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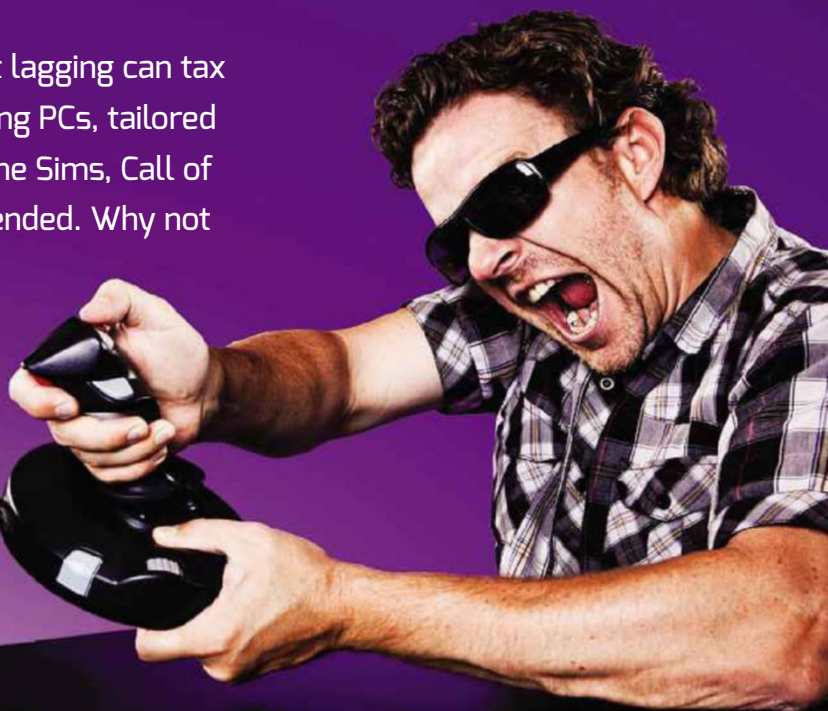
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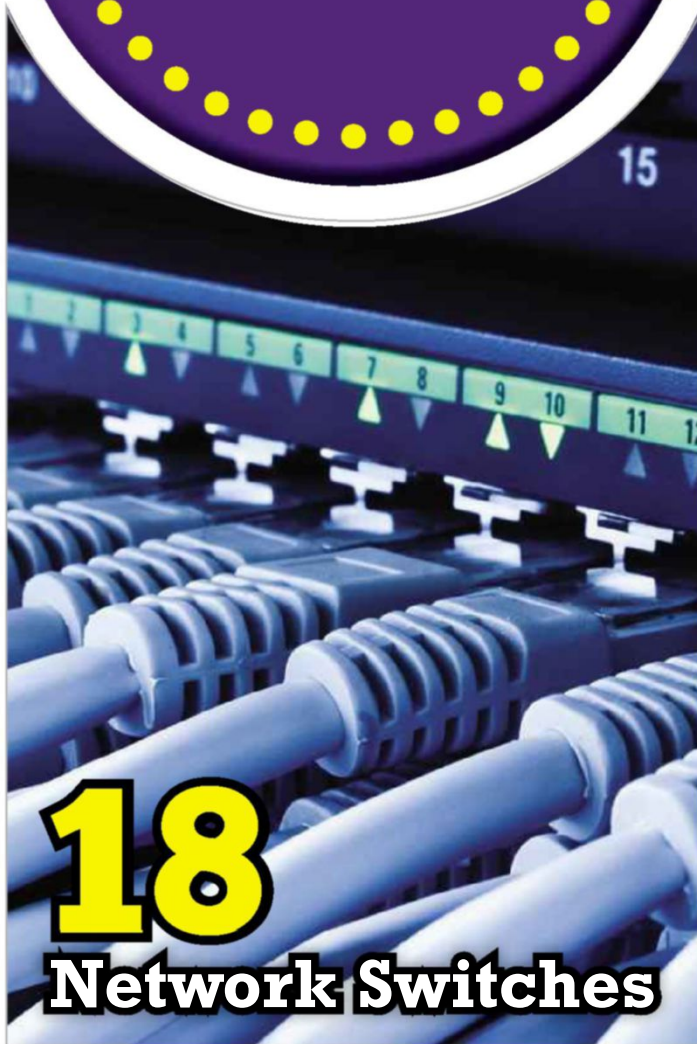
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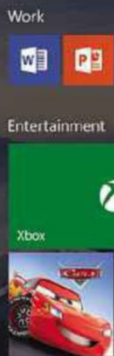
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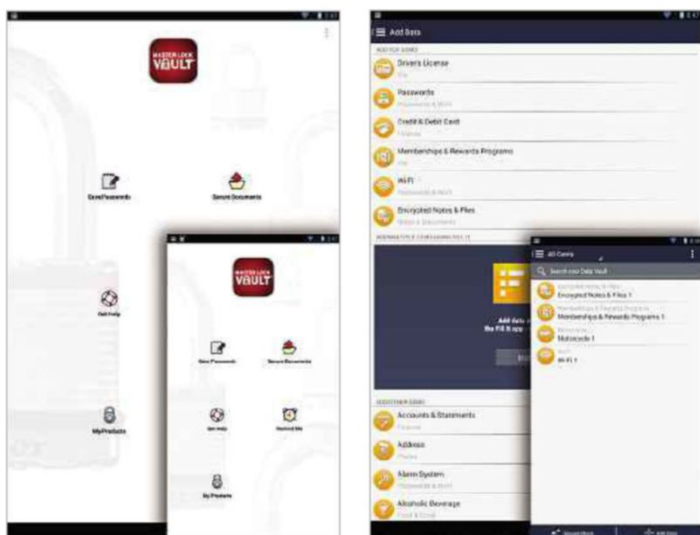
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What Can We Expect From **Windows 10**?

Microsoft will launch Windows 10 later this year, replacing both 7 and 8, but what difference will it make? David Crookes finds out



fall in love with Windows 10 and for billions more to decide to make Windows home."

Judging from the reaction of Twitter, it may just be on to something this time around.

What, then, can we expect to see from Windows 10? The short answer is **adaptability**. Microsoft has outlined its hopes for a single platform that will work on anything from the smallest of phones to the largest of televisions. It will be used to power wearables and it will find itself seeping into the living rooms of many with integration into the Xbox One console. In short, Microsoft is hellbent on ensuring that Windows 10 becomes the new standard, and it hopes to achieve this market penetration by ensuring it will not cost you a penny. That's right...

Windows 10 Will Be Free

PC users running Windows 7, Windows 8.1 or Windows Phone 8.1 will be able to upgrade to Windows 10 at no cost as long as the upgrade takes place within the first year after launch. Once the operating system is installed on qualified computers, there will be no unexpected fees and Microsoft's executive vice president of operating systems Terry Myerson has vowed that Windows will continue to be supported during the lifetime of the device for no additional charge.

Some have been puzzled by the meaning of the word 'qualified'. Microsoft says that some hardware and software requirements will apply and that the availability of features may vary depending on the device. Details of these will, it promises, be made more clear in the coming months but, for now at least, it's free Windows 10 for all.



When Microsoft unveiled more details of Windows 10 at a recent special event, one thing really stood out: this is a company that can keep secrets. Although a good many of the details had been second-guessed before the curtain went up on its CEO, Satya Nadella, Microsoft still managed to throw in a fair few surprises while setting out its vision for the immediate future of computing.

The years to come promise much: a pleasing operating system that will put to bed the issues surrounding Windows 8, a major belief in gaming and (most eyebrow-raising of all) the launch of a holographic computing concept that has the potential to be the basis of GUI for decades. It all seems to add up to Microsoft being a force to be reckoned with yet again.

"Windows 10 marks the beginning of the more personal computing era in the mobile-first, cloud-first world," said Nadella, of the operating system that has already been installed more than three million times as a beta version. "Our ambition is for the 1.5 billion people who are using Windows today to





Why make it free, though? Given Microsoft has traditionally made most of its money from the sale of its operating systems, a trend which began when Windows was launched by Bill Gates in November 1985, this move has the potential to dent profit margins significantly. It will, however, ensure that the take up of Windows 10 is high and it will unify the Windows ecosystem. "The question, 'what version are you running' will cease to make sense," says Myerson.

“ Windows 10 marks the beginning of the more personal computing era ”

This business model takes its cue from Apple, which offered Mavericks for free in 2013 and did the same with Yosemite last year. The take-up of these has been strong, with 70% of the total Mac userbase now running one of the two. Microsoft, meanwhile, has seen Windows 8 and 8.1 take up a market share of just 18.65%, way behind Windows 7 at 56.41%.

While Apple OS X downloads could certainly have been higher – some Mac users have stuck with older operating systems even though their machines are capable of running the upgrades – Microsoft would nevertheless like to eradicate the current market fragmentation of Windows.

There Will Be Universal Apps

Windows 10 will make use of the Continuum interface, which dynamically adjusts the OS's UI elements depending on how you are using your device, to attempt to make switching from desktop to touchscreen as effortless as it can. Myerson also spoke of plans for "mobility of experience"; that you will be able to work on one device, move to another and immediately pick up where you left off – because "Windows 10 will support the broadest device family ever." This reflects a desire to make the operating system integrated and ubiquitous across PC, tablet, Windows phone and even Xbox, with the experiences on each tailored to suit the different devices.

For that to work, the OS needs a good selection of universal apps, and Windows 10 will provide them. Microsoft says there will be "one product family, one platform, one store" with everything made available in an integrated shop (called The Store). A new version of Office will be just as available for Windows 10 phones and tablets as it will be for the desktop.

Microsoft HoloLens

During its presentation, Microsoft pulled out a piece of kit that astonished everyone who saw it: a wireless holographic computer. Made to be worn over the head, it has a pair of holographic high-definition lenses as well as spatial sound. It works alone, needing no phone or PC connection, and it overlays virtual images on to the real world.

