel's new 100 series 'Sunrise Point' chipsets.

Major changes between the Haswell/Broadwell generation of chips and Skylake/Cannonlake include the removal of the FIVR voltage regulator and the integration of the Platform Controller Hub on the CPU die for mobile variants, essentially turning it into a system-on-chip design.

Interestingly, it's expected that Skylake chips will retain backwards compatibility with DDR3 to ease the transition to DDR4, which suggests that 100 series motherboards may come in both DDR3 and DDR4 versions.

After 2015: AMD Zen

Planned for release in late 2016, if not early 2017, Zen is going to be AMD's serious attempt to get back in the desktop game with a ground-up redesign of an x86 chip, and hopefully putting the relatively disastrous Bulldozer era behind it once and for all.

Not much is known about Zen, officially. There are reports that it'll support DDR4 (a virtual certainty – its predecessor Excavator does, after all) and that it will use a 14nm fabrication process and support the new Socket FM3, even though it won't necessarily be an APU. Some leaks have suggested that Zen will sell under the FX series with a sister line being developed for an APU incarnation of the hardware.

In any case, it's known that Zen will be the basis of CPUs code-named Summit Ridge, so if you're interested in giving AMD a chance with its new hardware, that's what you're waiting for. It's all a long way off right now, though, so don't hold your breath on any of this. We'll let you know when Zen is getting near.

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Mobile platforms will be able to take advantage of the new UniDIMM standard, which is a type of SO-DIMM capable of carrying either DDR3 or DDR4 memory.

Other improvements for the Skylake generation of chips includes PCI-Express 4.0 support (confirmed for Skylake-E only), Thunderbolt 3.0 support, SATA Express support and Iris Pro graphics on all chips as standard. All of the chips will be quad-core, and the Pentium/Celeron lines will also be updated after missing out on Broadwell replacements. Skylake will also end VGA support, so you'll have to move your monitor to either HDMI or DisplayPort!

Finally, for the mobile platform, Skylake laptops will use a wireless charging technology known as 'Rezence', which all major vendors have pledged to support. Rezence can supply 50 watts at distances of up to 5cm and is activated by a Bluetooth smart link.

Should You Wait?

If you can wait for Skylake, you probably should. It's debatable whether it'll actually make it out this year, but the lack of any confirmation might turn uncertainty about Broadwell into a self-fulfilling prophecy. Unless Intel denies a 2015 release, it might be worth holding off rather than backing a lame horse.

Carrizo

With all the Intel releases going on, it's important not to forget about its rival AMD, which is also releasing a new platform in March. The follow-up to Kaveri, the Carrizo line of chips will include Excavator cores (succeeding Steamroller) and a new generation of Graphics Core Next GPUs.

As part of an attempt to get the drop on Intel, Excavator will support both DDR3 and DDR4 memory controllers, though it's not known at present if both of these will sit on the same die or whether the processor will come in two distinct variants. The platform is also designed using high density libraries normally included on GPUs to reduce the size and power consumption of the die, leading – we're told – to an extremely handy 30% increase in energy efficiency.

Carrizo APUs will use Socket FM2+ and feature four cores, with a TDP of 65 watts. They will also incorporate a Southbridge controller. It's notable that they will be based on a 28nm fabrication process, delaying AMD's predicted shift to 20nm. Despite this, the processor is expected to be the fastest and most efficient APU yet. Indeed, efficiency is a big part of the push for Carrizo's rollout, particularly because it isn't shrinking its die process.

To achieve this, AMD has introduced Voltage Adaptive Operation, which runs the chip at a low average voltage and spikes demand upwards only when necessary – something that wastes less power than constantly shifting up and down.

Carrizo is planned to be compliant with HSA 1.0, which improves graphics performance by sharing resources in parallel and will make it easier to run the chips on non-standard operating systems. A CPU-only variant named Toronto will be made available for server and enterprise markets. Excavator will also be the final iteration of the Bulldozer architecture before it's replaced by Zen (see box-out).

Although Kaveri represented a big improvement for AMD's desktop chips, few would deny that it has underperformed. Many attribute this to AMD releasing the chip during a period of decline for the overall market. It's hope that AMD's focus on the mobile market, with a new one-size-fits-all motherboard for mobile Carrizo devices, will help them regain some market share – but as ever, it's hard to predict the direction things will take.

Should You Wait?

If you're running an AMD system and want to upgrade, then definitely. It's almost upon us, and whatever comes next is going to be so different from Carrizo that there's little chance of salvaging the core components. If you don't update now, it's going to be a long and pointless wait for your next AMD system, which isn't due until late 2016 at the earliest. mm

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THE LATEST SSDS EXAMINED

We've often touted a solid state drive as being the best upgrade you give a PC – and here are our favourites

If you're upgrading a PC, it's getting harder and harder to ignore the positive effect that putting an SSD in a system can have. These days, memory and processors are so quick that mechanical drives simply can't keep up, and create a bottleneck that hampers performance in all areas – from boot times to framerates within games. Swapping your old hard drive for a solid state alternative will up your system speeds across the board.

The benefits of a solid state drive aren't just limited to speed, either. SSDs are more compact, make less noise and generate less heat. They're also less prone to failure and live longer. In almost every way you can think of, SSDs are superior to mechanical drives, except for the small problem of them being considerably more expensive in terms of cost per gigabyte. This puts a dampener on many people's enthusiasm for them; for the same price as a 500GB SSD, you could fill a system with enough multi-terabyte mechanical drives to last you for years.

There's no rule that says you can't have both, though. SSDs might not be cheap – but they are, finally, cheap enough. Why buy four terabytes of mechanical space you'll never fill, when you could buy a terabyte of file storage and 256GB of pure speed to run your operating system and software from?

Assuming you're convinced, the next step is choosing an SSD. Here, things get tricky: distinguishing the new from the old can be difficult, and it's hard to tell what makes one better than another. To try and help, we've taken a look at the current SSD retail market to see what models you'll find, and why you'd want to buy them (or not). If you want to stay on the cutting edge, this list of SSDs will be your guide.

What To Buy

Even with the information in front of you, picking an SSD can be a massive headache. To help simplify the process, we've whittled down the lines we looked at into this handy top 5, presented in the order you should look for them. If a drive doesn't appear here, that doesn't mean it's bad, though – just that something else might be better. It all depends on how and why you want it!

1. Samsung 850 EVO
2. Crucial M550
3. OCZ Vector 150
4. Intel 730
5. Crucial MX200

Adata XPG SX900

Available in 64GB, 128GB, 256GB and 512GB capacities, the Adata XPG SX900 has a few miles on the clock. It was originally released in February 2012, and sports the familiar and unremarkable SF-2281 SandForce controller, so there's not much interesting about it. Prices for the various models range from £48 to £183, so they're at the extreme cheap end of SSD pricing – but then, at their age, you'd hope so. The storage itself is made of 20nm MLC NAND cells, and speeds aren't hugely impressive on any model – all within the 520-560MB/s range. Not bad if you want a low-price SSD, but it's hard to get excited about in any quarter.

Corsair Neutron GTX

The Neutron GTX is Corsair's flagship line of SSDs, designed for high-end desktops and notebooks. Available in capacities of 120GB, 240GB and 480GB, prices range from £86 to £288 with the 240GB model particularly well-priced at £143. These SSDs have also been around a while (May 2012) but use the less common LAMD LM87800 controller, which has better performance than the SandForce. Again, expect speeds of 500MB/s and above. One good reason to favour the Neutron GTX line over any other is its use of Toggle NAND, which has better performance than MLC and lasts a lot longer – hence the expensive price on this rather old line of SSDs.

Crucial M500

The Crucial M500 line was released in July 2013 as a successor to the M4 line, and it's a strong reminder of the company's credentials as SSD pioneers, even if it's since been surpassed by the M550. Still available in capacities of 240GB, 480GB and 960GB, speeds are strong, but not excessively high: 500MB/s read and 400MB/s write (80k IOPS read and write). The controller is the Marvell 88SS9187 found in some of SanDisk's SSDs, but without SanDisk's customisation it doesn't perform as well. The flash memory is 20nm MLC NAND. As a package, it's the combination of a low price and high capacity that makes it special. Costs range from £80 for a 240GB drive to £315 for the 960GB, and at £154 the 480GB version is still a great way to get a high-capacity SSD for a low price.

Crucial M550

Released about a year ago, the Crucial M550 line improved on Crucial's already-strong M500 performance to create one of the best SSDs on the market. Although it looks like a minor upgrade, numerically speaking, the M550 has a new controller and manages to offer slightly more space than the M500 by dropping the amount of NAND flash kept in reserve. This means that drive health is theoretically worse in the long term, but estimates show that the M500 was overly conservative about how many of its cells would fail. Read and write speeds are comfortably above 500MB/s for large files, and read/write speeds were vastly improved for small file sizes too. Capacities range from 128GB to 1TB, priced £70 to £350. That's not bad for a 1TB drive, but the 256GB is a steal at £120.

Crucial BX100

One of the most recent SSDs in this entire guide, the BX100 line was released at the start of this year and comes in 120GB, 250GB, 500GB and 1TB capacities. It's a budget SSD, which uses Silicon Motion's much-praised 2246EN controller and 16nm NAND, but drops some of the M-series enterprise features – so no hardware encryption or SLC caching. The price ranges from £50 for the 120GB model to £285 for the 1TB model – so it's as cheap a 1TB SSD as you can get despite being right up to date, and while its write speeds aren't fantastic (450MB/s), it's not hard to absorb a 10% speed drop for a 30% saving on price.

Crucial MX100 / MX200

The Crucial MX100 was a low-priced SSD aimed at mainstream users, but which is in the process of being replaced by a 2015 refresh called the MX200. The only notable change between the two models is that the MX200 features SLC caching (called 'Dynamic Write Acceleration'). Both drives feature a Marvell 88SS9189 controlled with 16nm NAND and eDrive encryption. The MX200 is available in 250GB, 500GB and 1TB capacities priced £110-£380, and the slightly slower MX100 is available in 128GB, 256GB and 512GB capacities priced £58 to £176. On average, the MX200 is about 10% more expensive than the MX100, which isn't bad for the latest-generation hardware.

Samsung 840 EVO

The Samsung 840 EVO hit shelves in August 2013 and was the first to run on 19nm TLC NAND flash. The use of TLC NAND was notable because no other company offered this type of NAND to the consumer, mostly because it was less durable than MLC NAND. It was more commonly found in flash drives rather than SSDs. The controller in the 840 EVO is Samsung's proprietary multi-core MEX SSD, which can achieve more than double the sequential write performance of the vanilla 840 – 540MB/s write and 520MB/s read. Prices range from £100 for the 120GB version to £310 for the 1TB version.

Samsung 850 EVO

Released in December 2014, the Samsung 850 EVO is a successor to the 840 EVO in terms of balancing power and price, but the internals have largely changed. It's now using V-NAND TLC flash (which is some of the cheapest per-gigabyte yet) with over 500MB/s read and write speeds. Prices for the 850 line start at £70 for 120GB and top out at £360 for 1TB, but the 500GB model is probably the best-priced at £200 for 500GB. Note that the 850 EVO shares a line with the 850 PRO, which is basically the same drive with enterprise features, a 10-year warranty and higher pricing. Like all Samsung drives, it uses Samsung's own controller.

Kingston V300 SSDNow

Released in February 2013, the Kingston SSDNow V300 is available in 60GB, 120GB and 240GB sizes. Based on the same SandForce SF-2281 controller found in many drives around this time period, performance is good, if not great. Sequential Read/Write are quoted as "up to 450MB/s" with 85k IOPS read and 43k IOPS write, but its performance is actually better than stated (the same 540MB/s read and 520MB/s write found in other SandForce SSDs). You might wonder why Kingston would downplay the performance of its own hardware, but it's probably to drive people towards an enthusiast option, in the form of its HyperX line. Don't be fooled, though: HyperX SSDs cost double what the V300s do, but their performance is only a little better – they're certainly not twice as good!

Kingston V310 SSDNow

In August 2014, Kingston released the V310 SSDNow as an upgrade to the V300 line. Oddly, its performance was rated vastly lower than its predecessor, and it is only available as a 960GB model (at £380 on its own, or £411 with an upgrade kit that includes software and accessories to aid a quick drive clone). That's expensive however you slice it, especially given its low speeds. Essentially, it was developed to appeal to people worried about how to transfer data from their old drive to the new one. An almost baffling release, all things considered.

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Intel DC S3500

Added to Intel's SSD range in June 2013, the Intel S3500 drives are sold in capacities from 80GB to a massive 800GB. The drives use 20 nm MLC NAND flash and an Intel-built controller that gives them a maximum of 400k IOPS read and 11.5k IOPS write, translating to 475MB/s read and 450MB/s write. If that sounds like an oddly unbalanced number of operations, it's' because these drives are aimed at the Enterprise market, which means they're "read-oriented". They're therefore best left to non-desktop users. The price ranges from £100 for the 80GB model to £600+ for the 800GB, so in that sense there's not much danger of you buying one anyway!

Intel 530

First released in July 2013, the Intel 530 (Dale Crest) SSDs come in capacities between 80GB and 480GB and use 20nm MLC NAND flash memory with the ultra-reliable SandForce SF-2281 controller capable of 540MB/s sequential read and 490MB/s sequential write (41k IOPS read, 80k IOPS write). Prices range from £65 for 120GB to £200 for 480GB, so there's not a huge financial disincentive to buy them, but it is possible to find similarly capable drives for less.

Intel 730

Available in just two capacities – 240GB and 480GB – Intel's year-old 730 series was an attempt to replace the generic Intel 530 with a better, consumer-focussed drive. The first completely in-house design since the Intel 320, the 730 uses 20nm MLC flash with read/write speeds of 550MB/s and up to 89K IOPS. It uses the same NAND as Intel's enterprise drives and has far better endurance than the 530-series SSDs, but it does lack hardware encryption. It's not the fastest drive in its price class, and £260 for a 480GB drive means it's more expensive than most. It's better than an Intel 530, yes, but it's really competing with the Samsung 850 EVO – and in that sense, it's barely putting up a fight at all.

OCZ Vertex 450/460

The Vertex 450 was released in July 2013 and uses OCZ's Indilinx Barefoot 3 M10 controller with 20NM MLC NAND, which offers speeds of 540MB/s read and 530MB/s write with 85k IOPS read and 90k IOPS write. It's actually slightly slower at reading data than its predecessor, the Vertex 4, but faster at writing data. The hardware comes in 128GB, 256GB and 512GB capacities and has built-in 256-AES encryption. £95 for 128GB and £361 for 512GB make its pricing unremarkable. Its successor (the Vertex 460) came out about a year later and contained 19nm Toshiba NAND, the same as the higher-priced Vector 150 (but with lower performance-validated parts).

OCZ Vector 150

Part of OCZ's superior Vector line, the Vector 150 is an enthusiast SSD designed from the ground up by OCZ and designed to compete with the Samsung 840 PRO. Available in 120GB, 240GB and 480GB capacities, it contains 25nm MLC NAND and has a five-year warranty. Prices range from £75 to £240, making it cheaper than some of the competition while retaining read and write speeds above 500MB/s. The existence of the Vertex 450/460 complicates this slightly older drive's place in the line, but ultimately it's got a good balance of price and performance, considering how high-end it is. **mm**

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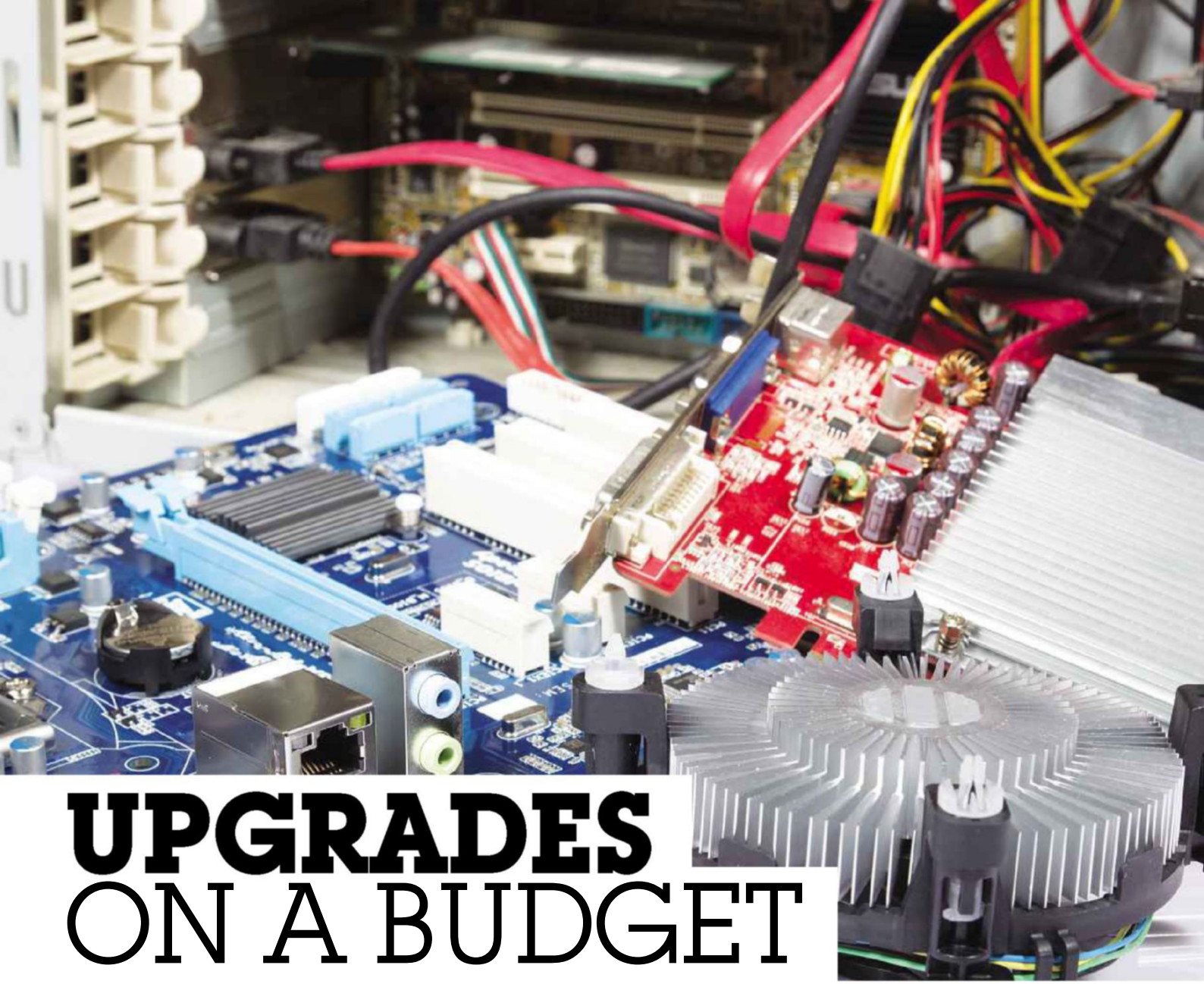


UPGRADES ON A BUDGET

Give your PC a boost without spending big

Upgrading a PC doesn't have to be an expensive task. But how cheap can it get? In order to prove that you don't have to spend hundreds to improve the way your PC works, we've come up with a list of suggested upgrades for every price level. Whether you have £10, £35 or £70 to spend, there's something here that can make your life better.

Can You Upgrade For £5?

If you're looking at a £10 minimum threshold and imagining the days when you have that much to spare on your PC, maybe there's still hope. There are upgrades you can make for a fiver. Not flashy ones. Maybe not even good ones. But at least you get something tangible for your money (and we're not even cheating by listing cables, mousepads and blank DVDs!)

On Networks DSF005 5-Port Ethernet Switch (£4.98)

Need to set up an Ethernet network and don't need wireless or routing abilities? How about this five-port switch? A bargain at less than £1 per port. If you need to extend a router's networking or simply link up some systems without trailing cables or unreliable wireless, this is easily the cheapest way.

Yvi Wireless Mini Mouse (£4.72)

This optical wireless mouse uses a 2.4GHz radio connection to provide an eight-metre range and comes with its own storable USB receiver and sensitivity switch button for flipping between precision and speed modes. Ideal for partnering with a laptop if trackpads aren't your favourite input method. One AAA battery is even included.

Aerocool Lightning Series Transparent 14cm Red LED Fan (£4.68)

Want to cool down your case? This 140mm Aerocool fan can output 48cfm of air at up to 1200rpm. A transparent black frame and transparent red blades with quad red LEDs give your system a stylish look, while the 11-bladed fan generates a consistent and high pressure air flow. And it comes with special low-vibration screws!

£10 UPGRADES

You'll struggle to get into the cinema on a tenner these days, so upgrading your PC in any significant way is pretty much out of the question. But don't think that having basically no budget stops you from performing any improvements. At this price you're largely limited to things that might make your system a little more convenient to use rather than any more powerful, but if you want to treat yourself for under a tenner, we have three suggestions that'll give your system a little extra spark without burning holes in your wallet.

TP-Link TL-WN781ND N150 Wireless Adaptor

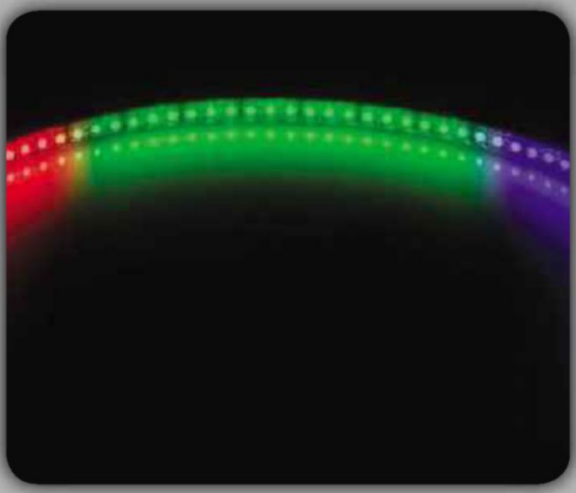
If your desktop system is still getting by with a USB wireless adaptor, why not upgrade to this internal one? You should get change from a tenner (we found it on sale for £8), and its 150Mbps speeds are three times what Wireless G offers. Its in-hardware processing reduces strain on the CPU (so it's ideal for systems that are already taxed), and you won't have the inconvenience and precariousness of a wi-fi adaptor hanging loosely out of a USB port anymore.

Furthermore, an external, detachable antenna provides better coverage than any USB key, and its WPS protected setup makes connecting to your network as simple as pushing a button. It's not a particularly exciting upgrade, but if you've struggled on with a USB adaptor for years and still don't have a Wireless AC network, now might be the time to change.

Transcend JetFlash 700 16GB USB Drive

There are plenty of USB thumbdrive models available for less than a tenner with a capacity around 16GB. That might sound meagre, but it's about as much storage as a low-end tablet or the average phone. Using a USB drive to transfer files is easier than uploading or emailing them, and it's often less hassle than trying to get two networked devices to talk to one another reliably as well.

Of the many options available, we're quite pleased with the Transcend JetFlash 700. The 16GB version can be picked up for around £8.75, and although it's considerably more chunky than some of the micro-sized USB drives on the market, that does at least mean you won't lose it in your pocket. Crucially, it's one of the few sub-£10 drives around that includes USB 3.0 support, and the extra speed that gives you access to is more important than saving the tiny amount of space you can make up by buying one of the USB 2.0 options. Oh, and it comes with a lifetime warranty as well. Not bad!



Phobya High Density 30cm RGB LED Flexlight

Lots of modern cases include a window, but most of the time there's very little interesting about the inside of a PC case. For £9, you can change that with a 30cm Phobya Flexlight. Using a four-pin molex extension, this LED striplight can be fixed anywhere inside or outside your case using pre-applied adhesive strips. Waterproof binding allows you to combine it with a water reservoir (if that's your thing) and ensures that there's no chance of the light causing shorting or damage if they touch your components. The lights have extremely low power consumption, and their plug is a pass-through design, so you don't have to sacrifice a power cable to run it!

The light itself uses a triple-LED design so it can be illuminated in red, blue or green, and if you buy a separate controller, you can set different patterns and behaviours for the LEDs to give your PC a flashy makeover (literally). 30cm long, 10mm wide and with 18 LEDs, this is one way you can spend a tenner and make sure the results get seen.

£20 UPGRADES

Having £20 to spend gives you considerably more room to manoeuvre with regards to buying power and still costs little more than the price of a meal out (for one, at least). Again, you're not quite spending enough money to significantly upgrade your computer's power and capabilities, but £20 will give you the means to significantly improve some pieces of hardware. And if you don't believe us, here are three sub-£20 upgrades we picked out.

Roccat Lua Tri-Button Gaming Mouse

If you're a casual game-player, you probably use the same mouse for first-person shooters as you do for navigating a spreadsheet. But what if we told you things could be different? For £20, you could buy a Roccat Lua Tri-Button gaming mouse.

It won't make your system perform any better, but it will significantly improve the way you interact with it. It contains a 2000dpi sensor that can be customised on the fly, it has an ambidextrous left- or right-handed design, and there are cool LED lights and rubberised pads for extra comfort and grip. It'll change the way you play computers games, giving access to levels of precision and comfort that you were previously denied. It's not the best gaming mouse on the market, we admit, but if you're trying to enter that world, it's as good a way to dip your toe in as any. And let's face it, when was the last time you replaced your mouse anyway?

Logitech S150 Stereo Speakers

In the past we've championed the Logitech S120 as one of the best budget speakers systems around. Well, it's been retired, and in its place stands the Logitech S150, which comes with a host of improvements and still costs just £12 for a pair of 1.2W stereo speakers, powered and connected entirely over USB. If you're using a tinny laptop speaker or you're trying to find a speaker system that'll turn your phone into the portable sound system you know it should be, these are what you need. As well as on-unit volume controls and a master power switch, there's a convenient (and rarely seen) mute button. You even get a free carry case so you can protect them while you're on the move. They look great, they're sturdy and stylish and have strong metallic grills protecting the drivers. At less than £20, they're an absolute steal.

Microsoft LifeCam HD-3000 Webcam

The LifeCam HD-3000 might be a few years old now, but that only serves to make it pleasantly cheap; you can indeed pick one up for under £20. It's not exactly spectacular in technical terms – it has a 720p sensor that can record at 30 FPS, and video calls are restricted to a resolution of 640 x 480 – but it's small and sturdy, and a rubberised mount means it fixes securely to desktop monitors or laptops. There's even a built-in noise-cancelling microphone to keep your talk clear and interference-free.

The bundled software is good fun for kids too, with a selection of 'quirky' effects and more serious digital zoom and picture adjustment features. It's not a webcam that's going to excite anyone and no better than what you might find in the average laptops or tablet, but if you don't have a webcam yet, there are no excuses when this one's priced so low.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£35 UPGRADES

If you're trying to upgrade your computer system, £35 can get you all sorts of things. You can buy a router, a network card or a TV card – basically any expansion or upgrade outside of the 'big three' of CPU, motherboard and graphics card – and even then you can probably find cheap versions of those available if you're trying to fix up a low-end system. At this price limit, there's the danger that any hardware you buy might not represent an upgrade on what your system already contains, but stick to peripherals and you're bound to see an improvement.

Veho 360 M4 Bluetooth Speakers

Bluetooth speakers are typically quite expensive, but at £24.99, the Veho 360 M4 is priced well, especially for the sort of portable use it's designed for. It's just 6.5cm high and 5.5cm across, with a built-in battery (charged over mini-USB) that powers it for up to five hours of playback. A carry sock protects the unit wherever you choose to store it while you're on the go. It is quite unashamedly designed for use on the move, rather than at home.

Its dual 2.2W drivers mean the sound isn't exactly mind-blowing, but if you're using it with a phone or tablet, it's still likely to outdo the built-in ones by some distance. A 3.5mm jack input allows you to connect it to non-Bluetooth devices, but what really makes it stand out from the pack is the built-in micro-SD slot, which allows it to play MP3s and – combined with the on-unit volume and track controls – effectively turns it into a stand-alone stereo. It's basically a stereo and speakers in one, and who doesn't want that for under £35?

Cooler Master CM Storm Devastator

You're tried a gaming mouse, so how about this gaming keyboard? Although it retails at £39.99, we've seen it on sale for as little as £32.50, which makes it fair game for anyone with £35 to get rid of. The Devastator bundle actually comes with a gaming mouse, though it's obviously not as good as one you might spend £20 on in its own right. Most of the money is going into the keyboard, which is great.

How great? Well, it's got blue LED accent lights and backlight, anti-slip surfaces and grips, a custom membrane that makes it more durable and improves tactile feedback, laser-etched keys, a set of dedicated multimedia shortcut keys and more besides. It's wired, so you don't have to worry about battery power or input latency (just keeping a USB socket free), and there's an on-board volume control. It's great to type on, perfect for gaming, and it looks fantastic too. If nothing else, it tells you how Cooler Master got its reputation for high-quality gaming hardware.

Sharkoon VG4-W ATX Case

A new case can give your system the visual makeover it needs to look cool, but don't forget that a well-designed case can also improve performance, by allowing extra active and passive cooling features to be introduced. For £29.99, you can buy the Sharkoon VG4-W case, which comes with four different interior colors (black, green, blue or red), which are visible through the acrylic side window.

On the front there are two USB 3.0 ports, two USB 2.0 ports and two audio connectors, and inside you can fit a full-length graphics cards and up to seven expansion cards in total. Dust filters are pre-installed, along with two extractor fans and room for optional water cooling. There are three 2.25" drive bays, an externally accessible 3.5" drive bay, three internal 3.5" bays and four 2.5" drive bays, all of which use tool-free fastenings. You'll struggle to run out of space with the Sharkoon VG4-W, and its build quality means you'll be able to hang onto it for years without having to consider another. At the rate desktop computing is changing, this might even be the last case you ever need. Not bad for £30!

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Western Digital Green 1TB Hard Disk Drive

There are plenty of 1TB hard drives you could buy for under £50, but Western Digital's are some of the most reliable around, and if you're investing in long-term storage, that's a quality worth valuing. Although we'd normally recommend the Western Digital Blue as a good all-rounder, that's more use as a replacement for your main hard drive – and really, if you're upgrading that you should be seriously thinking about buying an SSD instead. If, however, you're adding a 1TB drive to your PC because you want a little extra storage, we quite like the Western Digital Green.

That's because Green drives are low-power, which means when you're not directly accessing it, the power switches off, saving you money, preventing heat build-up and reducing overall noise levels in your system. It's designed to be the perfect secondary drive, and that's what it is. It still has a huge capacity, two-year warranty and access speeds as quick as you can expect out of a 3.5" hard drive. Until the day when a terabyte of SSD storage is this fast, the Western Digital Green is a great way to give your system a massive chunk of extra storage in a single hit.

EVGA 500B 80 PLUS Bronze 500W PSU

At £39.99, this 500W PSU is ideal for powering a high-quality mid-range system. It's got all the features you could want: an ultra-quiet 120mm fan, 40A +12V rails (good enough to power a graphics card), a three-year warranty and 80 Plus efficiency rating to ensure that your PC gets a reliable, efficient supply of energy without excess heat generation.

Although this is as good a PSU as you'll find under £50, what makes it worth buying specifically are the details. A compact design with external power switch and fully sleeved cables aren't standard by any rate, so features like that make it stand out from the competition. A new PSU might not be the most daring upgrade, but it's always worth making. The consequences if your PSU gets too old are negative in the extreme, especially if your system is drawing close to the unit's maximum, and it's the sort of component that can persist across builds if properly managed. And hey, if you want a platform that can handle more capable upgrades, like a new PSU or better graphics card, you need to have the power to back it up.

Asus SBC-06D2X Blu-ray Drive

The Asus SBC-06D2X can be picked up for dead on £50, which is great if you want to add a Blu-ray drive to your system. Although the current trend is to do away with optical drives in favour of cloud-based and digital storage, that doesn't help if you like DVD extras and/or want to watch existing discs on your PC. It's still rare that any PC has a Blu-ray drive, but this is an upgrade you should be able to get a fair amount of use out of.

As well as access to the huge storage of recordable Blu-ray media and HD video, the Asus SBC-06D2X is easy to swap between systems thanks to its external interface, while the unique upright design ensures that it looks great and doesn't take up too much desk room. Obviously, it requires a compatible display to get the most out of HD content. One quirk is that it's powered by USB and requires two cables to run, but if you have an adaptor going spare, you should be able to plug it into a conventional power source as well.

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Seagate 2TB Expansion Portable Hard Drive

While you can get an external 1TB drive for around £50, it makes a lot more financial sense to buy a 2TB drive instead. Essentially, the first terabyte costs you £50, and the second just £25. And it's not even a low-end drive that we're talking about. Seagate's hardware is famed for its reliability, so this 2TB external drive will keep your data safe however and wherever you want to use it, whether it's bound to your desk or travelling around with you in a bag or pocket.

Feature-wise it's fairly basic, but it has a USB 3.0 interface for high-speed transfers, and that provides all the power it needs as well. It doesn't need any drivers or software to work, and it's supported by all incarnations of Windows from XP onwards. Sleek, sturdy and with enough space to keep your data safe for years to come, there's no doubt that the Seagate 2TB Expansion drive is a great way to relieve yourself of £75.

Fractal Design Kelvin T12 Hydro CPU Cooler

If you're looking to overclock your CPU or simply want a quiet cooling solution to minimise your system's noise, water cooling is the way to achieve great results. And if you have a £75 budget to play with, you could do a lot worse than invest in the Fractal Design Kelvin T12 Hydro Cooler.

Simple to install, with near-silent operation, the Kelvin T12 is a high-performance ceramic pump, strong enough to cool multiple components in a single loop. Constructed from enthusiast-class components, the CPU block and radiator are made of pure copper for maximum performance and increased product life, with no maintenance required. It's expandable (not all water coolers are), and the tubes are fastened with two-part brass fittings, providing a secure seal while being easy to open and reseal with standard tools. It's not necessarily an entry-level cooler (this isn't a sealed loop component, after all), but if you're looking to get your system some serious cooling performance, it's as good as you could want.

TRENDnet TEW-800MB Wireless Bridge

Home networks can always do with a little beefing up, and if you want to get the most out of your Wireless AC network, then an accessory like the TRENDnet TEW-800MB is the way to do it. This Wireless AC bridge costs £74 and is capable of providing speeds of up to 1,200Mbps if connected to a 802.11AC access point. That makes it ideal for situations where you might be attempting to stream high-definition media to a console, smart TV or set-top box. In addition to connecting to a router over gigabit-speed wireless, it also supports four wired devices on its gigabit Ethernet ports, meaning it can even serve multiple HD streams simultaneously and act as a network access point for wired devices.

In addition to blistering speeds, you also get plenty of convenient features: one-touch WPS connections, encryption support and backwards compatibility for all network types. If you're running a large network or have a lot of traffic to deal with, this wireless bridge is an upgrade that'll solve all your problems. **mm**

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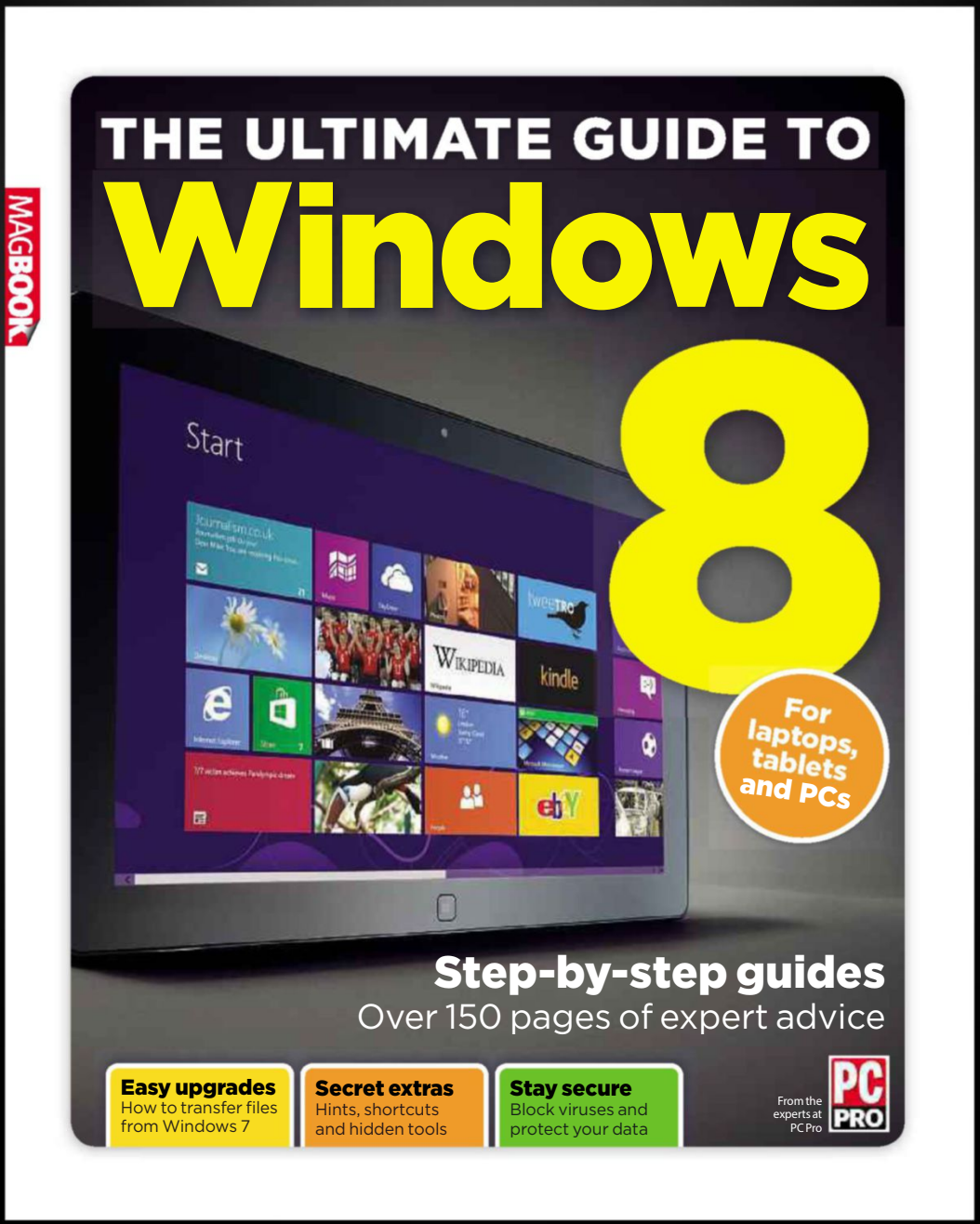

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THE BEST CURRENT-GEN CPUs FOR YOUR BUDGET

If you have a definite spending limit, here are your best options

Putting together a new system tends to begin with selecting a the processor that fits your budget best, narrowing down make, performance and price until you have the one you need. What are the best CPUs on the market right now, though? The industry evolves constantly; so are Intel chips still better than AMDs? Which of Intel's platforms is the best? Should you buy an FX-series CPU or a Fusion APU? These questions and more will be answered in our guide to the best current-gen CPUs on the market right now.

UNDER £50

Intel Pentium G3240 (£43)

The cheapest Haswell CPU worth buying, the Haswell G3240 is a dual-core Pentium clocked at 3.1GHz. A cut down version of the Intel Core chips, Pentiums differ in a few ways: there's no Hypert-Threading on any dual-core Pentium, only 3MB of level 3 cache, and they contain Intel HD Graphics GT1 GPUs, which is only half as good as the HD Graphics 4600 chips found on higher-end Haswells. The G3240 supports dual-channel RAM up to DDR3-1333, but all others support up to DDR3-1600.

Designed for use in office and low-end systems, Pentium chips don't represent particularly good value, but they're also the fastest chip you can buy new under £50. That said, don't expect to get much graphical performance out of them unless you're pairing them with a decent graphics card – their GPU is designed for office use only.

If you're building a budget system, the best reason to buy a Haswell Pentium over any other chip is that it's potentially compatible with Broadwell chips further down the upgrade line. The G3240 is a Socket 1150 CPU, so pair it with an Intel Series 9 board and you could potentially swap in anything up to a Core i7 Broadwell chip at some point in the future. It might be the bottom rung, but at least it does get you on a ladder that could carry you a lot higher when need dictates or budgets allow you to do a little bit of climbing.

AMD A6-7400K (£45)

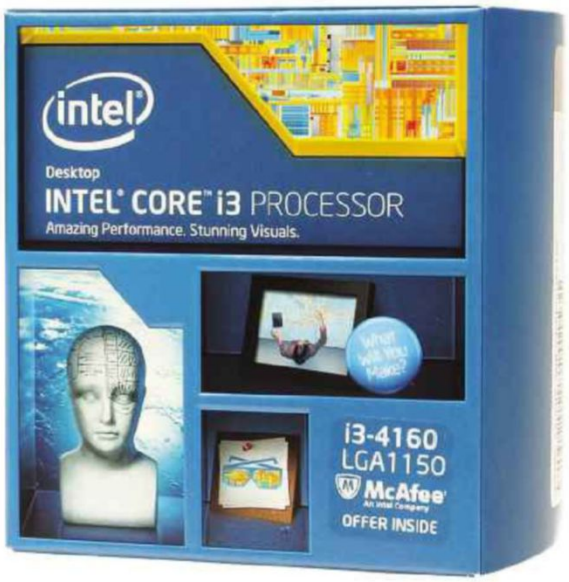
The AMD A6-7400K is a Kaveri-based APU that uses the FM2+ socket, with six cores clocked at 3.5GHz. The retail price is actually somewhere above £50, but it is possible to find it cheaper without much difficulty.

AMD's low-price chips are arguably superior to Intel's when it comes to building a powerful system, as long as that system isn't intended for gaming use. Indeed, the A6-7400K compares quite favourably with the Pentium G3240. Multi-core performance is about the same and single-core performance is slightly lower, but the Radeon R5 graphics chip is far superior to the Pentium's on-board version and it supports DDR3 up to 1866MHz. Although the TDP is about 10 watts higher, so be aware of that if you're building a low-power system.

The thing that really makes the A6-4700K worth considering, though, is that it can be overclocked. Done right, this will push performance up above the Pentium without much difficulty, giving you a better return on your money. If you're looking for a cheap gaming system, this ability – combined with a better GPU – is your best chance at getting one with a CPU under £50, unless you want to buy a graphics card too.

UNDER £100

Intel Core i3-4160 (£90)



Intel's Haswell CPUs are great for gaming, but chips in the core line are expensive and it's often tough to tell whether you're getting a good balance of price and performance. That's not the case with the i3-4160, which hit shelves in July 2014 and quickly proved itself to be a well-refined competitor to other Core i3 and Core i5 chips, standing out instantly thanks to its solid performance and low price. Anyone trying to build a gaming or media system on a budget would do well to consider it, especially if you're wedded to the idea of buying Intel rather than AMD.

This dual-core chip has a 3.6GHz clock speed, two hardware cores, on-board Intel HD Graphics 4400 and a pleasingly low TDP of just 54 watts. Although it can't be overclocked thanks to locked multipliers, benchmarks show that Hyper-Threading gives it gaming prowess beyond the suggestion of its model number and price. It's one of the best value Core i3s that Intel can offer, and for the sake of a few quid it's worth going with the faster version over any other.

Be warned that varying availability means you might find some slightly worse chips at a higher price than the i3-4160. In particular, the Intel Core T-series chips are cherry-picked for low power performance, but this selection process adds a few quid onto their price. The Core i3 4130T, 4150T and 4160T are all easily found for more than the vanilla 4160, but that's because batches with low power ratings are rarer. Unless you're desperate to save a few watts on the TDP, go for a vanilla 4160 instead.

AMD A10-7800 (£99)

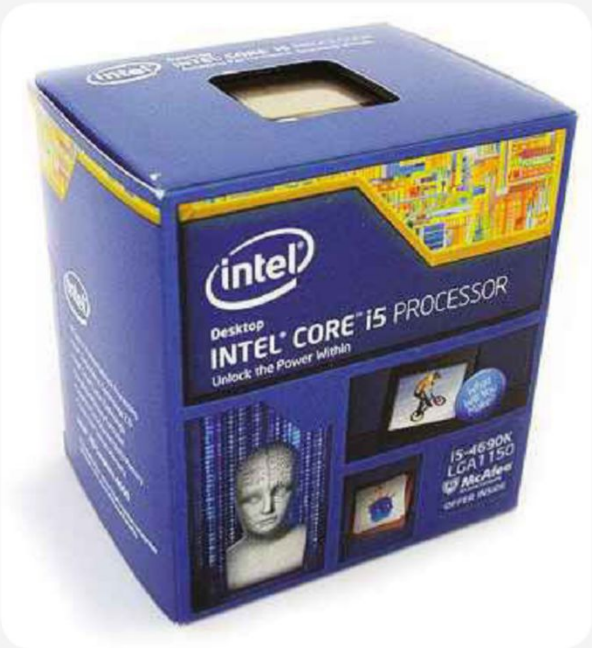
Brushing right up against the bracket for our intermediate budget, the A10-78800 is a 3.5GHz FM2+ Kaveri APU with 12 cores, a 65 watt TDP and support for DDR3 up to 2133MHz. Again, it matches its Intel equivalent quite closely in a number of areas. The Core i3-4160 has the edge when it comes to single-core performance, but multi-core performance is actually a little better on the AMD chip.