Microsoft showed off a video of this new technology which, in an instant, appeared to put the likes of Oculus Rift and Project Morpheus in the shade (although HoloLens will work with Oculus' VR system). The indications from those who have seen it are that the images are amazingly lifelike and the video certainly seemed to suggest that. It showed people having a Skype conversation while walking around the room and it showed a game of Minecraft – handily owned by Microsoft – being played in a living room as if it was physically there.

It showed how an item on screen could be displayed in virtual 3D via these see through chunky glasses on the desk and then manipulated, and it also highlighted a man plonking himself on the sofa, having brought up a virtual screen on which to catch up on the latest boxsets on Netflix. HoloLens (nicknamed Project Baraboo) will be powered by a new Holographic Processing Unit and have advanced sensors. It was the unveil which got everyone talking.

According to Microsoft this enables a shift from "the traditional machine-centric view of computing to an interaction that is much more personal and humanistic". Windows 10 will include full support for the headset, including a set of APIs that enable developers to create holographic experiences in the real world. Holograms will be universal apps and all Windows universal apps will be able to work as holograms. What is perhaps most astonishing, though, is that Microsoft has worked on this technology for five years whilst managing to keep its existence a secret.

Quite simply: it ups the ante. With Sony and Oculus attempting to bring VR to the masses, perhaps Apple will now look at its own system. HoloLens is set to be released within the next four years.



The same is true of Outlook which Microsoft showed to share a unified look across PCs, tablets and phones. PowerPoint and Excel will also appear near-identical on all devices, albeit with touch-control and screen size optimisation.

As expected, the cloud will play a major role in Microsoft's future plans, allowing all of these devices to sync content. A

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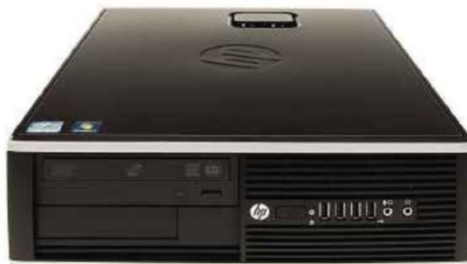
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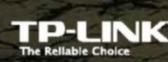
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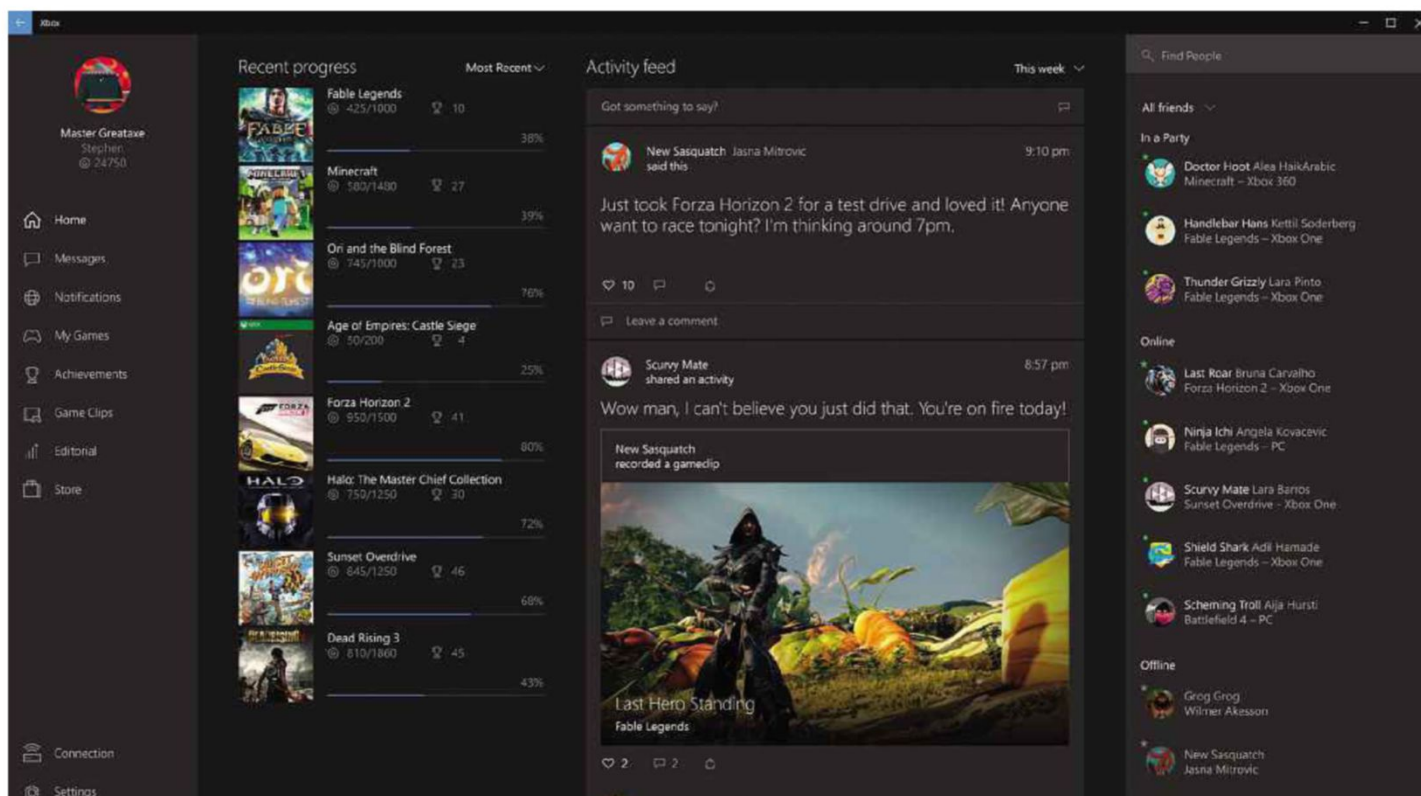
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new photos app will allow for sharing (it also cleans up images, remove duplicates and auto-enhances) and there will be support for the syncing of contacts and music, with everything backed up in Microsoft's One Drive. Of course, a lot of these features may well depend on the mass adoption of Windows tablets and phones – though that's an area where Microsoft really does have a job on its hands.

Cortana Will Say "Hello"

Joe Belfiore, the corporate vice president of the Operating Systems Group at Microsoft, showed off Windows 10's integration of Cortana, the digital voice assistant, which has up to now been confined to Windows Phones. With an almost-natural voice and an ability to handle some complex instructions, Cortana is able to learn the interests of users, presenting relevant information. This could include the sports results of your favourite team, or updates on flights that you have booked. It will allow you to dictate your emails and turn apps or music on and off.

Cortana will also operate as a search engine, scouring your computer and your OneDrive account as well as Bing, but for those worried that about the Start button – which was dropped in Windows 8, sparking a huge furore – it will be pleasing to read that Cortana will also sit nicely alongside it on a PC's desktop taskbar. It will also form part of other Windows devices, with Cortana taking up an entire screen on smartphones.

With support for seven languages and a Yoda impersonation, Cortana is shaping up to be a very useful feature. It will also respond to text input for those moments where speaking to your computer will make you appear a little silly.

This Is SPARTAN!

Cortana will also be built-in to Spartan, a new web browser that will be taking over from Internet Explorer, effectively putting an end to its solid 20-year run. As it stands, IE has around 60% of the global market share; while that sounds impressive enough, thanks

to anti-competition rulings and strong showings from Google's Chrome and Mozilla's Firefox (as well as competition from Apple's Safari), it is far from the monopoly it once enjoyed.

"Project Spartan is a new browsing experience tuned for being mobile and working across this family of devices," said Microsoft's Joe Belfiore. While we can't vouch for that just yet, it certainly does appear to be a step in the right direction.

It will take time for it to roll out to all devices, but when it does appear, it will feature a new rendering engine. It will also allow web pages to be annotated, giving users the ability to ring areas, draw arrows and scribble thoughts before sharing it with other Windows 10 users.

“ Microsoft says there will be “one product family, one platform, one store” ”

As we said, Cortana is integrated into Spartan, and it will keep a watchful eye on what you are searching for. If it believes it has the answer to a question you are about to ask, it will draw on its own resources – and, as creepy as this feature sounds, by second-guessing what you may want, it could save you time, perhaps by serving up the menu or opening times of a restaurant you have just searched for. Or by delivering reviews that may or may not put you off going.

As well as being optimised for your device, Spartan will also include an updated version of the Reading Mode that made its debut in the Internet Explorer app on Windows 8, allowing users to concentrate purely on the main text of a page. It also takes on the features of popular third-party apps such as Pocket, by letting users save articles for later reading (either online or offline). It even has PDF support.



It Will Work With Xbox

Given that Microsoft owns the popular Xbox brand, it is no surprise that Windows 10 will have a built-in Xbox app. "Over the last 13 years, Xbox has been focused on creating and expanding great gaming and entertainment experiences on console," said head of Xbox Phil Spencer.

"We're incredibly proud of the Xbox One and are fully committed to ensuring it's the best place to play console games in 2015 and beyond. Now, we are also bringing that same focus, passion, and commitment to gaming on Windows 10, enhancing the PC games and gaming devices you already love, including the Xbox One. We've listened and learned from our past efforts in PC gaming and I am excited about what the future holds."

The Xbox app will allow you to manage your Friends, Activity Feed, Achievements, and Messages. It will keep a note of the games you play on Windows 10 and on an Xbox One console. Gamers will be given the ability to record gaming sessions via the Game DVR tool – a feature that already exists within Xbox One – by simply pressing Windows+G. Those editable recordings will then be sharable, and this feature will also work with Steam.

On top of that, it will be possible for gamers to enjoy multiplayer gaming across Xbox Live and Windows 10, letting PC and console owners pit their skills against each other (Microsoft announced that *Fable Legends* will run on Windows 10 PCs on the same day as it is made available for the Xbox One). Indeed, the two products are going to be so assimilated that it will be entirely possible to stream Xbox One games through a home network to a Windows 10 device. What's more, many Xbox One accessories will be fully supported by Windows 10 too.

In order to boost the power of PC gaming, DirectX 12 will become part of Windows 10. It is designed to make games run faster and benefit from richer visuals. It will be supported by the Unreal Engine 4 and Unity, and Microsoft says it will "squeeze

Surface Hub

While the presentation rolled on, a screen in the background displayed the Windows 10 logo. It seemed a waste until it became part of the unveilings. For this screen was Surface Hub, a large-screen device aimed at offices and groups of people, enabling folk to share ideas and create projects.

Surface hub has multi-touch and digital inking capabilities, along with built-in cameras, sensors and microphones. It uses Windows 10, Skype for Business and Office 365. It also has cutting edge digital white boarding, instant remote conferencing, the ability for multiple people to share and edit content on the screen from a laptop, tablet or phone and a trusted platform for large-screen apps.

Microsoft announced that it would come in two sizes: 55" and 84".

The New Office Suite

The new Office for Windows 10 will give a fresh spin on Word, Excel, PowerPoint, OneNote and Outlook. They will have touchscreen-friendly features and Microsoft says they have been entirely redesigned so that they work on all of the Windows 10-supported devices.

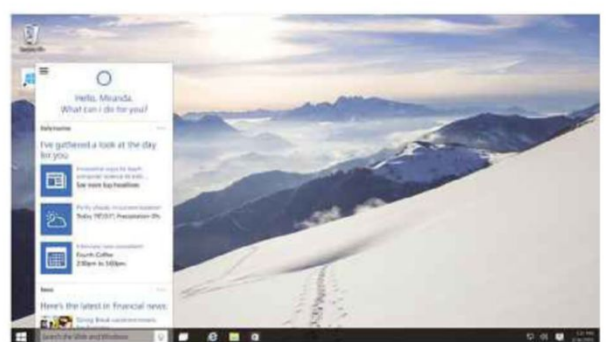
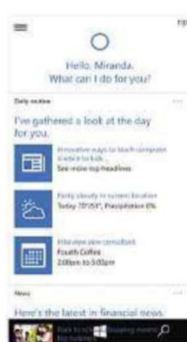
PowerPoint will have a new inking feature so that users can annotate slides in real time. New touch-first controls in Excel will make it easy to create and update spreadsheets without a keyboard or mouse. "They're going to deliver a consistent, highly rich, and complete Office experience," Microsoft's Joe Belfiore said.

every ounce of performance out of your supported hardware and open up a new wave of innovation for high-end graphics." Spencer says Direct X 12 can improve performance by up to 50%

And There's More

One of the first things Microsoft showed off at the Windows 10 unveiling was a new bar that could be swiped in from the right. This looked to be similar to the Notification Center on OS X, delivering controls such as Airplane Mode as well as app notifications. It will let you see new emails and invites to instant message apps, and it will alert you to Facebook posts.

There will also be decent security. Indeed, Myerson said that the Windows 10 would have headed off most of the cyberattacks the industry has witnessed in recent weeks and months. Microsoft also announced last September that it would be bringing two-factor authentication as standard in Windows 10's enterprise versions.





As we also saw last September, Windows 10 will be taking the best of Windows 7 and the best of Windows 8 (yes, there were some good bits) and bringing them together. That Start menu will merge the interface and live tiles the two relied on and bring a modern look to the new offering. To that end, there will be support for multiple desktops, improvements to Snap and a new feature called Snap Assist that lets you grab apps from multiple desktops within another feature called Task View – which presents thumbnails of open apps.

There are also clever things going on with Skype. It will be built into Windows 10 for Phones via a new Phone and Messaging app. It will be able to detect whether or not two users have registered their phone number with Skype. If they have then Windows 10 will recognise this and switch to the service. It's similar to iMessage in this respect, and it cuts out the need to switch between SMS and Skype.

“ Windows 10 will be taking the best of Windows 7 and the best of Windows 8 (yes, there were some good bits) and bringing them together ”

Get Going With It

With all of these innovations and changes, Microsoft is hoping to be able to consolidate what it offers without confusing the market (a market that may be unaware that Windows 9 just doesn't exist). Throughout the presentation, it appeared that Microsoft was looking to distance the new OS from Windows 8, which was only released back in 2012 – and nothing makes this more clear than the numerical gap between the two.

“Everything about Windows 10 – the experiences, delivering it as a service and the free upgrade – means that Windows 10 isn't just another product, it's an ongoing relationship; one that will give ongoing value to all our customers,” said Terry Myerson, executive vice president of the Operating Systems group at Microsoft. “The new generation of Windows is a commitment – a commitment to liberate people from complex technology and enable them to do great things.”

Windows To Date

November 10, 1983: announces Windows 1.0
December 9, 1987: Windows 2.0 released
December 9, 1987: Windows/386 (or Windows 386) released
June 1988: Windows/286 (or Windows 286) released
May 22 1990: Windows 3.0 released, with an upgrade version made available
October, 1991: Windows 3.0 (or Windows 3.0a with multimedia) released
April 1991: Windows 3.1 released; within two months, it sells more than a million copies
October 1992: Windows for Workgroups 3.1 released
August 1993: Windows NT 3.1 released
February 1994: Windows for Workgroups 3.11 released
September 1994: Microsoft Windows NT 3.5 is released
June, 1995: Microsoft Windows NT 3.51 is released
August 1995: Microsoft Windows 95 is released; within four days it sells more than a million copies.
August 1996: Microsoft Windows NT 4.0 released
November 1996: Microsoft Windows CE 1.0 released
November 1997: Microsoft Windows CE 2.0 is released.
June 1998: Microsoft Windows 98 released.
July 1998: Microsoft Windows CE 2.1 released.
May 5, 1999: Microsoft Windows 98 Second Edition released.
1999: Microsoft Windows CE 3.0 released.
February 2000: Microsoft Windows 2000 released.
April 19, 2000: Windows Mobile launched
June 19, 2000: Microsoft Windows ME (Millennium Edition) released
October 25, 2001: Microsoft Windows XP released
2001: Microsoft Windows XP 64-Bit Edition (v 2002) for Itanium systems is released
March 28, 2003 Microsoft Windows Server 2003 released
March 28, 2003: Microsoft Windows XP 64-Bit Edition (v 2003) for Itanium 2 systems is released
August 6, 2004: Microsoft releases Service Pack 2 for XP
April 24, 2005: Microsoft Windows XP Professional x64 Edition released
January 30, 2007: Microsoft Windows Vista is released
July 22, 2009: Windows 7 is released
November 8, 2010: Windows Phone launches and replaces Windows Mobile
February 22, 2011: Service Pack One released for Windows 7
October 26, 2012: Windows 8 is released
December 20, 2012: Windows Phone 8 launches
October 17, 2013: Windows 8.1 is released
September 20, 2014: Microsoft announces the next Windows will be Windows 10
January 21, 2015: Microsoft firms up Windows 10 details

Both the Windows 10 Preview build and the Windows 10 build for phones are out now, and we've been told that we should expect the full launches later in 2015. Myerson is adamant Microsoft has got it right this time: “There's about one and a half billion people using Windows today and devices outnumber people. Windows is at a threshold, and now it's time for a new Windows. Our new Windows must be built from the ground up for a mobile first, cloud first world. It wouldn't be right to call it Windows 9.” **mm**



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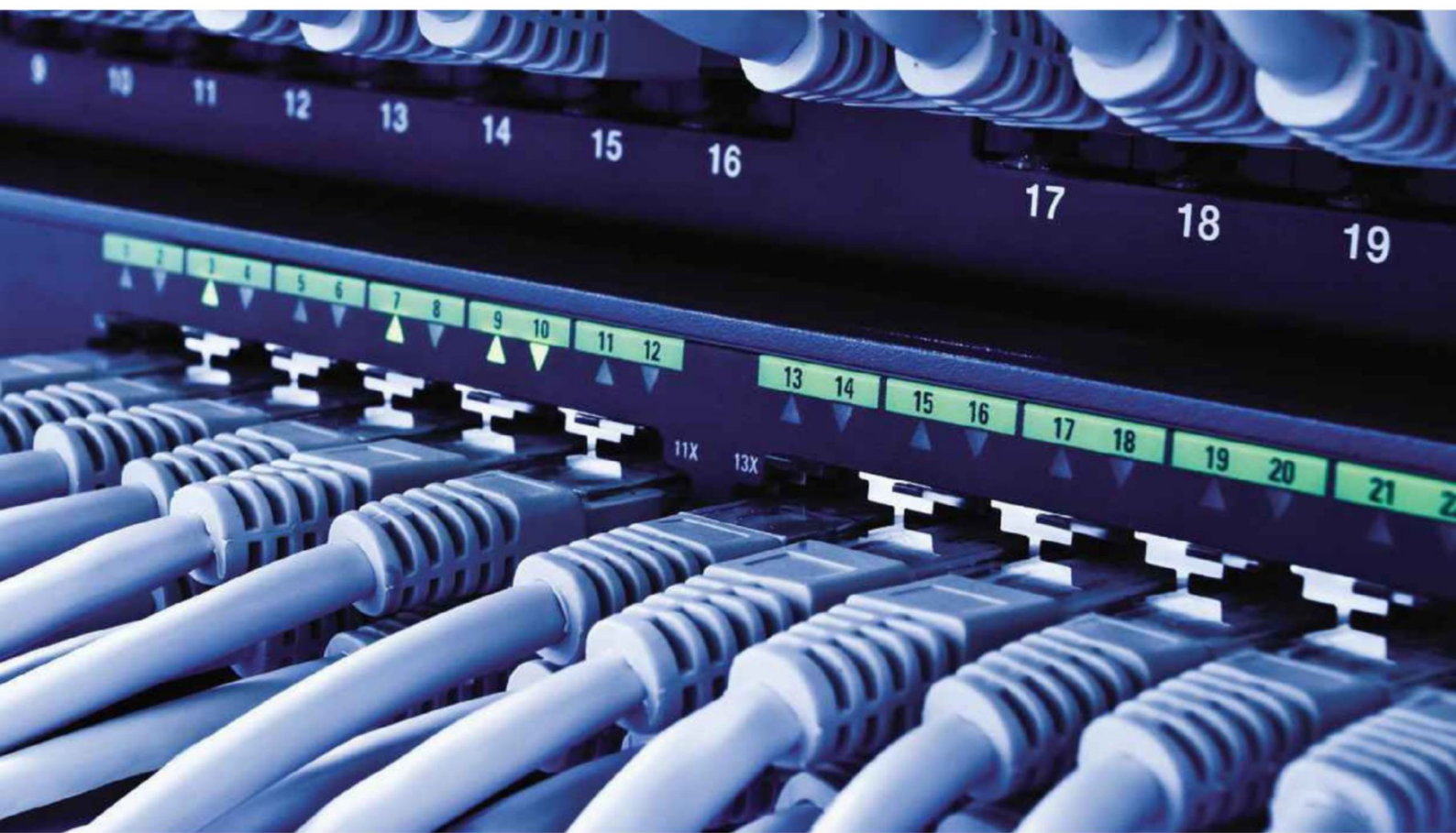