This AMD isn't unlocked, though, so you won't squeeze any extra performance out of it – and it's 10% more expensive without being 10% better. The FM2+ socket does mean you could upgrade to a Carrizo chip in a few months, but if you're planning on that, we'd just to wait for the new line to be released.

Again, the best reason to consider the AMD chip over the Intel one is its GPU. It's so much better (a Radeon R7, in this case) that if you're trying to make a gaming system without a stand-alone graphics card, you'd be better off with the AMD. As an all-rounder, however, it starts to noticeably struggle against Intel's chips, and that trend only gets worse. Unless you're a staunch AMD supporter, this is the best AMD chip we can actively recommend.

UNDER £200

Intel Core i5 4690K (£192)



First seen on shelves in June 2014, the quad-core i5-4690K has a 3.5GHz base rate that's 100MHz faster than Intel's previous best i5, June 2013's 4670K. That translates to better single-core performance and slightly better value than the older chip, which makes it more than worth tracking down instead. The 4690K has a TDP of just 88 watts and on-board Intel HD Graphics 4600, though if you're buying it for a gaming or media editing system you'll want a proper graphics card in there.

The main advantage with the K-series chips is their overclocking capabilities, and if that's what you're looking for then it's a good idea to go for the latest, fastest chip in the Core i5 line. The newer materials will stand up to that little bit more stress. Obviously, if you want a faster Haswell chip you could look at the Core i7 series, but for single-threaded tasks (like gaming) there's very little advantage to be had by paying extra. In any case, once you start buying in that price bracket the performance you get per pound starts to drop significantly. The Core i5-4690K is, by far, the gaming chip with the best speeds for the best price.

Remember, too, that if you're definitely not planning to overclock your chip you can save around a tenner by going for the locked version (without the K suffix), and it's probably worth doing that – the selling point of K-series chips is their overclocking potential and if you know you won't exploit it, don't waste your money.

AMD A10 7850K (£130)

At the very top tier for AMD's A-series chips, the quad-core, multiplier-unlocked 3.7GHz A10-7850K is currently priced at £130 – about half the amount that Intel's top-end Haswell Core chips cost. That, if nothing else, illustrates the scale by which AMD and Intel's performance differ. This is as good as AMD gets, and it's not even competing with Intel's mid-range core chips: the closest-priced Haswell CPU is the Core i3-4350, which is the fastest Core i3 chip and slightly cheaper than the A10. If your budget is up to £200, you can't do any better than this for an AMD chip without going for an older CPU.

Again, what makes Kaveri attractive isn't its single-thread performance, but the superior graphics capabilities. Again, the AMD chip has an R7 GPU which is outright superb compared to Intel's HD Graphics 4600 – though if you're building a mid-level gaming PC, it's unlikely you're looking to buy a Core i3 without a graphics card. Literally the only useful thing the AMD chip does that the equivalent Intel doesn't is support 2133MHz RAM.

The A10 7850K is unlocked, so there's a little more performance to find within it, but even then it's struggling to match Intel's line. AMD might put up a reasonable fight when you're building a budget system, but if you want one that'll handle the strains of high-definition gaming or entertainment, this isn't really the option to go for. Either way you need a graphics card, and once you've hit that point, Intel has the edge in performance, price and upgradeability terms.

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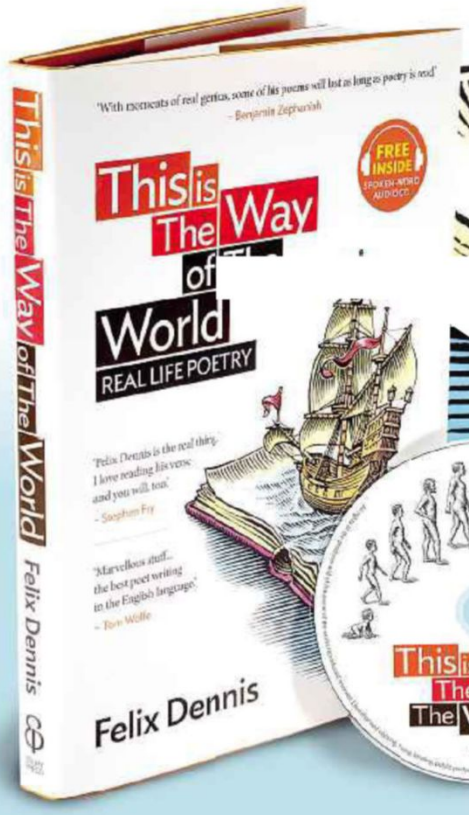

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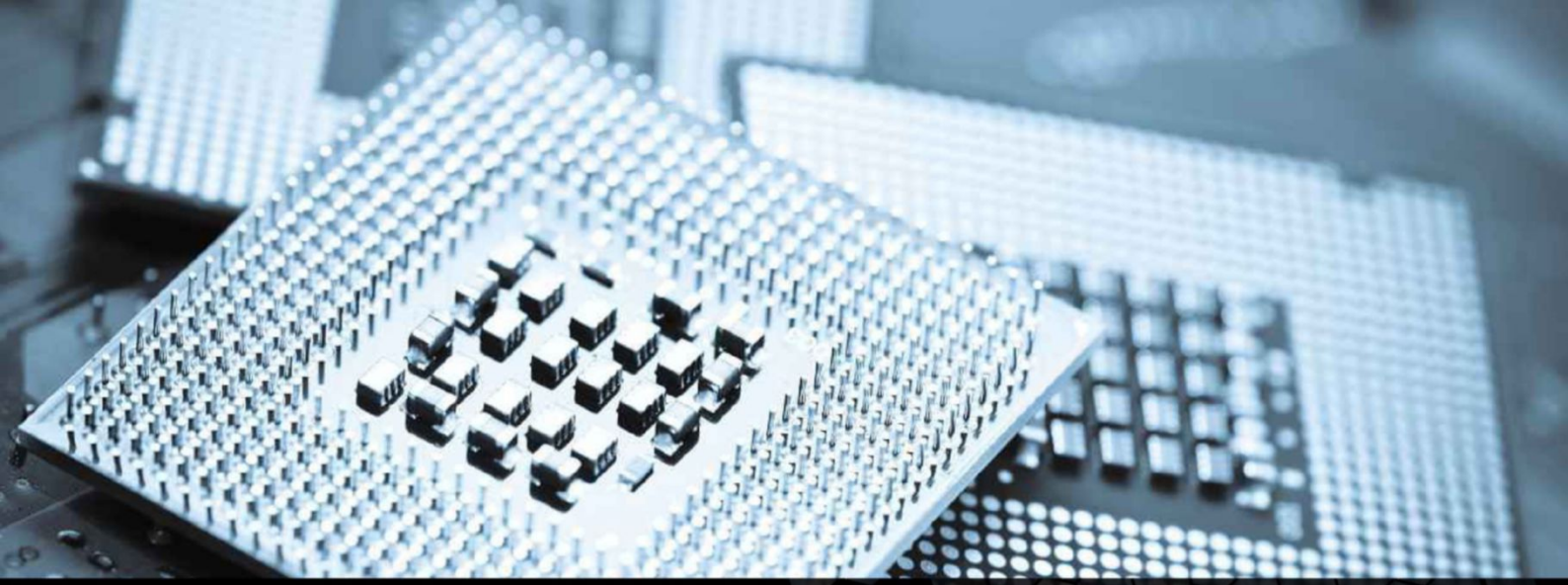


OVER £200

Intel Core i7-4790K (£275)

Intel's most expensive Haswell chip is actually the Haswell-E i7-5960X – an eight-core 3GHz chip (16-core with Hyper-Threading) that costs no less than £850. It is, of course, so expensive that buying one for a desktop system can't really be called the act of a sane person.

If you're going to go for a high-end Haswell chip – and let's face it, if you're trying to get the best PC, you want to – you should probably stick to the more affordable regions of the standard Haswell platform. The Intel Core i7-4790K is a 4GHz quad-core CPU with Hyper-Threading, and the fastest in the standard Haswell line. It doesn't outperform the i5-4670K as much as you might think, but it does outperform it, and in a battle of sheer power that's all that matters. The only downside is that it's a lot worse in terms of performance per pound, but that's been a standard problem with the Core i7 line ever since it was introduced. They're not CPUs for people who are scrimping.

The fact that the 4790K is unlocked does mean you can squeeze a little more performance out of it as long as you have a sufficiently good cooler, but we wouldn't recommend that as a strategy. Unlike Core i5 chips, Core i7s are already operating at their limits, so it takes some heavy-duty hardware to get them past it by any significant proportion.

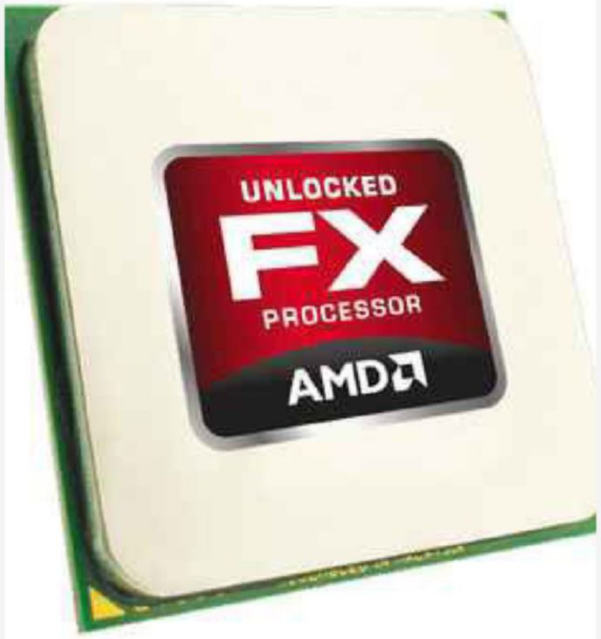
AMD FX-9590 (£200)

As we've previously discussed, AMD's Kaveri APUs don't go past £130, but let's imagine that you want a high-end AMD chip for your budget of more than £200. What can you get?

In this case, your only real option is the last-gen Piledriver-based FX-serious chip, which has no on-die GPU. An eight-core chip clocked at 4.7GHz, it's the fastest FX-series AMD manufacture, and probably always will be, since the FX-series seems to be dead now.

On the plus side, it's the first AMD CPU in years that can actually hold its own on gaming systems (if you have a graphics card, otherwise it's useless) but there's a slight problem in that it's still vastly underperforming for its price. It competes with Intel Core i5 chips like the 4670K, rather than the similarly priced Intel Core i7s, and it still loses out to them – the even without overclocking, the i5-4670K is substantially better at single-core processing. The FX-9590 also consumes almost three times more power than the i5, isn't any better at running multi-threaded software, and it runs on a CPU socket (AM3+) which is essentially dead, making it an expensive investment in a system with only a short lifespan left.

The only reason to even look at this chip is if you own an AM3+ system already and aren't willing to upgrade. For £200, though, we'd be tempted to suggest you just buy an Intel board and CPU instead. It's no surprise, when you look at the FX-9590, that AMD refocused its desktop line around budget APUs. It's simply not in the same league as Intel's chips. **mm**



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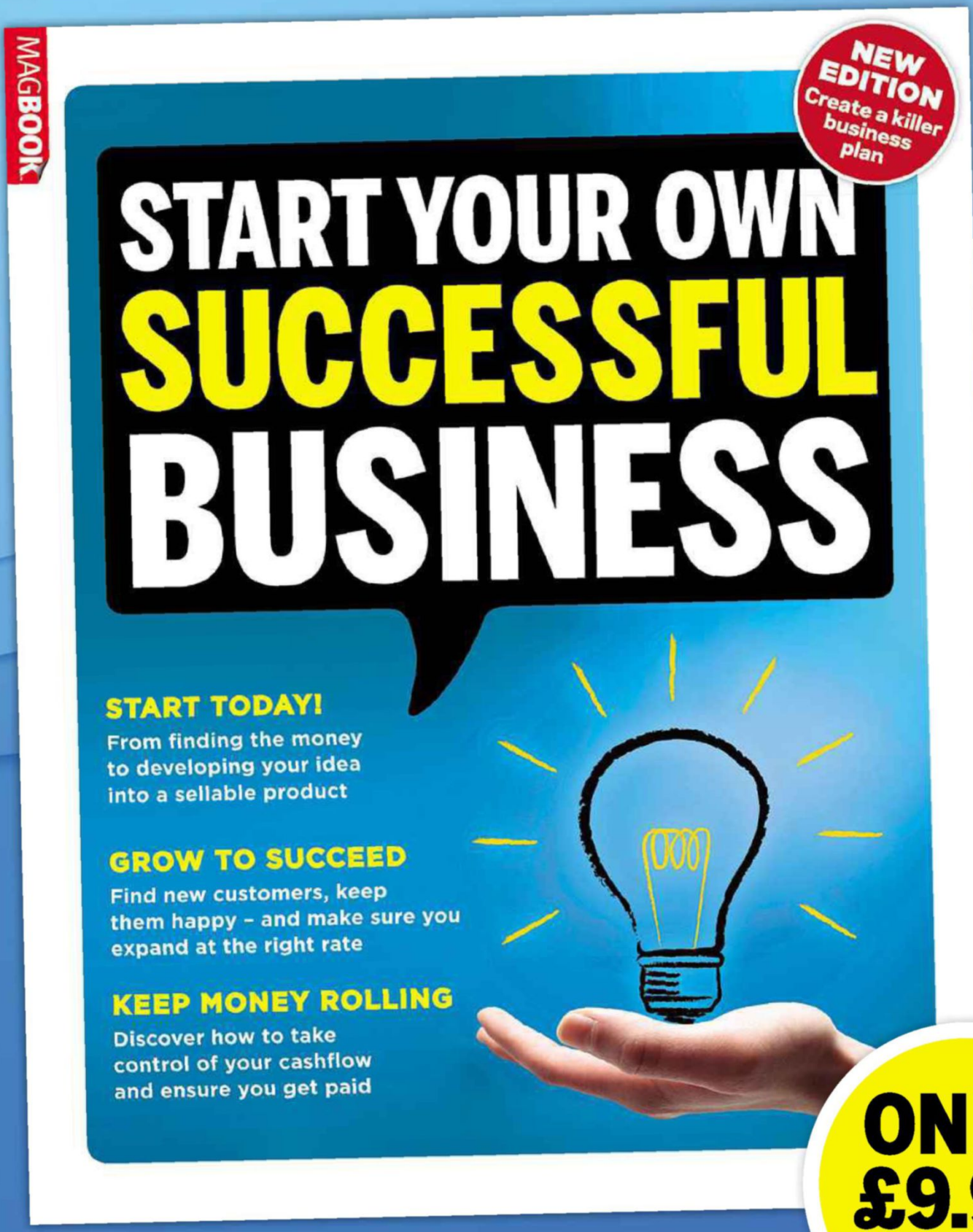

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THE BEST GRAPHICS CARDS FOR YOUR BUDGET

How much do you really need to spend on a GPU?

Like CPUs, there's almost no limit to the power and capabilities a good graphics card can provide. That's why it makes sense to pick your budget first and choose a card that fits within that range – otherwise you'll always be wondering what £10 more can get you. Graphics cards also have the added problem that older cards might be slightly better than the latest model, and cheaper thanks to price drops.

That's why we've put together this guide to finding the best graphics card for you budget. Whether it's new or old, AMD or Nvidia, you'll be able to find the best card for your money right here.

The Cheapest GPUs

The prevalence of integrated GPUs means that low-price cards are increasingly pointless, but that doesn't mean there's zero call for them. If you want to rehabilitate an old system, repair a broken one or just give yourself a second option, there are low-end cards you can buy. Here's what we think of them.

MSI G210 1GB (£18.99)

If you're in the market for the most basic graphics hardware possible, Nvidia's G210 is the chip you need to look for. Most major companies have done their own version of the G210 design, but Asus makes the lowest price version – and if you're frugal enough to be buying this card rather than making a more extensive upgrade, we think price is the most important factor to consider.

Hardware-wise, you're paying for a GPU from 2009, manufactured with a 40nm process. It has 1GB of DDR3 RAM and three output ports: VGA, DVI and HDMI. The GPU is clocked at 589MHz, and the maximum resolution is 2560 x 1600. Despite its cost and age, it does support DirectX 10.1 and OpenGL 3.1.

We mostly imagine this card going in very basic office PCs, but it might also suit a very cheap home cinema system. Asus's version doesn't have much in the way of notable qualities besides its price, but it is silently cooled using only a passive heatsink, which not all G210 cards are. That makes it best aimed at media systems, other silent systems or anything that needs a native HDMI interface added on the cheap. And not much else.

MSI HD 5450 1GB (£19.98)

MSI makes the cheapest low-end AMD card, the Radeon HD 5450, and it's in much the same boat. There's slightly more power in the HD 5450, but if you look at it percentage-wise it isn't really a good deal. The extra power is enough to make it more practical, but that doesn't mean it's actually practical.

Like the G210, the HD 5450 is several generations old and about as powerful as an Intel HD Graphics 3000 or the on-board Radeon GPUs, the HD 6310 and the HD 6320. Again, you get 1GB of DDR3 RAM and support for DVI, VGA and HDMI output with a maximum resolution of 2560 x 1600. One advantage it has over the G210 is that it supports DirectX 11 (as opposed to version 10.1), but we can't imagine this will matter much outside of the games this card isn't powerful enough to play anyway.

While Radeon HD 5450 cards are more powerful than their Nvidia equivalents, it's not power that matters at this level. If you're interested in playing HD video, then this card will make a slightly better choice, but ultimately that's a low bar for anyone to clear.

UNDER £70

Nvidia: Gigabyte GT 740 1GB (£69.99)

The GeForce 700 series may have been succeeded by the 900 series, but if you're looking for a gaming-capable budget buy, then the GT 740 remains your best choice. Specifically, we liked the look of the Gigabyte GT 740, with its 1072MHz clock speed, 1GB of GDDR5 RAM, max resolution of 4096 x 2160 and Gigabyte WindForce cooling system. Interfaces include dual-DVI, VGA and HDMI.

As an entry-level 700-series card, it's actually using the GK107 GPU originally found in the 600-series, but don't let that put you off – you have to go all the way up to a GTX 780 to get a card where that isn't the case. As a DDR5 version of the GT 740, it has more than double the memory bandwidth of its DDR3 line-mate, and it's still relatively fresh hardware – it came out in May 2014.

The sticking point here is that the GT 740 is noticeably slower than the AMD equivalent, the R7 260. It does have a significantly lower TDP (65 watts), making it excellent for low-power systems, but in almost every other way (including price) an R7 260 is better. Even the cheapest GT 740 – the Zotac low-power version – is only a fiver less, which doesn't offset its performance drop (but does make it yet more appropriate for specialist systems, like HTPCs).

AMD: MSI Radeon R7 260 1GB OC Edition (£68)

Most R7 260 cards are slightly more than £70, but if you look around you can find the MSI Radeon R7 for just under that price, with the added bonus that it's factory overclocked. Only by a tiny amount, admittedly: the GPU is clocked at 1,050MHz instead of the reference 1000MHz, but that's enough to give it a slight edge over the competition, especially when it's also much cheaper than them.

The card comes with 1GB of GDDR5 memory and features MSI's exclusive 'propeller blade' fan technology, which gives it superior cooling – though the fact that it contains a single, larger-than-average 10cm fan also helps with that and means it's quieter too. Connectors include dual DVI and one each of HDMI and DisplayPort, and power consumption is a fairly untroubling 95 watts. Its maximum resolution is 2560 x 1600, and it supports OpenGL 4.3 and DirectX 11.2.

In terms of the Radeon's previous numbering system, the R7 260 falls somewhere between an HD 7770 (which it's a little faster than) and the HD 7790 (which it's a little slower than). If you can get your hands on the latter for a lower price, then it might be worth going for that; there's nothing the R7 260 does that the HD 7790 won't, but with HD 7790s out of production, it might be more hassle than it's worth. Certainly the R7 260 is far better than Nvidia's similarly priced equivalent, the GT 740, so in that sense it's the card to go for.

UNDER £150

Nvidia: Asus GTX 750 Ti OC Edition (£120)

The sub-£150 price range is a bit of a wasteland for Nvidia hardware. Even the most expensive of its sub-£150 cards, the EVGA GTX 750 Ti (with custom coolers) tops out at £130, and it's significantly worse than any of s similarly priced cards.

While that sounds like a bad thing, it does mean that Nvidia has a slight advantage when it comes to budget buying. Indeed, the best GTX 750 Ti we could find was Asus's factory-overclocked card, and you can pick that up for as little as £120. Not an insignificant saving to make, all things considered.

The Asus GTX 750 Ti OC edition has 2GB of GDDR5, a clock speed of 1072 MHz (against the reference design of 1020 MHz), a max resolution of 2560 x 1600 and interfaces include D-sub, dual DVI and HDMI. Its TDP is a frankly meagre 60 watts, which puts it in a completely different class to the AMD cards its priced against. Crucially, it's the fastest card on the market that doesn't require an external power supply, which means that you can convincingly upgrade virtually any system regardless of how low-end it is.

That does mean this card is good if you want to put it in a budget or specialist system – there's no danger it'll need a new PSU to power it, and you won't end up with a system that sounds like a jet turbine readying for lift-off, but if raw performance is your goal (and with graphics cards, it so often is), then you'll really have to aim for a Radeon card of some description.

AMD: Gigabyte Radeon R9 280 3GB (£144)

There's no contest, really. Originally retailing for £180, a price cut has placed the Gigabyte R9 280 well within our budget, and it trumps even the most factory-overclocked R9 270X you can find for under £150 (which, for reference, is Sapphire's).

The Gigabyte R9 280 we're looking at is the 3GB GDDR5 version, which has a clock speed of 950MHz. The R9 270X actually benchmarks a little higher than it on pixel rate, but in all other categories the R9 280 is either slightly or significantly better, which makes up for a loss in that one area. A TDP 20 watts higher than the R9 270X (200W vs 180W) is also nowhere near enough to put us off.

The R9 280's specs include a triple-fan cooling system, Dual-DVI, HDMI and a pair of Mini-DisplayPort adaptors, and a max resolution of 4096 X 2160. In this case, it absolutely thrashes the nearest Nvidia equivalent, the GTX 750 Ti. In every way you can conceive, it's almost twice as good, and yet there's only a £15 price difference between the two cards. Even if you go over budget and buy a GTX 960, the R9 280 is operating well ahead of its competition in most areas.

In case you can't find an R9 280 for under £150 (and we suspect they'll move fast), then it's worth mentioning that the AMD card you're most likely to find under £150 – the Radeon R9 270X – is also better than the GTX 750 Ti in most ways. So once again, AMD has the upper hand when it comes to even mid-priced GPUs.

UNDER £275

Nvidia: Zotac GTX 970 4GB (£259)

If you've been worrying about Nvidia's performance up until now, don't worry. At the high end, things are a lot less clean cut in AMD's favour. The Zotac GTX 970 is a latest-generation card with 4GB of GDDR5 RAM, a clock speed of 1076MHz, 4K max resolution and dual DVI/HDMI/DisplayPort interfaces. It's also an absolute beast of a card.

Notably, the GTX 970 benchmarks faster than its AMD equivalent (the Radeon R9 290X) in almost every way. It has a higher GPU and memory clock speed, and the TDP is almost half as much – 148W versus an insanely high 290W on the R9 card. Technically speaking, Nvidia doesn't always have the edge, because the memory bus is 256-bit, not 512-bit like the Radeon's, but that doesn't hugely affect performance in most cases.

At £259, it's obviously an expensive card, and that will be the most difficult hurdle to get over if you're looking to beef up a gaming system. But that's arguably reflected in the performance, and to put things in perspective, it's currently the cheapest 900-series card available. The next 900-series card up is the insanely expensive GTX 980, which you won't find for less than £461 and which could easily cost north of £500. With those stats in mind, this doesn't seem like such a rip-off after all.

AMD: MSI R9 290 (£230)

In many ways, this is the point where the tables turn on AMD. Their MSI R9 290X cards are the closest-priced to GTX 970, but their performance (and efficiency) is substantially worse to the point where it's hard to find a reason to recommend one. But if you want to save money, the R9 290 is as much as £30 cheaper than the GTX 970, but it has performance that's in the same league.

The R9 290 is a 4GB GDDR5 card with dual DVI, HDMI and DisplayPort interfaces and a 1007 MHz overclocked GPU core. Its TDP of 250W is quite high, but well below the 290W of the R9 290X. It's also worth noting that as an R9 card, it's part of Radeon's latest hardware line. This is as up to date as graphics technology gets, and the list of AMD cards that are better is so short we might as well just list it here: the R9 290W, the HD 7990, and the R9 295X2.

Although Nvidia has the edge in almost every area, this MSI card is, at least, a lower-priced alternative. If your budget stretches to £275 then that may not be a huge concern, but on the other hand, if you're thinking of building a dual-card SLI/CrossFire system that's £60 you've saved while sacrificing only a tiny fraction of the performance. We can't recommend it outright, in part because the power requirements are so ridiculously huge compared to the better-performing Nvidia cards – but it is, at least, worth considering if your budget is low. Nothing Nvidia prices at £230 or under can beat it. **mm**

ARE YOU MISSING OUT?

Is there an upgrade you don't know you could benefit from? Read on to find out…

Most people decide to upgrade their systems when they slow down, fill up or stop being suitable for the software they want to run. But that doesn't mean those are the only reasons to get some new hardware. Sometimes, the reason is to add compatibility for a feature that your current system doesn't support. But that only applies if you know what you're missing in the first place.

If you're running an old system, it's likely that there are technologies and standards that you don't have access to, even though you don't realise it. Upgrading old hardware can give you access to faster USB speeds, better wireless connectivity and support for the latest software. But what do you need to buy, and are there any alternatives? In this article, we look at what the latest standards are, why you'd want them and how to get them if your system is currently a little past its prime.

"USB 3.1's new SuperSpeed+ transfer mode can deliver data at up to 10Gbps"

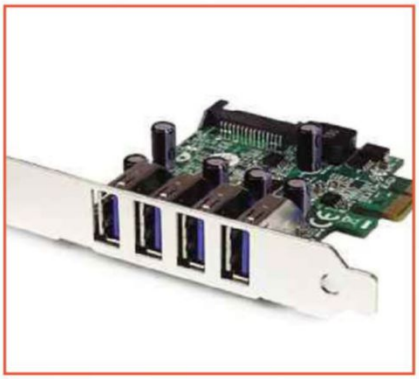
USB 3.0

USB 3.0 is (as the name suggests) the third major revision of the USB standard. Its release improved data transfer rates and upped speeds to as much as 5Gbps, as well as adding a second communication path to allow full-duplex communication. It also offered superior power management and improved device notifications over its predecessor. In practical terms, the standard is ten times faster than USB 2.0, and its duplex ability doubles that again.

USB 3.0 support has been standard on many systems for a while now, but if you bought your motherboard before 2011 or have a compact or budget model, then it's possible that it only supports the older, slower USB 2.0 standard. If you're unsure, you can usually check USB ports for USB 3.0 compatibility by checking the colour. If it's black or grey, it's probably USB 2.0 (or earlier). But if it's blue, that'll be a USB 3.0 port.

If you don't have USB 3.0 ports, you do still have options for adding them. All you need is a free PCI slot into which you can fit a USB 3.0 controller. This isn't just for adding USB 3.0 support to old hardware either; you can also do this on any modern system if you just want to add a few more of the high-speed ports so you don't have to swap cables around all the time.

Although there are plenty of models available, the Startech PEXUSB3S4V controller pictured here is particularly good value, adding four full-speed USB 3.0 ports to any system with a spare PCI port at the cost of just £29.99. You can also pick up a two-port version for as little as £16.50. This will give your PC the ability to connect to any USB 3.0-supported device at the maximum speeds the protocol supports, even if it doesn't have a USB 3.0 port at present, with data delivered to your system through the wide bandwidth of the PCI bus. Brilliantly convenient.



▲ *USB 3 controller*
➤ *USB 3.1 motherboard*
▼ *USB vs USB Type C*

USB 3.1

If you already have a USB 3.0-compatible motherboard, don't think that's the end of it. USB 3.1 is coming, and if you were already aware it, you might therefore be wondering if there's any way you can add support for USB 3.1 to your system.

But first, for those who aren't aware, what is USB 3.1? From its name, you've probably guessed that it's the next revision of USB 3.0, but in practice it's a lot more than that. Originally specced in 2013, it's likely to come to market maturity in 2015 as consumers look for next-generation hardware upgrades.

USB 3.1's new and improved SuperSpeed+ transfer mode can deliver data at up to 10Gbps, making it as fast as the first wave of Thunderbolt devices, while the completely redesigned USB Type C connector also introduces a number of improvements: reversible connectors, faster charging for USB-rechargeable devices and smaller hardware overheads. Although you can get USB 3.1 ports in standard (Type A) form, the Type C connectors are designed to be the long-term evolution of USB ports, and for that reason they've been designed so that initially, USB 3.0 devices with a standard (Type A) connector can make use of USB 3.1 Type C ports using a convertor (and vice-versa). This shouldn't persist for long once the standard is up and running, but there will likely be a period of adjustment for all involved.

At present, there aren't any stand-alone USB 3.1 controllers that you can buy. The only way to get USB 3.1 support in a system is to swap your current motherboard for one that supports the technology, which is something of an extreme solution, admittedly, but not unheard of if you want cutting-edge technology.

The biggest problem is that there aren't many USB 3.1 motherboards actually on the market right now. The BioStar Gaming Z97X (v5) is on shelves at the moment and features USB 3.1 support, though only with a pair of Type A ports rather than any of the new Type C kind. It's not exactly cheap either: you'll pay around £320 for this Haswell board, which puts it at the extreme high-end of motherboard pricing. And even once you have it, you'll still need to wait for a USB 3.1 device that can make full use of the

new technology before you can actually enjoy owning it.

But still, if you want USB 3.1 support, this is currently one of the few ways you can get it. We'd suggest that, for the moment at least, USB 3.0 is a good enough standard for anyone. But keep an eye out for USB 3.1 support the next time you feel the need to upgrade. Just because it's early days now, it doesn't mean things won't change fast once the technology matures.

Bluetooth 4.0

The short-range wireless transfer standard Bluetooth has been in use for over a decade, allowing everything from quick file transfers to audio streaming to mouse input. Although the technology has been specified up to Bluetooth 4.2, the most recent version in common use is Bluetooth 4.0, which was finalised in 2010 and has been common in Bluetooth hardware ever since.

Although most popular in mobile devices such as laptops and tablets, Bluetooth connectivity is less often found in standard desktop systems, even though the ability to connect to speakers, peripherals and mobile devices wirelessly is an undeniably useful option to have. For their part, most desktop systems simply prefer the high-speed plug -nd-play convenience of cables.

Still, if you have Bluetooth peripherals and a spare USB port, you can add support for Bluetooth 4.0 to your system for less than £10. The Belkin Bluetooth adaptor (model number F8T065BF) is so small as to be practically invisible once it's in your PC, but it adds Bluetooth 4.0 support with a 10-metre indoor range and virtually no power draw. It's compatible with Windows and Mac hardware, and it's backwards compatible with all earlier versions of Bluetooth as well.

In an era where mobile devices are increasingly connected, this simple, inexpensive Bluetooth dongle will give your desktop PC the extra connectivity it needs to remain a vital part of any computing ecosystem. There's almost no end to the extra options it gives you, from simplifying file transfers between your phone and PC to allowing you to connect multiple wireless devices without the need for proprietary, single-use adaptors and RF receivers. If you don't have a Bluetooth adaptor already, there's no better time than the present to take advantage of it.

Wireless AC

The latest consumer version of wi-fi, Wireless AC (also known by its IEEE name, 802.11ac) is the fastest form of wi-fi currently available in the home. A single Wireless AC connection alone will provide a connection of up to 433Mbps, but this is usually paired with a single Wireless N connection (150Mbps) to give a minimum speed of 600Mbps (often annotated as AC600). Various speed combinations exist: dual N, dual AC (1,200Mbps) is common, but the fastest hardware has a throughput of 3,200Mbps – 600Mbps on Wireless N and 2,600Mbps on Wireless AC.

Upgrading to a Wireless AC network is going to be increasingly essential as HD content delivery becomes more common. From online television to streaming video services to increasingly complicated games, a high-speed network is going to be a necessity for keeping households running smoothly, and that means if you're still running an outdated network on Wireless N (or, worse, Wireless G), then upgrading is essential.

Don't worry if you have existing Wireless N or G

"Adding HDMI 2.0 to your system isn't difficult, but there is only one real way to do it"

Belkin F8T065BF (Bluetooth 4.0)
TP-Link Archer C20i
TEW-805UB

hardware that you want to keep connected, though; to comply with the standards as defined, all Wireless AC hardware must include a 2.4GHz antenna, giving it Wireless N compatibility as well. This is useful, because although Wireless AC is faster than basic Wireless N, it does have a slightly shorter maximum range. Including Wireless N compatibility doesn't just retain legacy support for old hardware; it also means if you're on the fringes of your network, you won't lose connectivity because the only available connection is a short-ranged Wireless AC one.

Converting your network connection to wireless AC requires two things: a Wireless AC-enabled router/switch, and a Wireless AC adaptor connected to your system. You can get the former for as little as £35 by buying the TP-Link Archer C20i, which is an AC750 dual-band router, and you can get the latter for just £9.99 if you buy the TRENDnet AC1200 dual-band USB adaptor (model number TEW-805UB). It's not exactly peanuts, but £45 total isn't a bad price for allowing you to take advantage of the latest network speeds. If nothing else, it's a solid investment in the future.

HDMI 2.0

Although HDMI is now a standard input and output on virtually all graphics devices, the latest version of the protocol isn't quite so ubiquitous. If you have a USB device released prior to 2014 (or even during that year), then it's overwhelmingly likely that it only supports HDMI 1.2 or 1.4. The chance of it supporting HDMI 2.0 is slim to none unless you've bought your hardware incredibly recently.

At the moment, it's arguably not a huge problem if your components lack HDMI 2.0 support. HDMI 1.4 supports a maximum resolution of 4K, making it more than capable of support most users' needs, while HDMI 2.0 is very much designed with an eye on the future. Even a 4K display doesn't need HDMI 2.0 to achieve maximum throughput.

HDMI 2.0 is advancing on the industry, however, so you might want to get in early – especially if you're a fan of above-HD displays. The major revision of HDMI adds support for UHD (8K) screen resolutions and 4K video at 60fps by increasing the maximum TDMS per channel throughput to 6Gbps (for a total of 18Gbps). Other improvements include Dual View; 25fps 3D support; up to 32 channels of audio; support for more, higher-quality audio channels, and improvements to technologies like auto lip-sync.

Adding HDMI 2.0 to your system isn't difficult, but there is only one real way to do it, and that's by buying a Nvidia graphics card with a second-generation Maxwell GPU in it. You can distinguish these from their model number – GM20x – which in practice means a GeForce GTX 960 (GM206), a GeForce GTX 970 (GM204-200), GeForce GTX 980 (GM204-400) or the soon to be released GeForce GTX 980 Ti (GM200). These are the only designs that support HDMI 2.0 right now. If you're an AMD fan who wants to add support for the technology, you'll have wait for the Rx 300-series cards due out later this year.

Of the available HDMI 2.0-supporting cards, one of the cheapest is the Gigabyte GTX 960, which you can pick up for around £160 if you choose the Zotac mode. It's a good graphics card in its own right, despite being the worst HDMI 2.0 card on the market (that's very much a relative description), and if you have yourself an 8K display, then it's probably worth spending the money to make sure you can enjoy your Ultra-HD movies and gaming in full.

So there you have it. Five technologies you might not even realise you're missing out on and how to get hold of them. If you didn't want to upgrade before, maybe you do now. Just be warned that we can't be held responsible for any purchasing decisions you make. If you want to start chasing the latest standards, just be warned: it could get costly! **mm**

▲ *Zotac GTX 960*
◀ *HDMI 2.0*

IS DDR4 WORTH BUYING?

James Hunt assesses the benefits of the latest standard of RAM

It's been close to a decade since DDR3 memory was first introduced and five years since it became the dominant form of RAM in home PCs. In an industry where anything older than 18 months looks seriously out of date, DDR3 is starting to seem positively ancient. It's no surprise, then, that the next evolution of the technology, DDR4 memory, is starting to creep into the latest high-end hardware.

At this point, there's a chance that the next computer you buy will indeed support DDR4. But what is DDR4 memory, and what are the practical benefits of it? And most importantly, is it worth aiming to include in your next system?

What Is DDR4?

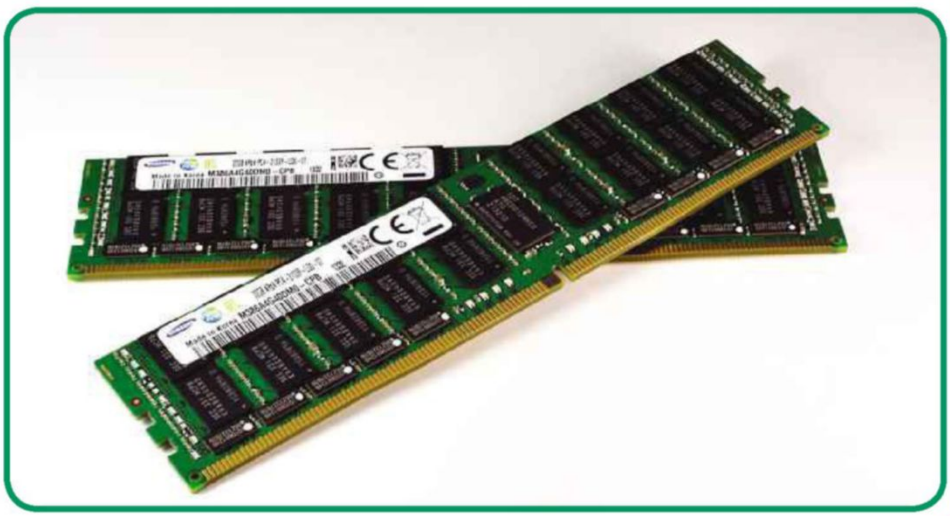
The RAM we use in our current computer systems is called SDRAM, which stands for 'Synchronous Dynamic Random Access Memory' – not that it matters much to consumers, because all RAM you can buy for your home computer is SDRAM. The bit where you get a choice is that your RAM can, at present, be either DDR3 or DDR4.

DDR is shorthand for 'Double Data Rate', and DDR4 is the fourth generation of that technology. It probably won't surprise you to hear that it was preceded by DDR3, DDR2 and standard DDR memory. DDR SDRAM works twice as fast as standard SDRAM, DDR2 is double that speed, and DDR3 is double that speed. DDR4, as you may have guessed, is twice as fast as DDR3.

As with previous RAM upgrades, DDR4 hardware is not compatible with any earlier versions due to a variety of factors. Different signalling voltage is one of the bigger reasons the two generations aren't compatible, but the modules will have a different physical interface to prevent any confusion. To use DDR4, you'll need a new motherboard entirely, and your old DDR3 modules will have to be thrown straight in the bin (or possibly sent somewhere more productive), because you're not going to be using them any more.

The majority of improvements in DDR4 are related to its speed. Faster clock frequencies allow greater data transfer rates, which speeds up memory access times, allowing faster framerates, loading times and data retrieval. DDR3 modules only officially support speeds up to 2133MHz, while DDR4 modules will start at 2133MHz and be rated up to 4266MHz.

In addition to this extra speed, DDR4's power usage is lower, because the modules run at a lower voltage – 1.05-1.2 volts,



compared to 1.2-1.65 volts for DDR3. Lower power usage means better battery life for mobile devices, lower power bills and less heat inside a system, which is good news all around. DDR4 also supports a new technology called 'Deep Power Down', which means it can use near-zero power when in sleep mode, since no refresh is required to keep the data active. DDR4 also has the ability to refresh individual chips on a DIMM, rather than the whole DIMM, which can improve latency.

DDR4's improved speeds also allow it to support greater capacity modules. Last year, Hynix announced that it had developed a 128GB DDR4 module based on a 20nm process. Most DDR4 modules are likely to be 16GB a stick thanks to its higher-density chips, whereas DDR3 typically supports no more than 8GB. Larger-capacity modules do have a slightly higher latency compared to smaller ones, but the improvements in other areas cancel out any negative effects you might see.

In terms of physical appearance, DDR4 modules will have more pins on the connector (284 vs 240) but are the same length because the pins are closer together. The new modules are taller than DDR3, but only by less than a millimetre – 31.25mm, compared to DDR3's 30.35mm – and thicker than existing modules by 0.2mm, to allow for more signal layers. As for the SO-DIMM variants found in notebooks and other low-space/portable devices, they have 256 pins (rather than 204) and are 1mm thicker, but have the same length and height as existing SO-DIMMs.

Can I Buy DDR4?

DDR4 modules have been on sale for a few months now, and it's entirely possible to walk into a shop and buy them today. But while you *can* buy DDR4, a much better question is whether you should or not.

The vast majority of current systems support DDR3 RAM, and if they don't, then they're probably DDR2. There's no point buying DDR4 on its own because it simply won't fit into your motherboard. Even if it could, the timings and power supply would be off in ways that would make it useless. To use DDR4 memory, you'll need to do a full upgrade of your system.

The only way you can install DDR4 modules at present is by basing your system on Haswell-E, Intel's latest 'enthusiast' platform. As well as introducing the new

chip socket (called LGA2011-3), Haswell-E is the first home platform to offer DDR4 compatibility. Any motherboard based on Intel's X99 Haswell-E chipset will require DDR4 RAM. Meanwhile, AMD will support DDR4 when it releases its new Carrizo APUs and compatible motherboards, which was expected to be this year, but has recently been delayed until early 2016.

While upgrading to Haswell-E would of course result in a very powerful system that uses DDR4 memory, it'll also cost a lot of money. Crucially, the new RAM is going to represent only a tiny fraction of its improvements but a large proportion of its cost. 4GB of DDR4 RAM costs £50, which is double the price of DDR3.

Partly, that's because the first batches of DDR4 are intended for use in high-capacity systems, which means it has to be high-fidelity as well. Servers are likely to make the most use of DDR4, and it could be some time until home systems require RAM at speeds fast enough to make the price worth paying.

Between the cost and limited compatibility, DDR4 isn't going to become the industry standard any time soon, so there's no rush to get it in your system. Haswell's successor Broadwell is due in the next few months, but even that will still run on DDR3. Once again, only the enthusiast variant (Broadwell-E) will support DDR4, and that's aimed at people who demand the highest-capacity systems. DDR4 won't be supported by the standard consumer version of Intel's platforms until Skylake, which you can expect to see in mid to late 2016 at the earliest.

Ultimately, there's nothing about DDR4 that makes it an upgrade worth chasing right now. Unless you can demonstrate that low RAM speeds are causing a significant bottleneck in any particular task, DDR3 is still cheaper, more compatible and fast enough to stick with – for now, at least. **mm**

"While you can buy DDR4, a much better question is whether you should or not"

What About GDDR5?

If you're wondering how you can have DDR5 RAM in your graphics card when DDR4 has only just been released, then you're not alone – but the answer to this question is simple. The answer is that you don't.

The memory on graphics cards is actually GDDR5, not DDR5. GDDR means 'Graphics DDR' and although it sounds like a small variant of DDR, it's actually a distinct technology that's largely based on DDR3, with some enhancements that make it more suitable to graphics use. GDDR5 RAM isn't an abbreviation of 'Graphics Double Data Rate RAM (fifth generation)'; it's an abbreviation of 'Double Data Rate Type Five Synchronous Graphics Random Access Memory' – something totally outside the conventions of standard DDR's generational numbering.

Actual DDR5 (with no G) is not expected until to be available until close to the end of the decade – and that assumes the technology even lasts until then!

MOTHERBOARD UPGRADES: WHAT TO LOOK FOR

Join us as we demystify the process of choosing a new board for your PC

When considering what hardware to upgrade, it's easy to get distracted by the simplicity of adding more RAM, a faster processor or a superior graphics card. But what about your motherboard?

A fresh motherboard brings with it a host of benefits. Unlike the incremental improvements that come with RAM or CPU upgrades, a new motherboard will instantly offer extra features and expansion possibilities that weren't there before. It will quite literally remake your PC.

But the number of co-dependencies your motherboard accommodates also makes it one of the most difficult pieces of hardware to upgrade – especially if you're not building an entirely fresh PC. Current operating systems have taken a lot of the strain out of swapping your motherboard for a new one, but it's still a difficult process that requires a fair amount of understanding to undertake.