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The Network Switch

Mark Pickavance gives a crash course on understanding your network's critical component and why it's so important to have a good one

When I first got involved in networking, most PCs communicated by means of a networking technology called Token Ring.

Its popularity stemmed from it being used by IBM and it being the default network protocol for Novell Netware. Initially it offered good performance, reliability and an easily implemented topology.

But it had a major flaw: it wasn't routable. By that I mean it was very difficult to have more than a certain number of users on a token network without requiring some expensive connecting hardware, and managing 100+ users was a bit of a nightmare. It was also really expensive for the token adapters and cables.

The alternative was thin Ethernet. This had a looped topology that meant a single PC in a chain could stuff all those others around it; it was slower than token, though card costs and cables were cheaper.

But (and this is why I'm telling you these things) it had a marvellous capability in that it could use routed protocols, like

TCP/IP. That meant it was much more suitable for large networks where you could segment the network so that the traffic of PCs didn't propagate everywhere.

The key to this type of divide-and-conquer thinking was the Ethernet hub, a concept that eventually morphed into the network switch we know today.

But let's start by explaining how a hub and a switch differ, and why we no longer use hubs in general.

Hub Vs Switch

With the advent of the twisted pairs Ethernet that we're all familiar with today came hubs that allowed you to easily wire all the computers to each other.

These were the electronic equivalent of railway stations, where data packets would enter from a connected computer and then be distributed to all the others.

The hub wasn't intelligent in any way, so it was like all the computers were stood in a large open room, with everyone hearing all the conversations.

That's not wonderful from a security standpoint. But also if we take that analogy further, when you get to a certain level of people, nobody can hear anything.

In practical terms, that point occurred with about 16 to 20 users on 10Mbit Ethernet, because the number of transmission retries started a failure snowball.

You could segment the network, running each set of users on a different subnet, but then you couldn't talk to a server on an alternative subnet to the one your system used. What was required was something *smarter*, because the basic Ethernet architecture relied on each PC analysing the packets of data as they arrived and then working out if they were destined for them.

“ The key to this type of divide-and-conquer thinking was the Ethernet hub, a concept that eventually morphed into the network switch we know today ”

The solution to this was the managed hub, where you could create subnets isolating groups of users from the traffic of others, while maintaining a routing table to allow data to spill into other subnets when required.

This worked well, if the IT people responsible for it fully understood how it worked and the routing tables were correctly input. With a big company, IT staff usually broke the network down by departments or offices, and it was necessary to document everything you did just in case a PC needed to be moved from one location to another.

While this provided a workable solution, it was rather hand-cranked, and what network admins really wanted was an automated traffic management device: the switch.

Switch Me On

The arrival of this technology in the mid-90s totally revolutionised Ethernet networks, because they went from being a major drain on time and resources to almost a fire-and-forget solution overnight.

The switch had two major advantages, the first of which was the traffic management features I've already mentioned. This functionality interrogated incoming packets, somewhat like an old telephone exchange where you asked the operator to connect you.

By doing this, the switch could determine where the packet was going and send it on its way. But unlike the hub, it would only send that packet down the wire in the direction of the target PC, and not to all attached computers.

The effect was like each PC was on its own on the network, getting all the bandwidth available, even if it was one of a hundred machines.

If the switch had 16 10Mbit ports, it usually had, say, 200Mbits of backbone where the traffic could be directed, avoiding that becoming overloaded by the numerous conversations.

The snag (and it was a big one) was that this only worked flawlessly if all the PCs were randomly talking to each other, whereas in reality most PCs would generally talk to a very small selection of computers, namely the file servers.

This meant that a bottleneck existed between the server and the switch, as all the requests made by the PCs got squeezed into a single 10Mbit link that connected the server to the switch.

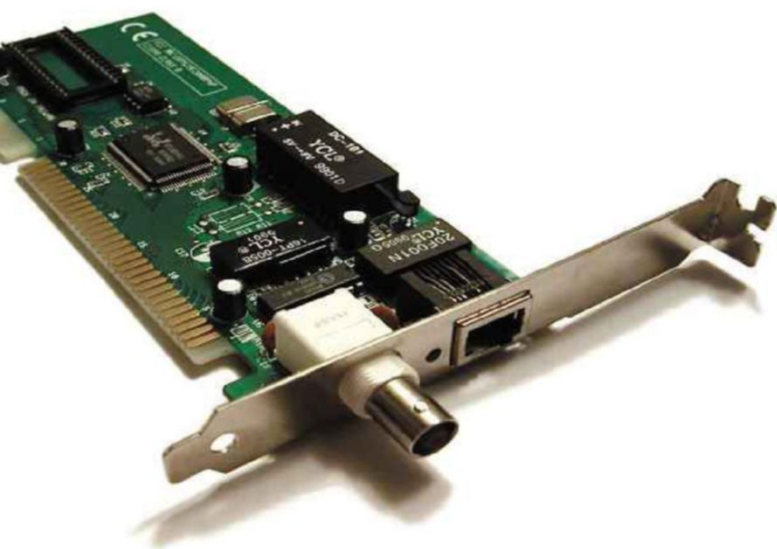
For this to work like intended, high traffic areas like switch-to-server pathways needed to be wider. Switch makers came up with two alternative means to achieve this, and they both worked for a fashion.

Channel Bonding

The first methodology was to use channel bonding, where the servers were given multiple network adapters. Early switches didn't support channel-bonding technology, but what you could do was connect one switch to each adapter and segment the network thus.

That kept the demands on each adapter down, increased overall throughput, and PCs on either side could talk to ones on the other adapters via routing on the server.





▲ This old network card has both the 'thin' coaxial cable-based 10BASE2 BNC connector and more familiar twisted pair-based 10BASE-T RJ45 socket

The downside of doing this was that if the server had a technical problem, then not only did that service end, but also any network devices (plotters, printers, modems) on remote segments would end abruptly.

A better solution was that offered by switches that supported channel bonding, where you could plug multiple adapters into one switch and have it logically stack the bandwidth by balancing the throughput on each channel.

“ Wired wins on speed, latency and reliability over any wireless technology yet devised ”

I remember implementing this with dual adapters, and some IT managers even installed up to four LAN NICs to achieve greater performance.

However, a much better direction lay in the creating of 'fat pipes', where the switch had special high-speed ports that were designed to link the servers with the backbone more directly. These were 100Mbit at first, but as the technology moved on, they became 1Gbit (optical on fibre) and then even greater.

These fat links were also used to chain switches together, cascading their backbones so that they could handle 250+ users without choking on the amount of traffic generated by multiple servers and PCs.

These days, for big systems the standard user-facing ports on the switch are often 1Gbit, and the inter-switch and server connections are 10Gbit, fibre or copper, though it is possible to get ones from the likes of Cisco that support 100Gbit and even faster.

Home Switches

I've so far talked about massive corporate networks, where the performance of the system is critical for the numerous users, but that isn't the problem that confronts most home or small office users.

Glossary

A collection of important switch-related terms that you might encounter if you are looking to purchase this technology.

ACL

A network that implements access control list (ACL) is the sort that those who handle sensitive information create. At the simplest level it defines which IPs (therefore devices) can talk to each other, and in more complicated setups it even tracking user specific service requests and server responses.

Auto MDI/MDIX Crossover

In the past, if you wanted to connect two switches to each other (a cascade), then you needed to use a crossed cable, wired differently from a standard Ethernet patch cable. These days switches either have specific cascade ports or, more likely, they automatically sense the other switch and adjust the port accordingly.

100 Base T

Each of the speed ratings has a different specification base on the wire used, and how it's cabled. 100Mbit connections come in various types like 100 Base TX and 100 Base T4. However, the ones that people generally use these days are 10 Base T, 100 Base T and 1000 Base T. These all use twisted pair cabling, in the various CAT standards.

Bandwidth

The amount of network traffic that any part of the network can handle at any one time. The faster the communication and the handling of that data in the switch the more bandwidth you have available. Communication over any piece of wire has a finite amount of bandwidth,

CAT5 and CAT6

Category 5 (or CAT5) is a cabling standard that was defined for carrying Ethernet over twisted pairs, originally up to frequencies of 100MHz. It was superseded by CAT5e (e for extended) and then CAT6.

Most people networking today will use CAT6 cable, designed for gigabit speeds and beyond. Using this it is possible to have cable runs of up to 100m at gigabit speeds and 55m at 10Gbit.

Convergence

Having separate cables for computing, telephones and video security can be complicated, but these days it isn't necessary. Convergent networks aim to push all these services through the same cables, with switches built to distinguish the different types of traffic and manage it accordingly. Networks that carry more than just computing traffic are 'converged'.

Jumbo Frames – The speed of Ethernet on gigabit is limited by the amount of header information that accompanies each data frame. One way around this is to increase the amount of data in each packet, reducing the proportion of packaging to data. Jumbo

fractal

design

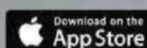


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▲ Older switches only support either 10 or 100Mbit operations, where modern ones can connect at gigabit or even faster speeds

In these environments, there are often less than ten simultaneous users, and therefore it's reasonable to ask if a switch is really necessary.

The majority of home users just use what switch functionality comes with their broadband router. That's usually a four-port device, and in the majority of cases they are often only 100Mbit Ethernet connections.

The irony of that specification is that if the router offers good N or AC class wi-fi, it's actually quicker to communicate through it using wireless than via the wired LAN.

Those wanting better performance need to make sure they have a router that supports gigabit speeds and/or an independent gigabit switch.

“ Those with greater network ambitions who want to cable numerous locations will need more ports, and probably a secure location for the switch to live ”

I say and/or, because realistically most of us don't have greater than 100Mbit broadband links, so communicating to the outside world is usually fine on 100Mbit LAN. Where the gigabit switch comes into play is when computers and servers or, in the home context, NAS boxes, want to talk at greater speeds.

I'm sure that some reading this will wonder why I'm promoting wired networks for home users, when running cables isn't easy in many UK homes.

Having used wi-fi, Ethernet cabling and even Powerline technology, I can say without fear of contradiction that wired gigabit Ethernet provides the most consistently high performance almost irrespective of the size and construction of the building. Therefore, if you really want to have the best network, then resorting to some cabling provides that, even if it is only in the critical connections between the most heavily trafficked routes.

Many people use wi-fi to connect their desktop PC to their broadband router, but they'd get much lower latency playing online games if they wired directly to them or via a switch.

Wired wins on speed, latency and reliability over any wireless technology yet devised, at this time.

frames are a standard method to do this, where network hardware agrees to increase the frame (usually to 9000k bytes) from the standard 1,500 bytes.

This can make a substantial difference on big file transfers, if both the network adapter and switch support Jumbo frames.

Packet

When data is moved across a network, it's organised by the system into manageable blocks or packets. These can vary in length and carry with them additional header information that is designed to help routers they encounter direct them correctly towards their destination. The terms 'packet' and 'frame' are interchangeable and can also be called a datagram.

PoE

Distributing a network doesn't always fit perfectly with the power layout in a building, so Power Over Ethernet (PoE) was devised. This subverts some of the wiring of the Ethernet cable to power a device at the other end, allowing local small switches to be deployed without needing new power sockets adding at locations they currently don't exist. Switches with PoE are made to send data and power of their ports, not just data.

QoS

With networks of all types, there is a danger that one user hogs all available bandwidth, souring the experience for everyone else. Quality of service (QoS) is technology that is designed to stop that happening and more fairly distribute the available resources.

RJ45

This is the chosen connector for Ethernet and works with wiring standards called CAT5, CAT5e or CAT6, which consists of four twisted pairs (eight wires) that are needed for gigabit network operations. Switches generally come with RJ45 sockets, unless they use fibre, and these are also how the corresponding wall sockets are also wired.

VoIP

Voice over IP is a method by which telephony can be redirected over a digital computer network as if it was ordinary data. To maintain the quality of the audio in a call it can be necessary to ring-fence the stream's bandwidth from being interrupted by other network traffic.

Home Vs Business Switches

A visit to any switch maker will reveal a wide range of products, accounting for those with both shallow and deep pockets. Normally they're divided into home and business use, and sub-divided into small business and corporate ranges.

So other than the price and the massive amounts of ports that some business customers like, what is the difference between these solutions? Simply put, it's a feature fest, where home users generally get unmanaged switches with a limited backbone and automated responses to traffic. The cheaper ones don't support

The logo features the word 'Mi' in white on a green square, followed by 'DesignMi...' in white. The background of the top half of the advertisement shows a person's arm and a tablet mounted on the stand.

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< Some people's networking issues are greater than others

IPv6, and they're generally not sized or accessorised to fit into a rack system.

The business users get a much wider range of facilities and port configuration, allowing the switch to be tailored to the connectivity it is likely to encounter. There are also specialist products designed specifically for data centres, service distribution and per-office deployments. As managed devices, these interface to a central control system that IT staff can access, giving them the bigger picture of data traffic movement, allowing them to dynamically reorganise the flow to remove or negate bottlenecks.

They also can initiate fail-over modes where routes or hardware that is malfunctioning can be routed around to maintain system connectivity.

The very latest concepts for business networking are virtual networks, where hypervisors create the illusion of physical structures that only exist in software, dynamically maximising the performance of the hardware layers beneath them.

Having functionality like this doesn't come cheap, and where a home user might pick up a five-port gigabit switch for between £10 and £20, a managed business switch with 24 ports could range from £125 to easily more than £1,000. High-end Cisco switches designed for data centre use could easily run into tens of thousands, for those that want the ultimate in data flow control.

While I don't have a managed business switch, I can appreciate why even a home user might consider getting one.

Over the past few months I've been experiencing an intermittent fault that is probably cable related that causes my switch to unexpectedly restart. Finding this might prove challenging, given that I have at least 16 cables heading to it.

A managed switch would allow me to monitor the ports and report errors, so I could immediately identify the problem and not need to test all of them individually.

I'm happy to accept that probably doesn't justify the expense of a managed router, but that doesn't preclude me being attracted to the idea of solving the problem using one.

Home Use Switches

Here are some typical products that you might consider using in a home or small business.

TP-Link TL-SG108 8-port Gigabit Desktop Switch (£23)



A no-frills design that provides eight ports of 10/100/1000Mbps Ethernet with no configuration required. It's also sold as being electricity bill friendly, and has basic QoS built in. For less than £25, this is a decent solution that is perfect for home use.

These are the important features:

- 8 10/100/1000Mbps Auto-Negotiation RJ45 ports supporting Auto-MDI/MDIX.
- IEEE 802.3x flow control provides reliable data transfer.
- Steel housing, desktop or wall-mounting design.
- Supports QoS (IEEE 802.1p) function.
- Plug and play, no configuration needed.

ZyXEL GS105S 5-port Gigabit Switch (£14.99)



For the budget conscious, the ZyXEL GS105S is an excellent choice. It offers just five ports of gigabit Ethernet, in a tiny easily deployable package. Amazingly, the five ports support full duplex gigabit



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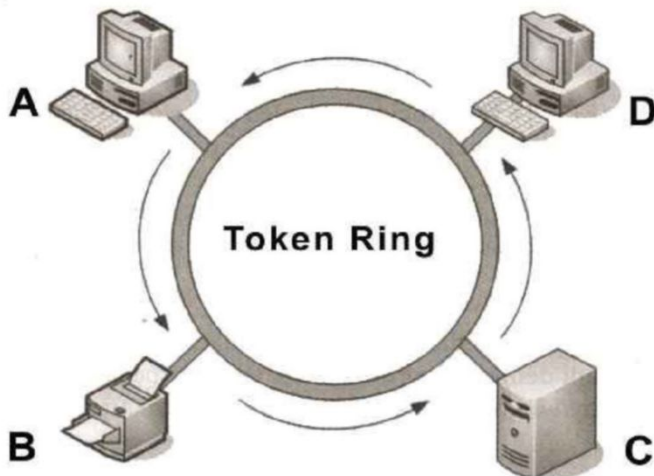
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▲ Early PC networks used Token Ring, before moving on to the cheaper and more flexible Ethernet architecture we use today

Home Use Switches

Buying a small switch for home use can be challenging, especially if you're not sure exactly how much you'll need or use it.

If you have just a handful of computers that you want to wire, then a five-port switch is probably fine, although I do strongly recommend you at least go for one with gigabit and not just a 10/100Mbit design.

Those with greater network ambitions who want to cable numerous locations will need more ports and probably a secure location for the switch to live. I've mounted mine in the attic, but under the stairs or even in the garage are all acceptable places.

It needs to have good ventilation, power and access for cables to be run relatively easily. It should also be somewhere you can get to, in case you need to reboot the hardware, should it get confused or malfunction.

For most homes either an eight-, 12- or 16-port unmanaged switch is fine, and I'd always recommend have at least three ports unused, should you want to add new locations at a later date. If you run out, you can simply add another switch and use a short 'patch' cable to connect the two together.

There are some relatively inexpensive 'smart' managed switches available, like the Netgear ProSafe GS724T (£125), but I'd only consider these if you need to manage your traffic and create virtualised LANs (VLANs). For most home users, these are overkill, but they're ideal for small businesses wanting to control their rapidly expanding networks.

In general, the deployment of a switch for home use is relatively straightforward, only complicated by the vagaries of running wires through a typical UK home. If you can meet the challenge of running CAT6 cables through your house without incurring a huge redecorating cost, then wiring up a switch is certainly the easy part.

operations (2000Mbps), and it has a 10 gigabit internal backbone to handle simultaneous transfers between connected systems.

But best of all it only consumes 2.5 watts, making it one of the greener small switches available.

D-Link DGS-1008P 8-Port Gigabit PoE Unmanaged Desktop Switch (£45)



The D-Link DGS-1008P costs more than a typical eight-port unmanaged switch, though it does include the very useful PoE (power over Ethernet) functionality. That capability is limited to four of the eight ports, and the total power distribution is 52 watts, divided by four.

In older PoE designs performance was sacrificed to provide power, but in this IEEE802.11n design, gigabit speed is maintained even when merged with power.

These are great for deploying security cameras, where the power and data can travel in a single cable.

TP-Link Jetstream TL-SG3210 8 Port Gigabit L2 Managed Switch (£77.99)



Managed switches aren't all super expensive, as the TP-Link TL-SG3210 well demonstrates. Costing usually less than £80, this eight-port managed switch is designed for small networks with the intention to grow.