CPU Sockets

If you're buying a new motherboard, you could start by selecting one that's compatible with your existing CPU. Whether you're upgrading your chip or not, making sure you have the correct socket is important. While most hardware can be convinced to work with any modern motherboard through converters or expansion cards, nothing will let you get a CPU into a motherboard it's not designed for.

There are several sockets you'll find on a motherboard, which determine the type of chip it takes.

LGA1150 is Intel's current-generation socket, supporting almost all desktop-size Haswell chips, from the lowliest Pentium to the fastest Core i7. There's a strong chance it'll also be the socket Broadwell chips use when they're released later this year, which means a motherboard with an LGA1150 socket gives you plenty of upgrade opportunities for the future. Its predecessor, LGA1155, supports any Sandy or Ivy Bridge chip, but is not compatible with Haswell CPUs.

LGA2011-3 is a socket that supports the 'enthusiast' version of Haswell, Haswell-E. These super-fast chips use a different socket to regular Haswell chips and aren't cross-compatible. Although physically similar to its predecessor, LGA2011, this socket does not support earlier generations of chips, and it's too early to say whether Broadwell-E will use it or another one, so be wary if you're looking for this type of hardware. Again, its predecessor is compatible with Sandy/Ivy Bridge-E chips only.

If you want an AMD motherboard, there are different sockets to look for.

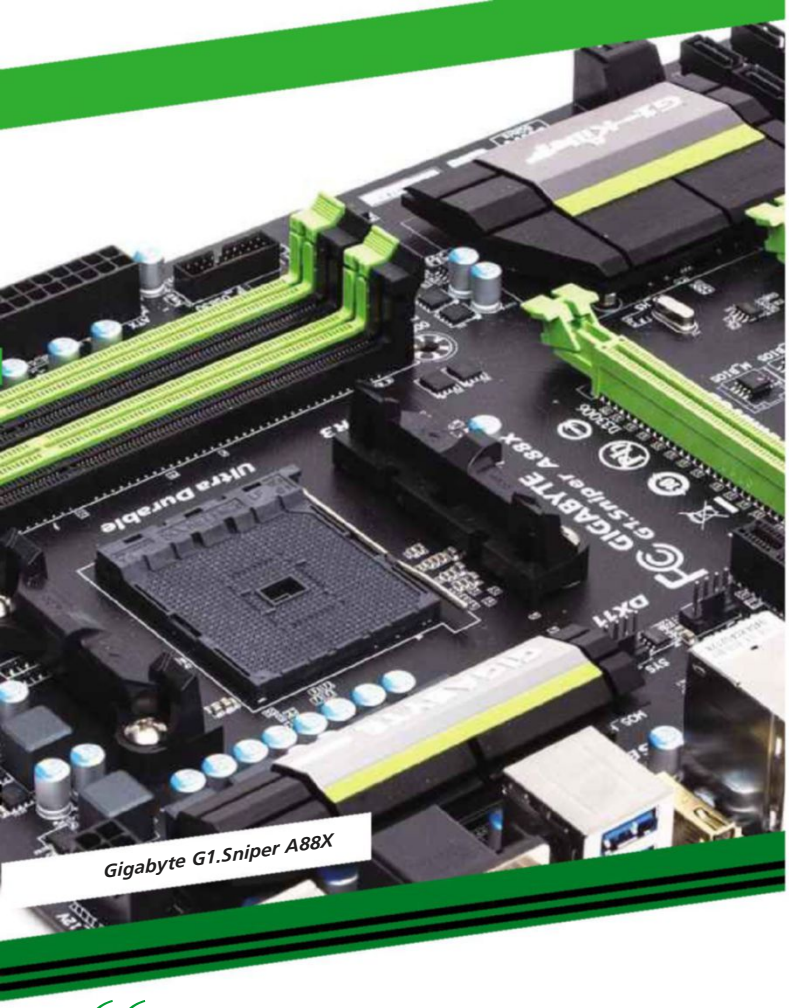
AMD's APU chips, which combined a CPU and GPU (like Intel Core chips) require a Socket FM2 or FM2+ depending on their generation. The current generation of Kaveri chips use Socket FM2+, and their successor, Carizzo, will also use this hardware. Its predecessor, Socket FM2, accepts Trinity and Richland chips but not the first generation of APUs (Llano), which used Socket FM1.

AMD also releases FX-series CPUs (which have no GPU), and at present, these all use the AM3+ socket, which is not compatible with any generation of Fusion APU.

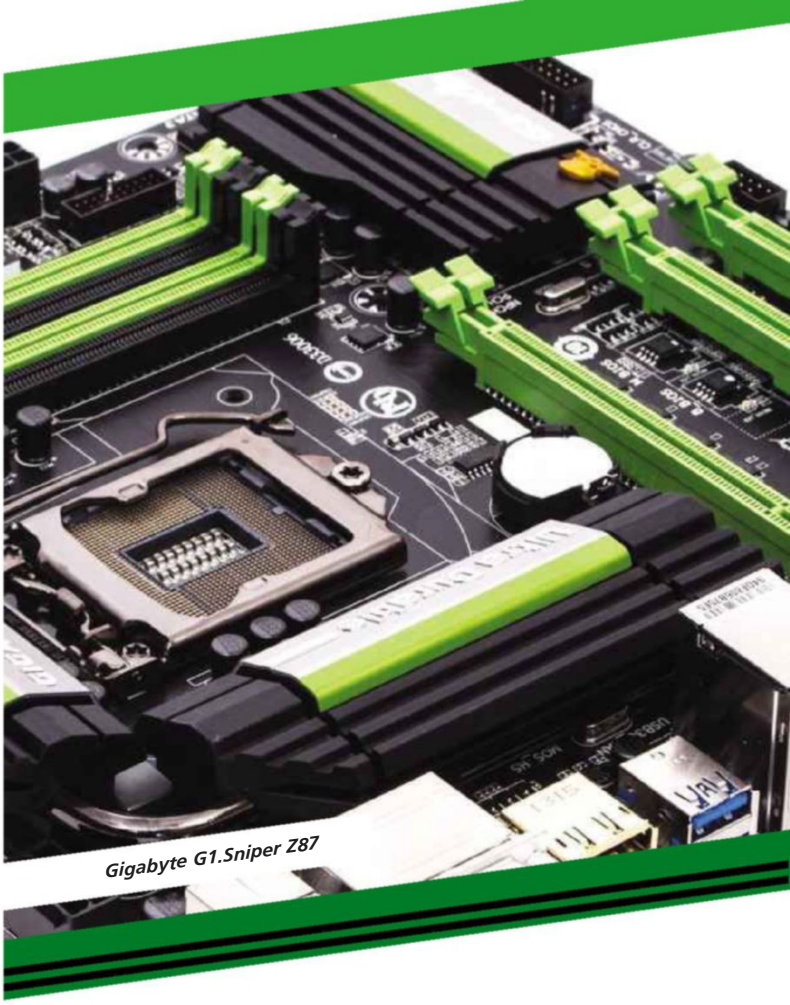
It's worth noting that Socket FM2+ motherboards can accept a socket FM2 chip, but Socket FM2+ chips cannot be placed in Socket FM2 motherboards. This makes upgrading slightly easier – if you have an FM2 chip already, you don't have to replace the CPU to upgrade the motherboard. Neither socket supports FM1 chips, and FM1 sockets only support FM1 chips.

The upshot of this is that if you're buying a new AMD motherboard, it makes sense to buy an FM2+ board. They have the most potential for upgrading and can accept at least one generation of older chips. AM3+ motherboards are acceptable if you already own an FX-series chip you wish to retain, but the technology appears to be destined for cancellation fairly soon, so as investments go it's risky.

Once you've narrowed your choices down to a motherboard that supports



Gigabyte G1.Sniper A88X


Gigabyte G1.Sniper Z87

> **The difference between manufacturers is reasonably small**

your preferred chip, there are a few other questions that need answering.

The size and capabilities of the board need to be considered, for instance. If you're aiming for a compact or low-power system (such as an HTPC or media server), then look for micro-ATX or mini-ITX boards. If you're aiming for a regular desktop PC, a normal ATX board is the standard choice. If you're aiming for power, get a board with robust overclocking features and plenty of support for cooling expansions.

The number of expansion slots is also worth taking into account. Smaller boards may only have a couple of slots, but that's fine if they're going in small systems. If you have plans for a multi-GPU setup, make sure there are plenty of PCIe slots. Some features, such as on-board wi-fi or USB 3.0, might negate the need for one of your expansion cards, so take that into account as well.

Most motherboard upgrades won't present any problems with RAM, though smaller boards may have fewer slots, so take that into account if you've currently got a full complement. There are two circumstances under which you'll also be required to buy new RAM when you upgrade your motherboard, however: if your current system is old enough to use DDR2 or if your new system uses DDR4. If you're upgrading from a DDR3 board to another DDR3 board, simply pull out your old RAM and put it in the new board and it'll work fine.

It's worth noting that in the same way that the ability to overclock isn't something featured on all CPUs, not every motherboard can do it either. If you're planning to overclock, check that the motherboard's chipset does actually support it. Some can't overclock at all, some will only allow a limited overclock on the RAM, and others – usually the most expensive chipsets – can fully overclock both the RAM and the CPU.

Price & Manufacturer

Motherboard prices run a reasonably wide gamut, from £30 for the cheapest varieties (typically smaller or older models with fewer capabilities) to £300 for the most feature-packed and advanced boards. That leaves a lot of room to manoeuvre when you're looking for the right one.

If you buy an Intel-based board, then you're unlikely to find anything using the newest chipsets for under £70. If you want something more modern, we'd recommend spending somewhere in the region of £80-£120. Above that, you're buying specialist overclocking- and performance-focused hardware that casual users don't need.

AMD motherboards start just as cheap as Intel's, but top out much lower. You won't find an AMD motherboard more expensive than £200. That makes the sweet spot for current generation purchases come in a little lower, so if you budget between £60-£90 for an AMD board, then you're sure to get something worth owning.

Once you've decided on a model and price range, you'll then have to decide which manufacturer to go for. In the long run, the difference between manufacturers is reasonably small, since they all manufacture hardware using the same chipset specifications anyway. If you're a casual user who doesn't poke around inside your BIOS or case very much, you can probably base your decision on price alone without anything to worry about. In particular, Intel's own-brand motherboards are highly recommended for buyers who want to get a good deal on the price but aren't interested in flashy design elements or additional features.

Pickier users are advised that Asus boards are often considered to have the best balance between features and reliability, but it's still a slim gap between Asus and its close competitors Gigabyte and MSI, so don't worry if one of the latter manufacturers has a feature (or price) you prefer!

Ultimately, upgrading a motherboard isn't a particularly difficult process; it just requires a few extra factors to be considered once you've made your initial decision. Don't be put off! **mm**

ARE CROSSFIRE X AND SLI SYSTEMS WORTH IT?

We look at the benefits of using multiple graphics cards

Trying to keep your PC's graphics capabilities up to a high standard can feel like being stuck on a treadmill. Even a good graphics card will only remain competitive for a year or two before it falls significantly behind the pack, and unless you have a huge amount of disposable income, the best visuals will always remain a few steps ahead of your financial capabilities.

Of course, if you want to get graphical capabilities beyond even your wildest imaginings, then running a multi-GPU system might be the way forward. It's well-documented that the best graphics cards' performance can be equalled, if not bettered, using a pair of cards instead of a single one. The power draw is normally higher, it'll take up more room in a system and it's still far from cheap, but the initial cost is lower, which means better value performance.

But is it really worth the money to run a multi-GPU system? And what are the true benefits of doing so? We've looked into it to try to find out whether Nvidia's SLI and AMD's (CrossFireX) configurations will truly give you a system worth paying for.

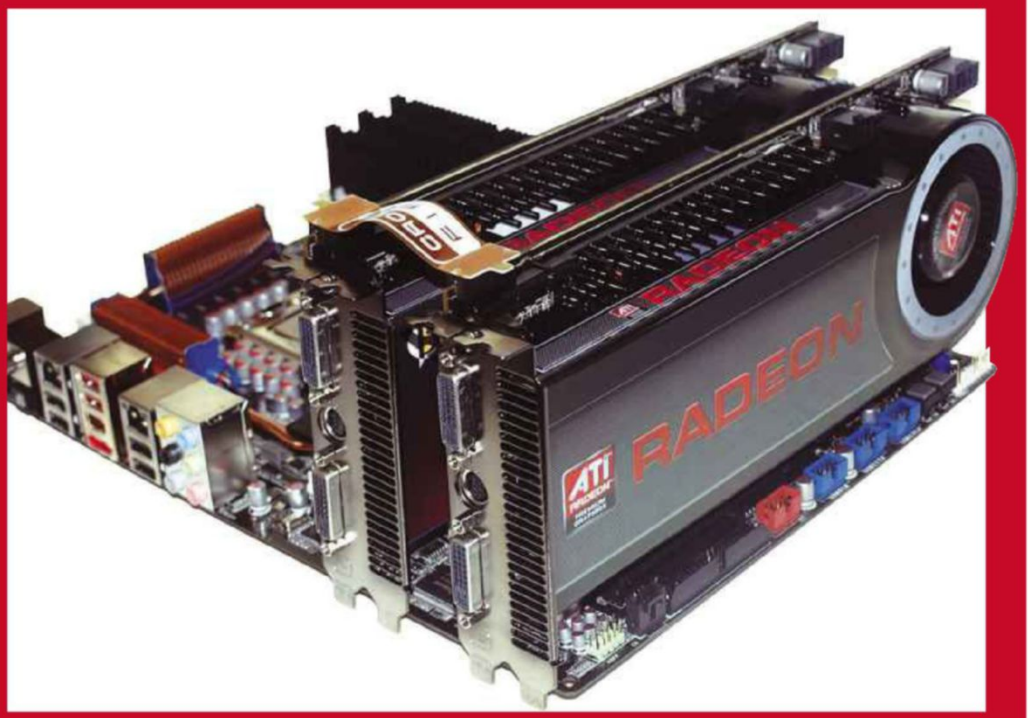
What are SLI & CrossFireX?

SLI is a proprietary Nvidia technology, which allows up to four GPUs to act as a single device, sharing and processing load between them. SLI stands for 'Scalable Link Interface', but that's not particularly important to know. The upshot is that SLI can link up to four GPUs together – hardware permitting, of course.

Contrary to a popular misconception, it isn't necessary that the exact same brand and model of card are used for SLI systems, only that both of the cards use the same GPU and have the same amount of RAM. The manufacturer, model and even GPU clock speed can all be different without causing any serious problems, though it's obviously better if they aren't. Using the same brand will minimise the chance of unforeseen compatibility issues between the hardware, drivers and software.

AMD's equivalent to SLI is a technology is known as CrossFireX and also allows for configurations of up to four GPUs to be used together, but unlike SLI this includes the on-board GPUs found in AMD's Fusion processors.

Like SLI, best practice is to use cards of the same model and brand, but CrossFireX is a little more flexible, allowing you to combine multiple



different GPUs of different brand and models. There are some restrictions – the GPUs must be from closely related lines, and they will all run at the clock speed of the slowest card, but in general you have a greater range of options with CrossFireX than with SLI.

Compared to SLI, CrossFireX also has a few advantages. The ability to use different GPUs makes it easier to create a configuration in the first place, since you can stagger your purchase of the hardware or pick up a second cheaply a few months later from a much larger selection. CrossFireX configurations also have better multi-monitor support. SLI will only run on up to three monitors at once, while CrossFireX can run on an essentially unlimited number, regardless of the resolution and display size.

Running cards in SLI or CrossFireX does require a system that can deliver the necessary power. An insufficient or poor-quality power supply will result in instability and could even potentially damage your components. If you're unsure what the power requirements are for running two cards together, you can use a system power usage calculator (www.extreme.outervision.com/psucalculatorlite.jsp) to find out how much wattage your system requires and how big a power supply you should install to meet those needs (remember to get a PSU with around 30% higher output than your system requires, to account for inefficiencies and aging).

Although performance can differ wildly between different GPUs, models and manufacturers, it's generally accepted that Nvidia SLI offers a slightly better performance increase over CrossFireX, especially at higher resolutions, while CrossFireX is easier and more cost-effective to set up.

What's The Catch?

Given the many advantages of a multi-GPU system, you might be wondering what the catch is. Well, there are a few. Multi-GPU configurations aren't magic bullets and don't necessarily meet all expectations.

Above all else, it's important to realise that using two GPUs together doesn't mean the hardware will give speeds twice as quick as a solo configuration. Indeed, you can be certain it won't, because the two cards must use some amount of processor time just to communicate and synchronise their output with one another. Overall speeds also depend on the software's ability to take advantage of extra rendering power and the presence of other bottlenecks in a system.

In the best-case scenario, multi-card setups will be about 80% quicker than one of the cards on its own. In the worst case, they might actually be slower than a single card (when the improvement they offer is lower than the multi-GPU processing overheads). Most gamers will see around 30%-50% improvements across the board, but there are no guarantees of that.

Poor multi-GPU performance is most often seen at low resolutions, when a single GPU is already capable of running at or close to full-speed. The higher the resolution, the better chance you have of seeing a gain from a multi-GPU setup – worth taking into account if you only have a low-resolution monitor.

The phenomenon of 'micro-stuttering' is also a problem. Experienced by some gamers, though inconsistently, micro-stuttering causes average frame rates to look considerably lower than the frame rates reported by benchmarking software, to the point where it may even look worse than a single card alone.

The problem only occurs on multi-GPU setups, and in particular, only in dual-GPU configurations. It is caused by a variety of factors and manifests as inconsistent frame updates, which cause the output to look jerky or jittery. Although visible to humans, the hardware sees no specific defect, making it hard to pin down and eliminate. Luckily the problem is not widespread and only affects specific cards on specific games, rather than all software and hardware generally. It's usually repaired by patches or a driver update once the problem is noticed.

In addition to their extra power requirements, multi-GPU systems also place other constraints on a system. The extra heat generated by an additional graphics card (or two or three!) means that cases may require extra exhaust fans to keep temperatures low. High system temperatures can affect the performance of both the graphics cards and other components, such as the CPU and RAM, so it's important to maintain a low system temperature if you're adding extra graphics capacity.

These extra fans (including the graphics card's on-board fans) also generate a significant amount of extra noise, so fans of quiet systems should be advised that there's no such thing as a quiet SLI system!

Despite these issues, running in SLI is generally a good idea if you can afford it. Two mid-range cards are almost always better than a single high-end card costing the same price, and while there are potentially extra financial requirements involved in buying a better PSU or new cooling components, these are good investments for the health of any system and are likely to pay off in the long term. **mm**

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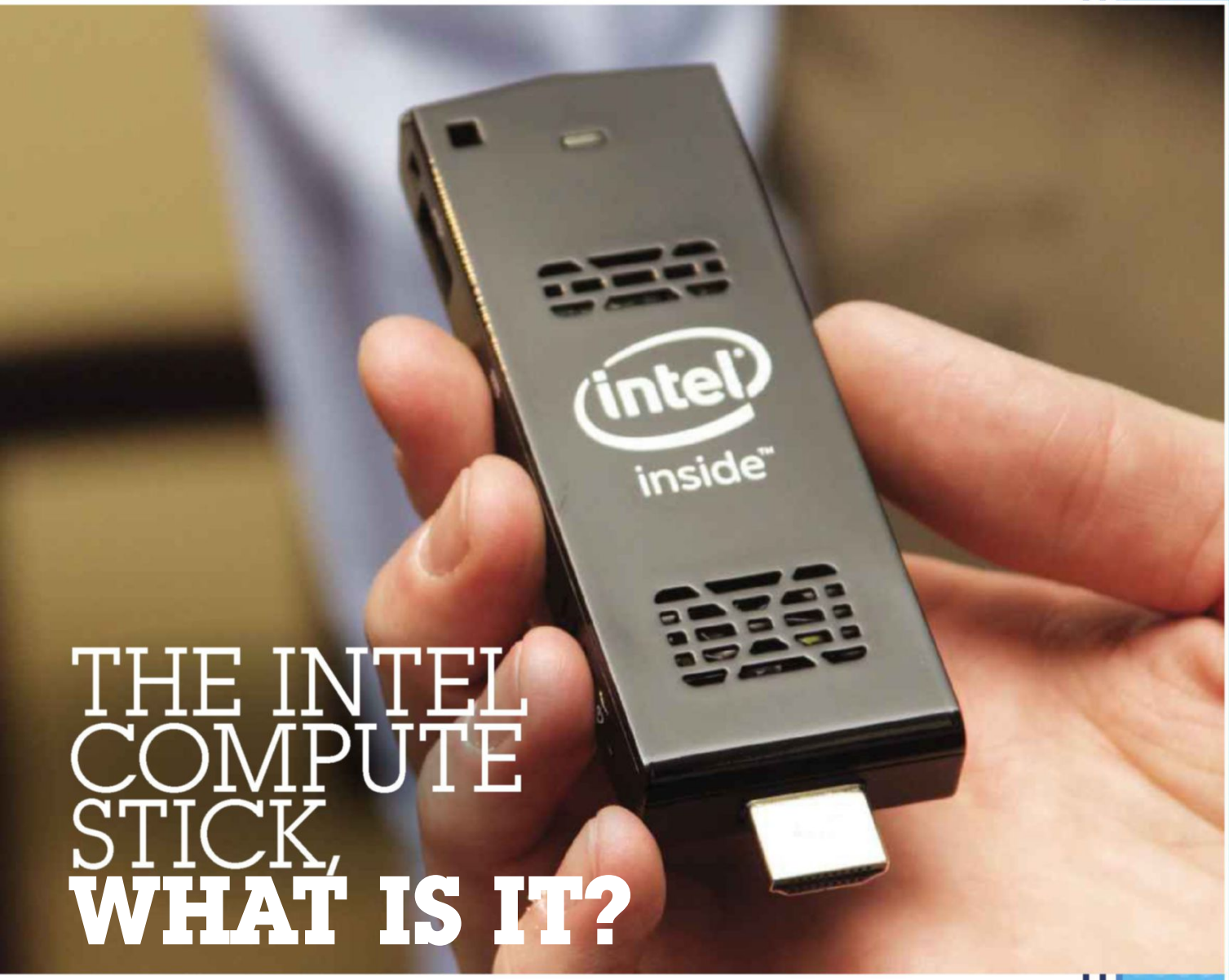


THE INTEL COMPUTE STICK, WHAT IS IT?

David Hayward has a brief look at new micro computer

ARM hardware has enjoyed substantial growth these last few years, thanks to the fact that the design processes used to make the chips are relatively cheap, and they're small enough yet also powerful enough to fit into some exceptionally tiny places.

The chief destination for ARM processors is, of course, mobile phones, but tablets and other devices are a significant factor. More recently we enjoyed ARM- and Android-powered micro consoles and handheld consoles, which again prove that you can have quad-core power in a device that's the size of your hand.

The miniaturisation of ARM technology didn't stop there either, and soon enough devices were released that were not much bigger than USB flash pens – ones that plugged directly into the HDMI port of your monitor or TV and delivered an OS on a stick, for those who wanted a smarter approach to their entertainment.

The x86 family of processors hasn't had quite as much success. True enough, there were x86 tablets before the more popular ARM-based tablets and there still are, but the numbers haven't been anywhere near as huge as the number of ARM chips sold.

ARM is dominant in the high-performance, low-power industry, which is where small devices lie. The x86 is, naturally, more dominant in the desktop and server market, so for that reason, Intel (we'll refer to x86 processors as Intel processors from this point on) has never been all that bothered about creating the sort of low-power usage chips that ARM has done since its early days. Indeed, Intel has had its fair share of low-power products, but nothing like what ARM has produced.

One CPU that Intel has produced for some time, though, that has made a huge difference in the power use of x86 architecture is the Atom. The Atom processor is a CPU that has been made purely with low power, rather than speed, in mind. As it matured over the years, Intel adopted more technology, better processes and finally, in 2012, introduced the Atom SoC (System on Chip) platform, designed purely for smartphones and tablets.

The Z-range of Atom SoC models has seen service in many different devices, from the Asus ZenFone, to the VivoTab and MeMO Pad 7. One of the latest chips, the Z3735D, is being used in the Tesco Hudl 2 and it's this architecture family we're interested in here.

“The 1GB version with 8GB eMMC storage is designed for users to install Linux on, so it’ll be somewhat cheaper”

Amid the extreme and the glorious of the 2015 CES, a device that’s not much bigger than a Chromecast took centre stage: the Intel Compute Stick. Its tablet-like hardware and presentation had journalists and consumers alike drooling, and it’s not difficult to see why.

Hardware

The diminutive device packs a fairly decent hardware punch. In its heart you’ll find a 64-bit quad-core Atom Z3735F CPU, the sibling of the Hudl CPU, which runs at 1.33GHz with a boost to 1.83GHz.

There’s 2MB of L2 cache on this processor, along with a memory bandwidth of 10.6GB/s and an SDP of 2.2W. The graphics specification is handled by an Intel HD Bay Trail running at 311MHz with a graphics boost frequency of 646MHz. While not an amazing graphical processor, the Bay Trail can outperform an Adreno 320, which is found in SoCs such as the Snapdragon 600 range. Roughly speaking, it’s about the same overall performance as a Tegra 4 GPU.

The Z3735F is based on the Silvermont Atom architecture, which packs in a number of improvements over previous Atom-based processors. For one, there’s an increase in performance – around 50% as stated on the Intel pages. And thanks to the smaller 22nm processes and the CPU being designed with tri-gate transistors, the energy efficiency of the CPU is greatly improved too, delivering a far more impressive performance-to-power ratio than previous models.

Alongside the processing powers of the Compute Stick, Intel has also packed in either 1GB or 2GB of RAM, 8GB or 32GB eMMC storage, a full-sized HDMI output, micro-SD card slot, a single USB 2.0 port and micro-USB for power. Finally, there’s Bluetooth 4.0 and built-in wi-fi 802.11 b/g/n.

The RAM and storage selections are based on two versions that Intel plans to ship, which may be very soon, depending on when you’re reading this (estimated around March). The 2GB version with 32GB eMMC storage is designed for Windows 8.1 (Bing Edition) as the core OS and will undoubtedly cost more. And the 1GB version with 8GB eMMC storage is designed for users to install Linux on, so it’ll be somewhat cheaper.

Software

Windows 8.1 may not be everyone’s cup of tea; the fact that it’s near enough universally despised has had something of a negative effect on sales, to say the least. But Windows 8.1, in terms of the file system, is a far more efficient operating system than Windows 7. Booting times and overall operation is snappier, and there’s more scope for future technologies to make use of what it can do.

It’s also slightly smaller than the previous version of Windows, so even with 32GB of eMMC storage available, you’ll still effectively have at least 25GB free for your own use once the OS is up and running. And let’s not forget that this is an x86 PC, so whatever you can install on your ‘normal’ desktop, you’ll be able to install on this device too.

Linux, on the other hand, is smaller and faster still. But again, it’s not for everyone. Those who prefer Linux over Windows will no doubt already have an idea in mind as to what flavour of the OS they’ll be installing, and for our testing we’ll probably see how the latest version of Linux Mint runs.

One more note: we’re not sure if you’ll be able to install Windows 7 or earlier if you wanted to. We imagine you probably can, but since there’s been no real-world testing yet, we can’t confirm it. If you can, though, we suspect that it’ll draw a wider audience who really don’t want to stick with Windows 8.1.

PC On A Stick

So what can you do with the Compute Stick, and is it something we should be getting a little excited over?

The enthusiast in us cries yes, we're excited. The cynic, however, sees this as just another 'thing' that potentially offers lots, but due to its lack of computing power delivers very little.

Ignoring the cynic, though, let's have a quick think about the uses the Intel Compute Stick could offer. First of all, in its Windows guise, by hooking up a Bluetooth keyboard and mouse, the Intel Compute Stick can make for a handy browser stick, portable enough to be carried with you in your pocket – although the power may be a bit bulky. Also it's a handy hot desk computer, for those who simply require basic office computing, and it'll work well in colleges and universities too, we imagine. We also imagine that when connected to a touchscreen monitor, Windows 8.1 will come into its own and work in the way Microsoft intended it to, but we'll have to wait to get hold of a Compute Stick before we can confirm that idea.

While triple-A gaming isn't going to be on the cards, there are still many older titles and independent games that can be played either stand-alone or through a browser. And while we're on the subject, don't forget the thousands of retro games available through emulation, which the Compute Stick could handle right up to PlayStation 2, Wii, GameCube and the like. Plus, as a side thought on our part, imagine the custom arcade machines you could build with a PC on a stick. There are several projects already forming in our mind.

"Amid the extreme and the glorious of the 2015 CES, a device that's not much bigger than a Chromecast took centre stage: the Intel Compute Stick"

In theory, the HD graphics should be enough to allow HD content to be streamed and played without too much difficulty. Therefore, we can assume that when connected to your LAN and with something like VLC installed, you'll be able to watch everything you have stored on your NAS drive. So effectively, this could make for a decent, tiny media centre.

The other version of the Compute Stick, the 1GB variety, will allow the user to install any version of Linux that you can install on a normal desktop. Linux being the way it is, it will no doubt work tremendously well, and there's no reason why all of the above scenarios won't work with it.

Clearly, the Intel Compute Stick has a lot of potential, and if used within the defining limits of its processing power, it'll happily do everything you ask of it. Don't hook one up and expect to be able to play *Crysis* on it, though.

The Competition

The Intel Compute Stick isn't the first x86 PC on a stick, and due to its reception, it won't be the last either. There are a few companies that have already been developing sticks based on the Atom Z3735F and similar chips, and some are already available. One of these is the MeeGo Pad T01.

The MeeGo Pad T01 is a Chinese-made PC stick whose hardware mimics that of the Linux version of the Intel Compute Stick and has been available since at least October last year. It costs in the region of $110 (roughly £78), and you'll have to factor in import taxes on top of that. The key problem, though, is the fact that you'll have to bulk buy at least 500 units before you can get hold of one. Still, at least you'll have plenty of spares.

Another Chinese-based company, Beelink, which is quite well known in the micro computing market, has for some time been developing ARM-based sticks with Android installed for smart TV use. Recently, though, it's announced that it will start selling the same kind of things as the Windows version of the Intel Compute Stick, called the Pocket P2, but with USB 3.0 instead of the Compute Stick's USB 2.0 port.

There's no word on price yet, and you won't get a lot of information from their site either with regards as to when it'll be made available.

The best competition the Intel Compute Stick has at present is the already available Hannspree Micro PC (**goo.gl/2TO9gW**).

As with the Compute Stick, this has an Atom Z3735F quad-core CPU,

Windows 8.1 Bing Edition

As you may have already read, the Intel Compute Stick is set to come installed with Windows 8.1 Bing Edition. If you're at a loss as to what exactly the Bing Edition is, then join the club. After a bit of reading up on it, though, we found out the following.

The Bing Edition of Windows 8.1 is simply the cheapest possible Windows OS to have pre-installed on any device. Previously, the cheapest edition was the Core Edition of Windows 8, but apparently when Windows 8.1 was released Microsoft changed things around a bit, because it likes doing that, and made the Bing Edition the cheapest.

How cheap is cheap, though? Well, it's pretty cheap, in that it costs nothing for a computer manufacturer to ship a PC, laptop or any other device with the Bing Edition installed.

The Bing Edition, though, has a set requirement, in that the computer manufacturers have to ship the OS with the default search engine as Bing for Internet Explorer. That's it. You, as the users, once you've got hands on the system, can change to whatever browser and search engine you like. But the manufacturer has to make sure that the OS points to Bing for internet searches.

So now you know.

with 2GB of memory, 32GB eMMC storage and Windows 8.1 installed. Display output is via the HDMI part of the stick, and there's also a micro-USB, a single USB 2.0 port and micro-SD card reader, in addition to Bluetooth 4.0 and 802.11 b/g/n wi-fi.

Pricing varies depending on where you look online, but the average seems to be around the £150 mark. For example, Office Nerd sells one for £151 (**goo.gl/R7G3Ca**) and Expansys has them available for £169.99 (**goo.gl/g0n4zp**).

Either way, the Hannspree Micro PC is available now and offers the same level of performance as the Intel Compute Stick.

Conclusion

The final price of the Intel Compute Stick is still unknown, but others have speculated that it'll be available for around $150 (roughly £98). Unfortunately, the whole dollars-to-pounds conversion thing rarely works that way when the product hits the shelves. For that reason, and based on past experiences, the likelihood is that the Intel Compute Stick will probably cost the same as the Hannspree Micro PC, at around £150. Then again, maybe Intel intends to put the cat among the pigeons and offer a PC on a stick for under £100?

Whatever the final decision is, Intel may have a bit of a battle on its hands, since the Hannspree Micro PC is already available and will have had a good head start by the time the Compute Stick is even on the shelves. This advantage could work for Hannspree, as it could be ready to upgrade it at the drop of a hat if needs be, leaving Intel trailing behind. Despite the attention on the Compute Stick so far, then, if we were the betting sort, we'd put our money on the Hannspree Micro PC to come out on top. Time will tell, no doubt.

On a personal note, if the future of x86 micro PC computing is via a HDMI stick, then we're happy to climb into that bed – just as long as we always have the option of significantly more power through our desktop PCs as well. **mm**

Component Watch

Component Watch

James Hunt picks out some deals on a powerhouse graphics cards

The Radeon R9 290 has spent a while at the top of the heap, but now that AMD is gearing up for the release of R9 3xx series cards we thought it'd be interesting to look back over the R9 290's pricing and see how it's fared. 12 months ago, these were the best in their field, all costing upwards of £300. What are their prices like now?

Deal 1: Asus R9 290
RRP: £359.99 / Deal Price: £243.95
While it was never the cheapest R9 card on the block, the Asus R9 290 has held onto its price surprisingly well. That's probably because of Asus's reputation for strong performance and high-quality components.

This card isn't particularly special – it has the 4GB of RAM found in all 290 models, it's got a GPU clocked at an impressive 947MHz and it has 2,816 stream processors, but at £244 you need to care about quality to make this worth buying. One for overclockers, perhaps?
Where to get it: Scan - bit.ly/1p3UiMr

Deal 2: PowerColor R9 290 OC
RRP: £329.24 / Deal Price: £224.99
The PowerColor R9 290 is, as its name suggests, overclocked from the reference design. That means you get a full 28 additional MHz on the GPU over the reference design. Whether that's enough to make it worth buying depends on how badly you want the fastest card available, but we should point out it's not a straight comparison – this model has just 2,560 stream processors. It is one of the cheapest R9 290s still available, however!

Where to get it: Ebuyer - bit.ly/1A0dVrm

Deal 3: MSI R9 290
RRP: £349.99 / Deal Price: £229.98
MSI's gaming series cards are geared heavily towards performance gamers, and this one is no exception. The clock is a massive 1007MHz in overclock mode, with 977MHz in gaming mode and 947MHz in silent mode (although take that descriptor with a pinch of salt). At this low price, it's definitely good enough to be worth considering over the competition's cards, especially if you're trying to squeeze as much out of a system as possible!

Where to get it: Ebuyer - bit.ly/1BjvoN6

Deal 4: XFX R9 290
RRP: £339.99 / Deal Price: £231.67
The XFX card is broadly identical to the Asus card, at least in terms of specs, so it isn't necessarily worth paying extra for; it is, after all, mostly just a reference board. That said, XFX has put its own touch on it, with a few differences: solid capacitors, ferrite core choke and a dust-free IP-5X fan.

Where to get it: Scan - bit.ly/1B2jg4x

Deal 5: Gigabyte R9 290
RRP: £369.99 / Deal Price: £219.98
Another fairly standard R9 290 card, this one at least has the Gigabyte name going for it, alongside the lowest price on the market. Few card manufacturers are as respected within the graphics card world, and if it seems like you're paying a lot for an R9 290 reference design, then remember that you're buying quality as much as power. It won't run faster than its competitors, but it might last longer and hold up better if overclocked, and at this price it has to be our first choice.

Where to get it: Novatech - bit.ly/1zOR57q

BT Inks Deal To Buy EE

Multi-billion pound deal signed and sealed

Samsung: "Don't Talk To Your TV"

Okay... This is scary

If you own a one of Samsung's Smart TV, the company that made it is warning that you should pay close attention to what you say in front of it. The idea of watching what you say behind closed doors might seem preposterous but, as the world gets smarter, it seems that our own personal space is getting ever-smaller.

While the prospect of being able to control your television via voice activation may have seemed like the stuff of Tomorrow's World, it could turn out to be a nightmare as these smart sets "listen" to every conversation and might share details of what's been said with Samsung or third parties.

With all this in mind, Samsung is effectively warning customers to avoid discussing personal information via its privacy policy concerning web-connected TVs. The details of that policy have come to light because of a Daily Beast story that published some of Samsung's wording.

Samsung has since said that no voice data is retained or sold on, but nobody likes to think of people listening in on what you're saying in the comfort of your own living room.

Kingston's Latest Sticks Adopt Stellar Encryption

DataTraveler drives promise next-gen protection

Memory stick specialist Kingston would very much like you to know all about its latest pair of DataTraveler drives. The DataTraveler 4000 Gen.2 and 4000 Gen.2 Management Ready Flash drives are most notable, certainly in its eyes, for the incredible encryption at the heart of them, protecting sensitive information with high-level security.

The 4000 Gen.2 is FIPS 140-2 Level 3 certified (that's US government security level) and additionally comes with a tamper-evident seal for physical security from prying eyes and sticky fingers. Data is protected by hardware-based 256-bit AES encryption and the drive itself is made of titanium-coated stainless steel.

The Management Ready model is much the same, but also offers optional SafeConsole management courtesy of BlockMaster, with tools such as the ability to remotely reset passwords. Both drives provide USB 3.0 data transfer rates and come in 4GB, 8GB, 16GB, 32GB and 64GB capacities, backed by a five-year warranty. Clearly, you'd have to be seriously security-conscious, and most likely a small business owner, to be interested in these – but then security features are one of the battlegrounds for memory sticks these days.

Visit **www.kingston.com** for full details of what these devices could potentially offer you.

QUICK BITS... McAfee Labs has revealed in its latest security threats report that over 300 new threats are detected every

The much-touted deal between BT and EE has finally come to fruition as BT has agreed on definitive terms to acquire the mobile network operator for an awful lot of money.

The acquisition will also mean that BT is buying an awful lot of power, as it will know be able to provide fibre broadband, mobile and traditional landline phone services, alongside TV packages. EE is a significant acquisition in itself as it has the largest 4G customer base of any European operator and BT is going to pay the handsome sum of £12.5bn for the privilege.

The conversion of the telecoms industry continues apace, then...

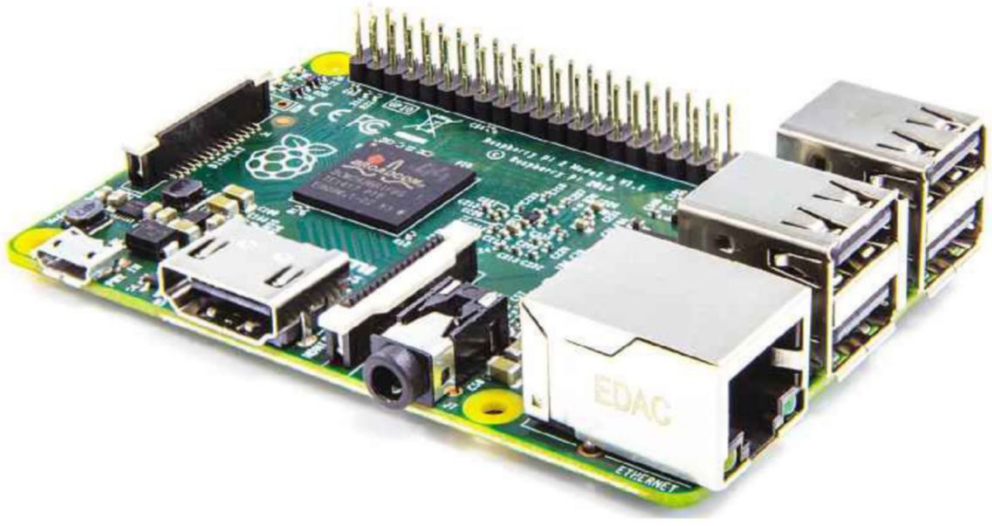
Raspberry Pi Reboots After Flash

Odd...

Last week we brought you news of the latest version of the Raspberry Pi barebones PC. Now, we have some more Raspberry news for you.

The BBC has reported that the Raspberry Pi 2 has taken to rebooting itself whenever a camera flash goes off near it. So, consequently, anyone taking a photo to show their new kit off to their mates had best make sure that flash is turned off. By all accounts, this is down to something called the "photoelectric effect", discovered by Albert Einstein. That describes a phenomenon whereby metals emit electrons when hit by light, which in terms of the Pi 2 means that some silicon junctions are malfunctioning when hit by the camera's flashes, causing the power supply to drop out. Ingeniously, one forum user's suggestion for fixing the issue is to cover up the problem cells with Blu-Tack. Brilliant.

The bug certainly hasn't impacted on its early popularity, though, with 300,000 orders in its first week of being launched.



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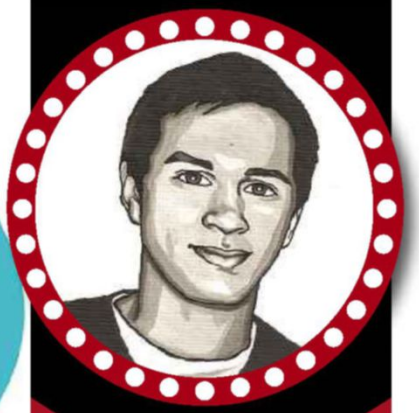


One of the best things about desktop PCs is that they're so easy to tinker with. Naturally, you want your computer to run as smoothly as possible, but when something does go wrong or doesn't behave quite as it should, solving the problem will often give you an enormous sense of achievement. And let's not forget how versatile they are, allowing us to install almost whatever we like and to change the operating system completely, if we choose.

That, of course, isn't so simple with other electronic devices, like tablets. But it's not impossible. As this week's look at custom firmware shows, there is still some scope to give your hardware a makeover. Personally, I've been using custom firmware with my devices for years now. Even my E Ink ereader had Android on it at one point.

Sadly, I don't have the ability to code this myself, so I rely on the work of other. So thanks to those guys, whoever they are. Long may they continue.

See you next time...

Anthony

Editor

Meanwhile... On The Internet...

As the ripples of Gamergate continue ever outward, the board that became synonymous with much of the aggression seen as part of it, 8chan, has hit the headlines again. This time, one of its users released documents containing personal details – including, *Ars Technica* reports, a mailing address – of one of the Silk Road trial judges, Katherine Norris (**tinyurl.com/MotI1350a**).

As a result, it seems that those behind the running of the 'Baphomet' 8chan board, notorious for such activity, decided to remove significant parts of the board's history to get rid of the data and other incriminating evidence regarding so-called doxxing. Perhaps unfortunately for them, records exist of it elsewhere – which, you'll find, is a bit of theme this week.

Honestly, if Seth Rogen had put the idea of a rousing march espousing internet censorship into one of his films, we'd have called it too far fetched. Yet, this tune (**tinyurl.com/MotI1350b**), called *Cyberspace Spirit*, is apparently very real, the work of the Chinese authorities and does exactly that. Ironically, the video of the song – apparently performed at the behest of the Cyberspace Administration of China at a Beijing Internet Association event last week (**tinyurl.com/MotI1350c**) – has become hard to come by, as those responsible seem to have had second thoughts about the wiseness of a tune that harks back to revolutionary songs of the past, and they've since gone about, well... censoring it by removing all official references to it.

Of course, this is the internet... and, not for the only time this week, it bears noting that it's very hard to hide something there.

Congratulations to software engineer Laxman Muthitya, whose report of a vulnerability in Facebook has netted him the biggest reward for such a find ever handed out by the company (**tinyurl.com/MotI1350d**). Indeed, so bad was the flaw – which exploited the Android app to allow the deletion of photo albums – that Muthiya went so far as to claim he had "the key to delete all your Facebook photos." It's a good job he's a nice guy, then, isn't it? Also: much richer now.

Facebook engineers were so worried by the flaw, described as "trivial to exploit by an attacker with little more than a script and a Raspberry Pi", they immediately moved to patch it. Ironically, for something potentially so harmful, this was done within hours.

So we can all sleep safe in our beds knowing those pics of our cat/lunch/drunken party are safe once again. Thanks, Laxman!

We've run stories similar to this one in the past (like the case of Redditor Narratto, who confessed to the murder of his sister's boyfriend via an Advice Animal Meme (**tinyurl.com/MotI1350m**), but that didn't make the story of Maxwell Marion Morton any less shocking. The grim nature of his crime makes it more so, in fact.

The 16-year-old is facing murder charges after allegedly sending a selfie picture of himself and the disfigured corpse of fellow student Ryan Mangan, whom he claimed to have murdered, to a friend over the social network Snapchat (**tinyurl.com/MotI1350n**).