To this end, TP-Link included two SFP (small form-factor pluggable) slots that can modules for chaining switches together using SFP transceivers. The 20Gbps backplane, denial-of-service defence and VLAN features make it as equally at home in enterprise installations as it would be in a home or small business setting.

What would help immensely is if the quality of the switches that are incorporated into broadband routers improved dramatically, as did the number of ports they provided. Until that happens, there will still be a place for the switch in small and big networks alike. [mm](#)

Everything you'll ever need to know about **Windows 8**

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Your Letters

Dinosaur Runs Ubuntu 12.04 LTS

My wife, Mrs Erk, recently bought a Toshiba 15.6" laptop running Windows 8.1 (comments later!), and sold her Windows 7 midi-tower for a good price to our widow friend. I inherited the latter's midi-tower running the very first edition of Windows XP Pro. **Strangely**, since her husband died in 2005, the original Microsoft XP disc or COA label was never found, and it would not accept service packs – a real **mystery**, as her husband was scrupulously honest. The machine became totally overloaded; I had, years ago, added 250MB RAM to the original 250MB.

At home, I opened up the pristine **midi-tower**, beholding an immaculate ASRock K7S41GT micro-ATX motherboard with on-board video and sound. Rebuilt circa 2003, the AMD Sempron 2200+ (thoroughbred) 1.56GHz was a great reliable CPU in its **day**. The on-board graphics only have 64MB of RAM – tiny by today's standards – and the 40GB HDD is minuscule compared with **today's** entry-level 1TB. (On my **wife's** laptop!) The 350W ATX PSU must have coped all these years, although the fan is noisy; the machine, originally running Windows 98SE, must be circa 2000.

The motherboard has RJ-45 LAN, parallel port, game port, four USB 2.0, VGA, PS/2 keyboard and mouse, 5.1 audio, as well as two USB 2.0 front, plus audio. Of course, there's the ubiquitous FDD and Asus CD-ROM 52x with the delightful audio socket and volume control; aaagh! Also fitted was a 'hardware' dial-up modem – those were the days!

Nostalgia kicked in. Could I really dispatch this beautiful machine to sudden death down at our local council tip? I didn't have a legal copy of Windows to install. Hold on! I had various Live Ubuntu distros, but which would run on the dinosaur? Various pundits on the web suggested lite versions of Linux, but I wanted to be adventurous. Without wanting to splash out on a replacement IDE DVD **player**, I was

confined to the 700MB CD-ROM. However, my 695MB Ubuntu 11.10 Live fitted the bill. It installed flawlessly as a clean install on the whole HDD. Everything worked, including the internet, but the audio **player**, Brasero, gave trouble. To my astonishment, the VGA supported 1440 x 900 on my Hanton 19" widescreen **monitor**.

I was about to sort out the audio when a message flashed up. Did I want to upgrade to Ubuntu 12.04 LTS? You bet! I clicked **okay**. The repository did its stuff; 20.30 I might add, then the install flashed up: "Installing 1 day, 7 hours remaining." I go to bed at 23.00! As it happened, it finished at 22.10. This time, the audio worked perfectly under Rythmbox.

Surely this 'old girl' deserves a reprieve? I've now written this letter on Libre Office 3. I was tempted to fire up the dial-up modem to send it, but I have another novel to write, so broadband won out. Yes, my HP 6510 printer worked on USB input, but I balked at setting it up on wireless, as it meant using the 'terminal' and HP Linux drivers. Another time!

Back to Mrs Erk's new Windows 8.1 laptop! Yes, it is a technical **wonder**, running a bloated 64-bit operating system and has a staggering 8GB of **memory**. Doing basics (email, browsing, word **processor**, music), sure, it goes like a rocket – at a cost! The Sempron 2200+ does exactly the same at a leisurely stroll and with free software. My advice to Micro Mart newbies: don't abandon your geriatric working mini-towers. Experiment. See which Linux distros work for you. Ubuntu 12.04 LTS works fine for me.

In case you were wondering, the AMIBIOS does not support booting from USB.

Tron Fisher

GET IN TOUCH...

Smartwatches

Your article on the first stainless steel smart-watch from Burg (issue 1345) puzzled me. Surely one of the first stainless steel smart-watches was the Pebble Steel? This smartwatch has been underestimated in my opinion. It works with just about any phone you care to mention, regardless of operating system. It has its own store with a good selection of apps, and the price is very reasonable, certainly compared to the latest Samsung watch, which is about the

same price as their smartphones, and it won't work with other manufacturers.

I dread to think what the new Apple watch will cost!

Why do people need to write texts or use their watch as phone? They'd look a bit daft walking down the street talking to their watch – they're not the FBI!

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Component Watch

The intensely competitive tablet market is home to some fantastic deals at the moment. Here are some of our favourites – all safely under £100

Although finding big-name tablets at low prices can be a difficult task, those aren't the only options. However, if all you want is a cheap device for browsing the web and watching TV on, there are tonnes of low-cost, low-investment devices you might want to look at in lieu of something by Apple or Google. That's why in this week's in Component Watch, we're taking a look at some oft-overlooked tablets and figuring out the best price you can get for them.

Deal 1: 3Q Q-Pad MT0729D

RRP: £88 / Deal Price: £64

Essentially the cheapest tablet on the market today, the Q-Pad is based on a Mediatek MTK8312 dual-core Cortex-A9, with a 1024 x 600 TN display. It offers five-point multi-touch operation, with a built-in micro-USB connection and runs Android 4.1. It's even got room for a 3G slot allowing it to take calls and use the Internet without wi-fi should that be on your wishlist. This price is for the 4GB model, but a micro-SD slot allows you to add up to 32GB of storage to that. It won't be much good for games, but as new Android tablets go, you can't fault the price.

Where to get it: Ebuyer (bit.ly/1xW0N0c)



Deal 2: Hisense Sero 8

RRP: £80 / Deal Price: £70

The Hisense Sero 8 has four times the storage of the Q-Pad as standard, by virtue of its 16GB of SSD memory, as well as 1GB of RAM, a 1.4GHz RK3188T Rockchip CPU and an 8" IPS display. You also get two cameras (2MP rear, 0.3MP front) as well as Bluetooth and wi-fi – all of which operates via Android 4.4 (KitKat). It's still low-priced (with the £10 discount it's only £6 more than the Q-pad) but you get a huge amount more for your extra moolah – although beware that the larger screen means it doesn't actually run much faster!

Where to get it: Ebuyer (bit.ly/1vIV6ab)



Deal 3: Linx 7

RRP: £85 / Deal Price: £78

This Windows 8 tablet has an Intel Baytrail 1.33GHz quad-core CPU, 16GB of SSD storage, 1GB of RAM, a micro-SD slot and a 7" 1280 x 800 pixel IPS screen – the highest resolution yet. Both front and rear cameras are 2MP each, and there's support for Bluetooth and wi-fi. Despite having Windows, it's not really a work machine, but if you prefer the familiarity of Internet Explorer to other browsers, it might be worth your extra cash.

Where to get it: Expansys (bit.ly/1Jefa8G)



Deal 4: Toshiba Encore Mini WT7-C-100

RRP: £100 / Deal Price: £80

Another 7" Windows 8.1 tablet, the Toshiba Encore Mini is, at least, from a manufacturer you may have heard of, which gives it extra pedigree. As does the presence of an Intel Atom CPU, 16GB of storage and 1GB of RAM. Interfaces include a microphone, micro-USB, micro-SD, 2MP rear and 0.3MP front cameras. The screen is a little disappointing – only 1024 x 600 – but for a £2 different, the name might be convincing enough.

Where to get it: Staples (bit.ly/1yKUt55)



Deal 5: Lenco CoolTab 72

RRP: £100 / Deal Price: £93

A 1.2GHz device with 512MB of RAM, the CoolTab 72 also has 4GB of Flash and a 7", 1024 x 600, touchscreen. Running Android 4.2, it provides dual cameras, support for wi-fi, Bluetooth and micro-SD and USB inputs.

Although there's little to recommend it over cheaper Android devices, it does have an HDMI port, which makes it useful for attaching to a larger TV. Whether that justifies its price is debatable, given the competition, but at £7 off it's at least a little better than it could've been!

Where to get it: Ebuyer (bit.ly/1yHFUgA)