Obviously Morton did this believing, as is Snapchat's unique selling point, that the evidence would promptly be destroyed, but a screengrab of the gruesome scene, taken by the recipient and later shown to his parents and police, has now become a key piece of evidence in his prosecution. It's a shocking reminder that nothing can really be considered private on social networks, but a reminder nonetheless.

It's not often that we get to feature birds of prey in the Meanwhile column, so it's only right that we take the opportunity to put that right with not one, but three, tales from the world of sky-borne predators.

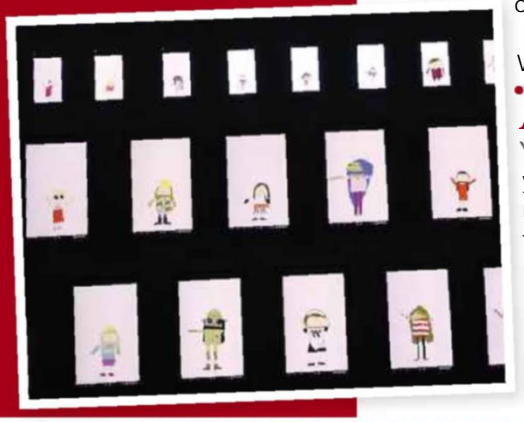
The first comes from Redditor/Instagrammer hewlandrower/Drewnold, who posted pictures and a short video showing the aftermath of a large hawk crashing through his bedroom window and, presumably in a dazed state, promptly trashing the place (**tinyurl.com/MotI1350e**). However, the reward for his tale of woe was great (at least in Reddit terms), specifically nigh-on 6,000 upvotes, 2,000 comments and one absolutely priceless picture of the a very annoyed looking eagle (captioned with NSFW language: imgur.com/PLmCRd7). The price of internet fame is, indeed, high.

Our second dose of avian antics comes courtesy of that ever reliable source of viral video, the GoPro YouTube channel, which carried this adorable video of baby burrowing owls (**tinyurl.com/MotI1350f**) getting their pop-and-lock moves down DiCaprio-stylee (**tinyurl.com/MotI1350g**) while investigating one of its cameras (**tinyurl.com/MotI1350h**). The footage, taken by wildlife photographer Megan Lorenz was not the only owl-related meme of the week, though. As befits the time of year, the **#Superb_Owl** (a play on 'Superbowl': **tinyurl.com/MotI1350j**) hashtag was rolled out again recently, with the poster kids this year being a batch of burrowing owls (**tinyurl.com/MotI1350k**) who came with their own backstory.

So, burrowing owls are a thing, then? What a wonderful world.

.AVWhy? Videos For Your Eyes... Not Necessarily For Your Brain

Google Japan has posted an absolutely astounding video showing Android phones and tablets coming together to perform a version of Beethoven's *Ode To Joy* (albeit heavily modernised) in perfect harmony. Each phone was given its own Androidify (**tinyurl.com/MotI1350o**) character, and the team used USB connections to sync all the performances together to create a mesmerising final result (**tinyurl.com/MotI1350p**), which performed for audiences in Tokyo earlier this month.



Aaaaaaaand Finally...

You know we love *Star Wars*, right? Yeah, y'do. Y'know we like a robot or two, right? So, well, imagine the reaction in the Meanwhile office when we clapped eyes on Robothespian delivering the Luke/Vader big reveal scene from *Empire Strikes Back* (**tinyurl.com/MotI1350l**). Of course, we do a better version, but for a robot he's not half bad...

QUICK BITS... A BBC Learning poll says over half of the UK's 11-to-16-year-olds have done something "risky" or anti-social online

Caption Competition

A fortnight ago, we presented you with this strange-looking show of solidarity between two of nature's greatest enemies (if the cartoons we watched as kids were true). Let's see what you thought might be going on:

- **doctoryorkie:** "New YouTube board members revealed."
- **~Wiz~:** "Pet Smart."
- **Thomas Turnbull:** "Once we sober up we will be fighting like cat and dog, but we have our memories to look at."
- **Alex Davies:** "Yes, they might seem smart, but they haven't worked out how to use a front-facing camera yet."
- **Glen Richards:** "Yeah, we've got specs appeal."
- **Ed Winslet:** "Technology: breaking down the barriers of inter-species love."
- **Ted Parsons:** "No, I wanted to interview PopCap, not PupCat."
- **Robert Wheelhouse:** "Feline fine…"
- **Sean Moran:** "Best friends fur-ever."
- **John Walker:** "In the middle of filming, they realised they couldn't find the paws button."

Thanks, all, and congratulations to our winner, Adrian Rea, who suggested, "I'm sure I googled for images of 'Datsun cogs!'"

To enter this week, head to the 'Other Stuff' section of our forum (**forum.micromart.co.uk**) and say something funny (but not too rude) about the picture below or email us via **caption@micromart.co.uk**.

Google Glass May Not Actually Be Dead After All

Rises again, according to US reports

Isn't it just typical? You report that Google Glass has been put out to pasture, only for reports to then come out that, actually, Google is starting it all up again. The perils of journalism.

Yes, according to the *New York Times* Google is indeed working once again on Glass with the project having been 'reset'. Developed internally, with far less fanfare surrounding it this time around, this new Glass will only be released once it's finished and ready for use. Google has learned from its past mistakes, it would seem.

The problem would seem to have been that by getting the general public so involved and invested in the project from the start, Google over-exposed Glass before it was truly ready to be seen. According to the report, some developers working on the project became so exasperated with this approach that they decided to leave it behind entirely.

With the new project apparently being run by former Apple guy Tony Fadell, who previously worked on the likes of the iPod, Google will be hoping for a much better outcome second time around.

Turkey Ponders Minecraft's Violence

Country investigates game

The government of Turkey is taking an interesting stance on the oh-so-popular video game *Minecraft*: it's looking into suggestions from a journalist's report that the computer game is too violent.

A minister in the government has launched an investigation into the game as it has been suggested that it leads to and promotes aggression. If this report does indeed find that *Minecraft* is too violent, then it could be banned.

The journalist behind the investigation spoke to the minister involved on how players get points for killing characters. PEGI describes the violence as "non-realistic-looking" and anyone who has played *Minecraft* would doubtless agree. So, an odd stance and we'll be keeping an eye on this to see if the country does indeed ban the game.

QUICK BITS... **Over 16 million people have registered to play Destiny, according to publisher Activision**

Snippets!

Canon's 50MP Cams!

While megapixels aren't everything, Canon has made a serious play in the digital camera market with the release of a couple of new DSLRs housing 50.6 megapixel sensors. The 5DS and 5DS R, which carry the huge full-frame sensor, are pitched at studio and landscape photographers. 50 megapixels, eh? The mind boggles, it really does.

Tech Is Queue Cue

Research has been revealed suggesting that new technology is most likely to have consumers queuing up. Indeed, one-in-five consumers admit to having waited in line to buy phones, tablets, consoles, etc. Of course, Apple was the brand that most consumers name as creating memorable product launches, thanks largely due to the iPhone and iPad – and key to these product launches were the accompanying websites, with over half of consumers wanting to see online offers and/or competitions, compared to one-in-eight who have attended a launch event for a product.

Drones Deliver Food

You've seen Flying Monkeys in the movies, now you can witness flying waiters in Singapore. No, really. Infinium Robotics in Singapore has developed the drone waiters, which can carry up to 2kg of food and drink – though it the idea of plates and bowls of hot food floating above your head doesn't weird you out, you're a better person that us. Frankly: not thanks.

These Maitre'Using infra-red sensors to make their way around a restaurant, the drones could be a crucial development as there's a waiter shortage in the country because of how low the wages are over there.

Ubuntu Smartphone Coming. Finally

Flash sales initially

Please welcome the Aquaris E4.5, an Unbuntu-powered smartphone that's finally appearing after a failed crowdfunding campaign and months of waiting. Only currently available via flash sales around Europe, it's being dripped to market so developers can gauge if there's much interest beyond the niche Linux market.

The phone, built by Spanish outfit bq, is very different to most smartphones, as the UI uses 'Scopes' to show content on one screen, so you don't have to enter an app to get at information. The core specs of this €170 dual-SIM include a 4.5", 240ppi screen, 1GB RAM and 8GB storage space.

Wi-fi Coffee Machine For Lazy, Lazy People

Brit company behind unique device

Pitched as the 'intelligent' way to make coffee, we feel this might really be the laziest way to make yourself a cup of joe. That's not to say we don't want one, mind you... Oh no.

Developed by British company Smarter, and we do love a British success here at *Micro Mart*, the iKettle wi-fi coffee machine can be controlled via free Android and iOS apps and they will inform you when the machine needs refilling and will even ask if you'd like a hot beverage when you step in your front door.

You can also set drinking schedules and even link it with a fitness/activity tracker to automatically recommend a stronger coffee when you wake up after a rough night's sleep. Kinda sells itself, right?

The machine costs £150, which is quite a lot for a coffee machine, and will be available to buy in stores in March. The smart home just got smarter. Or far, far more lazy. Paging Santa!

QUICK BITS... The government says superfast broadband is now available to four-out-of-five UK homes

Compact Speaker Packs Punch

Bluetooth 3.0 connectivity and 10m range

Portable bluetooth speakers are commonplace but, if you'll forgive us, here's yet another one.

The Bass Connect Speaker, which can be purchased from The Hut (**www.thehut.com**), promises crystal clear treble and deep bass with a Bluetooth connectivity range of up to 10 metres, making this a no-brainer for listening to your tunes around the house or in the garden. The battery life of up to five hours is decent enough for the £30 cost. As for charging after that life is up, there's a micro USB charging cable included and the speaker works on Android 4 and iOS 7 devices and better.

Qualcomm Pays Up

Massive multi-million dollar fine in China

American chip maker Qualcomm has agreed to pay the mother of all fines to Chinese authorities in order to resolve a long-standing anti-monopoly investigation.

The company is going to fork out nearly a billion dollars ($975m) to China's National Development and Reform Commission, an amount of money that represents the largest such sanction in China's corporate history. The sanction, imposed upon Qualcomm because of high licensing fees charged to manufacturers, will also see the company lower royalty rates on licences relating to mobile patents in China and adhere to a bunch of other stipulations that are frankly a bit boring to get into here.

The bottom line is that, by agreeing to this fine, Qualcomm can get on with the business of operating in China in a way that the authorities accept, potentially meaning that its processors can make their way into more devices than before. With a bigger slice of the global market the ultimate goal, this is a high price to pay for a potentially even bigger financial return in the long run.

Symantec Pay Up Too!

Patent infringement bags another victim

Imagine being happy at having to pay $17m to a company in a legal wrangle. Difficult to do, right? Yet, while we're sure the bosses at Symantec aren't exactly skipping at having been ordered to pay that sum, it sure beats having to pay out nearly $300m.

The legal case, over in America, revolved around Intellectual Ventures, a patent-holding company with over 30,000 patents on its books. A jury found that two of those patents were infringed upon and lawyers representing Intellectual Ventures wanted $299 million as compensation for those breaches. The jury, however, felt that was way too much – which, ironically, amounts to slice of relatively good-ish news for Symantec.

The Best PC Simulations Ever

David Hayward looks at some of his personal favourite sims

Simulators have taken a certain amount of flak over the years, with people mocking them for their nerdiness and poor presentation. Indeed, some of them really are terrible and fully deserve that reputation. But there are just as many fantastic simulation titles as there are bad ones, and that's what I'd like to look at here.

I love the fact that a simulator done well, regardless of whether I'm flying a plane, star ship or gently manoeuvring a several thousand ton ship into harbour, can transport me to the actual situation and fire the imagination.

Indeed, there's a lot of joy to be had from a good simulator. It forces you to use the your grey matter for once, instead of pointing a gun at a horde of the undead and pressing a mouse button. And there's usually a simulator out there for every individual's personal tastes.

Therefore, I thought I'd list a handful of my favourite PC simulator titles (I don't really regard them as games, as such, but that's up for debate), which I think covers an eclectic range of concepts and predilections.

Elite: Dangerous

I reviewed *Elite* a few weeks ago now, and as you can surmise from its content, I'm rather fond of this enormous space trading simulator.

There are many who won't regard the *Elite* series as simulators at all, but considering the level of trade, the flight, the docking, the combat and the dynamics within the *Elite* universe and political shenanigans between the title's factions, there's more of the simulation there than a simple point-and-shoot game.

Anyway, *Elite: Dangerous* is a simply amazing simulator which is capable of putting you in the seat of your choice of ship and allowing you to explore over 400 billion star systems that make up the Milky Way. It's a monstrous task trying to become the Elite, but one that's sure to suck you into the environment around you.

Football Manager

I'm not a footballer, in any way shape or form. I don't know any of the players, other than the ones who seem to be continually in the eyes of the media, and I couldn't tell one iconic ground from the next.

However, there's something about the *Football Manager* games that really captivates me and has done ever since the old days of *Championship Manager*. The fact that there are pages of stats, endless micromanagement and tactical planning is a sheer delight, regardless of the fact that I have no idea who's who and what the best formation is for a particular match. Mind you, I have no idea how celestial physics affect escape velocities, but I don't worry too much about that when playing *Elite*.

Football Manager has the necessary addictive ingredients that will keep you glued to the screen and fascinated with every aspect, while your life passes on by beyond the confines of the monitor.

Microsoft Flight Simulator

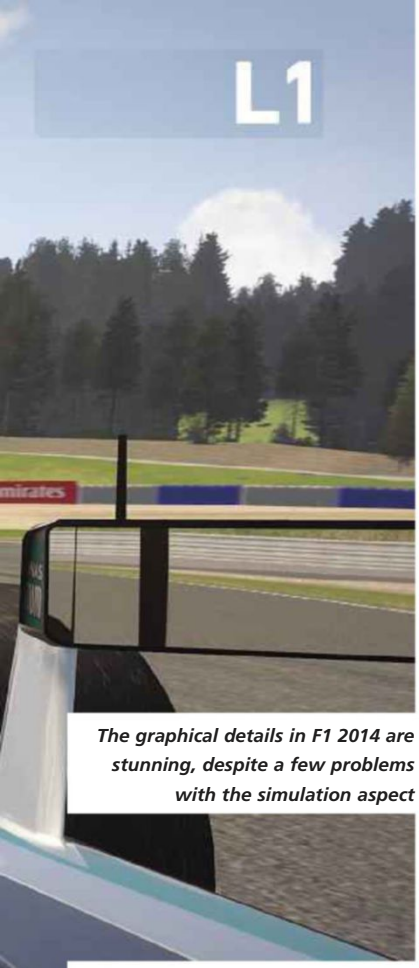
Flight sims have always fascinated me. The level of detail involved, in both the graphical splendour of the aircraft and scenery and the physical world outside of the cockpit window, is simply astonishing.

It's great to be able to pilot anything from the smallest Cessna 172m, through to the most advanced F-22 Raptor – and let's not forget the massive jumbos that require an arcane knowledge of flight dynamics.

It may not have the top slot in terms of the latest graphical features (that probably goes to X-Plane), but *Microsoft Flight Simulator* holds a special place in the heart as being one of the first flight experiences most of us had on the PC.

F1 2014

F2 2014 didn't have the best reviews when it was launched last year, and to be fair there are some problems with it. But for the F1 and racing sim purist,



The graphical details in F1 2014 are stunning, despite a few problems with the simulation aspect

Microsoft Flight Sim is quite extraordinary

The Falcon series of combat simulations still holds up well

Sid Meier's Civilisation is an epic simulation

I have no idea who any of these people are

it's one of the finest racing experiences on the PC.

It is, when you look beyond the niggles, a fantastic simulation; where the levels of detail on the tracks and the technical aspects of each vehicle are taken to an extreme degree in a package that actually makes you feel like you're a driver of a car that's engineered to such perfection it makes the machinations of NASA look simply archaic.

Hook up a good force-feedback racing wheel to your PC and you're in for one of the most exhilarating moments in PC entertainment. And if you take the time to hone your skills and build up your career path, then you'll get to drive some serious ERS-powered cars and hold your breath as your tires cling for dear life while taking a bend a little too fast.

All in all, there's a great time to be had in *F1 2014*.

Pacific Fighters

Pacific Fighters is an older combat simulator, but one that's still extremely good. The flight controls may be somewhat simplified, and graphically it's not quite up to the standards of a modern title, but you still get the thrill of the chase while trying to bring down a few Zeros.

The F6F Hellcat, a personal favourite, was a wonderful plane to fly, and you could feel its manoeuvrability when at high speeds. Likewise, it was also quite fragile, and once those Japanese 20mm cannons opened up, you knew your expiry date was fast approaching.

It is looking its age these days, but if you do manage to dig out a copy, it's worth giving it some appreciation for a few hours.

Falcon 4.0

Another older combat sim here and one that has quite the illustrious heritage behind it. The Falcon series is one of the most detailed combat sims available. There are fond memories here of *Falcon* on the Atari ST and *Falcon 3.0* on a 486 with a maths co-processor fitted to bring out the finer details – despite the inherent bugs.

Falcon 4.0 was superb, including the light bedtime reading of the 600-page accompanying manual. Every aspect of the simulation reacted to your time in the cockpit; enemy troops advanced or withdrew according to the mission you completed and what targets you neutralised. In fact, behind the scenes, this impressive war simulation was extraordinarily complex for the time.

Sid Meier's Civilisation

Are *Sid Meier's Civ* titles games or simulations? To be honest, I've always viewed them as simulations, due to the level of micromanagement and strategies involved.

The *Civ* titles have always been firm favourites of mine and, despite the latest version seeming to lose some of the essence of what makes a *Civ* title great, they probably always will be.

Whether it's the fact that you can toil over expanding your kingdom, improving the happiness of the citizens, scouring the landscape for resources and increasing your scientific and technological advantage or simply being a terrible warmonger, the feeling of wanting to be a great leader is all-consuming.

Over to you

There are plenty more favourite simulations I could mention, but I'll leave those for you to email us about. **mm**

More Notable Suggestions

War Thunder: Okay, so it's more of a game as opposed to a simulation. But if you opt for more difficult settings, then you'll soon find yourself wrestling with pitch, yaw and other simulation-like controls.

Train simulator: Personally, I find this a little dull. But each to their own and, besides, it's actually a very good simulator.

The Sims: I don't like *The Sims* and never have done. But as above, there are those who do, so it's worth a mention at least.

X-Wing and Tie Fighter: Early space combat simulator or more of a game than sim? It's up to you to decide, but I still enjoy playing these two.

Give Your Gadgets A Facelift

We look at how custom firmware can give your old gadgets a whole new lease of life

When hardware reaches a certain point in its life, it's normal for a company to declare it deprecated or unsupported. This means that it stops issuing updates and fixes for its software, and consumers are expected to move on to the next device, whether they want to or not.

But not everyone takes that lying down. If manufacturers don't want to update their devices, they reason, maybe they can. And so the hardware is adopted by custom firmware developers, who want to add new functions and capabilities to hardware that the industry has lost interest in. This practice of creating new operating systems and applications for 'closed' devices is also called 'homebrewing', and it's popular on a huge variety of consumer electronics, from obvious candidates like games consoles and routers to more offbeat items, like digital cameras.

Of course, aside from the amount of time it takes to develop firmware, nothing precludes the possibility of writing custom firmware for current devices, but manufacturers are a lot less forgiving towards that. Installing custom firmware might add new features, fix bugs and vulnerabilities and extend compatibility, but it'll also void your warranty, meaning the hardware is unsupported and unreturnable. In some cases, it's outright illegal to modify firmware, particularly if doing so bypasses copy protection.

But as much as manufacturers might protest, custom firmware is a great thing for hardware owners, and to prove it, we've been looking at some of the most popular firmwares in development today. If you have an old games console in the cupboard or an MP3 player collecting dust, why not dig them out and see whether any of these packages can turn them into something more?

MP3 Players

The increasing power and capacity of smartphones has left many

stand-alone MP3 players superfluous to requirements, but that's not a universal position. There's still a hardcore group of musi lovers who prefer a standard MP3 player for a variety of reasons. They're higher capacity, easier to manage, have a longer battery life and are less desirable to thieves – not to mention the fact that some people might just not have a smartphone.

Since most stand-alone players are now unsupported by their manufacturers, it falls to custom firmware providers to add new capabilities and features to existing hardware.

One of the most popular pieces of custom firmware for MP3 players is undoubtedly Rockbox. Originally developed in 2001 to expand the capabilities of Archos players, Rockbox has become an all-purpose MP3-player firmware upgrade capable of giving players additional support for a huge number of features and formats. Released under the GNU public licence, Rockbox is available free from its official website (**rockbox.org**), and now supports devices manufactured by Cowon, iriver, Olympus, Sandisk, Toshiba and more – including, of course, Apple iPods 1G through 5.5G, as well as certain Minis and Nanos.

In many cases, Rockbox can operate without deleting the original firmware, making it a surprisingly risk-free way to modify your player; if things go wrong, Rockbox can be erased, and the original, unedited firmware reasserts itself.

> **"The point of installing custom firmware on most devices is to give new life to aging hardware"**

Whatever device it runs on, Rockbox can add support for all sorts of features. It allows any player – even iPods – to play formats such as OGG, FLAC and WMA. It adds gapless playback, crossfading, a viewer for text and image files – it even adds games and emulators! The support for plug-ins allows for a wide range of features to be covered, as well as mixed and matched. Some older players can be upgraded with video support added, while players with microphones can be made to run on Rockbox's highly accessible voice-operated user interface, which is perfect for the visually impaired.

Unfortunately, as the release of new MP3 players has slowed down, so the development of Rockbox has slowed too. March will be the second anniversary of its last stable release, although up-to-date dev builds are available and still being worked on.

Mobile Phones

Android phones are surprisingly easy to modify in many cases, not least because Android itself is an open and open-source platform. Wikipedia lists 31 custom firmware projects for Android devices, and there are doubtlessly plenty more that aren't notable or popular enough to have made that list.

While the point of installing custom firmware on most devices is to give new life to aging hardware, Android phones are different. For the most part, new firmware is an attempt to give users greater control of a modern device, which is why some projects are even based on Lollipop, the latest release of Android. Rooting a device (as it's known) gives you greater control over all aspects of behaviour, performance and appearance. Essentially, your phone becomes as open and customisable as a desktop PC – with all the instability and unpredictability that implies.

Of the available firmwares, one of the biggest and best is undoubtedly CyanogenMod (**www.cyanogenmod.org**), to the point where it's essentially become a legitimate commercial enterprise, rather than an enthusiast project. For the most part, its default behaviour is close to stock Android, but it has some improved components like a better file manager and superior camera app included with it.

But where CyanogenMod shines is the sheer amount of settings you can change. From low-level hardware optimisation to minor UI tweaks (like adding a percentage amount to the battery indicator), CyanogenMod can do it. It's also hugely stable, thanks to a massive team of developers and testers who constantly update and revise it. It's available for loads of phone models (as well as tablets), and installation is as easy as you could like. The latest version, released this month, is CyanogenMod 12, which is Android 5.0 based.

On a different tack, LiquidSmooth (liquidsmooth.net) is a stripped-down build of Android, which is designed to get the most power out of even

the slowest hardware, which makes it good for older devices or people looking to get superfast performance out of their new one. It's not for the meek – it has the ability to undervolt and overclock your hardware, with the potential to cause damage to hardware and stress the battery, but the potential rewards are great.

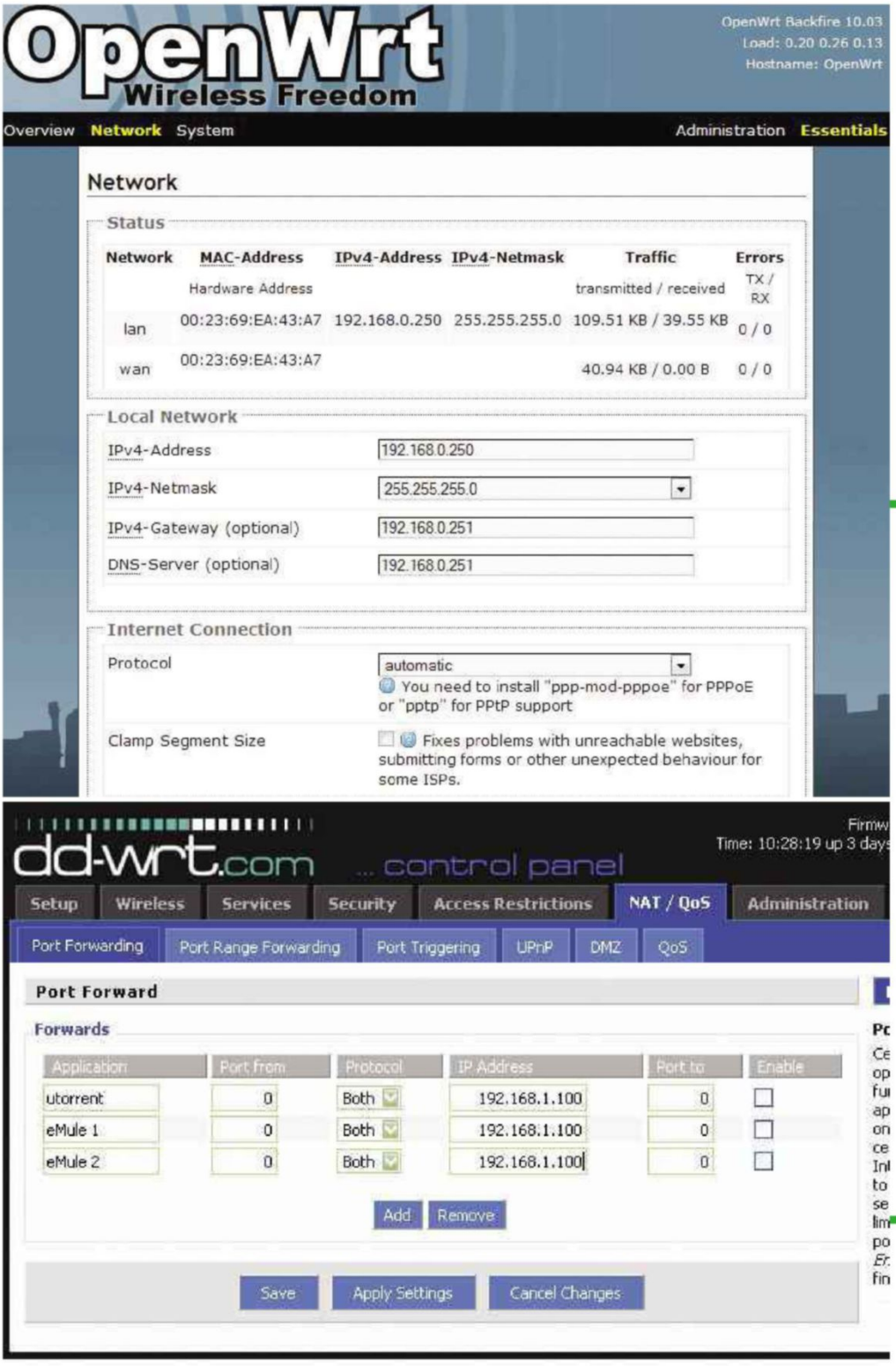
The only downside? LiquidSmooth isn't available for as huge a number of handsets as some other mods, but it is being constantly developed and is currently available as a modified version of Lollipop, so there's no huge impediment to giving it a try.

And although most custom firmwares are aimed at Android users, there is at least one, Whited00r, which is aimed at those who have an old iPhone that has been long-abandoned by Apple. Compatible with the iPhone 2G, the iPhone 3G and the first two generations of iPod Touch, Whited00r (**www.whited00r.com**) is based on old versions of iOS but adds features that bring it in line with newer ones.

These include an iOS7 look and feel, with updated icons and UI elements, updated push notification options, access to the official App Store and Cydia (the app store used by jailbroken phones) and a service called AppTimeMachine, which contains the last compatible version of applications that dropped support for older hardware. There's also an improved camera app, multitasking, a control centre and even voice control features.

Despite all this, the main aim of Whited00r is speed – keeping your hardware running as smoothly as possible, despite all the modifications. Given how slow official versions of iOS run on modern hardware, that's a feature worth treasuring.

If you hadn't guessed, this firmware isn't supported by Apple, which makes installing it a bit of a hassle and invalidates your warranty, but when the device is essentially impossible to upgrade through official channels, it's probably worth taking a chance on it.



Routers

Using custom router firmware is a good way to unlock the capabilities of a router that are otherwise closed off to you, whether because the software is old and out of date or because your ISP intentionally disabled some of the hardware's functions when it provided you with it. In many ways, it's like getting an upgrade for free. This probably explains why custom router firmware is a popular area for modification enthusiasts.

Upgrading a router requires you to get root access to the router's internal storage so you can alter the files on it. Note that this isn't the same as logging into the web backend; you want to access the actual web server it runs, which is what allows you to see the web backend in the first place. For the most part, finding out

Other Projects

Wherever you find firmware, you'll almost certainly find people trying to modify it. Here's a list of projects that, although a little too specific to cover in much detail, might interest the owners of compatible hardware.

Hummy (***hummy.tv***) – Customised firmware for Humax HDR-Fox and HD-Fox T2 freeview set-top boxes, adding features like a media recorder, remote GUI, EPG and media browser.

Fiio X5 Firmwares (***bit.ly/1yMyfxE***) – An archive of modded firmware for the Fiio X5 lossless music player, with new themes, adjusted menus and altered interface behaviour.

Buffalo NAS Firmwares (***bit.ly/1Bkukat***) – Custom firmware for Buffalo's range of networked storage devices, porting Linux and other operating systems to run on their hardware.

Wololo (***wololo.net)*** – Customised operating systems for the PlayStation Portable, allowing you to run emulators and other homebrew software on your PSP.

Make Smart TV (***makesmarttv.net)*** – A site with guides that help you convert your TV into a smart TV using secondary hardware, including custom firmware for tablets and consoles that can help with the process.

the admin login details isn't any more difficult than googling your router's make and model, but beware – if you're not familiar with a command line environment, there's a lot of scope for getting things wrong.

The world of custom router firmware is largely dominated by the Open WRT project (**openwrt.org**). It originally emerged because Linksys built the firmware for its hugely popular WRT54G model using GPL code, which meant it was obliged to release the source of the modified version, making it easy for motivated developers to alter and improve. Since the inception of the project, it has expanded to cover a much larger range of devices.

Based on Linux, OpenWRT has had several major releases, averaging one a year since 2006. The current version is called 'Barrier Breaker' (version 14.07) and supports a huge number of features, hardware-permitting, many of which are unavailable on the majority of commercial routers. Perhaps most useful is its ability to give any supported wireless device new modes, allowing it to function as a repeater, access point, bridge, portal or a combination of the same. It also extends USB support to any piece of hardware that Linux supports, so you could conceivably control your router using a USB keyboard or create a networked webcam (though you may need to install specific software on the router to do this).

The huge amount of features and massive modification potential of OpenWRT is what gives it its fans, but it's worth noting that not every router supports every function, and many models aren't supported at all. A full list of supported devices is available on the OpenWRT site.

It's worth noting that as an open-source project, OpenWRT has become the basis of multiple derivative projects. Coova Chilli is a fork based on wireless hotspot management and provision. Packet Protector is a version that adds extra security settings, including built-in antivirus. BlueBox and AutoAP are variants designed for use on the move, which scan for and then automatically connect to any open wireless connection.

But perhaps the most successful fork of OpenWRT is DD-WRT, which has even been included as the firmware on commercial routers from Buffalo Technology. DD-WRT is designed to be easily installed and configured, which makes it popular with home users – especially those with limited experience of Linux. While DD-WRT has fewer functions than OpenWRT, it caters for the needs of most home users and can prove far less time-consuming to install and activate. Unless you're a network buff, DD-WRT (**dd-wrt.com**) is the version to go for.

> **Upgrading a router requires you to get root access to the router's internal storage**

There are other customised router firmwares available that aren't based on OpenWRT at all, although many are restricted to specific chipsets and hardware. In general, the functionality offered is a subset of OpenWRT's and frequently no more convenient or capable than DD-WRT is.

One interesting project is maintained by OpenWireless.org. The group exists to encourage users to allow free network access to anyone within range in the hope of creating ubiquitous and high-speed internet access across all urban spaces. While much of the project is based on routers' existing functions, it also offers custom firmware (at this time, only for the Netgear WNDR3800 router), which is specifically used to create and administer an OpenWireless network hotspot. It is believed that other devices will be supported in the future.

The huge number of projects based on OpenWRT does mean that it's difficult to pick one to use, but the similarities packages show to one another does mean that once you've installed one, it's usually not hard to install and configure the others. If you're interested in custom router firmware, try a few out and see which you like the most. Just remember that if anything goes wrong, you may not have an internet connection available to help you fix it!

Digital Cameras

Standard digital camera firmware omits a huge number of features, often because manufacturers want to save them for higher-end devices that cost more to buy. Enthusiasts have, of course, found a way to put these features back in, using customised operating systems. Again, it can breathe new life into an aging camera or expand the capabilities of even a brand new device.

One custom firmware called Magic Lantern (**www.magiclantern.fm**) is particularly popular with photographers, not least because it can give supported devices the ability to capture RAW video – normally a feature seen in high-end devices only. It also runs off a memory card, which makes it easy to try out, as you won't have to modify (and risk damaging) your original hardware.

At present Magic Lantern only supports Canon DSLRs and is tilted slightly towards people who want to shoot video as well as photographs, with greater control over audio capture, improved focus tools, bitrate control and device/location logging on video and more besides. Photography features include exposure helpers, a software remote release, an 'astro' mode for exposures up to eight hours and more besides.

If you don't have a DSLR, however, you could try the Canon Hacker's Development Kit (CHDK). Intended to add DSLR-like features to point-and-shoot cameras, CHDK is a firmware enhancement that adds new features across all aspects of photography, from better information on your LCD display to RAW image processing, manual shutter control and HDR photos, all of which are unavailable on most point-and-shoots. A low-quality sensor will always put an upper limit on the camera's capabilities, but with CHDK you can squeeze a bit more out of it or even learn about the features before you spend your money on a DSLR.

Similar tools exist for Panasonic cameras (Ptool – **www.gh1-hack.info**) and Nikon hardware (Nikon Hacker – **nikonhacker.com**), but neither is advanced as Magic Lantern or CHDK, making Canon the hardware to look for if you're trying to improve your camera for free.

Consoles

Updating the firmware on a new games console can mean spending a lot of money in replacement hardware if anything goes wrong – not to mention that it could be considered illegal if it also allows you to bypass copy protection. At the very least, you'll void any warranty, so if your console does go belly up, you'll be left holding it with no chance of a manufacturer replacement!

However, support for aging consoles gets dropped quicker than a hot rock, so the temptation to repurpose your older hardware into something new is strong. The lure of free games and the ability to run unofficial code is undoubtedly a major factor too, but not everyone is that dishonest.

Indeed, on modern consoles, you don't really get a chance to be. Microsoft uses a system of mod-detection so complicated that seasoned hackers have yet to defeat it completely, and throughout it lifespan, thousands of mod-using Xbox 360 users woke up to find their systems permanently locked out of Microsoft's online services as punishment for breaking the

> **"Updating the firmware on a new games console can mean spending a lot of money"**

console's terms of use with an unauthorised modification.

Nintendo is slightly more forgiving than Microsoft – if you used hacked firmware on a Wii, Nintendo doesn't take specific action against you, but mandatory updates to the official firmware deletes unofficial software. For a time, Sony actively aided users who wanted to install Linux on their PS3, but that eventually changed too.

Installing fresh firmware on older consoles, however, isn't a difficult thing to do, and if you have hardware sitting in a cupboard gathering dust, it might just make something of it.

For example, Evolution X for the original Xbox is a replacement dashboard, which gives you the ability to run games and applications from any connected storage, and it runs an FTP server so you can log in from a desktop system and upload new software. It can even be launched off a CD, if you'd rather not permanently modify your console.

Similarly, Cromwell is a replacement firmware, which is actually a version of Linux modified to run on Xbox hardware. Practically speaking, it turns the Xbox into a fully featured PC and can be combined with a keyboard and mouse. Because it doesn't use any of Microsoft's code and can't run games, it's completely legal.

Perhaps the most famous firmware mod is XBMC, which began as a way to transform the original Xbox into a media centre and grew far beyond its roots to become Kodi, one of the dominant HTPC platforms in use today. The original project is still maintained as XBMC4Xbox, so if you want to turn an Xbox into a media centre, that's where to start looking.

Interestingly, the PlayStation 3 was designed at launch to run other operating systems, and for a time Sony even provided instructions for running Linux on the machine. After a time, support for this feature was removed (due to 'security concerns'), leading to (unsuccessful) class action lawsuits against Sony, but its initial inclusion ensures a healthy modding scene exists around the hardware even today.

Unfortunately for anyone wanting to modify their console, most of the homebrew software scene is dedicated to allowing systems to run pirated and otherwise hacked games, which is well outside the boundaries of legality. For this reason, there's almost no interest from manufacturers in softening their stance on modified software. Modifying consoles can still be a fun and rewarding thing to do, but you have to approach it with the full knowledge that you're essentially getting into a fight with the manufacturers – and sometimes that makes it more hassle than it's worth. **mm**

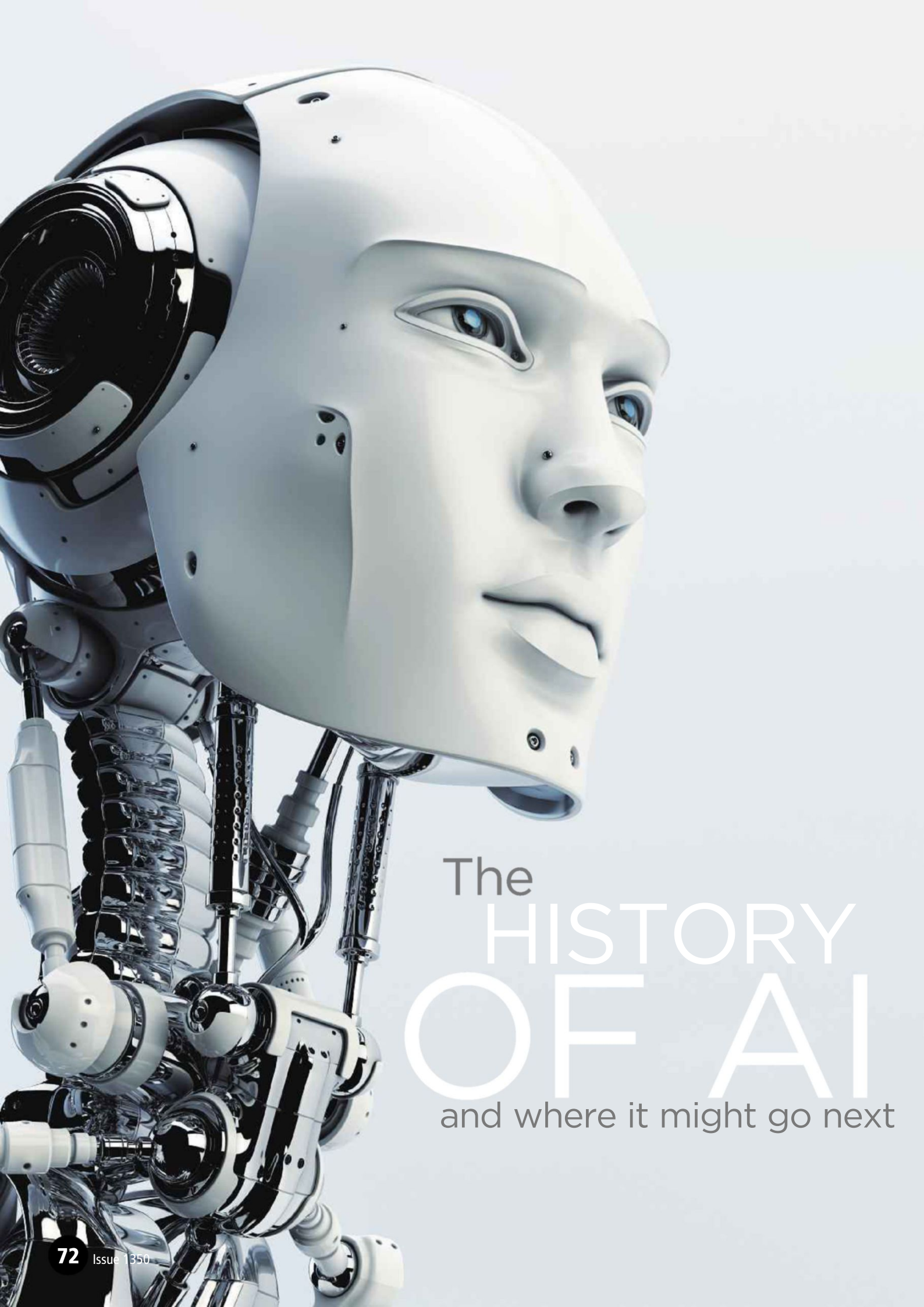
DVD Drives & Players

Custom firmware for DVD drives and DVD players is almost always designed to do one thing: remove region protections. In many cases, it's not that difficult to do once it's been discovered how, but it does almost always require a lot of work on behalf of the original modder. If the method for your particular hardware has been discovered, you're in luck; if it hasn't, there's not much you can do. Indeed, if you're planning to remove region protection, it makes sense to research the available firmware modifications before you buy any hardware.

In the case of DVD players, all you need to do is download the firmware, burn it onto an optical disc or extract it to a flash drive (if the player has USB compatibility), then put it in the drive. The software contained on the storage will take over, update the firmware, and your new capabilities will be immediately accessible.

For DVD-ROM drives, you normally need to run a firmware-flashing application from within Windows. These utilities are often available from the manufacturers' websites but must be combined with a modified ROM to deliver the altered firmware.

Either way, if you want to find a variety of custom-modified firmware with all sorts of tricks up its sleeve for your particular drive, the best place to look is undoubtedly the forums of The Firmware Page at **forum.rpc1.org**. If you can't find what you're looking for there, it almost certainly doesn't exist!



The HISTORY OF AI

and where it might go next

Artificial intelligence has been the goal of many scientists for years, with various results. **Aaron Birch** looks at its history and possible future

The idea of artificial intelligence is nothing new, and long before actual machines were created by man, people dreamed up the idea of intelligent, non-organic beings. As far back as Greek myths, intelligent machines of sorts were mentioned in tales, such as the bronze man, Talos, and other fictional beings like golems. The idea of these wasn't entirely scientific, of course, and were mere legend and myth, but the core idea was there. Thinking objects, able to decide their own actions and act on them.

Move forward several centuries, and the idea of artificial intelligence as we know it started to emerge. From the earliest complex machines and computers, the idea of thinking machines that could operate on their own has been debated and researched in earnest. One man galvanised this research, coming up with the criteria for true artificial intelligence. That man was Alan Turing.

In 1950, Alan Turing created the 'Turing Test' in a paper called 'Computing Machinery and Intelligence.' This was to be used to test any machine for the ability to exhibit intelligence and behaviour that was indistinguishable from that of a human. It's one of the very first methods of describing AI, and to acknowledge that machines could actually think for themselves. It focuses on a person's ability to tell if what they were seeing was actual intelligence or artificial. An example is a simple text-based conversation, where a judge converses with two others, one a person, the other a computer. The judge has to decide which of the two is real and which is an AI.

The Turing Test would continue to remain a central pillar of artificial intelligence research, despite many criticising it as not actually testing intelligence. In fact, recently, there were calls for a new Turing Test, but more on this later.

Also in 1950, Isaac Asimov penned the Three Laws of Robotics, and although largely rooted in science fiction and used in many stories and movies, they are considered by many to be important in the creation of AI, especially amid fears of actual computerised intelligence and the dangers it may pose. The three laws are as follows:

1. A robot may not injure a human being or, through inaction, allow a human being to come to harm.
2. A robot must obey the orders given it by human beings, except where such orders would conflict with the First Law.
3. A robot must protect its own existence as long as such protection does not conflict with the First or Second Law.[1]

These laws were first used in a short story he wrote called *Runaround*. This was featured in a story collection called *I, Robot*. Many will no doubt be familiar with this thanks to the 2004 Will Smith movie of the same name. Actual AI, however, wasn't far away.

Do You Want To Play A Game?