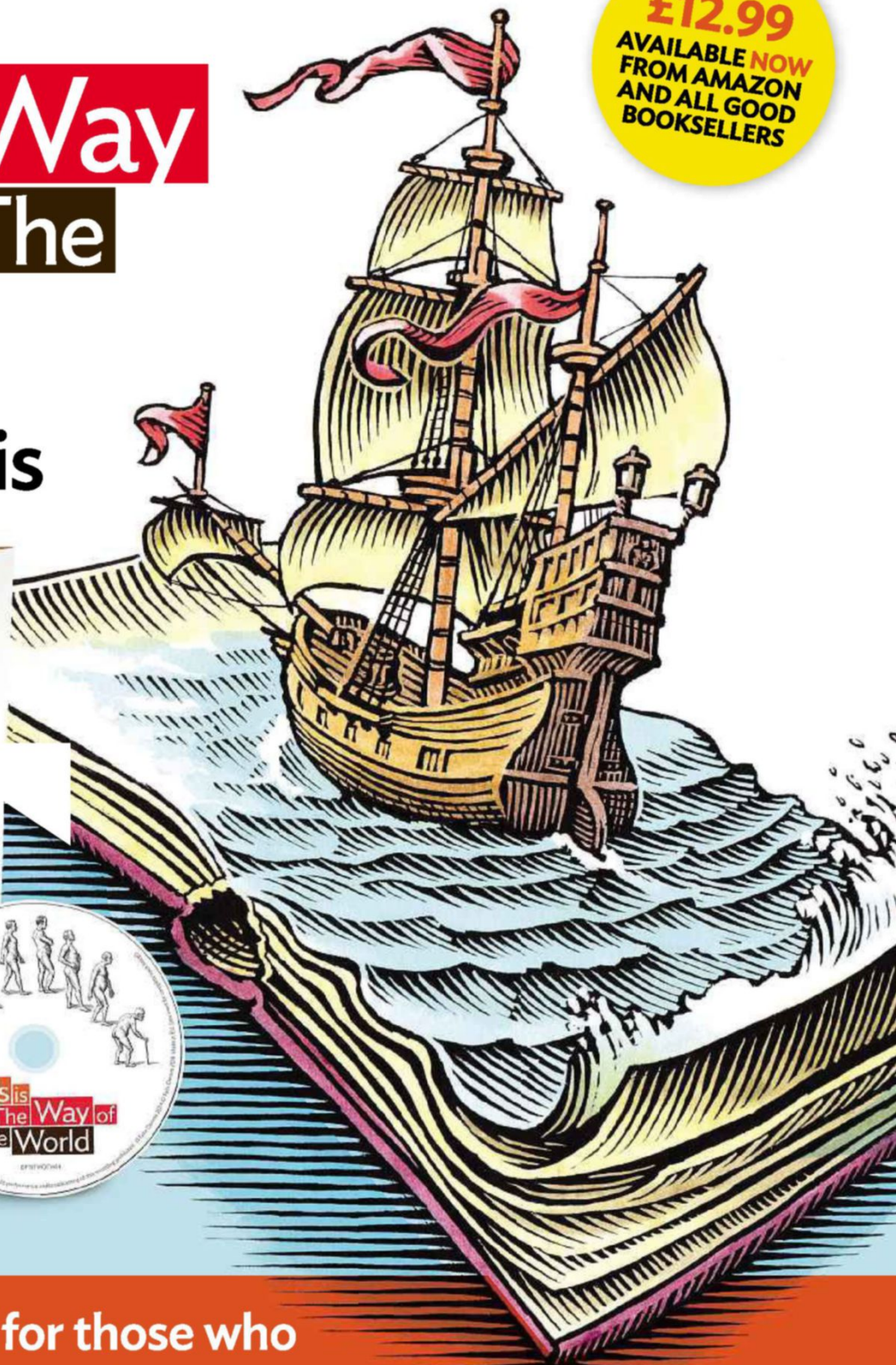
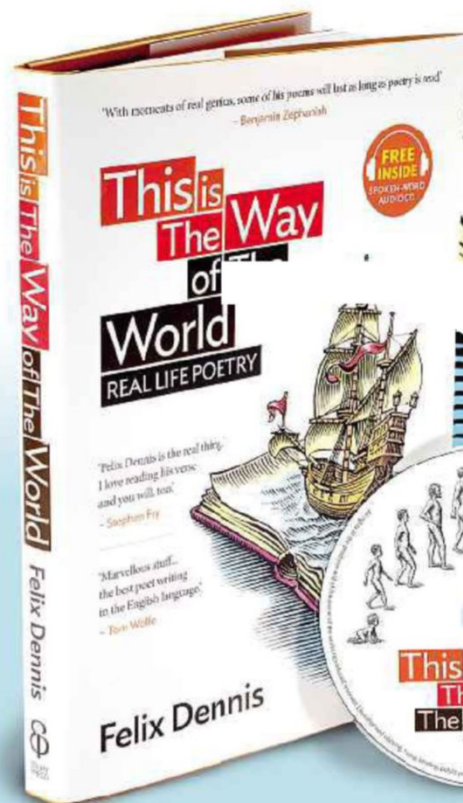
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Barclays Brings Coding To Classrooms

Bring on the Digital Eagles!

A Teeny Weeny Computer From Hannspree!

It's a PC on a stick!

Remember when buying a PC meant walking down to your local computer shop to pick up a bulky, beige desktop box? We do too, but the times they have a-changed.

No, computers are not what they used to be, certainly when you look at devices like Hannspree's PC on a Stick, currently the smallest computer on the market, and available to buy right now for just £169. However, while you can purchase it as a standalone computer, you can also get it as an all-in-one PC bundle with a selection of HannsG's touch screen monitors.

This, people, is the mobile office at its purest, allowing you to set yourself up within minutes. The device runs

on a quad-core Intel Atom processor, high-speed, high-bandwidth 2GB DDR3 RAM, and Intel HD Graphics clocked to 311MHz, or 646MHz in burst frequency mode. It comes with Bluetooth and 32GB

internal storage, which isn't all that much but it also has a micro-SD slot for up to 128GB storage. It's built for Windows 8.1, you can take a closer look by visiting www.hannspree.co.uk.



Britain's banks are, more often than not, getting stick from all quarters. So, it's surprising to be able to welcome an interesting piece of news from Barclays.

Said news is the launch of Code Playground, a digital initiative that aims to bring coding back to life. Monthly two-hour coding sessions will be held in selected branches for seven to 17-year-olds, while the Code Playground site itself can be accessed via Barclays own site.

Hey, you might even set up a bank account for the kids while you're there – or that's probably what Barclays would like you to do, anyhow.

The actual microsite is pretty basic coding stuff, allowing you to change the properties of various moving objects on screen and watch some short films on coding, but it's a nice start for a society not raised on the sweet stuff of life. By all accounts, three quarters of parents think that coding is important, so well done to Barclays for bringing this initiative to the fore.



Some time ago, I signed up for the Windows 10 preview, but ultimately I never found time to actually download it and give it a go.

For obvious reasons, I didn't want to replace my everyday operating system, so the ideal solution would have been to install it in a virtual machine. Yet still I didn't do it, which makes me wonder why.

I guess, if I'm honest, I'm just not that excited about Microsoft's latest OS. I'm quite happy with Windows 7, and I tried 8 but soon grew frustrated with it preventing me from using my PC like a PC.

I imagine I'm not alone in my indifference to Windows 10, so it's good to hear that it will be a free upgrade. Assuming it's not as annoying as Windows 8, there seems very little reason not to install it.

That said, I'm not going to upgrade without trying it first, so it's probably about time I set up that virtual machine.

What are your thoughts? Drop us a line and let us know.

Anthony

Editor

Guess Who's Back? Spectrum's Back!

...Only not quite

Any of you with fond memories of the ZX Spectrum – and that's an awful lot of you, we'd wager – may be pleased to hear that the mooted relaunch of the machine is finally coming.

SMS Electronics, based in Nottinghamshire, is making the Sinclair Spectrum Vega – which has been developed by Retro Computers in Luton, making it a truly British effort through-and-through. Due to go on sale in April with production starting next month, the Vega has become a reality thanks to a crowdfunding effort on Indiegogo, in which it smashed its £100,000 target. Sir Clive Sinclair has even publicly backed the project and while it's great to see the name in print again, this is, in truth, a far cry from the original machine.

Coming with no keyboard and incorporating Bluetooth so that it can be used as a remote



gaming controller itself, the model is essentially a very nice-looking emulator, pre-loaded with thousands of classic games. So, it's really a gaming machine that has successfully tapped into people's nostalgia banks, which is no bad thing, we suppose.

It's just that it will never be as beautiful as the original. That said, if you were one of the lucky 1,000 to put your bid in, we'll be jealous when these land on your doorstep.

Meanwhile... On The Internet...

Moot (the online handle of a man much less famously known as Christopher Poole) is a four letter word that, in the 11 years since it started, has become synonymous with 4Chan. As the person at the helm of a site that has been equally loved and loathed over the years, whatever side of the fence you fall on over the fruits of his no-doubt considerable labours, he has undeniably been one of the most influential forces on the web we know today – ironically, all by trying to run a site that's as close to laissez faire as its possible to get away with in this day and age). Now, however, he is stepping down as its one-and-only admin (tinyurl.com/Motl1347a).

It's anarchic nature and Wild West feel has continually refused to be polished by the ever more commercialised internet that has grown up around it since 2004, a lot of which is surely down to the fact that it has been helmed by one man with a small group of volunteers working on the technical side. In fact, the numbers (42.6 billion page views and 1.7 billion total posts) are quite staggering. And it's no surprise that with that amount of traffic and little oversight of content, it has been widely misused and oft-misunderstood (tinyurl.com/Motl1347b), especially when its antics have spread out into the real world (tinyurl.com/Motl1347c). Yet, it's hard to disagree with Moot when he calls it "what is easily one of the greatest communities to ever grace the web", for he has genuinely created a force of human nature that makes Reddit look like Seaworld compared to its Cape Horn (pun absolutely intended).

Now, it seems, Moot feels he has grown apart from the monster he helped give birth to. In an interview with The Daily Dot (tinyurl.com/Motl1347d), he claims that while the recent CelebGate events didn't directly affect his decision, ultimately "all of the responsibility [for the site] bubbled up to me", and that after something like 10,000 hours in the company of the site, and as the "single point of failure", as he put it, "it was just time."

If you've ever been caught out by something disappearing from Netflix before you had chance to watch it, you'll probably be pleased to know that the BBC has re-linked its deal allowing the streaming service to carry a tranche of its classic shows (tinyurl.com/Motl1347e), just as the agreement struck in 2011 (tinyurl.com/Motl1347f) was set to expire.

It's possibly news that's more relevant to those in the US, as they get to keep streaming classic *Doctor Who* (which we in the UK don't get – we 'only' get the first seven series of Ecclestone/Tennant/Smith incarnation, and the McGann-fronted movie at present) and other shows, like *Luther*, that are presumably more niche over there. Still, it's a reminder that nothing will be permanent in an all-streaming world.

As a well-embedded thorn in the side of lawmakers across the world and a man currently facing extradition for a litany of charges pending trial in the US (tinyurl.com/Motl1347g), you'd forgive Kim Dotcom for keeping his head down. It's obviously not his style, though, and you gotta kinda dig that. It's little surprise, then, that he's looking to poke the latest worldwide internet hornet's nest by launching a new, end-to-end encrypted messaging service called – you guessed it – MegaChat (tinyurl.com/Motl1347h).