In 1951, at the University of Manchester, the first actual AI programs were written and ran on a Ferranti Mark 1 (also known as the Manchester Electronic Computer). These programs could play both checkers and chess, making their own moves. The programs were crude, but the computer understood the rules of the games and could act on them. The next year, IBM developed another checkers program, but this was more advanced, able to

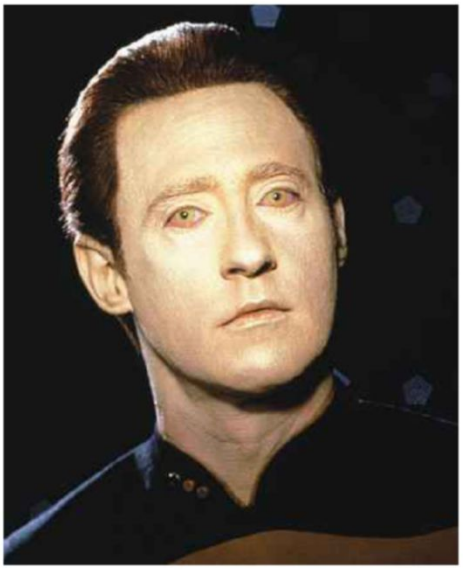
◤ *Alan Turing is seen by many as a pivotal figure in AI*

▲ *Isaac Asimov's fictional three laws are just as relevant to real life applications of AI*

◀ *Movies like Wargames shunted AI into the public eye, even if it was exaggerated for the time*

◀ *TV stars like Battlestar Galactica's Cylons helped make the idea of AI popular, even if the period mostly cast AI as evil*

◣ *AI eventually found itself as a tool for the toy market, with Sony's AIBO being one of the most famous*



actually beat an amateur human player.

Even though people had been working within the field of artificial intelligence for many years, the actual term wasn't used until 1956. This was actually coined in 1956, some time after the Turing Test's creation. It was first used at the Dartmouth Conference, where the field of AI was launched and was given the name.

Sadly, when the scientific community was picking up steam in terms of research and results, reduced funding of AI in the early 70s led to a downturn in the field, which some call the 'Winter of AI'. Interest waned, and people grew despondent about the possibilities of intelligent machines. That is, in the science world, but there was another market that was eager for more.

By Your Command

Popular media kept AI alive and kicking, with major TV hits such as *Battlestar Galactica* and movies like the *The Terminator* and *2001: A Space Odyssey* making intelligent robots stars of the screen. People loved the idea of thinking machines, especially ones cast as the villain, but even this eventually gave way to over-familiarity and saturation, and people grew tired of the idea. A second so-called Winter of AI dawned in the late 80s and early 90s, but sci-fi juggernaut *Star Trek* helped to reinvigorate people's interest with the creation of fan-favourite character Lieutenant Commander Data (played by Brent Spiner), who was a very different on-screen portrayal of AI and was an android who had the goal of becoming more human – a theme that would run throughout the TV series and the later movies.

Although just a TV show, *Star Trek: The Next Generation*'s portrayal of artificial intelligence was very different and very important. Here we had Data, who was not an evil or maniacal machine, but a good guy and one that valued humanity above all else. In terms of intelligence, he was the very embodiment of what scientists would like to actually create and one that would easily pass any and all intelligence tests. In fact, *Star Trek* itself examined this in the early episode 'The Measure Of A Man', in which Data is put on trial to determine if he's a mere machine or a life form.

Of course, this and other TV shows and movies were just fiction, but as is often the case, it was very important for real research, as popular culture can often shape real technology. The Enterprise space shuttle, for example, was named so thanks to Gene Roddenberry's series.

With renewed interest, real-life AI took a major turn for the better in 1997, one that was globally famous, when the IBM super computer Big Blue defeated world chess champion Garry Kasparov. It proved that a machine was actually capable of outthinking a human, even one at the top of his or her respective field, and was a major step forward for AI research.

Further similar events took place in the following years, including an Othello program called Logistello defeating world champion Takeshi Murakami. The late 90s also saw the first robot toys, including Tiger Electronics' Furby line and Sony's more advanced AIBO robotic pets. The first web crawlers, programs that could look for and extract information from the internet, also emerged. It's a period where AI moved from exclusivity in the lab and really rooted itself in the public consciousness. Helped by TV and film, AI was becoming a viable tool for making money.

Intergalactic, Planetary

In the early 2000s, artificial intelligence advanced from toys and board games and reached for the stars. Following Earth-based robotic endeavours, such as the Nomad's exploration of Antarctica, NASA's Spirit and Opportunity rovers explored the surface of Mars. Back to Earth, Honda built the famous ASIMO robot, a humanoid robot with artificial intelligence and the ability to walk like a human.

This was all impressive enough, but then in 2011, IBM made another leap with its 'Watson' project. Named after Thomas J Watson, the founder of IBM, Watson is a cognitive system that can read and understand natural language, is capable of dynamic learning and can formulate its own hypotheses. It's presented with information from which it can recover anything it needs and is able to be taught by users and interact with them. Its most famous outing has to be its appearance on US quiz show ***Jeopardy***, where it was able to beat two previous show winners with relative ease, amassing one million dollars. You can see much more about Watson, as well as the *Jeopardy* challenge at **tinyurl.com/ps38y54**.

Later in the same year, and although not as impressive as IBM's success, Apple brought AI to the masses with its Siri personal assistant for the iPhone 4S. This was a system that could recognise and respond to user questions and

▲ *Star Trek's Lieutenant Commander Data is one of the most optimistic depictions of possible future AI*

▲ *The Eugene Goostman chatbot passed the Turing Test, causing controversy as it did*

another big step toward bringing AI to the public.

Google also delved into the world of AI in 2012, when a Google Brain computer actually trained itself to recognise a picture of a cat from millions of images found in YouTube videos.

Arguably the most impressive feat for an AI, however, came in 2014, when the chatbot Eugene Goostman was reported to have actually passed the Turing Test, the first of its kind to do so. This occurred at a test session at the University of Reading, where it successfully fooled 33% of the judges and quickly sparked a lot of controversy. This ultimately led many researchers to call for a new, updated Turing Test. Many claimed other chatbots have had similar results (with some even being more successful). Goostman was criticised for not being a true AI but simply a well-coded program, one that was good at analysing data, rather than displaying real intelligence. Critics then went on to claim that the Turing Test wasn't good enough and was more a test to see if a machine can imitate intelligence, instead of possessing it, which isn't an incorrect assessment, as that's what Turing had in mind when he came up with it.

Despite the divisive feedback, what was so important about the Goostman Turing Test incident? Why was this more impressive than the Watson winning *Jeopardy* or Big Blue beating Kasparov or even a robot exploring Mars? Well, simply put, Goostman was able to fool people into believing it was real. This chatbot that pretends to be a 13-year-old Ukranian boy, actually appeared to be a real person – one of the core criteria of the Turing Test – and you could argue that to do this, a measure of intelligence is needed. Both Big Blue and Watson, although undeniably impressive, can't currently do this, even though they may be technically superior (we have no doubt IBM could change this). They're single-task systems, programmed to achieve one thing – winning at chess and *Jeopardy*. Goostman can, or at least appears to be able to, handle unforeseen events and can adapt to any question given to it. There have been reports of less than impressive sessions with the bot, but on the whole, it seems very impressive, regardless of whether or not it employs actual intelligence.

▼*NASA makes extensive use of robotics and AI, with Spirit and Opportunity being prime examples*

▼▼*IBM's Watson is one of the most impressive examples of problem solving and adaptive AI*

Welcome To The Matrix?

From such humble beginnings as simple stories and legends, artificial intelligence has come from the stuff dreams are made of, to machines that can walk, talk, beat people at games, explore far flung planets and even fool people into believing they're also real flesh and blood. It's a fast evolutionary tale and one that's certainly not going to end any time soon.

For a time, the focus on artificial intelligence was seen as that of creating a humanoid robot that physically resembles a real person, but this has changed in recent times into researching actual intelligence and chatbots, as well as automated phone services that can recognise and adapt to audio input. And these are just the beginning. The successes of machines like Big Blue, Watson and Goostman will be improved and elaborated on, and given the speed at which we've arrived at our current understanding of AI, we may well see more major leaps forward very soon. But in which direction?

The internet has proven that it's a perfect playground for artificial intelligence study, and we'll no doubt see more and more experiments appear. There are already many companies using chatbots as so-called 'live support', and the technology for these is getting more and more impressive.

Research on robotic machines still continues, with more and more complex and mobile results, so much so that there's a fear of a world dominated by machines. In fact, this is such a real concern that artificial intelligence experts from around the world have signed an open letter started by the Future of Life Institute that urges researchers to work together to ensure AI never grows beyond humanity's control. You can see this at **tinyurl.com/o77ll8e**.

This is an understandable fear, probably not helped by the prominence of movies and other media that paint AI as a danger, but the truth is that we're likely decades, if not more, away from actual artificial intelligence that could pose any kind of real threat. As good as current AI may be, it's a far cry from the kind of creations we see in fiction. Like so many good science fiction creations, though, there's no doubt we'll end up emulating the things we see on the silver screen. With recent concerns, however, this may well be more controlled.

If the scientific community takes such things as the aforementioned open letter about careful AI research seriously, there will likely be a more restrained and controlled development of AI. This may slow down results, much like the limitations placed on other areas, such as stem cell research, but in the end, we all know that science is rarely held back, and AI will be no different.

There are many AI and robotic projects being worked on by the military interests of the world, and robots are now routinely used in rescue operations by fire departments and are used in bomb disposal. Fitting these robots with AI could lead to even more effective results. Let's just hope the aforementioned Future of Life letter is adhered to, lest we all become human batteries. **mm**

Backupper

Prepare for disaster but hope it never happens. Roland Waddilove tries a handy backup solution

DETAILS
- **Price: £34.19**
- **Manufacturer: AOMEI Technology**
- **Website: backup-utility.com**
- **Required spec: Windows, 1 GB RAM, 1GHz processor, 110MB disk space**

Only a small percentage of computer disk drives fail, and many people never encounter a problem, but just as you wouldn't drive a car without an insurance policy that will replace it in the event of a crash, you really shouldn't use a computer without a backup solution in place that can replace the contents if it crashes.

There are many backup programs, but one you may not have heard of is AOMEI Backupper. There are several versions, and the one on test is Backupper Professional. There is a free version that is surprisingly comprehensive, but the Pro edition has a few extras that make managing backup jobs easier.

The interface has clearly been designed to be simple and straightforward to use. There are no complicated options, features or menus, and you can be backing up a minute after installing it. There are tabs down the left-hand side, and selecting Backup lists the types you can perform in very simple language. File Backup enables files and folders to be selected, which is useful for making copies of the Documents, Pictures, Videos and Music folders, and any others you want to protect.

The second option is System Backup, subtitled One-click system drive backup. This backs up the PC's internal drive, and it really is one click. It automatically selected the PC's disk as the source and a USB drive as the destination. One click set it going, and it was fast. CPU activity was minimal, but it ran the disks flat out, which made using the PC while backing up a bit slow, but the job finished quickly.

Three levels of compression are available to save space on the backup disk: backups can be split (to fit on CDs or DVDs, for example), just the used disk sectors or all sectors can be copied, the backup can be encrypted, and there are incremental and differential types that save only the changes since the previous backup. Backups can be scheduled, and the facilities are flexible, ranging from every hour to the first day of each month.

The restore facility enables you to restore all the files in the backup or just the ones you select. Existing files can be left alone or overwritten, and the location can be the same or a different one. In order to perform a full restore of the PC's internal disk, you must create a bootable CD or USB flash drive. As with all Backupper functions, it's very easy. A couple of clicks turns a USB flash drive into a bootable device, and when the PC is started with it, Backupper runs automatically. It is identical to the one in Windows, so you can easily select a backup and restore it.

The main difference between the free and Pro versions is the backup management. Old backups can be automatically removed according to rules and multiple backups merged. This enables it to continually back up to the same disk without ever running out of space.

I love the freeware version, but the Pro edition costs £5 more than the excellent Paragon Backup & Recovery 15 Home, and I would prefer it to be cheaper. **mm Roland Waddilove**

> **Three levels of compression are available to save space**

An excellent backup utility that is easy to use and works well

Toshiba Canvio AeroCast 1TB

Toshiba blends a 1TB hard drive with a wireless access point

DETAILS
- **Price: £109.46 (Dabs)**
- **Manufacturer: Toshiba**
- **Website: www.toshiba.eu/hard-drives/wireless-storage/canvio-aerocast/**
- **Required spec: Windows 7 or later, Mac OS X**

Both Seagate and Western Digital have released wireless external drives in the past year, and now it's Toshiba's turn with the Canvio AeroCast.

This sticks firmly to the same model we've seen previously, where you need an installed app to access any contents from mobile devices. Technically you can attach the drive as a mountable drive on the PC, but \\10.10.10.254\share isn't an obvious location, and a web interface might have been much more helpful.

In this initial AeroCast design, you get 1TB of hard drive storage and an SD card slot so you can easily transfer your camera images on to there for wireless distribution.

It supports six simultaneous users, and the on-board battery is rated to give you five hours of use before it needs a recharge.

Where the concept falls down is in the information it provides the user – that being practically nothing out of the box. You get a very small booklet, in which the two pages allocated to English include just four lines of text explaining how to set up the device by downloading the iOS or Android app.

Toshiba doesn't even give you the wireless password – a truly head slapping moment. This information I eventually found, along with the full manual on Toshiba's EU support website, but it's hardly an exercise in user friendliness.

The mobile applications comes with no instructions, although eventually I was able to track down some American videos on YouTube that Toshiba created that help explain some of how it all works.

The important knowledge it included is that it's possible to set up the AeroCast to work in bridge mode, allowing a mobile device to access the stored files and the internet simultaneously. And the AeroCast can also be used to stream directly to a Google Chromecast, should you also own one of those.

But the problems I had getting all this to work, like Toshiba suggested it should, were major. I loaded the drive using USB 3.0 on my PC and then expected all that content to be easily viewable on my Nexus 10 tablet. Not even the pre-loaded sample images appeared, disappointingly.

It transpired that the Toshiba Android app doesn't like the latest release of Android, Lollipop, because it did magically work on my KitKat-based Moto G LTE phone.

Those hurdles overcome, the AeroCast does what it promises, though most users might give up long before they got success.

What the AeroCast does have on its side is price, because it's much cheaper than the Western Digital My Passport Wireless 1TB and even undercuts the Seagate Wireless Plus 1TB.

If you can battle though the information void and have compatible devices, then this could well be the ideal travelling companion for long holidays, because you can bring plenty of content along and share it easily with everyone in your party.

Toshiba just needs to better explain out of the box how to use the AeroCast, and also a web interface for the PC side would also help. **mm Mark Pickavance**

Key Specifications
- **Capacity:** 1 TB
- **Wireless LAN standard:** IEEE 802.11b/g/n compatible with WEP/WPA/WPA2 security
- **Battery life:** Up to five hours
- **SD card slot:** Yes. Auto-transfer to drive.
- **USB connection:** USB 3.0
- **Mac NTFS compatibility driver:** Tuxera NTFS driver for Mac
- **Dimensions:** 124 mm x 86 mm x 20 mm
- **Weight:** ca. 260 g

A wireless capable hard drive for the technically minded user

Acer Predator XB270HA G-Sync Gaming Display

Nvidia G-Sync is the latest feature for Acer's gaming monitors

DETAILS
- **Price: £359.99 (Ebuyer)**
- **Manufacturer: Acer**
- **Website: www.acer.co.uk/**
- **Required spec: DisplayPort output running Windows 7 or later**

Computer displays are going through an odd phase at this time.

For those who like strong colours and excellent viewing angles, there are amazingly priced IPS panels. And for gamers, there's enhanced twisted nematic film (TN) technology. It might have less colour saturation and poor viewing angles, but it can also deliver the high refresh rates that gamers need to work with the high frame rates modern video cards can easily generate.

The Acer XB270HA is a TN panel made for that specific gaming market, offering a 1ms response time and a 144MHz refresh rate on a sizeable 27" screen.

What confused me initially about the review product was that it seemed to differ from the Acer Predator XB270H that I found on the Acer website. Soon the penny dropped that this 'A' version (part coded UM.HB0EE.A01) has an extra special feature. It's an Nvidia G-Sync compliant screen, critically.

What that means is that if you have an Nvidia Kepler or Maxwell GPU, then you can use a special mode where the monitor's refresh rate synchronises with that of the video card throughput, entirely stopping the tearing, lag and juddering we've long come to expect.

> **"The whole gaming experience is distinctly smoother"**

To make this possible, Nvidia built some clever electronics that the video card can directly communicate with, allowing the card to hold the display cycle until the latest frame is fully rendered before displaying it.

The compatible cards are most of the GTX 600, 700 and 900 series models, along with the GTX Titan. Few of those are especially cheap, and this monitor isn't either, so this is probably only of interest to well-funded gamers.

Having tried it, I can confirm that it just isn't marketing fluff. The whole gaming experience is distinctly smoother, and it makes big changes in frame rate noticeably less jarring.

There are, however, a few major caveats to this amazing technology, not least that it's about £90 more than Acer's core XB270H design that doesn't support G-Sync. In addition to the extra cost, Acer decided to also remove the HDMI inputs on this monitor, leaving it only with a single DisplayPort and missing DVI also.

While I entirely accept that G-Sync only works with DisplayPort, why remove the other inputs? That choice, and the lack of any speakers whatsoever, makes repurposing the screen highly problematic.

The only light on that horizon is that it did include a very nice USB 3.0 hub with four ports, reducing desktop clutter and cabling complexity.

And, on the subject of ports, if you insist on it being only DisplayPort, where is the through-port to chain the displays? The answer, I'm told, is that G-Sync doesn't support chaining, and the only way to get multi-display is to have a video card for each monitor (SLI).

Display
- **Size:** 27"
- **TN+film panel**
- **Resolution:** 1920 x 1080 Full HD
- **LED backlight**
- **Refresh rate:** 144Hz
- **Brightness:** 300cd/m2
- **Contrast ratio:** 100M:1
- **Response time:** 1ms
- **Viewing angle:** 170° / 160°

Connectivity
- **DisplayPort x 1**
- **USB 3.0 hub (1up, 4down)**

Features
- **Tilt:** +35°~-5°
- **Swivel:** +60°/-60°
- **Pivot:** 90°
- **Height adjustable:** 150mm
- **VESA 100 x 100**
- **ComfyView**
- **G-Sync**

Power
- **Power consumption on mode:** 29w
- **Power consumption sleep mode:** 0.45W

Dimensions (WxHxD)
- **640 x 408~558 x 247mm**

It's also entirely incompatible with anything similar that AMD has cooked up, in the predictably proprietary and anti-customer way that Nvidia often does things. Since what happened with PhysX, Nvidia has learned nothing, I'd assert.

> **"This costs a bundle of money purely to avoid screen tearing"**

AMD for its part has its own equivalent called FreeSync, which has been adopted by VESA as an approved component of the DisplayPort 1.2a specification.

So far, Acer, AOC, Asus, BenQ and Philips have all made G-Sync monitors, and BenQ, LG, Nixeus, Samsung and Viewsonic have made FreeSync ones.

Critically, though, AMD has also convinced three major LCD panel chip makers, MStar, Novatek and Realtek to support DisplayPort 1.2a Adaptive-Sync in their future products, expanding massively the number of displays that will support FreeSync in the coming year.

For those that prefer G-Sync, the Acer Predator XB270HA is probably the cheapest I've seen and a dramatic reduction on its original launch RRP.

Yet even at this price, this costs a bundle of money purely to avoid screen tearing, and that assumes you have a compatible Nvidia GPU handy and won't be forced to make a substantial investment there too.

Those that consider themselves serious gamers might consider it a price worth paying, though this reviewer isn't currently one of them.

Maybe if the XB270HA cost £30 more with G-Sync and had a full selection of inputs, then I'd probably be more enthusiastic, but it doesn't. **mm**

Mark Pickavance

An expensive display exclusively for hard-core gamers

XFX Type01 Bravo Mid Tower Case

XFX tries to lure gamers with its first foray into gaming case design

DETAILS
- **Price: £67.60 (Scan)**
- **Manufacturer: XFX**
- **Website: xfxforce.com/**
- **Required spec: ATX system**

Case aesthetics is a very personal thing, isn't it? The XFX Type01 Bravo case proves this point perfectly, because while it doesn't rub me the wrong way, I can see others might genuinely hate it.

It reminds me of those corrugated industrial buildings used to process minerals or cement, where there are gaps everywhere in the structure.

What is less subjective is that the Type01 Bravo can house a good sized ATX motherboard, a boatload of drives, up to eight fans and maybe even a water cooling system.

For a case that can hold as much system as the Type01 can, XFX IS selling this at a very reasonable cost, and there are tons of cute features embedded in the design.

But the first impression I had was that this is an unexpectedly heavy case, given the amount of plastic that is used throughout it. At 10.4kg, most of that mass comes from a central metal superstructure that's been painted black to match the largely plastic exterior.

As is the fashion, XFX went with a floor-mounted PSU arrangement, and that's where the air filters are placed to keep that flow clean. Three 5.25" external drives can be mounted on the front, along with a single 3.5", and internally there are removable cages for three 3.5" and five 2.5" drives. The plastic trays are a little too flimsy for my liking, but there are plenty for most people, given the preference for SSD technology over conventional drives these days.

Supplied cooling comes from a 140mm rear fan and a massive 200mm one at the front, with an obvious position for another 140mm in the roof. That might sound great, but the number of places air can enter this design unhindered makes it impossible to create any pressure discrepancy between inside and outside air, so exchanging all the warm air inside effectively will therefore be a problem.

The size of the roof opening also isn't ideal, as it's too small for the dual 120mm radiators that many closed water cooling systems now offer.

Cooling isn't a strong point of the Type01, and some other design choices are also rather suspect. One that really annoyed this reviewer was the placement of the USB and audio front ports, directly on the curved top, because users are most likely to place external drives there, where they'll then slide off and dangle by their USB cables.

Having a curved top might look interesting, but it just negates this space for any practical use. It also might lead to people assuming that this structure is for picking up the PC, applying stresses that it just isn't designed to handle.

These points somewhat undermine some of the positive aspects of the Type01, like the lovely cable management system and other system builder friendly features.

My biggest concern is that the Type01 Bravo wouldn't handle much wear and tear, and even at this price that's something to consider.

XFX should take note, because as its first case design, this isn't a fiasco, and it can only learn from its mistakes going forward.

mm Mark Pickavance

A gaming case for those who like 'different' and 'plastic'

Tesoro Kuven Pro 5.1 Headset

The Helm of Darkness is surprisingly comfortable

DETAILS
- **Price: ~£70**
- **Manufacturer: Tesoro**
- **Website: goo.gl/r05vo3**
- **Required spec: Windows 7, spare USB port**

Before we begin, Kuven, in case you're wondering, was the name for the helmet of Hades, also known as the Helm of Darkness. It apparently renders the wearer invisible to all, even the eyes of the gods, and it was forged for Hades by the cyclopes during the war against the Titans, alongside the trident of Poseidon and Zeus's thunderbolts.

The Tesoro Kuven Pro 5.1 headset unfortunately doesn't render you invisible, and we can confidently state that it wasn't forged by a cyclops – although we have been known to be wrong in the past. It is, however, a very well designed, comfortable and exceedingly good headset.

These are in fact quite a technical achievement. Each ear cup houses a set of four drivers that output one of the channels for a true 5.1 surround setup: voice, front, rear, centre and sub. As a result, each of the frequencies are outputted to a very fine degree, hitting all the right frequencies to near perfection.

The design of the headset too is good. The leather-covered ear cups are filled with memory foam and hug around the ear as comfortably as you could possibly wish for; they're also pivoted and can rotate in different directions to accommodate any ear and head size and shape. This also improves the overall environmental noise suppression, and the adjustable and further cushioned headband allows you to enhance that comfort further.

As with previous Tesoro products we've reviewed, the presentation is spectacular. The look of the headset, the decorative Tesoro-emblazoned metals plates on the outsides of the ear cups and the purple LED illumination throughout the device and its connected peripheral make for a visually impressive item to behold.

The peripheral is the desktop controller, which plugs into the headset via a custom Tesoro connector and to the PC through a micro-USB cable. The desktop controller allows you to adjust the volume levels of each of the sound channels individually by pressing the Tesoro logo button, which will then cycle through the channels as detailed by an LED. There's also a button to enable and disable the microphone and a final one to mute the audio altogether. It's a simple setup but effective enough, and the degree of control through the rotary knob is generally more than enough for most users. The more advanced audiophile will no doubt use a combination of the desktop controller and their soundcard software to achieve the best output for their tastes.

Of course, the benchmark of any headset is how well it sounds and how comfortable it is for longer periods of use. The Tesoro Kuven, thankfully, has a very good audio setup and despite the drivers being mounted so close to each other in the ear cups, the audio is surprisingly clear and manages to produce a higher-quality level of audio output. Furthermore, the microphone delivers a clear voice output and is also fully adjustable through the desktop controller. As we mentioned a moment ago, the comfort is perfectly fine and more than capable of several hours' of use.

Overall, we liked the Tesoro Kuven Pro 5.1 Headset. It has a greater range of audio control than most other headsets we've come across, and the level of engineering and design that's gone into making them as comfortable and as high quality as possible is commendable.

mm David Hayward

An excellent headset that's ideal for users and gamers alike

H1Z1 Early Access

After the apocalypse, the undead are the least of your worries

DETAILS
- **Price: £14.99**
- **Manufacturer: SOE/Daybreak Games**
- **Website: goo.gl/OA3rqQ**
- **Required spec: Windows 7 or later, dual-core 2.6GHz CPU, 4GB RAM, GTX 275/HD 6870+**

We're not cruel or callous people here at Micro Mart. In fact, despite the constant pressures of getting a weekly magazine out on time, we're actually quite well tempered. That pretty much went out of the window, though, when we came across our first 'real' person deep in the wilderness of *H1Z1*.

H1Z1, if you're not aware is the newest zombie infested MMO from Daybreak Games (formally Sony Online entertainment). It's still in the early access alpha release stage, but we were given the opportunity to see what all the fuss is about with regards to a zombie apocalypse.

It's an interesting concept and one that's become rather popular with the likes of *DayZ*. *H1Z1* throws you slap bang in the middle of America, sometime after the end of days occurred. Humanity has fallen, and what's left are numerous deserted towns, burnt out cars and houses overrun by weeds. Your job, of course, is to survive and nothing else – just stay alive.

To begin with, you have nothing but your bare fists, T-shirt, jeans and some kind of belt bag. From there, it's up to you as to how you go about finding the tools necessary to last the day. Luckily, there are enough abandoned vehicles and buildings dotted around the place that you can scavenge food, water, clothing, tools and weapons. When you locate certain objects, you can either choose to use them in the way in which they were intended, such as wearing a shirt, for example, or you can alter them to help craft something else – in the case of the shirt, it can be torn into strips to craft bandages.

Once you begin crafting various items, other objects become available. You can make bows, arrows, combat knives, axes, traps and so on. With better items at your disposal, you'll have more of a chance of lasting the night, and you can start to stave off the hunger pangs and dehydration by killing larger prey for food and using local wells for water.

Trying not to die of hunger, thirst or exhaustion is the least of your worries, though. The world is now plagued with zombies, who slowly shuffle around the world. Running into one isn't too bad, especially if you're armed; should the thing spot you, then it'll change direction and head your way. If it gets to within a few yards of you, though, the slow shuffle is suddenly replaced with a brutal spurt of speed, and it'll be on you in a matter of seconds.

One zombie is fairly easy to handle; two or three require some nifty manoeuvring to avoid being cornered. Any more than that and it's likely to be curtains for you. The undead, however, aren't all that bad, because they're fairly predictable. It's the other players you need to watch out for.

There are two main modes of play, PVP and PVE. PVE is you versus the environment, zombies and wild life. PVP is where things start to get nasty, and it provides a taste of what humanity would most likely end up like should a zombie apocalypse ever really occur.

Coming across another player, one of two things often happens. One, you both mutually agree (via voice chat) that survival in numbers is the key. The other, either one of you tries their upmost to wipe the other out. We fell foul to a few users, who practised their aim on us as opposed to the undead, and the end was swift and brutal. When the tables were eventually turned, we have to admit, with a modicum of shame, that we did enjoy using a hoard of the undead to spring a trap on some poor unsuspecting soul and reaping the rewards of doing so after.

H1Z1 has its flaws at present, most of which are graphical. But these are minor imperfections in the bigger picture, which is like a huge, open-world version *The Walking Dead*. There are lots of unique and interesting features here to be savoured and absorbed: running into a bear, for instance, hunting deer and rabbit or using them as a distraction while you sneak past a group of the undead. And of course, there's the feeling that some other player is watching you, and cautiously biding their time until they strike you down.

With these things combined, *H1Z1* comes into its own and represents a game that when fully complete will no doubt be one for your collection. For now, although problematic at times, it's certainly worth looking into for a mere £15. **mm David Hayward**

An interesting and absorbing MMO that'll certainly keep you awake at night

Mad Catz Strike M

A tiny keyboard that packs a big punch

DETAILS
- **Price: £59.99 (via PC World)**
- **Manufacturer: Mad Catz**
- **Website: goo.gl/Fs5QxK**
- **Required spec: Android 3.0 or later, Windows 7 or later, OS X 10.7 or later, Bluetooth connectivity**

With the launch of the M.O.J.O., Mad Catz is making a name for itself as the undisputed king of the Android-powered micro console. Because of the nature of Android, though, and the fact that the M.O.J.O. is really just a tablet on your TV, there comes the inherent difficulty of entering text.

The issue isn't just with the M.O.J.O.; it's with every device that's hooked up to a TV and uses some form of controller as the main method of input. A smart TV, for example, uses the remote, a PS3 uses its controller and so on. What's needed in these situations is a good old-fashioned keyboard.

Naturally, you could pair up any old Bluetooth or wireless compatible keyboard, but more often than not the size of such a keyboard is something of a turn off. The Mad Catz Strike M, however, has been designed specifically for this sort of scenario.

The Strike M is a small, stylish and capable keyboard, which is lightweight and compact enough to sit in a living room without getting in the way or taking up your lap when you choose to use it. It measures just 260 x 110 x 15mm, weighs a mere 0.197kg, and it features some pretty impressive functions.

For starters, it's backlit, with clear visibility across all the keys including the gaming W, A, S, D keys, and you can alter the brightness levels to your own tastes. It has an optical finger sensor, which acts as a kind of touchpad, and there are a pair of dedicated left- and right-click mouse buttons either side.

As well as that, there are also dedicated media controls for play, pause, skip forward and back and an integrated volume button. It's Bluetooth 4.0 and can pair with up to four devices at once, with a button to allow you to cycle through the paired channels, which are indicated by an LCD strip along one side. Just to note, we didn't have any problems pairing the Strike M with a PS3, Android tablet or PC.

The packaging comes with a micro-to-standard USB cable for charging, a foldout stand for the keyboard and a neoprene travel case, complete with the Mad Catz logo on the front. It's devilishly well designed and packaged in such a way that will undoubtedly tantalise the consumer.

The same eye for detail has been applied to the keyboard itself. The Strike M is available in a range of colours; our version was red with a black keyboard, which looked impressive indeed. Although diminutive, the keyboard has a decent tactile feel to it with 2mm travel and a 60g actuation force. This is thanks to the Mad Catz PULSE scissor key switches, which have been designed for longevity and responsiveness.

However, despite all this, the keyboard does present a slight problem. For people like us, who have giant sausage-like fingers, the microscopic size of keys make typing quite difficult. If you're simply entering a password or searching for an item, it's not too bad, as there's very little contact. Typing out anything lengthy, though, is a chore.

It's a niche device, in all honesty – one that fits snugly in the living room as a media keyboard or as a tablet keyboard, but when in that role, it's excellent and certainly worth every penny.

mm David Hayward

A great little keyboard, perfect for media centre duties and tablet-like gaming

GROUP TEST

Inkjet Printers Under £50

Although laser printing is now affordable enough even for home users, the inkjet is far from being put out to pasture, and many new ones are being produced, with great features and usability. Plus you can get them without breaking the bank.

Proving that point, David Hayward has six fine examples on test – each of which costs no more than £50.

Inkjet Printers Under £50

Canon Pixma iP2850

DETAILS
- **Price: £34.99**
- **Manufacturer: Canon**
- **Website: goo.gl/eQaEXt**
- **Required spec: Windows XP or later, Mac OS X v10.6.8 or later**

The Pixma range from Canon has proved over the years to be quite a solid workhorse and very popular with consumers. The range is, for the most part, consists of good-quality printers that tend to remain in active service for quite some time.

This particular Pixma is something of an oddity among its cousins on the shelves, as Canon has made the decision to buck the trend for multifunction printers and has released a standard printer aimed squarely at the home and SOHO user.

The Pixma iP2850 is a USB-only connected printer that's exceptionally cheap, at just £34.99. It's an all-white design that, when considered with the i-part of the title, puts you in mind more of an Apple product than the run-of-the-mill printer.

It takes just two cartridges, black and colour, with options for an XL cartridge to squeeze out a few more pages of text. On paper, the yield of the normal cartridge is 180 pages for both the black and colour, with the XL cartridges capable of knocking out 400 pages for the black and 300 pages for the colour.

The print speed was recorded at around eight pages per minute for a page full of text, while a colour photo took roughly three pages per minute. It's therefore not the quickest printer in production, but rather than rushing through the job, the iP2850 produced one of the best-quality text print we've seen in a sub-£50 printer.

Furthermore, the colour print – printed on to glossy paper – was an exceedingly high standard and quite surprising for a printer of this price. And it was fairly fast too, for a high-quality print. We even upped the details level to its maximum of 4800 x 600 for a colour glossy test, which was then printed after around 55 seconds.

The 60-page input tray flips up and settles back on its hinge to allow easy access to load up the paper, and from there you can also gain access to the cartridge slots. Overall, the entire hinge mechanism, the output tray, which slides out from the bottom of the printer, and the raised lid for cartridge access are well designed and solid enough to take a fair amount of abuse.

Obviously, depending on the environment the printer is going to be housed in, the stark white plastic may not remain very white for long. But with some care there's no reason why the printer won't be as clean and as presentable as the day you bought it.

The main issues, though, are the lack of modern connectivity and networking and the fact that there's only a single colour cartridge. The connectivity side of things can be fixed by hooking the printer up to a router or NAS drive with a USB port and sharing capabilities (print server too), but that means you're stuck with the printer in a single location. And should you run out of magenta, then you'll need to replace the entire colour cartridge.

Cost per page with the standard black cartridge, at £10.40 from Amazon, comes to around 6p per page. The standard colour at £12.15 from Amazon is around 7p per page.

micro mart
6 Quality
7 Value
6 Overall

HP Officejet 4630

DETAILS
- **Price: £41.92**
- **Manufacturer: HP**
- **Website: goo.gl/y88ePw**
- **Required spec: Windows XP or later, Mac OS X 10.6 or later**

> **“There’s a Swiss Army knife kind of functionality to it that's hard to fault”**

micro mart
8 Quality
8 Value
7 Overall

The HP Officejet 4630 multifunction printer is a product perfect for modern home offices. It scans, faxes, copies, prints, is wireless and USB connected, and has automatic duplexing. The only thing it doesn’t do is make you a cup of tea in the morning.

This particular model was actually one of the first to accommodate printing from a smartphone or tablet, and it features AirPrint, the Apple protocol from OS X Lion and iOS 4.2 onward. There’s also a scan-to-email feature, and through the wi-fi functionality you also get HP ePrint, which allows you to send a print to the printer's email address. In fact, you can administer the printer remotely if needed.

The design is surprisingly compact considering the dirty great 35-sheet document autofeeder that sits atop the printer. It’s actually quite a handy feature and one that you’ll soon come to appreciate, especially if you’re housing the printer on limited desktop space.

It’s finished in a matt-black effect, with a glossy, polished area for the front control panel. The control panel itself is reasonably simple to understand, with touchpad buttons to cycle through the various menus, a home button to return you to the start and OK to enable the highlighted selection. Alongside the LCD display you’ll find buttons for the wi-fi, ePrint or AirPrint and a rubberised number pad for the fax function.

Getting everything up and running and using the more modern aspects of the printer are also easy enough, thanks to the accompanying software. Once up and running, the printer performs well enough, with printing speeds of around 8ppm for text and 5ppm for colour, making the colour prints a little quicker than the previous Canon Pixma.

The standard black cartridge can handle 190 pages, and the individual colour cartridges (yellow, cyan and magenta) have a yield of 165 pages. The XL versions of each cartridge can offer a lot more pages, obviously, with black XL having a yield of 480 and the colours at 330 each. Price per page, based on the standard cartridge, comes out with black at £8.50 from Amazon at 4p per page. Colour, £11.19 from Amazon, was calculated at roughly 7p per page.

Finally, the print quality. Thankfully, the quality of both the text test and the photo test were very good. The lettering was clear, with no signs of stray ink blots, and the colours were generally good, although probably not as deep or rich as the Pixma iP2850.

The HP Officejet 4630 is a good enough printer for the home office worker. There’s a Swiss Army knife kind of functionality to it that’s hard to fault, although who uses faxes these days? For a price of just £42 (ignore the HP store price of £69), it’s certainly one to consider.

Canon Pixma MX525

DETAILS
- Price: £39.99
- Manufacturer: Canon
- Website: goo.gl/P623Td
- Required spec: Windows XP or later, Mac OS X v10.6.8 or later

This is the second Pixma in this group, and rather than being a single-use printer as before, this time we have an all-singing, all-dancing multifunction device that's crammed full of features.

The Canon Pixma MX525 is the direct competitor to the HP 4630, in that you can copy, scan, fax and print, with support for smartphones and tablets, along with Apple AirPrint and internet printing from any device and location. It also goes one step further and adds support for cloud technologies, allowing you to scan directly to your Dropbox account and the Pixma cloud.

As before, there's a 30-page automatic document feeder sitting on top of the printer, but this time it's in a nicely designed and compact manner that doesn't feel like it's simply bolted on as an afterthought. In fact, the entire design is compact and would fit comfortably on a desk without getting in the way. However, the plastic did feel a little cheaper when compared to the HP model we just looked at. It wasn't anything too bad; it's just the chassis of the printer wasn't particularly great.

Connectivity is certainly taken care of here. There's USB, fax phone sockets (RJ11), wi-fi and Ethernet, and there's also a 62mm colour LCD screen to navigate through the menus with. The control panel itself is spread across the front of the printer, with various buttons to directly enable or disable certain functions or to switch the printer to scan mode, for example.

Naturally the software can handle all of this without you needing to interfere with the buttons and, as before, you can also administer this printer remotely should the need ever arise.

The MX525, like its iP2850 relation, uses a pair of cartridges: a single colour and single back. As we mentioned before, this can be both a blessing and a curse, in that the overall cost is somewhat lower per cartridge, but depending on the volume you print, you may need to buy more colour.

Print speeds were roughly the same as the previous printers we've already looked at, with text being about 8ppm and the colour glossy being 3.5ppm. In terms of yield, both the standard black and colour carts will cope with 180 pages, whereas the XL versions will yield 600 and 400 pages respectively. The cost per page of the standard black, with a £10.72 cart from Amazon, is 6p; the standard colour cost per page, at £15.12 from Amazon, is 8p.

The print quality is good, probably about the same as the HP Officejet 4630, but with the colour being a touch better, deeper and richer. It was, though, not as good as the first Pixma we reviewed.

Overall, the Canon Pixma MX525 is a great multifunction printer. There's a touch more technology involved than the Officejet 4630, and the print quality is slightly better too. Plus we found this model being sold for just £39.99, which is pretty amazing considering what you get. The only real negative, which is minor, was the cheapish feeling of the plastic body. That said, as long as you don't stand there fondling the printer, you'll never notice.

HP Deskjet 1510

DETAILS
- Price: £29
- Manufacturer: HP
- Website: goo.gl/qHo7tb
- Required spec: Windows XP or later, Mac OS X 10.6 or later

The HP Deskjet range of printers have been around for what seems like an eternity. The old saying that you're never more than six feet from a rat could also be applied to HP Deskjets, as they seem to be the choice of printer for nearly every small office and home in the known universe.

The reason is, of course, that they're generally cheap to buy, cheap to maintain and can take a surprising amount of abuse before they go on to that great recycling plant in the sky or wherever it is these things go once they leave your possession.

The HP Deskjet 1510 is no exception. Although it's a pretty unassuming looking printer, it's designed to be a simple as possible while still offering basic multifunctional duties for as little as £29 (from the HP shop).

It can scan, copy and print up to 60-sheets from the flip up paper tray, while spitting the printed documents out through the pull down tray at the bottom of the printer. The control of the printer is pretty simplistic; there's no fancy LCD display like we saw on the last couple of examples and, of course, since this is USB only, there are no e-related functions or smartphone abilities. The control panel, therefore, is just a press pad affair for power, cancel job, and mono and colour scans. It works, but we did find that we needed to really give the pad a good push to activate the button. It put us half in mind of getting the hit-and-miss keyboard of a ZX81 to work.

It actually uses the same HP cartridges as the previous HP model we reviewed, the 301 range, with a single black and single tri-colour cartridge, so the cost per page and yield are exactly the same as before. However, the print speeds differed wildly.

Text printi came in at around seven pages per minute, with colour being measured at an astonishingly slow less than 1 page per minute, it actually took about three minutes for the print to finish. We're not sure why it took so long to spit out a colour print, the same colour photo that we've used on the other printers, but for some reason or another the printer decided to stop midway through the print and take nearly 50 seconds to contemplate what it was doing next.

As for print quality, the HP 1510 wasn't brilliant. A page of text was readable – there were some smears and a dab of loose ink at some points, but the text on the page was okay. It wasn't as sharp as the previous printers, and the same goes for the colour print. Although the quality was okay, it just wasn't up to the same kind of standard as the previous HP or the two Canons we've already tested.

So despite the low initial cost, it really isn't worth the hassle, and you'd be better off just spending more on one of the other printers in this group test. The multifunction elements work well enough, but slow printing and poorer quality means you'll be left wanting sooner rather than later.

> **"Despite the low initial cost, it really isn't worth the hassle"**

HP Envy 4507

DETAILS
- **Price: £49.99**
- **Manufacturer: HP**
- **Website: goo.gl/MWuOVh**
- **Required spec: Windows XP or later, Mac OS X 10.6 or later**

The HP 4500 range of multifunction printers were very much the darling of the high-street electrical store's shelves early last year. This was the newer range of inkjets from HP covering 2013/14, and for the most part they did a reasonably good job and flew off the shelves quick enough to replace the older Deskjet 3500s.

This is a fairly slim, low-profile, all-in-one printer offering print, copy and scan functionality. In terms of connectivity, there's USB and wi-fi, with Apple AirPrint and HP ePrint support. As with the Officejet, you can also send documents to print via your smartphone or tablet and, if needed, you can also administer the printer remotely.

It's a fairly discreet unit, looking not too dissimilar to the HP Deskjet 3520 that came out earlier in 2013. The same kind of LCD is used, as are the touch-sensitive buttons for navigating the system menu, enabling a highlighted function or going back to the beginning with a home option. There's also the same three wi-fi on/off, help and ePrint buttons as you'd find on the Officejet 4630.

Unfortunately, we found the Envy 4507 to be a little too cheaply produced. The quality leaves a lot to be desired, and there were plenty of times where the paper was fed through the printer at an angle, which then caused all manner of problems when it came back out again. It was also the only printer to actually jam from the word go. The first print sent through scrunched up like a concertina and proved to be quite the pain to unfold and clear away. After that, the rest of the pages were left with a slight fold along the top or with some ink smudges.

The text test we ran saw a print rate of around eight pages per minute; the colour managed to score a faster than normal five pages per minute. The quality of each, however, was less than average. The text was a little faded and not anywhere near as sharp as the other printers, and the colour was pretty drab and felt washed out.

The print cartridges used are the 301 range, once more, which means you'll get the same as the Officejet 4630.

This model is priced toward the top end of the group, averaging out at around £49.99. Considering we've already looked at better-quality printers, with better functionality and better printing, there's not much here to recommend this printer.

Canon Pixma MG4250

DETAILS
- **Price: £49.99**
- **Manufacturer: Canon**
- **Website: goo.gl/pl4Uvj**
- **Required spec: Windows XP or later, Mac OS X 10.5 or later**

Canon Pixma MG4000 printers are the middle rung of its home and SOHO multifunction range. They generally offer better performance and are quite heavy duty machines used for mid-volume printing and scanning.

The Pixma MG4250 is the follow-up to the MG4150 from early 2012, and aside from the design of the chassis, this model having a matt-black finish as opposed to the glossy piano black of its predecessor, there's really very little difference between the pair.

This is a print, copy and scan device with wi-fi and USB connectivity, Apple AirPrint, Pixma Cloud print and Google Cloud Print support, as well as a memory card reader and automatic duplex printing.

The design is very robust and features some neat extras to help tantalise the consumer. For one, there's a full colour 62mm LCD located in the top corner, which can flip up and display the relevant printer menus and controls, as well as a preview of the contents of the memory card – although for some reason, we couldn't get this feature to work. Below the LCD are an array of control buttons to navigate through the menus, increase the number of copies, select colour or mono prints and copies and cancel any jobs, among other things.

The input tray can handle up to a hundred sheets and is fed through the front pull-down panel. This too is remarkably well built and feels like it has been manufactured to a much higher standard than some of the other printers we've already looked at.

> **"A great home and office printer, and its build quality is second to none"**

Our full text page test measured the printing speed at around 8.5 pages per minute, with the colour taking longer at two pages per minute. Although it's not the fastest printer, the quality of both the standard text page and colour were excellent. The text stood out, with visibly sharper lines and edges to the lettering, and the colours were deeper, richer and far clearer than anything else so far.

The standard black and tri-colour cartridges offer 180 pages each, with the option for high-yield versions to be fitted that can take those numbers up to 600 pages for the black and 400 pages for the colour. In terms of cost per page, the standard black cartridge costing £10.72 from Amazon will set you back roughly 6p per page. The standard colour cartridge, priced at £13.46 from Amazon, comes to 7p per page.

The Canon Pixma MG4250 may not be the fastest printer on test, but it has by far the best quality print. It costs toward the upper end of the group limit, at £49.99, although we have seen some examples going for around a fiver cheaper.

Al in all, this is a great home and office printer, and its build quality is second to none. Running costs are reasonably cheap, although we still have a problem with the tri-colour cartridges, which seems to be the norm these days.

Canon Pixma MG4250

The Canon Pixma MG4250 had the best quality prints and was superbly built too. For the price, you couldn't ask for better. Plus you get a card reader and all the benefits of having network connectivity as well as mobile, cloud and e-printing.

Canon Pixma MX525

The Canon Pixma MX525 just managed to pip the HP Officejet 4630 to the Highly Commended post this time. There were a few extra touches we liked, and the print quality was a little better.

How We Tested

Each printer was hooked up to a Windows 7 PC via USB, as well as connected to a home network where possible. We ran a five-page full text print, along with a five-page colour photo and a high-quality glossy photo. And, where possible, we tested printing from a smartphone or tablet.

	Canon Pixma iP2850	HP Officejet 4630	Canon Pixma MX525	HP Deskjet 1510	HP Envy 4507	Canon Pixma MG4250
Price	£34.99	£41.92	£39.99	£29	£49.99	£49.99
Dimensions	426 x 235 x 134mm	445 x 331 x 188mm	458 x 385 x 200mm	425 x 552 x 252mm	445 x 334 x 120mm	449 x 304 x 152mm
Weight	2.3kg	6.2kg	8.7kg	3.6kg	5.49kg	5.7kg
Connectivity	USB	USB, wi-fi	USB, wi-fi, Ethernet	USB	USB, wi-fi	USB, wi-fi, card reader
Mobile/Tablet Printing	No	Yes	Yes	No	Yes	Yes
Cost Of Standard Black Cart	£10.40	£8.50	£10.72	£8.50	£8.50	£10.72
Cost Of Standard Colour Cart	£12.15	£11.19	£15.12	£11.19	£11.19	£13.46
Cost Per Page Black	6p per page	4p per page	6P per page	4p per page	4p per page	6p per page
Cost per page colour	7p per page	7p per page	8p per page	7p per page	7p per page	7p per page
Tray capacity	60-sheets	35-sheet ADF, 100-sheets	30-sheet ADF, 100-sheets	60-sheets	50-sheets	100-sheets

Your Letters

Small Things

I find it amusing when people complain that tablets and smartphones aren't somehow 'proper' computers. Why? Is it because the hardware can't be upgraded? If so, then I put it you, sirs, that the same goes for the majority of laptops. Do they no longer count as computers?

Of course they do, so what does that leave us with? The software? Well, if you have an Android device, you can install loads of different variations of that operating system, and they're not all produced by Google.

So it must be their size. The mobile haters must be getting their knickers in a twist over the fact these devices are smaller than PCs, as if the miniaturisation of technology hasn't been going on for decades already. Guess what? The kind of computing power you have in your home computer would have been enough to fill several large rooms in the 1950s. So because it's smaller than it used to be, does that mean your PC is some kind of abomination?

Should we go into our local computer shop, eye up the PCs and then tell the shopkeeper "Well, there are no vacuum tubes, so they're not 'proper' computers, are they?"

Of course, there's a chance you do actually say thing like that, in which case, I tip by bowler hat to you and say "How do you do?"

Chris Lloyd

Artificial & Unintelligent

First, thanks for the mag – I buy it every week without fail. Now for the nitty of the gritty, and the question that seems to be on many lips at the moment: are computers about to turn against us and take over the world?

Seems a bit far fetched to me, but that seems to be what some people are telling us: warning the world that artificial intelligent could in the future decide that human race is no longer necessary and then simply do away with us.

Am I scared? Not at all. Come on, people! It's just not going to happen.

Computers can only do what we tell them to do, and unless we tell them to kill people, they're not going to do that. Also, computers only carry out tasks because they're asked to, because we need things doing. They themselves have no desires – and even the most seemingly intelligent AI doesn't really want anything. It can, of course, act like it wants something, but only if someone programs it that way in the first place.

Basically, at the end of the day, I don't foresee a time when we create a truly intelligent computer, and ultimately the only danger we face is from other humans – as usual.

Ian Stone

> **"They can't treat their customers like idiots, because even the real idiots wise up"**

What I Think Of Ink

In this day and age, printing is something of a dying art. Everyone's moving towards paperless offices, and people just take their digital photos and look at them on services like YouTube.

Not me, though, I like to print my photos and put them in albums, just like people did in the olden days (or at least before 1995).

I don't have a ton of money, though, so I have a pretty cheap printers, and as well as not using the 'official' photo paper, I also use refillable ink cartridges, because the official ones are much too expensive. Now, the printer's manufacturer (I won't name names) disapproves of this, and in the user manual, it very sternly warns against non-official inks, because they could block up the printer, causing untold damage and grief.

I'm not going to say I haven't had any problems with blockages, because I have, but I don't know if they're the fault of the cheap ink. What I do know is that on the one occasion it became too broke to fix, I just bought a new printer, because it was cheaper than buying even one set of official ink cartridges.

I'm no eco warrior, but even I'm aware of how incredibly wasteful this is, but I can't justify paying what the printer makers are asking for their ink. It's frankly a ridiculous state of affairs, and I fully lay the blame at their door. When will they learn that they can't treat their customers like idiots forever, because even the real idiots wise up after a while.

Bob Catford

GET IN TOUCH...

By email
letters@micromart.co.uk

By post
Micro Mart
30 Cleveland Street
London
W1T 4JD

Online
forum.micromart.co.uk

The Download Directory

James Hunt scours the internet for the best freeware,a shareware and paid-for application releases

Welcome again to the latest instalment of The Download Directory. This month's applications include Ocster Backup, a personal file-archiving application; TransTools, a program designed to aid the manual translation of documents; TaskUnifier Pro, a to-do list and productivity manager; and Recent File Seeker, a search tool that helps you locate the most recently modified files on your system.

Ocster Backup: Freeware Edition 1.9.8

Release Type: Freeware
Official Site: www.ocster.com

One of the problems with modern backup software suites is that they're all a little too feature-laden. In an attempt to outdo one another, they turn the process of backing up your most treasured files into a chore that it's easier to simply ignore.

Ocster Backup takes a more streamlined approach. You define your backup task with the use of a wizard, and from that point on, all it takes is a single click to get your files placed somewhere safe.

The program can copy your files to a secondary or external drive or upload them to Ocster's servers for a small fee ($4.99 a month for 10GB). You can define backups by file or folder and add exclusion filters to make sure it isn't trying to back up things like large videos or MP3s that you might already have stored in the cloud. Backups can be compressed and/or encrypted, and an incremental backup process will ensure that only modified files get saved, which reduces the time a backup procedure takes to run. Backups can be run manually, scheduled in advance or automated.

Despite this large feature set, the wizard interface prevents the software from feeling bloated. You're unlikely to be overwhelmed with options, and a clear workflow means you won't get stuck trying to make sure you've set everything up before you hit go. It is, in many ways, better than many more complex backup suites.

The software is free but comes partnered with a more powerful version called Ocster Backup Pro, which includes support for data mirroring and the option to easily back up extra

Despite the name sounding a little bit like it's related to the Windows Task Scheduler, TaskUnifier Pro is actually a personal to-do list organiser

data, such as web browser bookmarks or mailboxes. Support for versioning allows you to store and potentially retrieve files that may have become damaged or negatively altered even if they've been backed up since. This version costs $49.99, however, which is pretty steep, and Ocster Backup's main attributes – that it's a simple, personal backup tool – apply less once you pile on the features.

Still, the free version is worth a look. If you're not in the habit of backing up regularly, this might be the software you need to get you interested in doing so.

Pros: Stripped-down feature set, clear workflow.
Cons: Wizard mode might slow down experts.
Rating: 5/5

TransTools 3.5

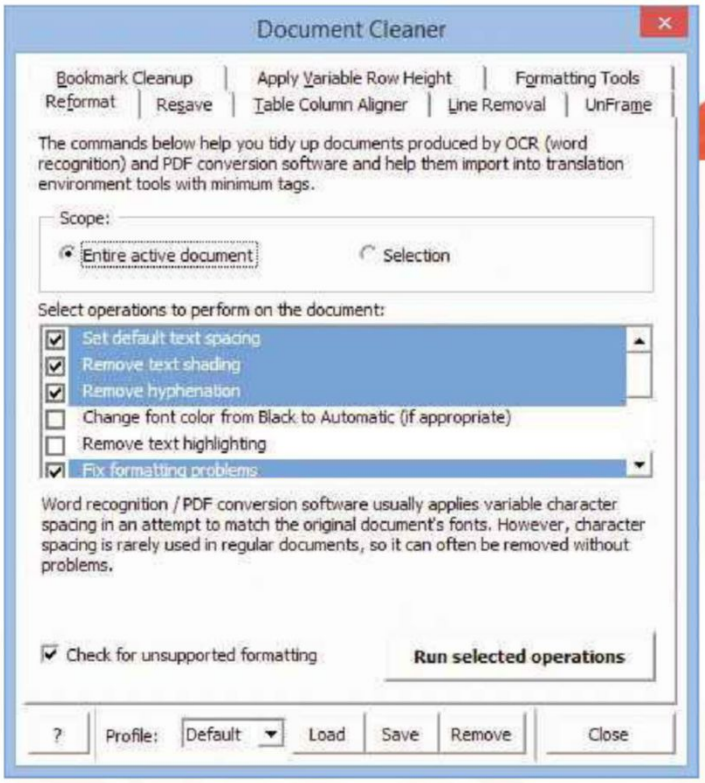
Release Type: Freeware
Official Site: www.translatortools.net

Free for personal use (but paid if you want to use it in a commercial context), TransTools is a suite of tools aimed at people who use office software to translate documents. It's compatible with the likes of Visio and Autocad, but we suspect the most popular use will be by those who integrate it into their installations of Word and Excel.

Indeed, the plug-in version is capable of linking up with virtually any version of MS Office. There are plug-ins for Office 2003 and earlier, and Office 2007 and later, in 32- and 64-bit formats where required. There's no question that it'll work with your preferred software.

As noted, the features the software adds to your Office suite aren't entirely restricted to translation tools. A 'Document Cleaner' tidies up files that were created through OCR and PDF conversion, standardising their formatting by correcting spacing, font styles and font sizes, removing unwanted frames, resetting indentation and more besides. If you have a document that's been through the wringer, this'll clean it up nicely.

The Excel version of the add-in has a number of spreadsheet specific tools as well. A cell resize wizard makes sure all text is visible, while the 'extract' function strips out copies of all text so you can view it in a single place. You can also then merge it



> **You'll have to sit there with Google Translate in one window and your document in the other**

back into the original document once it's been edited, which is a feature you can imagine being useful for translators.

It should be noted that the one thing this set of tools doesn't do is translate any text. Certainly, this software can help you keep formatting straight while you translate a document, but unless you're fluent in another language, you'll have to sit there with Google Translate in one window and your document in the other.

The software remains in development, and version 3.5 adds a number of new features, which is always a good thing to see. Aside from its potentially niche appeal, there's nothing here that doesn't work. Only the lack of actual translation tools can be criticised; in any sense that matters, it's actually a document cleaner!

Pros: Excellent integration with Office tools.
Cons: The remit is slightly misleading.
Rating: 4/5

Recent File Seeker 2.0.0.0

Release Type: Freeware
Official Site: www.carifred.com

When your system gets modified without your consent, it can be frustrating trying to figure out what's responsible so you can remove it. And even when you've reached that point, verifying whether you've been successful is just as infuriating.

Recent File Seeker aims to be a tool in that fight. The software scans your system, finds and lists and files that have been recently created or modified, and then allows you to deal with them as you see fit. Although it isn't primarily designed to locate and remove malware, it's certainly very effective a tool for doing so.

Although the download is extremely small (just 300KB) and the software itself is relatively basic, the effectiveness of its performance cannot be denied. The software includes a number of options, allowing you to tweak scan behaviour to make it more focused (only specific file types or locations) or more general. You can check results based on the modified or created time stamps, and then save your results to a text file so you have a comprehensive list that you can compare files against later. One particularly useful option allows you to exclude verified Microsoft files from the search, so there's no danger of you accidentally wiping something important.

Betawatch

To help you stay on the bleeding edge of software releases, Betawatch is a guide to the experimental and unfinished versions of some of the most popular applications around. Can't wait for new features? Now you don't have to!

Firefox 36.0 Beta

www.mozilla.org/en-US/firefox/channel/#beta

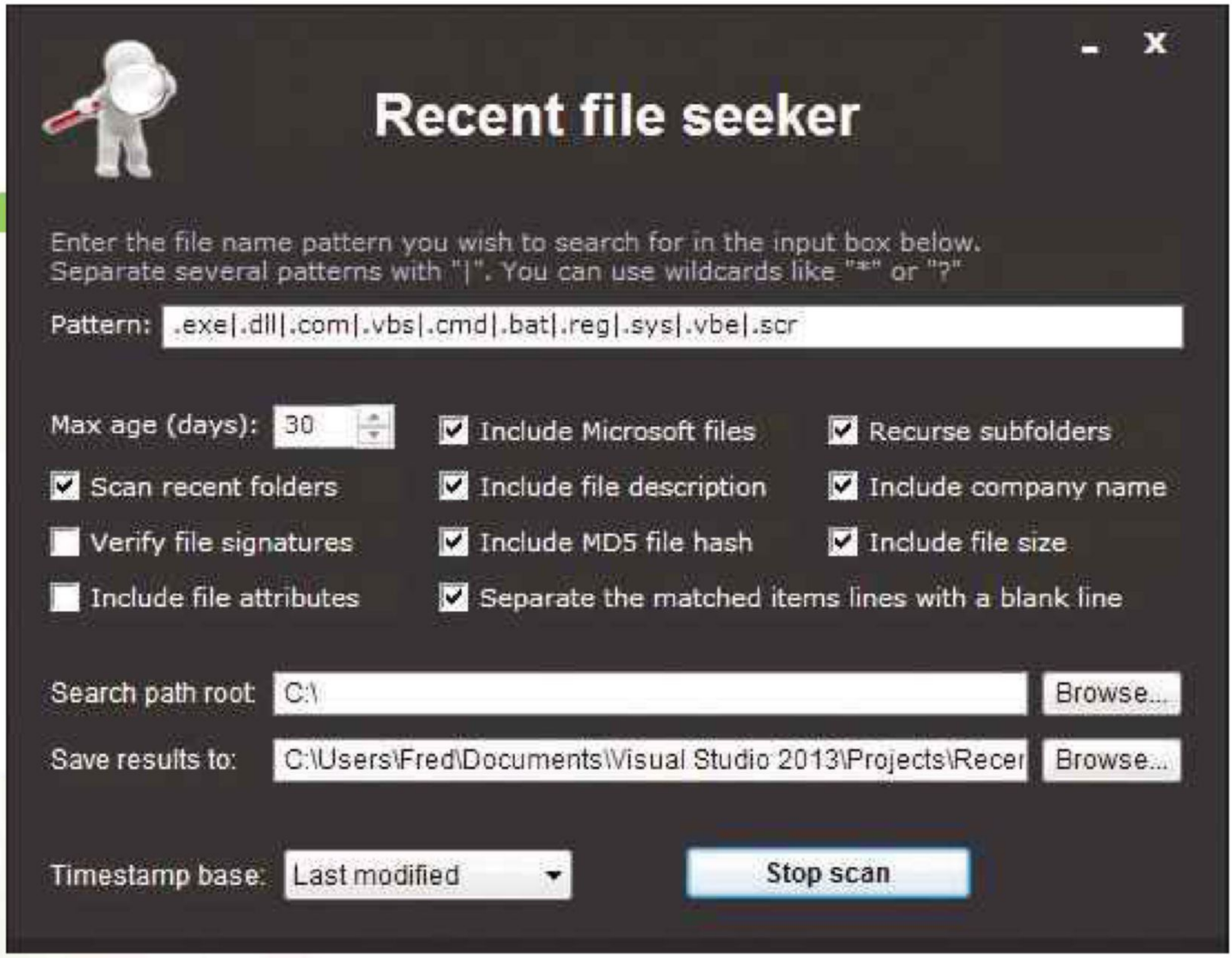
Another month, another iteration of Firefox, and this time the software's getting a rather extensive list of new features. Whatever you might accuse Mozilla of, allowing its flagship browser to stagnate certainly isn't one of them.

New features in Firefox 36 include the ability to sync your new tab page across devices, new preference options implemented and the addition of Uzbek to locales. Security updates include the disabling of Flash protected mode, an automatic dismissal of insecure RC4 ciphers where possible and the gradual phasing out of certificates with 1024-bit RSA keys.

HTML5 implementations also continue to be added, including increasing support for Media Source Extensions to allow native HTML5 playback on YouTube, with full support on the way, and the addition of ECMAScript 6 data types, Unicode-range CSS descriptor and CSS3 improvements including object-fit and object-position implementations. Nothing ground-breaking, but it's all useful for keeping web pages on the cutting edge.

Developers also get a few new features, including DOM inspection improvements, more paste options in markup view, a bugfix for unexpected session logouts and CSS gradient fixes. Again, nothing earth-shattering, but mostly nice to see.

As ever, the latest Firefox beta can be downloaded from the URL above, and if you stick on the beta channel you'll get to see the latest updates before anyone else with virtually no negative effects on your browser's performance or stability. We think it's worth doing.



“Despite the name sounding a little bit like it’s related to the Windows Task Scheduler, TaskUnifier Pro is actually a personal to-do list organiser”

Although some of the language is quite technical and the use of a filter pattern rather than checkboxes might be intimidating for some, the program is otherwise quite simple to use. If anything, it’s a little too simple, because it doesn’t even show you an organisable list of its results. The text file is all you get. It also suffers from something any file-enumerating program does, and that’s the way a scan can take a long, long time on some systems. You’ve always got the option to cut times down with a narrower scan, but it’s fair to say that you can only really perform a scan the hard way.

Still, it’s a nice idea, with room for improvements. We’ve no idea whether the developer plans to add more features, but we’d be happy to see it improved and expanded. This might be listed as version 2.0, but it does feel like a good proof of concept. Now let’s see a program that follows its idea to a more useful extent.

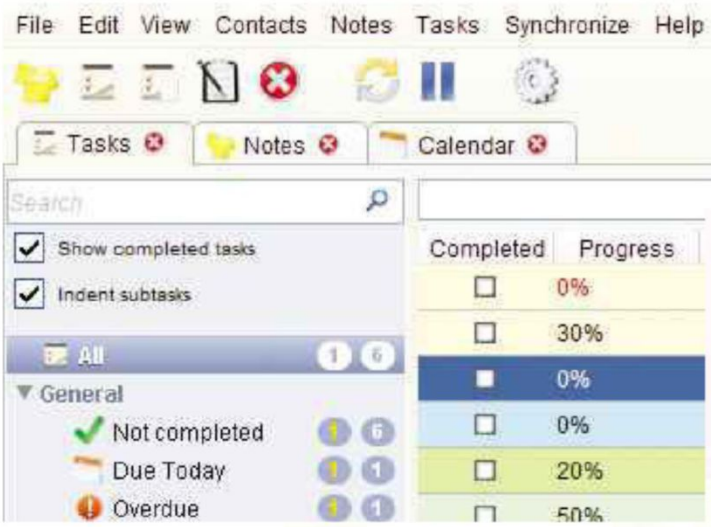
Pros: Tiny download, brilliant idea.
Cons: Not as fully developed as we’d prefer.
Rating: 4/5

TaskUnifier Pro 4.3.4

Release Type: Freeware
Official Site: www.taskunifier.com

Despite the name sounding a little bit like it’s related to the Windows Task Scheduler, TaskUnifier Pro is actually a personal to-do list organiser, which you can use to manage your productivity.

The program allows you to organise your tasks (which can be broken down into sub-tasks) in the form of notes, calendars or a simple list. You can group tasks by a number of criteria, such as the overall goal (e.g. ‘get job’ or ‘move house’) or location (home/work, etc.). Built-in and customisable task templates allow you to simplify the process of creating new tasks and projects by providing you a quickstart list of things to do. If, for



When your system gets modified without your consent, it can be frustrating trying to figure out what's responsible

example, doing your taxes requires the same steps every year, you're only a few clicks away from setting it up.

The software is cross-platform and can sync tasks with services like OrganiTask and ToodlDo, so you can maintain a unified list across devices. However, OrganiTask has just announced that it's shutting down in a few months, so maybe that's not the hugely useful feature the developer was hoping for. Integration with Google Calendar is perhaps more useful, especially if you're trying to collaborate with several other people. Usefully, TaskUnifier Pro can perform custom actions when you update a task, so it's easy to keep everyone informed about progress.

Although a lot of this sounds good, there are two big problems with TaskUnifier Pro that make it a little less attractive.

The first is that the interface is incredibly ugly – busy, cramped, teeming with colour-coding and icons that make it a virtual assault on the eyes. Compared to the likes of design-first task schedulers like the mobile app Clear, it looks like a reject from the mid-90s Visual Basic era.

The second, arguably bigger issue is that the developer has announced plans to stop maintaining the software. The Pro version used to be paid-for, but rather than continue to charge for software that has ceased development (and won't have any bugs fixed), it's taken the admirable decision to release it for nothing.

It's the moral thing to do, certainly, but it's not exactly a point in its favour. It wouldn't have garnered an especially strong recommendation if it was still going, but now that it definitely isn't, we're not sure there's any reason to check it out. At worst you'll get attached to a program that's going nowhere.

Pros: Multi-platform implementation, syncing with multiple services.
Cons: Looks awful, and development has ceased.
Rating: 2/5 mm

ReDownloaded

This month, in our regular retrospective section, we're looking back at the April 2013 instalment of Download Directory to see how the programs we reviewed have fared.

Recuva

www.piriform.com/recuva
Reviewed Version: 1.46, Current Version: 1.51

A broadly excellent undelete program from the app guru Piriform, the current version of Recuva is sadly almost a year old now, with no indication that it'll receive another update. The latest version of the software added improved scanning algorithms, GUI fixes and bug removals, but after two years it's disappointing more hasn't been done with the software. Then again, it's not like there's anything better out there, so maybe the complacency is justified!

UltraVNC

www.uvnc.com
Reviewed Version: 1.1.8.8, Current Version: 1.2.0.5

Another program that benefits from the absolute wasteland of software around it, UltraVNC is a highly configurable, highly powerful, completely free VNC client/server. It's had similarly little attention in the years since we first looked at it, and it's similarly as good a piece of software as you could want. Hard to criticise, but we can't help being disappointed more hasn't been done with it.

Malwarebytes Secure Backup

www.malwarebytes.org/securebackup
Reviewed Version: 1.0, Current Version: 1.3

The cloud-backup service from anti-virus king Malwarebytes was in beta when we looked at it, and since then it's been properly launched. Its selling point is that it ensures backups are always virus-free (so you're never stuck with an infected backup), but beyond that, it's not doing much to distinguish itself. Interestingly, the biggest development is that it's reshuffled its price tiers. Worth a look if you want a new cloud backup service, but probably not if you already have one you use.

True Launch Bar

www.tordex.com
Reviewed Version: 6.5, Current Version: 7.1

We found this Quick Launch bar replacement to be clunky, bloated and ugly when we first reviewed it and, worse still, it charged $14, which seemed expensive. Laudably, the software remains in active development with new versions every few months, but it hasn't improved significantly, and the price is now $20. So now we're even less inclined to recommend it.

Remembering...
Cassette Tapes

David Hayward recalls the mighty tape but admits he liked Rick Astley in his youth

Hands up all those who fondly recall taping Radio One's Top 40 on a Sunday night and having to hit the pause button on the tape deck the second the DJ started to talk– then writing 'Top 40: 20/06/85' or something on the label and pocketing it for playing throughout the week while you did your homework.

The cassette tape was such a part of everyday life that we often forget just how much we handled these things back in the day. For most of us, there was hardly a day that went by when we weren't in possession of a tape. Usually, the tape contained music, but often it was the latest game on the ZX Spectrum or C64.

Take a look back at an 80s school yard and you'll see the youths of the time exchanging cassettes, with the vast number of Spectrum games they've somehow managed to copy scrawled in pencil on the inlay card.

Furthermore, you'd often find yourself with a pencil stuffed into one of the spools of the cassette and waving it around to gather up the tape that was often chewed up in the aging machine it was fed into. And let's not forget bypassing the write protection of a cassette by pressing some tissue or the torn corner of a piece of paper into the little holes on the top.

On the whole, cassette tapes were pretty sturdy. If you had a decent player and kept the heads clean, then a tape would last you for many happy years of use. Car stereos were usually the worst offenders for chewing tapes.

Its History

The cassette tape can trace its history back to 1935, when the first reel-to-reel tape recorder was released, called then the Magnetophon.

It wasn't until 1962 that Philips invented the compact cassette, and from there onward the design and function of the device improved until it became the familiar pair of spools over which were wound the length of tape that usually offered either 30 of 40 minutes per side.

The cassette tape enjoyed nearly three decades of unrivalled success. It wasn't until the early 90s that the sales of cassettes began to noticeably decline. Of course, the main culprit for the drop in sales was the Compact Disc. CDs were better quality, eventually cheaper to make and could hold significantly more data or music.

Did You Know...

- A C60 tape was around 300 feet in length, and a C90 was around 440 feet.
- Just for fun, if you could load a modern game by tape (as you did with the Spectrum, which took about 11 minutes for 128K), then *Borderlands: The Pre-Sequel* at 7GB would be 54,687 lots of 128KB. That would mean it takes 67,51 C90 tapes to store the game, and 422 days to load. I think.
- The longer the recording time of a tape, the thinner the actual tape was: C60 was about 18 microns thick, C90 was about 12 microns thick.
- The actual plastic box that hold the cassette is called a Norelco Box.

In the computing industry, the 8-bit machines had died out and their mode of storage, the tape, was far too slow and didn't have the technology behind it to compete with floppy disks and the eventual optical discs.

The cassette tape refused to die, though, and from around 2010 there appeared on the scene a kind of renewed interest in this now archaic form of storage. Data was still out of the loop, unfortunately, although some programmers still make 8-bit games on tape, but the music industry and audiobook developers saw a rise in sales.

The Good

Easy to carry around, universal and rugged enough to survive a trip to the beach. Tapes were the ideal portable medium for transporting audio and data.

The Bad

Finding an old tape and having to explain to the kids why you recorded yourself singing along to Rick Astley hits in 1988. Then trying to explain the fascination you had with The Bangles. All good times, though.

he ZX Spectrum tapes were the first taste of data storage for many of us

This was a fairly common sight back then

RETRO ROUND-UP

Dave Edwards invites you to lose your soul, blunder around in the dark, watch the birdie, feel chills creep up your spine and explore a scrolling castle – all on machines that were first offered for sale more than three decades ago

Explore a gigantic, abandoned space station in Orion Prime

Egghead is able to run, jump and climb the ladders of his yacht in this superb platformer

Retro Round-up is actually a round-up of this month's brand new releases on retro machines. Last month's column had a theme, in that we were looking at new releases that were only available to buy on the original cassette/disc format. This month, we have more of a mixed bag, with three free games and three paid ones under the microscope.

Before we dive into these (and there are some marvellous games this issue!), a clarification. When you buy a paid retro game, all suppliers do also send you an emulator-file version of the game (whether that be by e-mail or on a CD) in addition to the original media. Additionally, I doubt that any paid retro games are created specifically to be sold for profit; the main reason why certain titles are distributed physically (with a small charge to cover the media) is because waiting for the game to be delivered is all part of the experience.

If you were around in the 80s, you will recall this experience very well – sending off your cheque and then waiting for the padded envelope containing your tape(s) to arrive.

If you weren't, don't knock it until you've tried it. This 'experience factor' is often under-appreciated if you simply click, download and play – which is usually the case with a free retro game.

Without further ado, let's enter this familiar world where games don't always make sense, where ludicrous ideas make an odd sort of sense and where you cannot help but marvel at what can be achieved on some of the oldest computers still living and breathing...

Amstrad Action

Orion Prime is a gargantuan point-and-click adventure for the humble Amstrad. You take on the role of a drug runner, who works a solitary and quite profitable flight-path between two planets. Until, that is, your life of Riley comes to an end when your craft is hit by a rogue asteroid belt and you limp into the belly of the Orion Prime space station. Eerily silent, it's quickly apparent from the dead bodies littering every scene that whatever happened here before, it wasn't good.

Orion Prime is a fascinating piece of software, particularly if your memories of the Amstrad extend little further than *Roland On The Ropes*. Every location of your new prison is illustrated and described in a flawless, detailed narrative. You make progress by clicking on whatever you can see to interact with it. Within the first few minutes, you'll also need to play one of the first mini-games, a variant of a sliding-block puzzle reminiscent of the PS2 game *24*.

It's sophisticated stuff, thoroughly modern and playable with the minimum of fuss on the superb WinApe Amstrad emulator. To see more, visit **www.youtube.com/watch?v=HF_Wwy-0BhI**. Note that a limited number of discs were physically produced of *Orion Prime*. Alas, stocks are now long depleted and considered genuine collectors' items. You can now download and play the game totally for free from the official site, **orion.cpcscene.net**.

Not So Angry Birds

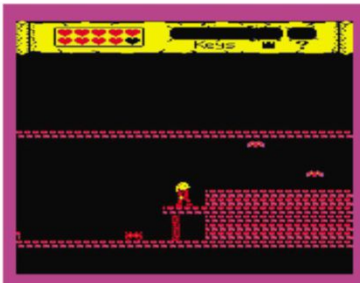
The Dragon 32 is always getting 'new' releases, because it shares a great deal of circuitry with the Tandy CoCo – so much so, in fact, that even 100% machine code games for the CoCo can now be converted between the two machines with relative ease. *Flagon Bird*, however, is a genuinely new Dragon game rather than a converted CoCo one (It's also, unsurprisingly enough given the above, available on the CoCo too!). The game is a version of *Flappy Bird* and is released by Bosco Software. Possibly one of the most addictive – and frustrating – games ever written, *Flagon/Flappy Bird* invites you to pilot a bird through a series of pipes by flapping its wings at the right moment. Easier said than done. Four games in a single minute can be seen here: **ww.youtube.com/watch?v=nv5bo0Ez8IA**

Flagon Bird is available for free from the Dragon Archive (archive.worldofdragon.org) – and you'll also find a great deal of further information on its fans, both here and abroad, on the forums of this site. To see a real master, why not visit Metr81's YouTube video at **www.youtube.com/watch?v=6Vkt_99YfEg**, where he puts my personal high score of 15 pipes cleared to shame with a whopping 254!

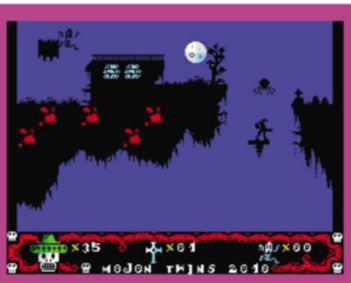
Anyone who's interested in the hundreds of other new titles for this fiery Welsh green-screen machine should also check out **www.dragon32universe.info**.

Beating The Beeb

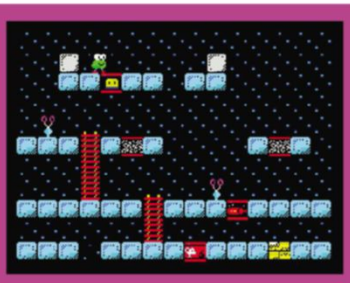
The bad news is that, for the BBC/Electron, 2014 saw the release of only a single game, but the good news is it's a cracker. Produced by Retro Software (**www.retrosoftware.co.uk**), *Castle Raider* is a scrolling graphic adventure of the keys-locks variety, setting you the task of exploring a huge castle and escaping with some of the treasure. You can wander left and right and jump the patrolling nasties, while entering the doorways takes you to other areas of the castle. You'll need to map it all out to find the quickest route to the keys you need to progress the quickest.



Retro Software's superb BBC/Electron scrolling Castle Raider



Zombie Calavera – and if you find it hard to make out what's going on, then you're not alone



El Stompo is a peculiarly British game, where old analogue televisions are built into the platforms

Psytronik's C64 game looks brilliant – yet it's soulless not only by name but also by nature

Actually, the most impressive thing about *Castle Raider* isn't the premise but the actual scrolling itself. Limitations of the hardware meant that not a single smooth-software-scrolling game on the Electron ever made it to completion back in the day; even classics such as *Stryker's Run* scrolled on the BBC but became a flick-screen on its baby brother. Programmer David Boddie set himself the personal challenge of writing code that could do it – and, on top of that achievement, it's fair to say that he hasn't managed a bad little game in *Castle Raider* too!

Castle Raider is available, again for free, on both tape and disc from Retro Software. However, rather than charge you for the game itself, the site supplies an inlay for you to print out yourself.

Lost In The Dark

Zombie Calavera (Zombie Skull) is a platform game from the Mojon Twins, released now by Monument Microgames in a superb oversized box. Alas, the game inside the box falls somewhat short of expectations.

You play Santos, and your task is to wander through rooms collecting crucifixes while jumping or shooting the roaming skeletons. While there's nothing new there, some ideas are laid on top of this tried-and-tested formula. Skeletons don't die when shot; they instead turn into vampire bats, which ricochet around the room instead. And colliding with anything that moves doesn't just deplete Santos' energy; it also throws him unpredictably around the room.

These are enough of a challenge alone, but thy're only half the story. The game is rendered entirely in dark blue and black, with Santos barely discernible at all in some positions in some rooms. See **www.youtube.com/watch?v=0Lj2sl0k3yo** for an example. In addition, having been supplied with a nice glossy booklet explaining the Legend of Santos and the Zombie Skull, you'd expect the text therein to be relevant to the game itself. Instead, it's page after page of waffle.

Zombie Calavera can be purchased from Monument Microgames (**www.monumentmicrogames.com**) for £7.00 (P&P included).

Fuzzy Televisions

And now, a short digression...

Old analogue TV sets were great, weren't they? One great big tuning knob, an aerial that you needed to position differently depending on the channel you wished to watch and the comfort that any problems with either could be easily remedied by whacking the top of the TV as hard as you could. Students would probably still be watching this way had the old analogue signal not been turned off. But it was – and those analogue broadcasts were lost into the ether.

But these signals have now arrived on El Stompo's planet, and the aliens there have a bunch of TVs that should allow them to enjoy their fix of *EastEnders*. Unfortunately, their TVs will only work after El Stompo has jumped up and down on each of them. This is the charming scenario in Monument's second offering, *El Stompo*.

What we have here is part arcade platformer and part logic puzzle. The game has 35 screens featuring ladders and levels, patrolling aliens and the odd button, brickwork or television to stomp on. Each screen is progressively harder, with a surprisingly colourful palette ('No colour clash!' screams the boxart, which is a peculiarly Spectrumesque claim!).

The backstory give the game its charm. For British players only, it also gives the opportunity to count the number of old TV programme logs they recognise. On top of this, *El Stompo* is actually pretty enjoyable, dispensing with a lives or password system in favour of just presenting you with each scene in turn until you win it (rather like *Angry Birds*). You can see the first few levels here: **www.youtube.com/watch?v=MMjzBpbgYT4**

Hole In Your Soul

Psytronik Software (**www.psytronik.net**) has an extremely large catalogue of games for sale, and *Soulless* is one of its more recent. According to the premise, your crime was to call for a pacifist society and, as a result, you were captured, turned into a beast and had your soul stolen, and your enemies locked you in a tomb for a thousand years. Nice.

Soulless begins with a graphical demo showing this entire story, complete with an explosion of amazing C64 music. This is promising stuff on such a dated machine, and the care and attention lavished on the programming, graphics and music is similarly breath-taking. A development team of three big C64 names (Georg Rottensteiner, Trevor Storey and Mikkel Hastrup) is responsible. You'd wonder what could go wrong?

However, *Soulless* commits the sin of being rather run-of-the-mill graphical adventuring. Its main failing is that although it includes a "massive map to explore", progress through the rooms is linear; you're not free, a la *Jet Set Willy*, to decide which room to visit next. Instead, each game becomes a tiring trek through the same rooms in the same order, and it's easy to collide with the roaming nasties and be sent all the way back to room one. After only a few goes, I became quite dispirited and was heading back to *Flagon Bird*.

Time And Tide

As you can probably gather, whether a game is free or paid in Retro World is largely unconnected to its quality. All of the games featured this issue are labours of love, where the main ingredient is passion.

This makes even the bad games seem good; particularly in this month's selection. Assuming I make it off *Orion Prime* in one piece, I'll be back next month to marvel at a new cave of wonders. **mm**

Whatever Happened To RealPlayer?

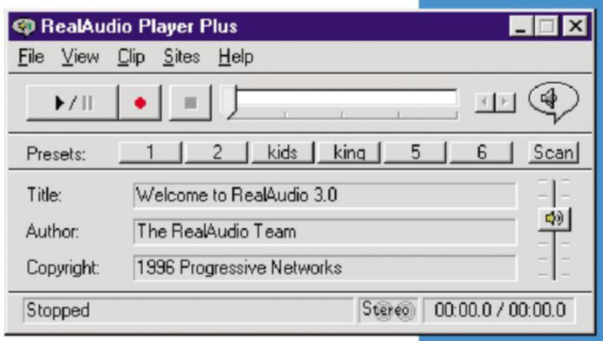
James recalls the not-so-good-old days of online video

These days, video on the web is so ubiquitous that you can forget what a chore it used to be. There was a time when it was a huge undertaking to get any sort of media playing in your browser, let alone video. In the days of dial-up, when content bitrates were low and modem bitrates were lower, one piece of software indisputably led in the field in terms of web-embedded media delivery. That program was called RealPlayer.

Given how the advent of HTML5 and flash streaming has made watching video as simple as clicking a button (or not, sometimes), it's hard to overstate just how essential RealPlayer used to be for watching anything online. Back then, when presented with a video, your browser would baulk at playing it. You could maybe have downloaded the file instead, but in the days when MPEG was only just starting to compress video to manageable sizes most connections would've taken so long to download a news report that by the time you watched it, it'd be out of date.

RealPlayer changed that. Before the software was released, playing video on the web was a long, frustrating and ultimately unrewarding experience. After the software was released… well, it was still a long, frustrating and ultimately unrewarding experience, but at least you actually got to see something at the end of it.

So, given the huge user base it had at the time, how has it come to



Whatever Happened To WinAMP?

The peculiarities of the MP3 codec's copyright and origins meant that it took a long time for Windows to play MP3s natively. When the format first began to grow, supported by online piracy, third party players were required. Of those, it was WinAMP that established its dominance.

When it launched in 1997, WinAMP wasn't the only MP3 player around, but it was the best. It was fast, simple to use, easy to install, and didn't cost anything (although there was a $10 shareware fee). It was not surprising, then, that by 1998 it had been downloaded over three million times.

In 1999, AOL bought the application's publishers, Nullsoft, for over $80 million. A much-derided AOL-sponsored 'WinAMP3' followed in 2001. Criticised for being less stable, it lacked compatibility with skins and plug-ins from the previous versions and upset users, many of whom stuck with the previous version, WinAMP 2.8. In 2003, Winamp 5.0 tried to repair the damage (version 4.0 was skipped to indicate that it combined the new features of v3.0 with the compatibility and performance of v2.0, because 3+2 = 5).

It looked like a new era, but it was probably a last hurrah. Only a month after Winamp 5.0 was released, its primary developer and Nullsoft's founder, Justin Frankel, left the company. The software was maintained after that point, but after hitting a peak of 90 million users in 2007, it slowly became less relevant. AOL almost shuttered the brand in 2014, but it was instead sold to online music platform Radionomy, which promises a new version of the software later this year.

"Before Real Player was released, playing video on the web was a long, frustrating and unrewarding experience"

pass that RealPlayer, and its parent company RealNetworks, now seem to be all but forgotten?

Origin Story

The first ever version of RealPlayer was released in 1995 by Progressive Networks, and was actually called 'RealAudio Player'. At the time it wasn't unheard of for websites to contain sound, in the form of short WAV clips or MIDI music, but high-quality audio at low bitrates was close to non-existent. The idea of streaming audio direct from a broadcaster to a home audience over the Internet seemed like a sci-fi fantasy (or at least, technically improbable).

So it was that the RealAudio format and its associated player came to exist. RealAudio compressed music and speech so tightly that it could be delivered over even the slowest connection. Sure, there was a significant loss of quality – but that didn't prevent AM radio from becoming popular. Two years after release, the RealAudio format was expanded to include video streams, with the visual and audio halves collected under the name 'RealMedia'.

The format saw plenty of success, and the software, now renamed 'RealPlayer', gained significant popularity when it was included in Windows 98's installation package. That's the scale of popularity we're talking about here: every computer that installed Windows 98 was given the chance to install RealPlayer so that it could be used to watch video and audio on the web.

That level of prominence is rarely afforded to software originating outside of Microsoft's campus, but the dominance of RealPlayer's proprietary video and audio online was so wide – it was even the preferred format of the BBC at one point – that Microsoft wanted to make sure Windows computers had the tools to experience it. Of course, the fact that Progressive Networks was started by former Microsoft exec Rob Glaser may have been a factor in that as well.

The software wasn't just capable of playing media in webpages. It allowed you to play various types of audio and video locally, and it included a selection of 'channels' which allowed you to watch or listen to free content. In a world without YouTube, it was arguably the next best thing, and by 2000, some reports suggested that over 85% of all streaming content online was in a Real-based format. Things could scarcely have been going more to plan.

A Real Decline

Of course, there's a saying about the best laid plans. RealPlayer was succeeding because it was the best option for playing video and audio over a slow connection – but connections were speeding up, and codecs were improving too.

> **It's safe to say that RealMedia gained a not-entirely undeserved reputable for looking and sounding awful**

At the same time, it was rare to find anyone who actively enjoyed the experiences RealPlayer had to offer. It's debatable whether the low-resolution, low-detail, low-framerate video was a consequence of the download speeds of the era or the codec itself (or even just inept use of the codec) but it's safe to say that RealMedia gained a not-entirely undeserved reputable for looking and sounding awful.

If you don't remember first hand, you can approximate the typical RealMedia experience quite easily. If you want to listen to a song or radio programme, simply play it down a loose phoneline and try to listen on the other end. If you're trying to watch a video, shrink it to the size of a postage stamp and watch through glasses smeared with Vaseline. It was better than nothing, but worse than almost everything else.

Similarly annoying was the software itself, which had a tendency to get its hooks into every part of your system. It installed itself as the default player for virtually all media formats, once it was running it'd bombard you with system-messages that were barely disguised adverts, and then when you wanted rid of it, it would promptly fail to uninstall correctly.

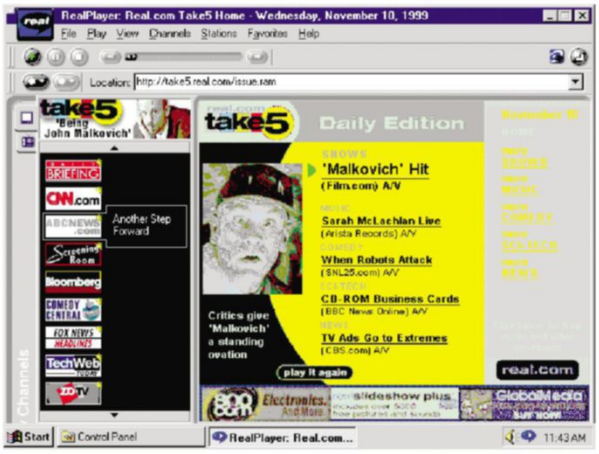
Even accounting for the fact that those tactics weren't exactly unique during the early attempts to make shareware profitable, RealPlayer's biggest crime was that it often failed to work. It was large and bloated, and there was no guarantee, after spending ages downloading a media stream, that you'd be able to view it.

The file format did itself no favours either. Although RealMedia could be downloaded, most sites delivered it in the form of streams, which meant saving a copy was effectively impossible. If you tried to download one, you'd get a simple file that pointed to the stream, which meant spending time and bandwidth downloading the media again. Not a popular option in a pre-broadband world, where every few bytes represented a wasted second of you day.

The proprietary nature of RealPlayer's media was another sticking point for users. Even with the software installed, there was no way to view RealMedia formats in more conventional video players. RealPlayer itself was far from streamlined, and insisted on frequent updates. There was at least one a new major version every year and each update seemed to make it harder and harder to wade past the adverts so that you could get at the content you wanted to see. Flashier graphics designed to improve the look of the program simply slowed it down, irritating users rather than impressing them.

Dissatisfaction with the software reached a particular peak when security researchers dissected the network traffic sent by RealPlayer's helper-app, the digital music library RealJukebox, and discovered that it was transmitting a unique user identifier and music titles without disclosing this fact. One assumes this was for the purposes of targeted advertising, but it also gave the software the potential to secretly leak personal or confidential information. It was reissued with the offending code removed, but at a time when concerns about Spyware were relatively new, it caused significant negative press.

Although there was no mass exodus from the software, its frustrations and irritations combined to the point where, when MPEG4-based rivals such as WMV and ASF came of age, they were quickly adopted as alternatives to RealMedia. MPEG2 video had created files too large for downloads, but MPEG4's superior compression and quality support made it a viable rival. And, of course, these formats could be played through any media player, rather than a single proprietary program. By the time coders released RealAlternative – a reverse-engineered codec that enabled third-party players to view



Whatever Happened To ICQ?

Before Google Chat, before Facebook, before WhatsApp Messenger, there was ICQ: the first big instant messaging program. At the time, ICQ was a huge deal. For the first time users could communicate directly with one another in real time, regardless of what ISP they were using and without the complicated networks and politics that accompanied IRC chat. The first version was released in 1996 by Mirabilis, and by 1998 it had been snapped up by AOL for $287 million.

Clearly, the idea of instant messaging caught on. By 1999, Microsoft, AOL and Yahoo had all launched their own-branded IM clients, and that instantly started to erode ICQ's success – partly because the competition was larger and sported more familiar brand names, but also because ICQ had a lot of character that not every user appreciated. Where ICQ favoured cutesy sound effects, bright colours and gimmicky features, the likes of AIM, YIM and MSN Messenger were comparatively stripped-back and professional in design. Spammers and phishers also plagued ICQ's network, making people wary of using it.

In 2003 a new CEO at ICQ returned it to profitability and growth by incorporating advertising into the otherwise free software, but it never reached its previous level of popularity. Multiple updates failed to recapture the early glory, in the US and Western Europe at least (ICQ remained popular in Eastern Europe and Russia), and in 2010, AOL sold ICQ for $187.5 million to Digital Sky Technologies – a Russian firm that maintains it to this day. The most recent version, ICQ 8, was launched in 2012, 2014 saw the company's first growth in user numbers since that acquisition.

RealMedia – the RealPlayer's fate was long sealed.

In fairness, it's hard to blame RealPlayer's decline on any single deciding factor. The rise of better codecs and general annoyances with the software were definitely part of its disappearance, but so was the expansion of Microsoft's own Media Player, the appearance of MP3 streams, and the constant improvements to Broadband technology. RealMedia was probably destined to lose out to open formats eventually – the Player's generally disagreeable nature only hastened that inevitable fate.

Keeping It Real

Of course, it'd take some severe mismanagement for a company with the recognition and history of RealPlayer to disappear completely. Although its flagship software holds only a shadow of its former popularity, the parent company – long since renamed RealNetworks to capitalise on its most popular product – is still going, involved in numerous strategic content alliances and IP-protecting lawsuits, but with less emphasis on its consumer-focused arm.

Indeed, RealNetworks' résumé does look impressive. In 1995 it streamed the first live baseball commentary on the Internet. In 2001, it was the first to try selling music from major record labels over the Internet. It was involved in early Netflix/Spotify-esque premium content services, and in 2005 it received $460 million from Microsoft to settle an antitrust lawsuit. Its proprietary Helix music engine made it onto a number of MP3 players, including those from Creative and Sansa. It's not like it hasn't been trying to move forward with the times.

Of course, its most recent acquisition – casino gaming site Slingo – was bought for its gaming division in 2013. Originally named RealArcade, the division was renamed GameHouse, and if you've played any amount of casual or social games, you've probably touched one of its titles.

So where does that leave RealPlayer? The software itself has been through many rebrands over the years. From RealAudio Player, to RealPlayer, through RealPlayer G2, RealOne Player, back to RealPlayer and most recently, RealPlayer Cloud. The RealMedia format has essentially been abandoned, and the player is now focused on multi-platform streaming, with the latest version incorporating an online storage cloud that allows you to share your videos across multiple devices. Essentially, the software is a video-centric version of Dropbox, with versions available for Android, Linux, iOS and Mac OS X, and compatibility with ChromeCast and Roku platforms.

At this point, it's hard to guess what the future of RealPlayer is likely to be. A return to its former greatness is hugely unlikely, but it's still serving a reported 25 million users worldwide, which isn't exactly small change. Perhaps the brand will continue to mutate when the hot thing that succeeds cloud streaming eventually arrives. Maybe it'll end up being sold to a company with better plans for it. Or maybe it'll cling to life on the strength of its brand recognition alone.

One thing is certain, though: now in its 20th year, there's no reason to assume that RealPlayer will disappear completely any time in the near future – even if you've forgotten it existed. **mm**

Puzzle Apps For iOS

Take a break from all the hard work with Keir Thomas' round-up of six of the best basic yet fun puzzle apps

When starting our regular apps group test over a year ago, we made the decision not to include games, because we felt gaming was a specialised area best served elsewhere. This week we're breaking that rule, because puzzle apps are different. They stand astride the spheres of productivity and gaming, in that people who simply wouldn't consider themselves gamers – or even fans of games – will happily load up a puzzle app to spend a few minutes relaxing. Thus, this week, we take a look at six of the best puzzle games, although we're careful to avoid any that comes even close to offering an arcade gaming experience. The apps reviewed below are 100% cerebral!

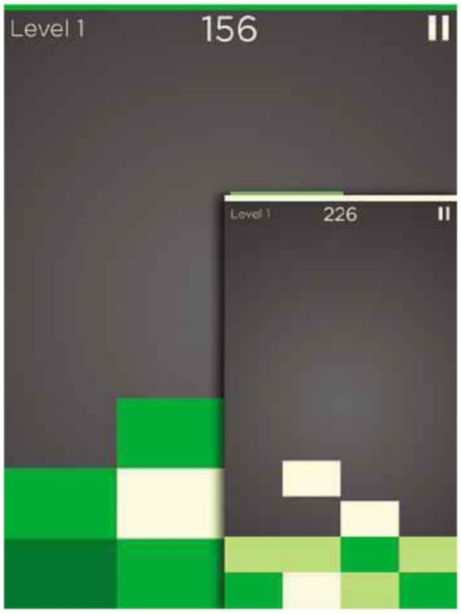
As usual, all the apps are available in the App Store and were tested on an iPhone 6 Plus and a Retina iPad – and due to their design, all the games demand an iPad or iPhone be held in portrait orientation. Most are free, but a minority are available for less than the cost of a cup of posh coffee. Often this is a price worth paying, because the in-app hard sell of upgrades' in the world of gaming can be extreme and, quite frankly, annoying.

> **"Put simply, Montezuma Puzzle is a curious mixture of Tetris, a jigsaw and Sudoku"**

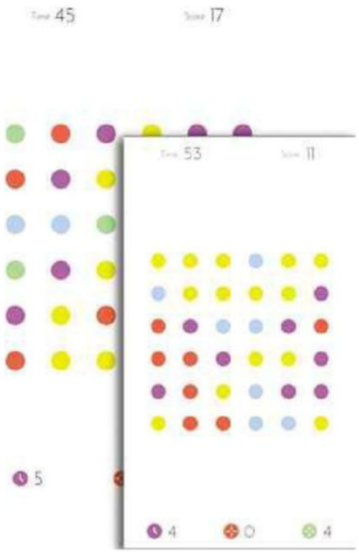
Shades: A Simple Puzzle Game

Best referred to as a *Tetris*-like game, *Shades* simultaneously builds on the concept of falling blocks while bringing entirely new strategies and techniques.

As the app's name states, this really is a simple game. Blocks fall from the top of the screen, and you must arrange them to form horizontal lines of the same colour shade by tapping in one of the



Shades takes the Tetris concept of falling blocks and remoulds it into a clever colour matching game



Dots offers a simple yet engaging style of puzzle game that will keep you coming back to play again and again

“Shades simultaneously builds on the concept of falling blocks while bringing entirely new strategies and techniques”

four possible columns. A swipe down in a column speeds up a block’s descent. Unlike in *Tetris*, the blocks are all the same size – flat rectangles – and they differentiate only in shade. Forming a horizontal line of the same shade causes it to disappear, in a *Tetris*-like way, and the goal is to avoid cluttering up the screen so that blocks reach the top.

Complicating things is the fact that blocks change colour if one of the same colour falls on top of it, forming a new single block of the next darker shade.

Thus, the player is forced to work out entirely unique strategies compared to *Tetris*. Disparate shaded blocks need to be stored out of the way until they can be dealt with, while you can set up vertical columns of blocks gradated in shade so that they all change and merge consecutively in one move – providing the maximum possible score.

There are three skill levels – easy, medium and hard – and you’re given a clue as to the upcoming block shade by a clever timer bar at the top of the screen that shrinks in size just before the new block appears. The colour of the blocks changes each time you play a new game, which is a nice way of adding variety and keeping the player on his/her toes.

At £1.49, *Shades* isn’t free but it provides the true puzzle app experience of being able to lose yourself for as long as you require without raising your heart rate too much. Recommended.

Dots

The very best puzzle games are the simplest – and what can be simpler than joining dots? That’s the premise behind this game, which shows a grid of different coloured dots and makes it your task to drag your finger between neighbouring dots of the same colour in order to join them up. Once joined the dots disappear and those above fall down to take their place, thereby introducing new dots at the top of the screen too. Points are given for joining dots, obviously, with more points gained for those times you connect a significant number of dots. However, the big points (and also a special sound effect/vibration on an iPhone) are sent your way should you manage to get your fingertip back to where you started. This might mean drawing a simple square using same-coloured dots, but by using strategy and removing certain other dots you can make it possible to draw a huge encompassing line that ends up back where it started, thereby earning a huge number of points.

All of this is timed, assuming you opt for the timed round option. You can also choose Moves mode, in which you’re given just 30 moves to get as many points as possible. A £1.49 in-app purchase will give you Infinite mode too, in which you can simply keep joining dots ad infinitum.

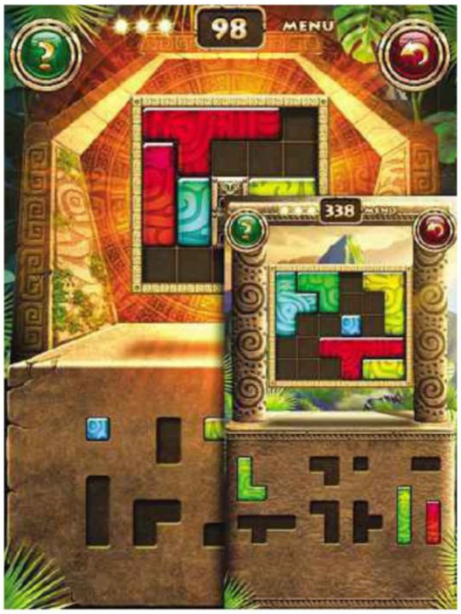
What do points make? In this game, they buy power-ups, which are not entirely necessary but bring interesting strategies to the game. There are three types of power-up. The first removes all dots of a particular colour from the board – useful for getting rid of a certain colour that is spread out from its neighbours. The second freezes the countdown clock for five seconds or adds five additional moves in Moves mode. Both these power-ups can only be used once per game. The third power-up simply lets you remove any individual dot, and you can use this as often as you wish within a game. By default, five of each power-ups are provided, and as well as earning more by playing and getting high scores, you can hand over cash via in-app purchases to buy more. Notably, and crucially, these purchases simply aren’t necessary to enjoy the game. In fact, occasional to moderate players of the game may not never even realise they’re an option.

Needless to say, the game mechanics work very well, and *Dots* is as addictive as bubble wrap. The game is entirely free with zero in-game adverts, and the lack of a hard sell for in-app purchases is utterly refreshing. By making purchases optional, yet introducing new aspects of gameplay, we reckon people are more likely to pay up. This is surely how it should be done.

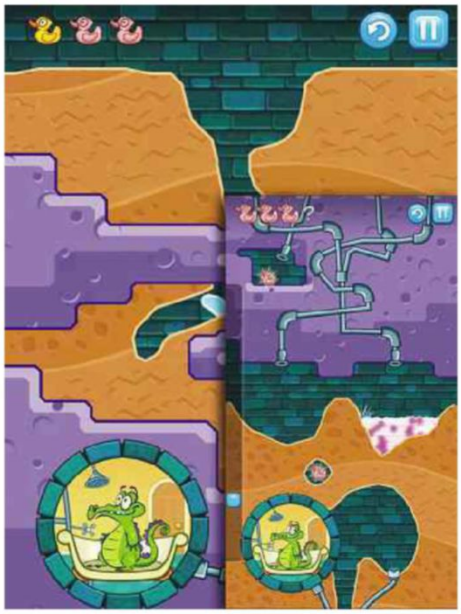
Montezuma Puzzle

Pity poor Montezuma. One of the more successful South American kings responsible for uniting the Aztec nations (yes, I can use Wikipedia), nowadays his name is appropriated for everything from bowel complaints to a brand of chocolate. And here he apparently endorses a series of games, of which *Montezuma Puzzle* is the first. However, aside from the vague South American setting, which makes each level look like a redressed *Tomb Raider* set, his input is somewhat negligible.

Put simply, *Montezuma Puzzle* is a curious mixture of *T*etris, a jigsaw and Sudoku. You’re shown a grid, underneath which are several *Tetris*-like blocks that



Montezuma Puzzle provides 400 levels of entirely free fun to keep you occupied for hours, if not days



Where's My Water gives you the task of providing bath water for a crocodile living in a sewer – and why not?

you must drag and drop onto the grid so that everything fits neatly. At that point you move to the next level. With smaller square grids, this task is relatively easy, but with larger irregular-shaped grids, the number of permutations rises, as does the number of blocks. Add in the occasional immovable block already present on the grid and things can get difficult – but never impossible. Because of the perfectly judged skill level, the game encourages an almost Zen-like state of completing levels without applying too much thought.

If you do get stuck, you can tap the question mark button to be shown where individual pieces go. Three lights at the top of the screen indicate you have three lives when receiving this help but, in fact, you can keep tapping the button to receive more hints after you've run out of lives. It's down to your own sense of honesty, we guess, as to how you progress.

Over 400 levels are provided out of the box, with even more promised. There's also a separate *Montezuma Puzzle 2* app that evolves the idea with new shapes and boards.

With a game as simple as this, there isn't much to criticise, although we felt placing the pieces on the board could be a bit fiddly. If you don't get them precise enough, the game assumes you're dropping them incorrectly and they return to their home positions. This can get irritating.

The game is free but uses adverts to generate revenue. These appear full screen when accessing the menu but, as far as we could tell, never during gameplay, which can continue uninterrupted for hours. There appeared to be no other adverts or even in-app purchases.

For a little mindless fun, *Montezuma Puzzle* really can't be bettered and offers literally days of enjoyment.

Where's My Water?

With millions of dollars up for grabs in the world of apps, perhaps it wasn't surprising that Disney appeared on the scene, and *Where's My Water* is its most popular effort – and perhaps its only effort not implicitly tied to existing movies or characters. The goal of the game is to route a supply of water to crocodiles that live in the sewers. The main croc is Swampy who, despite being coldblooded, is addicted to hot baths. However, his pipes have been sabotaged by evil crocs elsewhere. The water he requires typically starts at the top or bottom of the screen, collected in a pool or shooting out of a pipe, and it's your job to drag on the screen to carve away dirt, as well as remove algae and ooze or trigger mechanisms, in order for it to be routed to the correct inlet pipe. The game claims realistic physics, but in reality the water acts more like amorphous jelly. However, it's easy to get to grips with this.

Each level also has three rubber ducks that you can pop by running water over them. These don't do anything other than enforcing a cruel sense of failure should you fail to get every one of them. However, they also provide replay value, allowing you to return to levels to complete them fully. Also hidden within the dirt are items that you can collect.

Although ostensibly a game for children, the skill level has been judged just right, and this particular 42-year old found some of the levels pretty tricky – particularly those that scroll and involve multiple elements, forcing you to chain together several strategies.

Some levels add a time component by causing the water (or ooze) to start flowing immediately, while others involve timing the water flow so it works perfectly with moving mechanisms. These add a little excitement to the game but also felt a little out of place. We prefer to take our time solving puzzles. Luckily each level offers an infinite number of retries.

Where's My Water costs £1.49 and comes with hundreds of levels, plus a bonus 'Lost Levels' pack, although a free version is available offering 14 free levels. In-app purchases in the paid-for version let you introduce new characters in order to replay old levels in a different way, which is a nice method of expanding the game without penalising the player if they don't hand over more money. A small banner ad appears on cut-scenes, which is a little cheeky, but this can be dismissed easily.

Where's My Water is certainly popular, and there are several sequels expanding the concept. We'd be lying if we said the game wasn't fun. However, we felt some of the levels were a little plodding, perhaps because we were doing the same thing each time with nothing really evolving. If you're going to introduce characters and a backstory, then a constantly progressing narrative also seems reasonable, but that's largely missing.

"With millions of dollars up for grabs in the world of apps, perhaps it wasn't surprising that Disney appeared on the scene"

> **Those over the age of 30 and who are into electronics may remember hand-etching circuit boards. The trickiest part was routing circuit lines**

Poptile

Yet another evolved *Tetris* clone, *Poptile* is about as simple as puzzle games come. It starts with a grid of coloured squares. Tapping any causes that square to pop and disappear so that those above fall to take its place. If the square you tap borders others of a similar colour they all pop at once, and you get more points for the more tiles popped in one go (including cascades, whereby tiles dropping down also pop because they meet similar colours beneath). However, on each tap a row of random new squares are added at the bottom of the screen, pushing the rest upwards. Notably, new rows are not added every few seconds, as with similar games, which makes for a much more sedate experience. The game ends should any of the four vertical columns of tiles reach the top of the screen.

One of three different types of power-up become available once you pass certain score thresholds (seemingly multiples of 100) and are activated by tapping the buttons at the right of the screen. The Stop power-up simply lets you pop tiles without any more appearing beneath, but only lasts a few seconds. The Target power-up destroys all tiles on the board that are of the colour you tap, while the -3 power-up simply removes the bottom three rows of tiles – a potential life saver if any of your columns are nearing the top of the screen.

And that's about all there is to the game. The music is soft and trance-like and indicates the true nature of this game – you just start playing and enter a relaxed state as you tap away.

Poptile is free of charge, and we didn't spot any adverts while playing, although rather oddly there's an in-app purchase of 99p to deactivate ads. A second in-app purchase of 99p lets you buy new themes (that is, colour schemes and tile patterns) but this is strictly optional. Perhaps surprisingly it isn't possible to pay up to buy extra power-ups – a policy that seems very fair to us. You can also get bonus themes by installing some of the developer's other games, and those who are colour blind can activate a special option in the Settings panel that adds symbols to the tiles.

Note that there are two games called *Poptile* in the App Store. The one reviewed here is by 1Button.

Poptile is enormously fun and entirely undemanding – perhaps the perfect puzzle game.

Flow Free

Those over the age of 30 and who are into electronics may remember hand-etching circuit boards. The trickiest part was routing circuit lines. Each line couldn't touch any others, unless you wanted a brief explosion when power was applied.

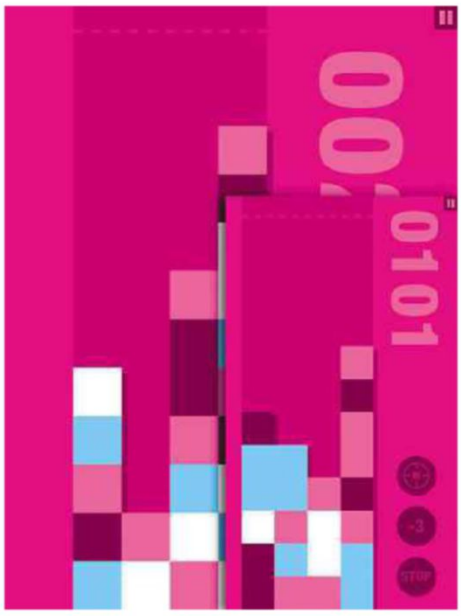
While circuits nowadays are designed using computers, the folks behind *Flow Free* clearly reckoned there was fun to be had with the concept. As its most basic level, *Flow Free* is a join-the-dots game akin to *Dots*, reviewed above. Each level opens to a grid of varying sizes with coloured dots on it, but always two dots of each colour. Your task is to draw lines between these dots, just like joining components on a circuit board. The more dots you join, the trickier everything becomes, because all available squares get used up with existing lines. Frequently you have to simply give up and start again with a new approach, typically after finding four out of five of the dots connect but the sixth simply can't.

If all this sounds too easy then you can opt for the time trial mode of play which – you've guessed it – imposes a time limit for each board of 30 seconds or 1, 2 or 4 minutes (the choice is yours).

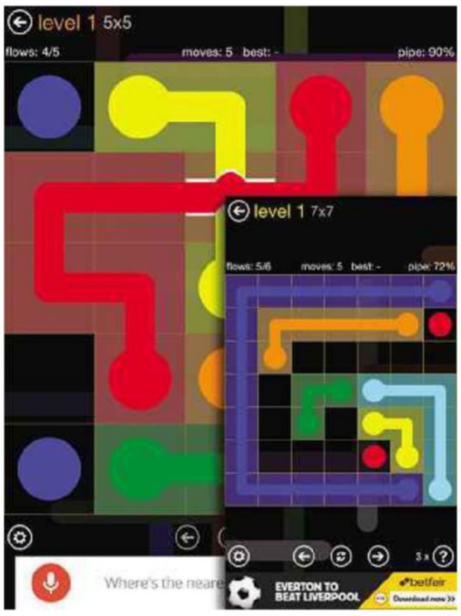
If you get stuck, you can tap the question mark icon for a hint, but only three of these are provided. Five more can be purchased as a 79p in-app purchase, while 20 can be had for £2.29. As the app name says, however, this is an entirely free app, and for the price of nothing you can play literally hundreds of levels across grids of increasing sizes. Once you've finished, more can be bought for 79p a go or you can buy them all for a reasonable £2.99. You can also switch the theme (that is, the colour scheme) for 79p a pop or for £1.49 to make a bulk purchase of all of them.

The Settings panel lets you add labels to the colours to aid those who have problems with colour perception, and a pretty terrific – and, sadly, unique – feature is the ability to share your progress through iCloud. In other words, install *Flow Free* on both your iPad and iPhone, and you'll always be able to continue at the latest level you've reached. All games should do that, really.

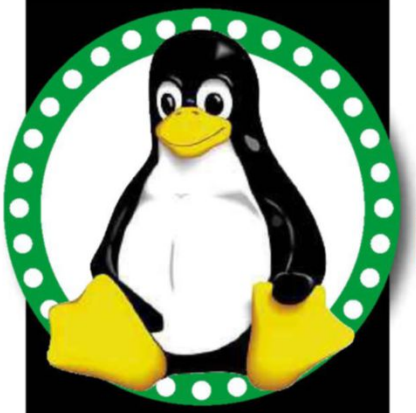
A banner ad at the bottom of the screen is visible at all times, even while playing, and those ads that flash words or images can be distracting. However, considering what you get – which is literally hours if not days of potential fun – we reckon this is a reasonable price to pay. **mm**



Poptile is about as simple as puzzle games get and induces a trance-like state of relaxation



Flow Free makes you join the dots – but it's much more fun than it sounds



Ubuntu Phone, And The Death Of A Distro

Do we need another phone?

David Hayward has been using Linux since Red Hat 2.0 in schools, businesses and at home, which either makes him very knowledgeable or a glutton for extreme punishment

A few weeks ago I mentioned the Ubuntu Phone – or, rather, the lack of it. Now, it's going to be made available, but has Canonical dropped the ball?

The Ubuntu phone as it will be sold isn't something to get excited about. It's called the Aquaris E4.5 and has so far failed to create even the slightest bit of excitement from the mobile world.

The first problem is the fact that the Ubuntu phone doesn't work in the way we were originally led to believe it would, in that it's not going to be able to become a desktop machine when you hook up a keyboard, mouse and monitor. Secondly, there's only going to be a flash sale of the phone over the next few weeks, in limited quantities, and it'll only be available in mainland Europe, with some units being available in the UK.

Also, rather than the usual app ecosystem in place, the Ubuntu phone will be using Scopes to present desktop dashboards that will display the content from the relevant provider. The problem here is that new phone concepts tend to be near-dead on arrival. Without a blooming and competitive app market behind it, the Ubuntu phone can't hope to compete with Android and iOS, Windows or even BlackBerry. And when you factor in the mediocre hardware it's being sold on, we don't have much hope for the future of the Ubuntu phone.

Finally you have to ask yourself why Canonical is even bothering. It sold the idea of the Ubuntu phone years ago and promised them throughout 2014, but they never appeared. Now it seems like it's going through the motions purely because it has to, rather than taking a step backward and saying, "Sorry, it was a bad idea. Look, we'll make the desktop OS better instead."

Having said that, there are enough people out there who covet the latest 'thing', so who knows, maybe the Ubuntu phone will find a foothold in the already super-tight mobile market?

RIP CrunchBang

CrunchBang Linux was a decent distro; derived from Debian, with a customised Opebbox window manager and some GTK+ widget developments, it did a reasonably good job.

But all things must come to an end, as they say, and now it's the time for CrunchBang to close its doors. As its developer, Philip Newborough, recently posted on the CrunchBang forums, "I have decided to stop developing CrunchBang. This has not been an easy decision to make and I've been putting it off for months. It's hard to let go of something you love.

"For anyone who has been involved with Linux for the past ten years or so, I'm sure they'll agree that things have moved on. Whilst some things have stayed exactly the same, others have changed beyond all recognition. It's called progress and for the most part, progress is a good thing. That said, when progress happens, some things get left behind and for me, CrunchBang is something that I need to leave behind. I'm leaving it behind because I honestly believe that it no longer holds any value, and whilst I could hold on to it for sentimental reasons, I don't believe that would be in the best interest of its users, who would benefit from using vanilla Debian."

So while the community will still exist, there will be no more official CrunchBang Linux development, unless someone takes up the mantle.

It's always sad to see a project die, but these things happen. Maybe something good will come of it in the future?

Farewell CrunchBang. You'll be missed by many

You've Been Framed

Apple's upcoming OS X release of Photos looks great. It's just a pity the company won't think different elsewhere

It's quite rare these days that I properly look forward to a piece of Apple software arriving. Although I remain a big fan of the Mac and iOS devices, I spend the vast majority of my time using third-party applications. I'd no sooner immerse myself in Pages than repeatedly smack my head against the desk; instead, Byword and Scrivener are where it's at for writing. And although I do admit to gritting my teeth and bearing the likes of Mail, that's largely because I'm a bit lazy when it comes to looking for alternatives and because Mail for the iPad is actually pretty good; I always hope (in vain) the same might one day be true for the OS X release.

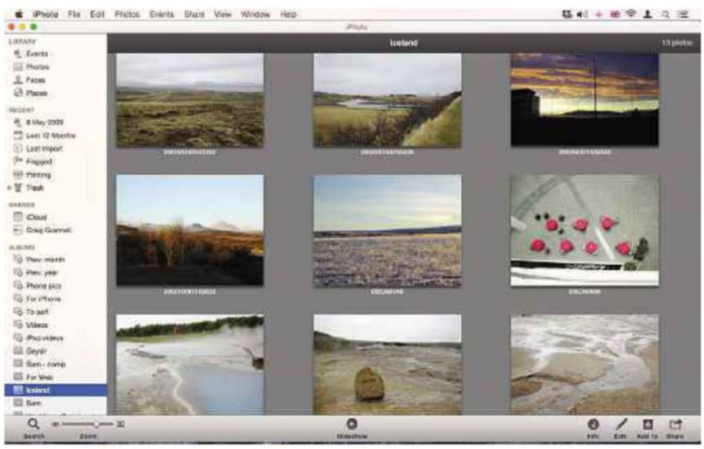
With Photos, though, I'm bucking this particular trend, because I can't wait for it to show up on the App Store. In part, this is because Photos for iOS just works really nicely. On my iPad Air, it's fast and responsive, zipping between local and cloud albums. The automatic categorisation is smart and suited to the way I navigate photos, enabling me to rapidly move between individual moments, collections and entire years of images. In a sense, it's everything iPhoto once wanted to be, but now very much isn't.

By contrast, Apple's desktop photo solution feels like it's made of lead. It beachballs so often that you wonder if the entire thing's written in BASIC, and scrolling through a large collection of images is painful. It also looks very much of its time. The interface is this dark monolithic thing spat out during an age when brushed metal seemed pretty cool. It doesn't make your photos shine so much as smother them in layers of grey.

At the time of writing, a Photos beta has arrived as part of the OS X beta. Apple also has a preview page up on its website (**apple.com/osx/photos-preview**). The app, as far as possible, apes its iOS cousin, with similar navigation and editing features. It currently lacks third-party extensions (although you can bet they're on the dev roadmap) but does bundle projects, making it absurdly easy to create your own prints and photo books. For Aperture users, it's probably not going to be enough – Mac-based pro photographers are going to have to get used to Adobe Lightroom or try to keep an aging Mac going indefinitely. But for anyone with more modest requirements, Photos looks like it's going to fit the bill – albeit with the caveat that it'll only work on OS X Yosemite, which remains a bit of a mess.

It's a pity, though, that Apple isn't taking this 'back to the Mac' simplification further, in order to deal with that other bloated monstrosity: iTunes. Photos looks so great on a Retina display, and it's so simple. It would be great to get Mac equivalents of Music, Videos, App Store (as in, the iOS one) and the like. Instead, we have iTunes 12, which pretends to be simple but is in fact iTunes 11 with all the (very many) deckchairs rearranged.

Rumours even surfaced recently that Apple is planning to bring ebooks and PDFs back into iTunes, having only recently housed them in the entirely separate iBooks app. I hope the company doesn't take such a retrograde step. The future of the Mac will be a much more pleasant one with refined, focused, streamlined experiences. The likes of iPhoto and iTunes should be put out of their misery, left in the past, but not forgotten – because everyone should be eager to not repeat the same mistakes.



Bye, iPhoto! Very much be a stranger!

Craig Grannell is a writer, designer, occasional musician and permanent loudmouth. He's owned Macs since 1996, when Apple was facing certain doom, and is therefore pleasantly surprised by its current success. Find **Craig** on Twitter at **@craiggrannell**

Windows Tablets Are Ridiculously Cheap Right Now

Sometimes you just have to tell it how it is, says Ian McGurren

There's a certain art to the headline, something I do attempt to practise in my columns. But sometimes the headline just needs to say it plainly, and the undeniable fact is that Windows tablets are ridiculously cheap right now and offer staggering value for money.

Windows tablets have had a strange gestation in the mobile world. Windows 8 itself was roundly decried on its release, as it was a touchscreen-enabled OS being released on mostly traditional computers, due to the lack of many Windows touchscreen devices. Then came laptops with touchscreens, further confusing buyers, until the then-premium Surface Pro showed Windows 8 could work both as a tablet and as a traditional computer. By then, however, with dominance of iOS and the rise of Android, Redmond's curious bipolar OS did as poorly as its mobile counterpart.

Now, however, sales in Windows 8.1 tablets are picking up. Is it because the .1 bump has improved the UI? Probably not. Is it because of the excitement about Windows 10? Unlikely. No, the reason here is a simple one: Windows 8.1 tablets are cheap, and not 'affordable' cheap, but rub-your-eyes cheap, with 8" devices around £100 and 7" ones even less. With further discounts applied in sales too, it has been possible to pick up a 7" 1280 x 800 Windows 8.1 tablet, with a Windows 8.1 with Bing licence and a year of Office 365 for a mojo chew under £50. That's cheaper than the Office 365 personal one-year licence costs in Currys alone.

Of course, you can point out that there are Android tablets for around this price too, and they're 99% a waste of the components they are made from. Naturally you'd expect the same here too, so £49.99 it may be, but that's probably just a waste of money. Surprisingly, that's far from the truth. Most of these budget unknown-name tablets are actually pretty good and certainly worth their money. Take, for example, a typical bestseller, the Linx 8.

The Linx is actually from a British company called Exertis, but you would be right in your assumption that the hardware is built in China. However, the device is well built, solid, and as easy on the eye as any mid-range Android tablet. The 8" screen has a 1280 x 800 IPS screen with good viewing angles, a quad-core Intel Bay Trail CPU (Z3735F here), with 1GB RAM and 32GB storage. It comes with wi-fi, Bluetooth, a micro-USB that can be converted to accept input with a USB OTG cable, and, crucially, a mini-HDMI out.

In use it's the same as pretty much all Windows 8.1 tablets, and Windows 8.1 computers for that matter – not surprising, given that's exactly what it is at heart: a Windows PC. It's quite easy to forget this though, especially if you stick with the tiled interface and buy purely from the (still lacking) Windows Store. In that sense it's a perfectly decent tablet, though its interface does take a few hours to feel right with. But beyond that, and beyond iOS and Android, this is a quad-core PC, and when plugged into a monitor or TV and coupled with a Bluetooth keyboard and mouse, it becomes a regular desktop machine. What's more, the Bay Trail CPUs have hardware video decoding on board, meaning not only do they handle HD video with ease, but you can use your tablet quite easily as a Steam In-Home Streaming unit. Just hook up a controller and you're away.

Windows tablets in general have some shortcomings, such as the higher-end, full HD devices still costing £250 or more, and the user experience being not quite as finger-friendly as Android or iOS. But unlike those devices, Windows 8.1 tablets will stand tall against any cheap tablet, laptop, media box or micro-desktop, and cost you considerably less.

There are loads of Windows tablets about now, all much the same, though they're still hidden away for the most part, being not quite as glamorous as the new iPad Air 2 or a Samsung Tab S. You'll find them in Argos (Bush MyTablet 8 - £99), Tesco (Linx 7 with Nokia 530 phone - £99!), Staples (Linx 7/8/10 - £79/£89/£149) and on eBay direct from China, though you're probably better off sticking with UK sales for now. Some, like the Linx, are even offering cashback for your old tablets too. So for the price of a family trip to the cinema or a meal out and a few drinks, you can have a new tablet and computer, with Windows and Office. That's unprecedented.

Ian is a professional IT analyst, a semi-professional writer and a pretty amateur electronic musician. He likes gadgetry and loves making gadgets do things they were never designed to do

Instant Gratification

A self-printing camera? We'll give it a shot says Andrew Unsworth

I feel sorry for hipsters. Much maligned due to their good manners, their face fur styled on the Victorian beards of the empire and, most damningly, their penchant for hell-red corduroys, hipsters have attracted more ire and verbal condemnation than would ever be visited on a mohican-crowned punk or football casual.

However, hipsters' good cheer and enthusiasm for absolutely everything is as infectious and life-affirming as it is genuine.

If you ask me, the only problem with the hipster is that it doesn't add anything new to our culture. The hipster doesn't challenge the status quo and force social and technological evolution. Everything the hipster does or loves seems to be drawn from an over-exposed reminiscence of a 1970s that never existed, at least not in Britain, which brings me onto the topic of this week's column: the Polaroid Socialmatic (**polaroid.com/socialmatic**). This is a rectangular smart-camera with a built-in printer that lets you print pictures as soon as you've taken them. It also has built-in wi-fi and Bluetooth, and runs Android, so you can upload your pictures to social media for the purposes of humble-bragging, should you not want to print out your efforts there and then. Then there's its looks, which are clearly inspired by popular consumer products of the 1970s. The Socialmatic is a decades old idea reinvented for the 21st century, and hipsters are going to love it.

However, the Polaroid Socialmatic has much going for it other than its appearance and built-in printer. It has a 14-megapixel front camera and a two-megapixel rear camera. On top of that there's a whopping 4.5" touchscreen, GPS, wi-fi and Bluetooth, 4GBs of internal storage and a micro-SD card slot for when 4GBs just isn't enough.

I'm sure the Socialmatic will be a decent product, but I'll reserve judgement on the overall quality of it until I've used one. The major thing that worries me is the battery life. The Socialmatic seems to be wi-fi only, so the lack of a 3G or 4G transceiver means that its battery power won't be sapped to nothing by snap-happy users uploading a constant stream of images to Facebook from the top of Mt. Snowdon. However, that relatively big touchscreen, the GPS system, the printing system itself and the computing power needed to run the Socialmatic's Android operating system will use up a tremendous amount of power. I couldn't find a figure for the Socialmatic's battery life, but I'd expect it to be pretty low, with nightly charges necessary. Still, one look at it and I'm certain I could live with carrying around a charger.

The Polaroid Socialmatic is clearly hipster-bait but, as with all good hipster-bait, the Socialmatic is dearly, hopelessly desirable and I dearly, hopelessly want one.

Andrew Unsworth has been writing about technology for several years, he's handy with a spanner, and his handshaking skills are second to none

Ryan Lambie has loved videogames since he first stared up in awe at a *Galaxian* arcade cabinet in his local chip shop. 28 years on, Ryan writes about gaming for Micro Mart. He's still addicted to chips and still useless at *Galaxian*

Mine Croft

Lara Croft returns for a Siberian adventure in Rise Of The Tomb Raider. Expect more grazed elbows, archery, and this time, a big angry bear

This week, Ryan takes an early look at Rise Of The Tomb Raider, and checks out the sudden sale of Sony Online Entertainment...

Plug & Play

The rebooted *Tomb Raider*, released in 2013, gave us a more human, believable Lara Croft. Gone were the twin pistols, tiny shorts and outlandish physical proportions. In their place were grazed elbows, tears by a campfire and an island of terror. It may have been a bit ironic that the *Tomb Raider* redux was heavily influenced by the PlayStation's *Uncharted* series of action adventures – a franchise itself influenced by Tomb Raider's platform-puzzle-shooting amalgam – but the more realistic slant was just what Croft needed. Reviews were positive, sales brisk, and a sequel was assured.

With *Tomb Raider* taking the franchise back to zero, and telling the story of Croft's transformation from quaking, marooned archaeologist to weather-beaten survivalist, the stage is set for a sequel that sees the heroine getting down to the important business of raiding tombs. Which seems to be exactly what we'll get in Crystal Dynamics' forthcoming *Rise Of The Tomb Raider*. Where the first game took place on a spooky island in the Pacific, *Rise* will greatly expand its canvas; this time, Croft's focusing her attention on Siberia, and specifically, an invisible Russian city called Kitezh.

Within this new setting, *Rise* will seek to amplify the survival aspects of its predecessor. Early footage unveiled by American magazine *Game Informer* shows Croft stumbling through a dank Russian forest, hotly pursued by a colossal and very angry brown bear. Faced with these decidedly natural threats, Croft fights back with her trusty bow and arrow (the twin pistols of old are still nowhere to be seen), while a newly introduced crafting system will allow her to make useful things like first aid kits, Molotov cocktails and traps with bits and pieces gleaned from her surroundings.

The crafting will be joined with other trappings from recent survival games: a day-night cycle, inclement weather and nocturnal animals. It's also said that an incidental character from the previous game – bull-necked cook Jonah Maiava – will become Croft's side-kick this time, though whether that means he'll be following Croft around as an AI character or merely showing up in flash-backs isn't currently clear.

What is clear, is that – as well as running from bears and building traps in the Russian wilderness – Croft will also get to dig around in lots of ancient chambers full of traps and mysterious runes.

"The most important thing to us," Crystal Dynamics say, "is to live up to that promise of tomb raiding, and make sure that as much as this is a game about traversal, exploration and combat, it's also very much about tombs and puzzle-solving."

Throw in the promise of other locations as well as Siberia – it's said that part of the story will take place in the desert – and it looks as though *Rise Of The Tomb Raider* will provide an interesting balance of old and new. That it's a timed exclusive for the Xbox One means that a PC edition won't appear this side of Christmas 2015, but if Crystal Dynamics can deliver on the promise of an evolved version of the solid 2013 reboot, then *Rise Of The Tomb Raider* should be worth the wait.

Online

The 15th January saw zombie survival MMO *H1Z1* appear on Steam Early Access. Sony Online Entertainment's answer to the highly successful *DayZ*, *H1Z1*'s had its fair share of controversy

Sony Online Entertainment is now independent studio Daybreak. Games like H1Z1 and Everquest Next are unaffected, though Station Cash will be undergoing its own name change soon

– not least its paid-for airdrops and the slightly odd decision to charge £15 to gain early entry to a free-to-play game – but early impressions have been cautiously positive for the most part.

Then, on the February 3rd, something surprising happened. All of a sudden, Sony Online Entertainment wasn't Sony Online Entertainment anymore – it was Daybreak. The division had, we soon learned, been bought up by a cash-rich investment firm named Columbus Nova, a company already known for its portfolio of tech businesses.

"Effective immediately," an announcement on the company's site read, "SOE will operate as an independent game development studio where we will continue to focus on creating exceptional online games for players around the world, and now as a multi-platform gaming company."

What this means is that Daybreak is now free to develop games for the Xbox One as well as PC and PlayStation consoles. So why did Sony suddenly decide to sell up? Speaking to financial website *Fortune*, analyst Michael Pachter thinks he has the answer: the MMO market has changed considerably since SOE was launched in 1996, and no longer the growth area it once was.

"Unfortunately, free-to-play is growing most rapidly on phones and tablets, and SOE wasn't there because those aren't really core Sony products," Pachter said. "SOE didn't support any of Sony's consumer electronics businesses, so it was easy to sell."

With Sony as a whole suffering financially in recent years – it made a net loss of $1.25bn in 2014's financial year, and has warned that it could face losses of around $2bn this time around – the sale is thought to be the company's move to focus its energies purely on games for its own consoles, like the forthcoming *Kill Strain*.

For now, it looks like business as usual for the former SOE's large catalogue of games, including *Payday*, *Planetside 2* and *H1Z1*. While Station Cash – the company's virtual currency – will be undergoing a name change, and fan event SOE Live is now cancelled, Daybreak president John Smedly has said that the expensive-looking, forthcoming MMO *Everquest Next* is still in production.

"We're still making *Everquest Next*," he wrote in a recent post, "Nothing has changed."

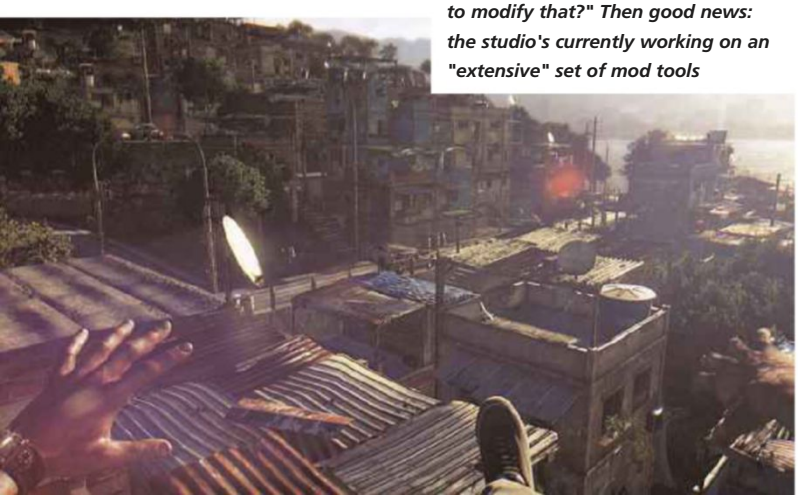
Incoming

By now, you may well have played Techland's free-running zombie survival game, *Dying Light*. It shares much in common with the studio's *Dead Island*, but with big-budget sheen and a more athletic turn of speed. In a heartening move, Techland has recently announced that it's set to provide "extensive modding tools" for PC users, hoping to improve or change the game – and they'll be available for free.

"Modders were a massive part of our gaming community since *Call Of Juarez* and *Dead Island*, and we wish to continue that with *Dying Light*," the studio wrote. "We plan to actively support the coolest mods created by players."

Although we don't yet know when the tools will be available, it's a heartening move, and an increasingly rare one from a fairly major developer.

Techland has already set up a modding forum (**bit.ly/1zgnNd1**), where you can keep up to date with the tools, and what players plan to do with them. Our favourite suggestion so far? A mod based on Japanese game show *Takeshi's Castle*, with robe swings and vault platforms. And, of course, zombies.



Have you played Techland's Dying Light and thought, "I'd like to modify that?" Then good news: the studio's currently working on an "extensive" set of mod tools

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Corsair Vengence 16GB (2x 8GB) DDR3 Memory CMSX16GX3M2A1600C10. Never used but box opened. Selling due to wrong voltage, these are 1.5V and I needed 1.35V. Asking £85.00 inc. postage to the UK.
Email: fabstock1@gmail.com

Used Asus Wireless Router for sale. Dual-band 4 x GB Ethernet Wi-Fi RT-N66U N-900. £65.00 O.V.N.O. Selling cause I have no need for it since upgrade to BT Home Hub 5.
Email: beme12355@googlemail.com

Asus A8V motherboard, socket 939. Clips holding CPU cooler broke, CPU overheated & shut down. M/B should be OK and there is 4GB of ram on board. Free, collect only. North Wales.
Tel: (01286) 678584
Email: gw7hav@googlemail.com

2 x 2GB DDR3 1600 MHz RAM. Recently taken from a 2012 mac mini. As new £25.
Email amstereofan@gmail.com

XFX GeForce Nvidia 8800Gts Graphics Card for Sale. £40.00 + Post/Packing. Perfect working order.
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Custom Built modified watercooled gaming desktop. i5 4670K, R9 280X, Silverstone RV-01 USB3, 1000W PSU: parachord sleeving, Z87M OC Formula, 8GB Kingston Fury 1866MHz, 180mm and 120mm Radiator. Numerous mods, Yellow and Black colour scheme! No Storage. Email for pics and info. Buyer collect: Gloucestershire. £800 ono.
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CPU sale. Intel Core 2 Duo E4400 2.0GHz £10, Intel Pentium 4 630 3.0GHz £7, Intel Celeron M 350 1.3GHz £5, Intel Celeron Mobile Dual core T1500 1.866Ghz £6, Intel Pentium 4 630 HT 3.0Ghz 2MB cache £8, AMD Athlon 64 3200 £5 Athlon 64 3500 £6 Athlon 64 3200 Dual core £10 postage £2.
Tel: Jeremy Gill (02089) 430683
Email: arthur.pewty1@virgin.net

Laptop DDR2 memory sale. 2 Corsair Value Select 533mhz 1GB £18 pair, 2 Hynix 800mhz 2GB £26 pair, 2 Generic 533mhz 1GB £15 pair,1 Generic 800mhz 1GB £10,1 Nanua 666mhz 1GB £, 1 Samsung 666mhz 1GB £8. Postage included
Tel: Jeremy Gill (02089) 430683
Email: arthur.pewty1@virgin.net

2 x 512MB PC3200 DDR400. These two sticks were removed from my working system, now redundant. £5, plus £1 P&P.
Tel: Alan (02084) 202322
Email: alan@asandco.co.uk

DDR2 memory sale. 2 x Nanua PC2 3700 256MB £6 pair, 2 x HP PC2 4200 256MB £7 pair, 4 x HP PC2 4200 512MB £10 pair or £18 for four.
Tel: Jeremy Gill (02089) 430683
Email: arthur.pewty1@virgin.net

Asus M2N2-SLI Deluxe motherboard bundle. With AMD Athlon 64 4000 CPU, 4Gb Corsair ram, fan, backplate, manual, driver CD. £40
Email: david.white38@ntlworld.com

Two 120GB Maxtor DiamondPlus 9 Drives plus one 80GB DiamondPlus 10. Can be supplied with two plug-in caddies. No reasonable offer refused.
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IBM/LENOVO SFF BASEUNIT. P4/ 2.8 H-T, 2GB RAM, 40GB Hard Drive, CD-Rom, 10/100 Network, sound, USB, Clean install XP-pro, fully updated, Office Suite, Anti-Virus, & all usual utilities, COA Licence Sticker & Install media, £25
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Email: pat4cars@aol.com

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Email: pat4cars@aol.com

DELL OPTIPLEX GX240 SFF. P4/1.6, 20GB hard Drive, 768MB RAM, CD-Rom, 10/100 network, Sound, Front USB, Clean install XP-pro, fully updated, works OK but slow by modern standards, £15.
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Email: pat4cars@aol.com

LG Flatron W2246S 22" monitor with power and VGA leads. No dead pixels in very good condition. £50 Buyer Collects (Verwood, Dorset)
Tel: (01202) 826057 Email: geoffandcynth@themailspot.com

2x 1GB PC2100-648. These two matched sticks were removed from one of my redundant systems. Plus one PC2700 (DDR 333Mhz) and one 512Mb PC3200 DDR400 stick. All for £5 plus £2 P&P.
Tel: Alan (02084) 202322
Email: alan@asandco.co.uk

SANSUNG GALAXY Tab 3 for sale. 2mths old, 8GB, wi-fi, £80 open to offers. Willing to post at a charge.
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HP Elitebook 8760w i7 2820QM @ 2.2GHz 32GB RAM 750GB HDD Quadro 4000M GPU. Only 2 small marks on whole machine. Cost £3500 when new. £900 ONO
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Email: jmbest2@sky.com

Toshiba C500D-B-11 laptop. Virtually new cost £279 will accept *£150 O.N.O.*
Tel: (01217) 535324

Intel 3930K processor. Used, but not overclocked. No box or fan. £220 ono. Will ship to UK address.
Tel: Tim (01623) 624509 Email tim.stirland@btinternet.com.

Amstrad PcW 9256 in good working order with software. Offers.
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Email: meeching@uwclub.net

Asus P8Z68-v LX socket 1155 motherboard. Original box 1/0 cover user guide driver disk fitted core i3 2100 CPU 3-1GHz and 8GB PC1300 memory. No fan. Working fast and fine. £125 + free postage.
Tel: (01619) 501218
Email: jmbest2@sky.com

Asus p8h61-mle motherboard socket 1155. Original box 1/0 cover driver disk manual together with Celeron 91620 dual core CPU and 4 9195 pc1300 memory. Working fine. No fan. £70 + free postage.
Tel: (01619) 501218
Email: jmbest2@sky.com

Toshiba Satellite SA60 laptop. Model PSA60E-092058EN. Windows XP Home Edition with Certificate of Authenticity. For spares or repair - broken power connector on mobo. No power cord. Otherwise in very good condition. £40.00 + p&p
Tel: Peter Scarth (01452) 372350
Email: pscarth@blueyonder.co.uk

SoundBlaster Audigy SE 7.1 soundcard for sale. Perfect working order. Selling due to not being needed any more. Just £12 plus postage.
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Email: ianmatthewuk@yahoo.co.uk

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Email: davethomas96@aol.com

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Tel: John Adams (02088) 641202
Email: meeching@uwclub.net

Panasonic KX-P7105 mono laser duplex printer. Some toner left. Up to XP only - hence £25. Buyer collects from N2, East Finchley
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Email: pnnikiel@gmail.com

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Intel 3930K processor. Used, but not overclocked. No box or fan. £220 ono. Will ship to UK address.
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Email tim.stirland@btinternet.com.

Apple Mac G4 Tower. 400MHZ cpu, 640MB Ram, 2xHardDrive 40GB,20GB. DVD & ZIP Drive. OS X v10.3 Panther+OS9. NO KEYBOARD OR MOUSE. £25 ono Buyer collects
Tel: (07941) 254296
Email: jasonnd@hotmail.com

Blueberry I-MAC. Good condition, all in working order, £55.
Tel: (01386) 832758

Dell Inspiron 660 Intel i5 QUAD CORE with ACER 23 Inch LED monitor. AS NEW. Operating System: Windows 8.1. MPN:620MT. Memory (RAM): 4 GB. Hard Drive: 1TB. Processor Type: Intel Core i5. Primary Drive: Optical DVD+/-RW, Processor Speed: 3.0 GHz, Features: Graphics Card GT620 1GB. Acer LED monitor 23" HD. £520
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INKJET CARTRIDGES suitable for Epson Printers T711 - T714 range, and T481 - T486 range. 79 pence each, plus postage. Work perfectly, good crisp printing quality.
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750GB SATA drive. Perfect working order. Formatted ready to use. Only £25 plus £3 p&p. Genuine Windows XP with Certificate of Authenticity can be pre installed for an extra £10.
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4GB (2 x 2GB) of OCZ Reaper PC2 6400 ddr2 memory. Fast gaming memory, used but in excellent condition, £49.95 inc postage.
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2 x 2GB Samsung DDR3 pc3-8500 1066 SODIMM. 204 pin as new laptop memory. £15 inc postage to inland UK.
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Dell OptiPlex 755 (80 GB, Intel Core 2 Duo, 2.33 GHz E6550, 1GB memory, DVD/CDRW) Ultra small form factor. Fantastic small and very fast computer. You will need to load the drivers. XP Pro or Vista Business can be loaded for an extra £10. The hard drive and memory can be upgraded for an extra cost. £70 plus £10 for delivery.
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HARDWARE WANTED

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WANTED: Corsair PSU cable bag. Please email me if you can.
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Acronis True Image Home 2012. Bootable CD. Application runs under Windows 8, 7, Vista or XP. Original Acronis CD with unused product key £5.
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Microsoft Office Small Business Edition 2003 with Business Contacts. Legitimate Office Small Office Business Edition comprising Word, Excel, Powerpoint, etc. Comes with small piece of OEM hardware and original license code (coa) £10 incl. delivery, cheque or PO. £10.50 by Paypal.
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SOFTWARE WANTED

Wanted: Windows 98 CD ROM operating system with boot disk, instruction manual and serial number. Tel: Craig (07867) 930265 or 01912093677
Email: craigtin44@hotmail.com

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• Keep copies of all correspondence

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ASK AARON

Meet Aaron Birch. He's here to help you with any general upgrading, software and system building issues. He's got advice aplenty, and you're very much welcome to it!

Send your questions to:
Aaron Bich
Micro Mart
Dennis Publishing
30 Cleveland Street
London
W1T 4JD

Contact Aaron by email at:
aaron@micromart.co.uk

Please try to keep your queries brief and limit them to just one question per letter, simply so we can squeeze in as many as we can each week. Please include relevant technical information too.

Aaron

Stalled Torrents

I've noticed recently that my ability to use torrent downloads has become little to none. While I used to be able to download torrents quickly, with decent download rates, now they simply sit there, either with minuscule download speeds, and ETA times of years, or they have no time, and instead an unlimited symbol.

I'm not sure what's going on, and as far as I can tell, I've got a perfectly fine Internet connection, and my broadband performs normally in all other ways, such as browsing and streaming video. I've run speed tests, and they all seem okay, and I notice no other problems. It seems to happen on any torrent too, not just specific ones (I assure you, I only use legitimate sites).

My torrent client is uTorrent, which I've used for a long time, and it's always worked well. Over the last couple of weeks, though, it's become useless, and I'm no longer able to download torrents. I have to wonder, am I being limited by my service provider in some way? If so, what should I do?

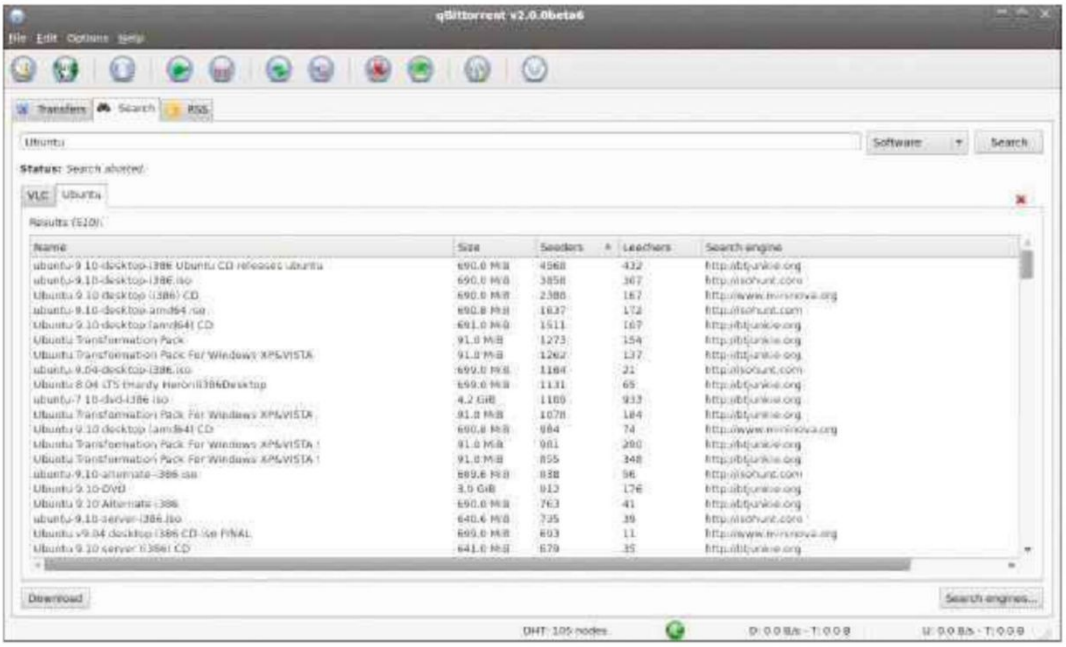
Bryan

Getting slow torrent download speeds could well be a sign of your ISP throttling your connection something many will do if there's what they deem, excessive use. Some ISP's may also take steps to throttle encrypted traffic, which includes torrents. If this is the case, there's little you can do, as your ISP has made this decision based on your usage. If so, you're in breach of the fair usage policy, which you had to agree to when you signed up with the ISP. Of course, this is all mere assumption until you find out for sure, so a call to support may be worth it, to see if you are, indeed, being throttled. If so, at least you know why your speeds are poor to non-existent.

However, throttling may not be your problem. I've seen many reports that some torrent clients can begin to malfunction, and quite a few instances of uTorrent causing problems that sound a lot like your symptoms. So, this may be the cause of your problem, and your actual connection may be fine. A good way to check this would be to uninstall your torrent client, in this case uTorrent, and reinstall it. This may fix the problem.

Another option would be to switch to a new client. Although uTorrent has long been considered one of the best around, many would argue that it's degraded over time, and isn't as good as it once was. A new favourite for torrent users is qTorrent. This is another slimline client, and has become a big hit with users. You can find this at ***www.qbittorrent.org****. Install this, and give your downloads a try, you'll probably find things to be much improved.*

qTorrent has become a favourite among users, replacing the likes of uTorrent



Download.exe

I've been keeping tabs on how well my PC is running, as I've noticed a few instances when it's not performing as well as normal.

To this end I've been using the Task Manager to have a look at what's going on with my system, and what's running. Doing this, I noticed an entry that worried me. It's simply called download.exe. There's no publisher listed, and the start-up impact is high in terms of system resources. I was immediately concerned, so I disabled it.

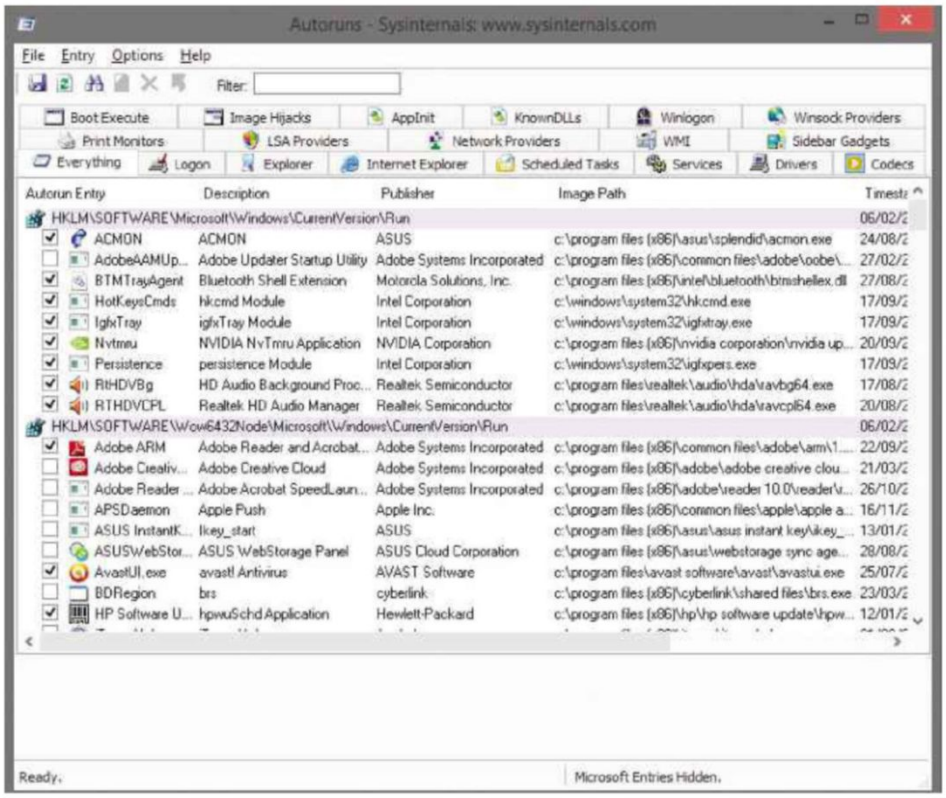
I'd like to know what this actually is, and if I should be worried. What steps should I take to ensure I'm safe?

Graham

In this situation, I'd certainly share your concern. Any unexplained entry that appears in your Task Manager is a potential problem, but one simply called download.exe that bears no publisher is especially concerning. Although it's possible it's a legitimate program, and nothing to worry about, with no publisher listed, it's also very possible that it could be some form of malware, so it would be a good idea to run a malware scanner, as well as antivirus, just to be sure. For best results, run a couple of different malware scanners. Hopefully, these will find and deal with the problem.

To find out more about the actual process, and what it could be, you could try an enhanced version of Task Manager called Autoruns. This free program provides more information about entries seen in Task Manager, and could help identify your mystery guest. You can grab Autoruns from Microsoft at ***technet.microsoft.com/en-au/sysinternals****.*

One thing I should make clear is that there's a high number of download.exe program variants reported, with a large range of uses and potential problems, so your entry isn't unique, it could be one of many different versions. It would appear as though the .exe files located within the Windows\System32 folder are less likely to be problematic (although this could still be a possibility), while download.exe files residing in Windows' temp folder are more likely to be a threat. So, take note of where the file physically sits before you decide what to do with it.



▲ ***Autoruns is a free tool that provides much more information about running processes***

UPnP?

Recently, I've been looking into my router's capabilities, as I'm not all too familiar with them really, and noticed a feature called UPnP, which I believe is quite an old technology used to forward ports (which I've already looked into to find out what it means). After finding this, I looked it up and found many people online advising that it's a security risk, and is a feature that it's advisable to turn off.

So, I'd simply like to ask what your opinion is. Is UPnP as big a threat as some say, and should I disable it? If so, would that mean I can't use port forwarding?

Lee

> **“Universal Plug And Play is simply a technology that makes it possible for programs to request port forwarding”**

UPnP, or Universal Plug And Play, is simply a technology that makes it possible for programs to request port forwarding automatically, meaning it doesn't have to be done manually. On paper, it's a very useful feature, but as is so often the case with convenience, it does also open up a potential security hole, which many have analysed and found to be a real risk. There are scripts that can run online that use flaws in UPnP, opening up your system to attack, and this can even lead to the use of unsavoury DNS servers, which can redirect your browsing without you knowing about it.

As with a lot of security risks, however, this kind of explotation is also still fairly rare, but if you're concerned, then disabling UPnP is probably a good idea. Many users do this to prevent any potential threats, and you can still manually apply any port forwarding you need. What's more, if you don't use any apps that make use of port forwarding, you may as well disable UPnP, as you don't really need it. Your router's documentation will have details on manual forwarding methods.

For a lot more information on potential UPnP issues ***www.upnp-hacks.org*** *is a great resource for those wanting to know more about the potential issues.*

▲ ***UPnP is a common feature, but can be a security risk in rare cases***

ASK JASON

Meet Jason D'Allison, a veteran of Micro Mart's panel of experts. He's here to help with any technical questions, including anything to do with tablets or smartphones, as well as PCs

Send your questions to:
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Dennis Publishing
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W1T 4JD

Contact Jason by email at:
jason@micromart.co.uk

While we try to cover as many questions as we can, we regret that Jason cannot answer your questions personally, but he'll cover as many as he possibly can each week. Please ask one question per letter and remember to include the full specification of your computer, including its operating system.

Jason

Poweraid

I'm planning to put together a small PC for office use. It doesn't need to be powerful – the hardest it'll work is adding up a few numbers in Excel. I'm looking at AMD's AM1 platform, perhaps with an Asus AM1M-A motherboard (about £23) and a quad-core Athlon 5150 APU (about £34). I've read that some people are powering PCs like this with picoPSUs. What are those when they're at home? Would I need a special case? What's the advantage? I'm a bit old-skool, and talk of 'DC-DC converters' just leaves me confused.

CM Kimberley, Cheshire

A picoPSU plugs into a motherboard's standard 20-pin or 24-pin ATX power socket, just as a conventional PSU does. The difference is that the plug is the whole PSU: it's a tiny circuit board no wider than the socket itself and which typically protrudes only a centimetre or two above it. There's no big black or silver box at the end of a bunch of cables.

What there is, though, is a power-brick. This converts the nominal 230V AC mains output to a 12V DC output. It's the same as a laptop power-brick except that the output there is typically 19V DC. A picoPSU has a flying lead coming off it – as well as Molex and SATA connectors – that terminates in a jack socket. This is mounted in the wall of the PC's case, and the power-brick plugs into it – again, exactly as with a laptop.

The term 'DC-DC' is used because all a picoPSU does is convert its 12V DC input to the 12V, 5V, and 3.3V DC outputs needed by the motherboard. The conversion from AC to DC has already been done by the power-brick. A conventional PSU is an AC-DC converter, as the one unit takes care of the whole job.

Should you go the picoPSU route? The chief advantage, of course, is that you could choose a much smaller case. Another plus is silence – there's no fan. Well, having said that, the latest picoPSUs can deliver up to 160W, and some of the available power-bricks for those do have a fan, but an 80W picoPSU should be adequate for a PC such as the one you're proposing.

The choice is yours. Fit a conventional PSU if you prefer, but don't be put off from using a picoPSU because of some confusion or misunderstanding. Hopefully I've helped show that the technology holds no mystery. Price is a consideration, though. An 80W picoPSU and accompanying power-brick will cost around £35, yet a 300W no-name conventional PSU can be had for barely a tenner. However, there's no question that the picoPSU would be better-made and more power-efficient.

Bear in mind that 'picoPSU' is a brand-name of Ituner Networks (which also trades as Mini-box). The term is now used pretty generically, with lots of third-party or knock-off items available. Be careful. There are big savings to be had, but there could be concerns about quality and reliability.

For a small-form-factor PC, a picoPSU is well worth considering

Just Deserts*

Have you discovered the hidden game in Android Lollipop (v.5.x)? I've just updated my Nexus 7 tablet and found the game in the settings. As you're a man who knows his phones and tabs, I expect you've already played it, but in case you haven't, go and find it and become an addict! Like me...

Joel, Gmail

Many thanks for writing in, Joel. I put Lollipop on my lad's 2012 Nexus 7 a month or so ago (I've yet to get round to sorting my mom's 2013 model), and the first thing I did once the update from KitKat (v4.4.x) had completed was fire up the About screen in Settings and jab at the Android version number. 'Sad' isn't the word, I know. There's been some treat or other hidden behind the version number since Gingerbread (v2.3.x).

As I'm sure you're aware, the Lollipop game is an homage to Flappy Bird (which is no longer available, of course, at least officially). For readers unfamiliar with the drill, you have to fly Andy the Android – or Bugdroid, to use his more official name – between a series of side-scrolling lollipops. Think of it as skiing between slalom gates. Andy's constantly tugged towards the ground under gravity, so to keep him flying, you give him little upward boosts by tapping the screen. It's as though he's wearing a jetpack. If he collides with anything but the sky, it's curtains.

And for me it's curtains an awful lot. The game is fiendishly difficult. So difficult, in fact, that initially I assumed there was some aspect of the control mechanism I hadn't properly picked up on. But no. It really is this hard – much harder than Flappy Bird ever was. My high score is 2 – yes, I've passed through just two lollipops. If you've managed a higher score, Joel, please let me know. I won't believe you, but please let me know.

** I've just realised, after all these years, that the phrase is *not* 'just desserts', even though that's how it's typically written. In fact, the phrase has nothing to do with puddings, so using it in relation to Android code-names makes no sense at all. Hey-ho.*

➤ ***10 points? Yeah, right. Methinks someone's a bit handy with Photoshop!***

Chips With Everything

My current PC's starting to creak with age, being based on a Core 2 Duo. I want to build a new one, this time using a Haswell-generation Core i7. I can't decide on a motherboard, though. Obviously I'm looking at LGA 1150, but there are so many chipsets – H97, B85, Z87, and so on. What are the differences? It's not easy to tell. I'm after a board with some quality about it – probably one from Gigabyte, Asus, or MSI – and if I'm honest I'm hoping to overclock. My budget's about £75, however, so I realise I may have to compromise.

Sam Halford, Essex

Eight chipsets are available for LGA 1150, and there are only subtle differences across all of them. The Z parts are aimed at enthusiasts; the H parts are aimed at the mainstream; and the Q and B parts are aimed at business users. Run your eyes past the table of main features I've drawn up.

As you plan to overclock, Mark, the Z parts are where the action is. These also allow the PCIe lanes from the CPU to be split over two or even three slots, enabling SLI and CrossFire configurations. They also pack the full complement of SATA 3.0 and USB 3.0 ports.

*Anyone after a board with a Q or B chipset and needing specific business-orientated features should glance at Intel's datasheets. There are loads of such features, and only the Q87 chipset, with its vPro certification, supports the whole lot. Here's the datasheet for the six 8-series parts: **bit.do/Y7Kz**. Go to page 52. And here's the datasheet for the two 9-series parts: **bit.do/Y7KD**. Again, flick to page 52.*

*Now, Haswell CPUs come in three flavours: original, Refresh, and Devil's Canyon. They're all compatible with all eight chipsets, but boards using the 8-series parts may need BIOS updates to work with CPUs other than the originals. Please see **bit.do/Y7P3** and **bit.do/Y7P6** for further details. In your case, Mark, just stick to the Z97 chipset, as Z97 boards typically cost no more than their Z87 equivalents. Prices start at around £60 – well within your budget.*

➤ ***When the differences are so small, what exactly is the point of selling eight chipsets instead of just three or four?***

COMPARISON OF LGA 1150 CHIPSETS

FEATURE	Z97	H97	Z87	Q87	H87	Q85	B85	H81
GPU PCIe configurations	1 × 16; 2 × 8; 1 × 8 & 2 × 4	1 × 16	1 × 16; 2 × 8; 1 × 8 & 2 × 4	1 × 16	1 × 16	1 × 16	1 × 16	1 × 16
GPU PCIe revision	3.0	3.0	3.0	3.0	3.0	3.0	3.0	2.0
USB ports	6 × USB 3.0; 8 × USB 2.0	6 × USB 3.0; 8 × USB 2.0	6 × USB 3.0; 8 × USB 2.0	6 × USB 3.0; 8 × USB 2.0	6 × USB 3.0; 8 × USB 2.0	4 × USB 3.0; 10 × USB 2.0	4 × USB 3.0; 8 × USB 2.0	2 × USB 3.0; 8 × USB 2.0
SATA ports	6 × SATA 3.0	6 × SATA 3.0	6 × SATA 3.0	6 × SATA 3.0	6 × SATA 3.0	4 × SATA 3.0; 2 × SATA 2.0	4 × SATA 3.0; 2 × SATA 2.0	2 × SATA 3.0; 2 × SATA 2.0
PCIe 2.0 lanes	8	8	8	8	8	8	8	6
DIMMs per channel (dual-channel)	2	2	2	2	2	2	2	1
Independent displays (CPU GPU)	3	3	3	3	3	3	3	2
Rapid Storage Technology (RAID etc.)	✓	✓	✓	✓	✓	✗	✗	✗
PCIe M.2	✓	✓	✗	✗	✗	✗	✗	✗
vPro	✗	✗	✗	✓	✗	✗	✗	✗
CPU overclocking	✓	✗	✓	✗	✗	✗	✗	✗
Introduced	May 2014	May 2014	June 2013	June 2013	June 2013	June 2013	June 2013	June 2013

Crowdfunding Corner

This week we're taking another look at crowdfunded games projects. But don't worry, the projects we've chosen are guaranteed Peter Molyneux-free!

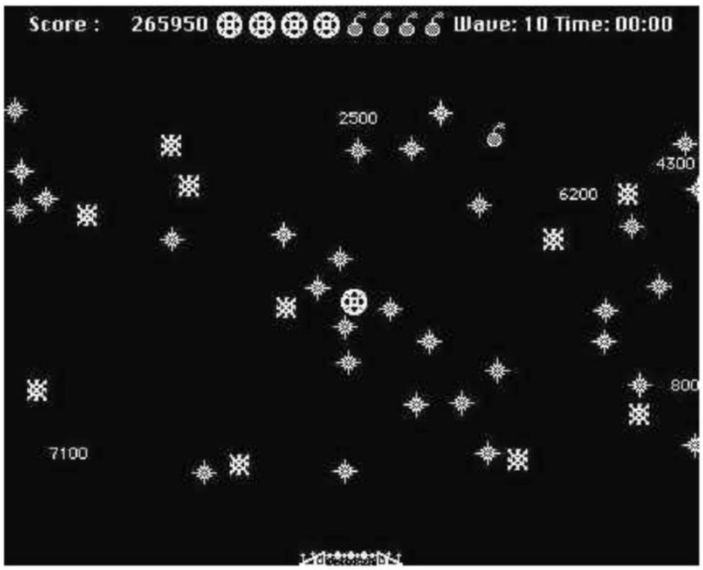
Crystal Quest Classic

Crystal Quest Classic is a revival of the 1987 video game *Crystal Quest*, which was popular on such diverse platforms as the Mac, Amiga, Game Boy and Xbox 360. This remake sticks to the original gameplay, asking you to collect crystals while avoiding mines and 12 breeds of alien bad guys in some high-octane, twitchy, retro-inspired fun.

This remake has an official licence to proceed granted by Patrick Buckland, creator of the original *Crystal Quest*, and any version that gets released will have his full approval. The idea is for the remade version to capture the vibrant look and feel of the original but in high-resolution and on modern platforms including Windows and Linux. The game will also come bundled with the CritterEditor, which allows you to modify the look and sound of the game's enemies on desktop platforms, just like in the original!

Planned for release in August 2015, you can get a digital copy of *Crystal Quest Classic* by backing the project for as little as $5. $20 gets you early access to the alphas and betas, while for $50 you can get 20 platform-independent copies to hand out to your friends. Higher tiers involve exclusive T-shirts and memorabilia, including physical copies at the highest levels. The target is a fairly hefty $30,000, but with weeks to go, there's every chance they'll reach it in time. If you're a fan of retro-gaming, this is the project for you.

URL: kck.st/1vnjVq3
Funding Ends: Monday, 9th March 2015



Orphan

If you liked the look of *Limbo* but felt like there was more of a game to be found in the idea, why not take a look at *Orphan*? A 2D platformer about a young boy who might be the sole survivor of an overnight alien invasion, *Orphan* sees you sneaking through open fields and dense forests, ducking behind rocks and trees, all while being pursued by an army of machines designed to destroy all life.

With gameplay inspired by classics like *Another World, Blackthorne* and *Oddworld: Abe's Oddysey*, *Orphan* has an emphasis on stealth, item discovery and strategic combat. As the game progresses, the player will become more powerful and gameplay becomes more action oriented. Achievements based on core gameplay and tons of secrets to uncover add extra value to replays once the game has been completed.

A single copy of the game costs backers $15, including your name in the credits and a digital instruction manual. $25 gets you all that and an art-book PDF, while $35 gets you beta access and an additional copy of the game. There are more tiers available, and the project is well on the way to its $32,000 goal, so back with confidence!

URL: kck.st/1BYIBdw
Funding Ends: Tuesday, 3rd March 2015

Disclaimer: Images shown may be prototypes and Micro Mart does not formally endorse or guarantee any of the projects listed. Back them at your own risk!

App Of The Week

Plague Inc

David Hayward takes a moment to wipe out humanity

Have you ever taken a moment to consider what it would take to infect the whole of humanity with a terrible disease, and subsequently wipe out every last person? Okay, it's not the kind of thing most of us think about, we'll grant you.

However, while a hundred years ago a lethal virus could effect one region badly without spreading to become a global pandemic, these days – with humanity thriving in every conceivable corner of the world – a sneeze in Heathrow could lead to a catastrophe in Australia a few weeks later. It's a sobering thought.

Ring A Ring O' Roses

Which brings us to this week's App, a game that delves into the nastier side of global population and travel links. *Plague Inc* is an older app, but an interesting one: basically, to win, you have to kill off the Human race. The way you attempt to do this is to infect the world with a deadly plague. To begin with you have a bacteria to bring down the end times on humanity, which you must nurture and evolve during the course of play in order to increase its infection rates and lethality.

You select the country in which to start your plague, with careful consideration to the location and transport links of the country in question. For example, a western rich country will be able to contain the spread of the disease better than a poorer country, with a lower standard of hygiene.

The transport links are all important too, after all you'll need to spread the illness to the farthest reaches of the planet. So somewhere that has a busy airport and shipping lanes can help move the illness across to other countries and continents. Land borders are worth considering as well, since you could potentially evolve the plague to infect birds, rats and other wildlife.

As you begin to infect the population you'll score DNA points, which you can spend on evolving the plague to be more lethal, more infectious, better resilience to drugs and research, and the ability to survive and infect people and animals in different climates. Eventually, the numbers of the infected will grow exponentially until there are no more healthy people left.

However, humanity isn't going to take this lying down. As the infection spreads the world becomes more hell-bent on stopping it and entire countries will shift their resources from more mundane matters to fighting the infection and ultimately finding a cure.

To stop that, you'll need to evolve your infection faster or make it more deadly so it can wipe out entire countries quicker. If you succeed, then you can opt for a harder level to unlock a new plague type: virus, fungus, parasite, prion, nano-virus or even bio-weapon.

Conclusion

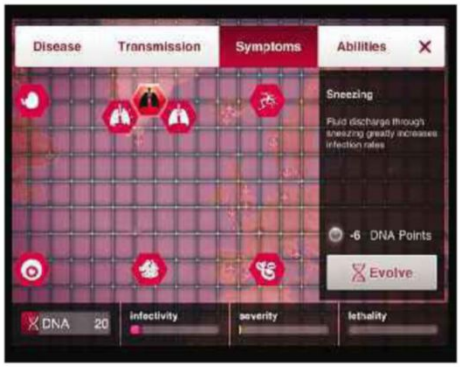
It may not sound like a very nice game, and in all honesty it's not. What it is, though, is quite thought provoking – it even caught the attention of the CDC (Centres for Disease Control and Prevention), which now uses it as a teaching tool for those that may be tasked with helping to deal with such situations.

Plague Inc is certainly interesting, we'll give it that, and we have seen some success with our virus (which we lovingly name 'Bumface') being spread globally and wiping out the world. It seems, then, that it's not a question of 'if' a virus can kill us all now, it's more like 'when'. **mm**

Features At A Glance

- Free
- Extra, paid for, add-ons that can extend gameplay
- An interesting strategy game
- Rid the world of humanity with amusingly named, but nonetheless deadly, pathogens

Spreading your deadly pathogen through transport links will ensure the end of humanity



Spend your DNA points and evolve the virus

Eventually infect everyone, and kill off human kind altogether

Logging Off

As I'm in my 50s, I'm well used to seeing politicians get up on a soapbox and prove beyond any reasonable doubt that they should be kept away from rational people for good reason.

But recently there have been some utterances that have boggled even my mind, mostly on the subject of encryption. According to these, the UK and US governments are both keen that encryption not only exists (because the ever reliable banks need it), but that it also always has a 'back door' so that security services can indulge their voyeuristic whims at every turn.

In short, this is the worst type of hogwash imaginable, spouted for the most part by those whose grasp on maths is as strong as mine on collective works of the Greek poet Herodas. The notion that you can have a means that is secure and simultaneously entirely open is one that only politicians could imagine, given their relish of cake-and-eat-it buffets.

This is utter tosh, because if an encryption system has a known and inherent way to circumvent it, then it's no longer secure. This idea seems the forerunner of a plan where the security services are allowed real encryption that keeps things generally secure, and the public, who really probably need it even more, don't get any that's worth having.

That would make us meat on the table for identity thieves and would probably end online banking and purchases in one economy dashing stroke.

The more you think about the implications of what's been seriously considered, the greater the conclusion that these remarks were made without any thought process at all, because you can't uninvent maths, and there are really good encryptions systems that people have relied on for centuries that don't need a computer or the internet. If people want to keep secrets, they will, unless GCHQ has a super-secret machine that can read people minds. Empirical evidence suggests not.

To cap it all, they keep harping on about internet services are 'supporting terrorism', because they use Twitter to communicate. However, I've never seen paper manufacturers dragged over the coals for something written on their stock, or BT accused of helping extremists keep in touch with Friends and Family.

Again and again, we've see the idea floated that because they're not outing people as potential terrorists, in a manner much like how humans are identified by aliens in *Invasion of the Body Snatchers*, then Google, Facebook and their ilk are somehow in cahoots with them. And each time there's some heinous act of savagery, wizened security

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experts come out from under their rock to demand even more powers to add to the almost limitless ones they already have but officially can't tell us about.

As we're now in that exceptionally silly season that prefaces a general election, I'm expecting politicians to make increasingly wild assertions about how they'll stop all this terrorist nonsense with just the right piece of personal freedom-infringing legislation. Like all the bills they've passed so far to protect us have… not.

As an uncommitted voter at this time, I'll be voting for the party that doesn't demonstrate their general stupidity by claiming they'll be banning encryption or how they'll tax prime numbers – serving only to remind us that without a box marked 'none of the above', how tough a choice we've all soon have.

Mark Pickavance

LAST WEEK'S CROSSWORD

Across: **7** Skeuomorphism, **8** S-Pulse, **9** Newton, **10** Split Up, **12** Trial, **14** Steam, **16** Marmite, **19** Kepler, **20** IQ Test, **22** Andrei Tupolev

Down: **1** Skip, **2** Nuclei, **3** Impetus, **4** Print, **5** Shower, **6** Assonant, **11** Patterns, **13** Maximus, **15** Allure, **17** Motion, **18** Droid, **21** Skew

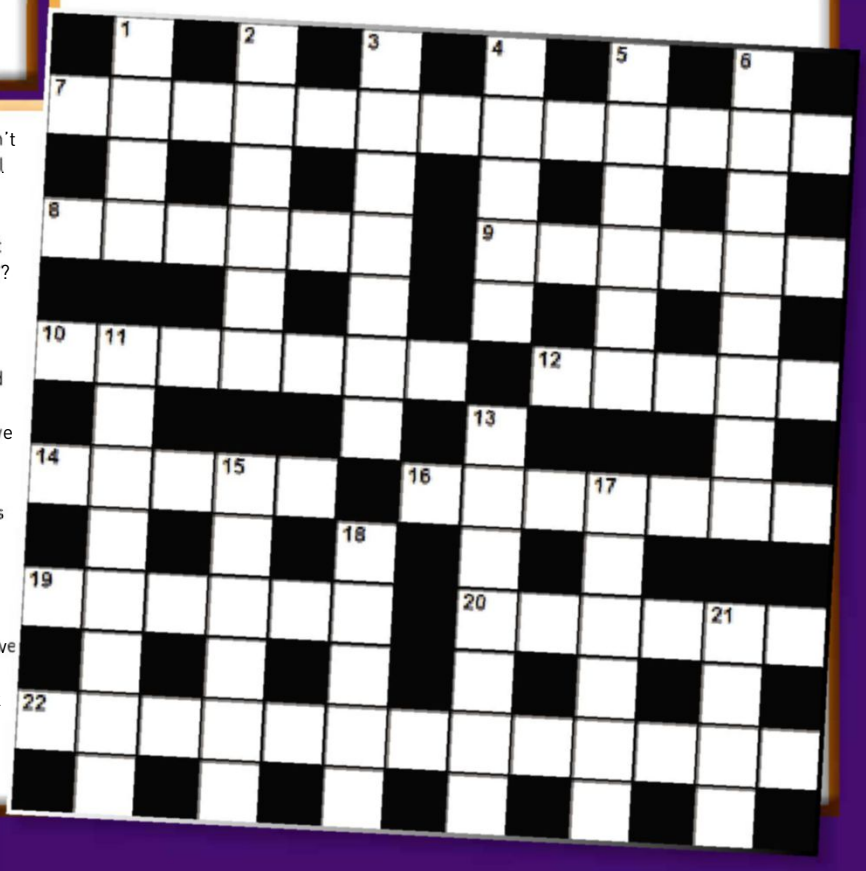
THIS WEEK'S CROSSWORD

Across

7 A radiogram made by exposing photographic film to X rays. (13)
8 German philosopher who argued that philosophical authoritarianism is inevitably oppressive and that all theories should be rejected. (6)
9 His inventions include automatic telegraph systems and the carbon microphone. (6)
10 The apparent change in the frequency of a wave due to relative motion. (7)
12 In heraldry, a subordinary of triangular form having one of its angles at the fess point and the opposite aide at the edge of the escutcheon. (5)
14 Take on or follow a known principle or course of action. (5)
16 The excess of revenues over outlays in a given period of time. (7)
19 A still shot inserted into a film or video. (6)
20 Marked by practical hardheaded intelligence. (6)
22 The size of each grouping into which a range of a variable is divided, as represented by the divisions of a histogram or bar chart. (5,8)

Down

1 A unit of language that native speakers can identify. (4)
2 Trick someone into committing a crime in order to secure their prosecution. (6)
3 An additional name or an epithet appended to a name. (7)
4 A numerical scale used to compare variables with one another or with some reference number. (5)
5 Deliberately make unattractive. (6)
6 A billionth of a volt. (8)
11 Numbers designating places in ordered sequences. (8)
13 Values automatically assigned to software applications or computer programs. (7)
15 Word used in a polite request. (6)
17 An outbreak of public anger or excitement. (6)
18 Artifact consisting of a narrow flat piece of material. (5)
21 Impairment resulting from long or arduous use. (4)



The Things That Frustrate Us About... PDF Files

One of the most common document formats also causes a huge amount of rage. Here's why...

The PDF – or portable document format – is one of those things that's so common we don't really think much about it. Designed originally to be used on different platforms without losing formatting or becoming unintelligible, it's still used commonly for things like user manuals or other formal text documents. Since 2008, it's been an open standard, which means you don't need to have proprietary Adobe software to open or create them – so If you're sending something that needs to look exactly the same to every recipient as it does to you, a PDF is a pretty good bet. What's more, if it's a document that's going to pass through several people's hands, sending a PDF means they're less likely to (accidentally or purposely) make changes.

There's always a 'but... ', though. Indeed, there are plenty of downsides to this format we're afraid. So here are some of our biggest frustrations with it:

Argh! Editing Fail

One of the main reasons people use the PDF format is so other people don't tamper with the contents of their documents. Sometimes you need to, though – if you've been asked to comment on a document, for instance, you might want to make quick changes to the text, and some companies even send PDF forms for job applicants to fill in, without formatting them properly. How do you type into a document that is, essentially, an image, though? Argh.

Fix it: Well, Adobe would like you to buy Acrobat so you can edit PDF files, but that costs money. So you might want to turn to another piece of software, like SodaPDF, which is cheaper than Acrobat, or you could try a free online tool, like PDF Buddy, which lets you upload and edit PDFs for free.

Urgh! Online Reading

PDFs are standard in publishing, because designers know that what they've created can generally be replicated exactly in the printed version. A PDF contains everything, from fonts to images, that needs to end up on the printed file. Just because PDFs are great for printing doesn't mean they're great for on-screen reading – and definitely not for reading on websites. This is a user error issue, really, but when documents have been prepared for printing and then end up uploaded to a website, they're not really optimised for reading on screen. Paragraphs are too long, font sizes are awkward, and there's no easy way to navigate the document.

Fix it: There's not much you can do from the reading side, but if you're thinking of just dropping massive PDF documents on your website, consider whether you actually need to, or if the information can be better presented in another way. By which we mean a shorter, simpler way. On a web page.

Bah! Copy And Paste Fail

Many, many times, when you're reading something in a document on your computer, you want to copy and paste bits of it out. Maybe you want to quote it, maybe you want to search for something, maybe you just want to save it for later, or incorporate it into another document. Copying and pasting out of PDF files used to be really difficult, but most of the time now it's fairly easy… except, when you copy something out of a PDF and into a Word document, all the formatting disappears and gets mangled.

Fix it: Nope. Sorry. No can do. **mm**

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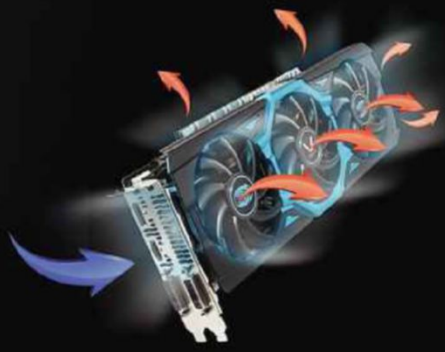

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