As is its style, website The Register is refusing to let go of Whiper (whisper.sh) now that it has its teeth into it (tinyurl.com/Motl1347n). Indeed, it has used the opportunity afforded to it by Neetan Zimmerman – erstwhile Gawker viral news superstar, hired as the site's 'editor in chief' – deciding to leave the beleaguered 'anonymous' social network in favour of a job with *The Hill* (thehill.com) to reiterate what it obviously sees as the site's abuses of its user's data.

Of course, the whole affair was kicked off when Zimmerman allegedly took it on himself to boast to representatives of *The Guardian* about just how the site was looking to milk sources using the site to create gossip-derived content for other news outlets. A faux pas that allegedly resulted in a hasty rewrite of the Whisper privacy statement instigated by The Guardian's plans to go public with what it had learned about how the site's back-end data collection tools worked (tinyurl.com/Motl1370).

The allegations have since resulted in an inquiry by the US Federal Trade Commission, the same body that recently took Snapchat to task over its practices when it came to protecting and using its users' data. If it's found that Whisper has been less than honest about what it's been up to, it could end up costing its owners an awful lot of money.

As it's currently involved in a spat with Microsoft over its decision to reveal bugs in Windows that could potentially be exploited by hackers (tinyurl.com/Motl1347i), it's good to see Google putting its money where its mouth is. Apparently it's just handed out nigh-on £90,000 to people that made it aware of faults within Chrome (tinyurl.com/Motl1347j) and subsequently patched 62 vulnerabilities in Chrome 40. Nice work all round, we say...

Aaaaaaaaand Finally...

Want to see what an overinflated water balloon looks like when it bursts in super-slow-motion? If you never thought you did, let us inform you that you do – and now you can (tinyurl.com/Motl1347k). If you enjoy a good infographic, this one's a doozy: tinyurl.com/Motl1347l. And while we're not massive fans of American football, we are huge fans of childish humour – and if the two happen to intersect (tinyurl.com/Motl1347p), we're right there (tinyurl.com/Motl1347m). Always...

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

We spend a lot of time in this column looking at the weird and wonderful things people get up to, but it's not all that often that we come across something that is hands-down astounding. We, personally, think this qualifies... Ladies and gentlemen, meet a hydrophobic material: tinyurl.com/Motl1347q.



Caption Competition

"Piracy prevention just got serious in Windows 10"

This rather aggressive bit of Ultrabook redesign was the subject of the caption competition back in issue 1345. Here's the best of the submissions...

Pete Heaven: "The auto update of Apple's remarkably life-like 3D Gullibility software took some users by surprise."

Thomas Turnbull: "Bad loser in computer version of Paper Rock Scissors."

Phil Octetes: "Kim Jong-Un receives an email from Seth Rogan."

Glen Harris: "Wow! These 4K screens really pack a punch!"

Martin Avers: "Making a good fist of this online tech support lark."

Chris Pegden: "Knuckling down to some hard work."

Brian Nash: "Home automation, step 1: turning the lights out."

Brian Nash: "You've been Tango'd!"

Tom Oates: "So that's what the Any key does!"

Robert Wheelhouse: "Now you know what happens when you put a Windows disc in a Macbook."

Thanks for all your entries, but the winner was Thomas Turnbull, with his ever-so-topical "Piracy prevention just got serious in Windows 10."

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.



UK Arrest From Lizard Squad Fallout

Teen ends up in the clink

Merseyside was the stage for a significant arrest earlier in the month, as an 18-year-old man was detained near Liverpool on suspicion of accessing computer materials without authorisation. The young chap has also been charged with other alleging he made threats to kill, and gained unauthorised access to computers with intent to commit further hacking offences.

It's thought that this list of charges is tied to the Lizard Squad attacks on Sony's servers, which took place on Christmas Day. Whatever the reason, various devices were seized, and no doubt examined in depth.

If it is the case, it's the second arrest related to the festive attacks, after Thames Valley Police detained a 22-year-old male early in the month on suspicion of having links to the hacking gang.

AI Mario Really Exists!

German researchers bring the little plumber to life

The nearest we've previously got to a Mario that had a mind of its own was the sight of the late, great, Bob Hoskins in the not-so-great *Super Mario Bros.* movie.

Thanks to some German researchers, however, the plucky Italian plumber can indeed think for himself via the Mario A.I. Project. The project has developed an artificially intelligent Mario that's self-aware and is also aware of his environment, responding to

spoken instructions. The group behind this has released a video on how the AI has been implemented and wee Mario can be taught that jumping on an enemy will kill it, that he should collect coins when he's hungry, and can work out how many moves are needed to reach a particular position on screen.

Will Mario become so self-aware that he decides to jump out of the screen and open up his very own pizza business in Slough? Probably not... Not yet, anyway...

Snippets!

EE Customer Refunds

A pot of around £1million will be shared among a number of EE customers that were wrongly charged VAT when using Internet data on travels outside of the EU. The number of customers affected makes up around 0.5% of EE's total customers and refunds per customer will be between around £2 and £80. Good news for EE's roamers, then.

Minecraft Simpsons

Xbox and *Minecraft* gamers rejoice – if you're a fan of long-running grown-up cartoon *The Simpsons* – as a costume pack in February will bring Homer, Marge and other *Simpsons* characters to the title. This pack is exclusive to the Xbox 360 and Xbox One and has good company as other character packs such as *Star Wars* and a *Marvel Superheroes* pack are already out there. So, if you've always wanted to have some *Minecraft* fun with Ralph Wiggum, Groundskeeper Willie and the rest, rejoice aplenty.

Torvalds: I'm Not Nice

Linus Torvalds has taken part in a Q&A session at a Linux conference in New Zealand, and he's let it be known that he's not in this business to be a nice guy. Responding to a developer who said that he had an abrasive tone in the Linux kernel mailing list, he is quoted as having said "Some people think I'm nice and are shocked when they find out different. I'm not a nice person, and I don't care about you. I care about the technology and the kernel – that's what's important to me."

Oooh, hark at 'im!

Google Glass Smashed

This is the end... Or is it?

Google Glass, in its current form, has been laid to rest after sales of the headset were stopped by Google. Launched in April 2013 and arriving on our shores last June, its whopping £1,000 price tag granted buyers (known as Glass Explorers) the chance to test its smart qualities.

But no more, as a blog post confirmed the end of the line. "We're closing the Explorer Program so we can focus on what's coming next," said a spokesperson for the tech behemoth. "In the meantime, we're continuing to build for the future, and you'll start to see future versions of Glass when they're ready. (For now, no peeking.) Hang tight – it's going to be an exciting ride."

Oh, they're such teasers – and for Explorers it's a frustrating end for their investment. Of course, much of the reality was that Google Glass headsets looked a bit silly and, once the initial excitement died down, smartwatches and fitness bands came up behind it to become the new tech of choice. Who knows if Glass will ever surface again?



Malware Alerts Largely A Waste Of Time

Antivirus software has too many false positives

Hey it isn't just you, you know? All those times you hit the roof when your antivirus software warned you about a horrible nasty virus, only to find that actually there was nothing on your system at all – it's not only you going through this frustration, after all.

A recent survey of IT professionals suggested that your average large company has to work its way through nearly 17,000 malware alerts a week just to find 19% of alerts that are actually "reliable". Of those, a little over 700 are investigated. By all accounts, these false positives and general messing around trying to find a problem that doesn't actually exist cost an estimated annual productivity loss of around \$1.3m each per year.

Fact is, then, that security products, as good as they are, are also throwing up more alerts

than any mere human can handle. So, turn your security features up to 11 and face more and more false alerts, or dial it down and deal with the consequences? By all accounts, IT security professionals are trained to ignore most warnings so perhaps it's best to take many of the alerts with a pinch of salt?



NES Cartridge Fetches \$35k

We beg your pardon?

We've brought you news of ancient video games going for a lot of money before, but this one... this one is pretty special. A sealed copy of *Stadium Events*, a title for the ever-wonderful NES console, has sold on eBay for a huge \$35,100. The fact that it was sealed presumably helped drive the bids up, as did the fact that this particular game stands out more than most.

Released in 1987, *Stadium Events* was intended for use with a floor mat peripheral

produced by Bandai, which was discontinued pretty swiftly after its launch, forcing the game to be pulled from shelves at the same time.

Making for a very limited run of the game, this all means that this is a very rare beast indeed. Some bids came in at around \$100,000 before being removed and then the final figure was finally settled on. What's the buyer going to do with it? Hopefully, visit an Antiques Roadshow recording very soon. Or maybe they just really, really want to play it?

Speak Easy

Notebook speakers from Edifier

So, the other day we were listening to the latest tunes from One Direction on our laptop and we just couldn't get away from the tinny audio quality coming out of the device. How to fix, how to fix...

Hey! How about this from Edifier. The Prisma Encore offers a stylish and modern-looking speaker set with a 40W subwoofer, a couple of 12W satellite speakers,

touch-sensitive volume and playback controls, plus a wireless remote control for good measure.

If the fact their Bluetooth-enabled doesn't suit, you can also hook it up via a 3.5mm Aux input and its gloss white or gloss black looks are quite the sight. Selling for £130, this should help us to listen to Harry and his chums in far better audio quality. Lovely. Look at it for yourself at www.edifier-international.com.



Tizen Phones Go On Sale

Cheap handsets available in India

Having already cancelled launches of its Tizen-powered mobile phones in Russia and Japan, it's welcome news that Samsung's mobile OS has finally seen the light of day over in India. Yes, mobile phones featuring the operating system have indeed gone on sale in the country for around £60 and promise to be a genuine market-leader when it comes to budget phones that promise an above-budget performance.

The Z1 phone featuring Samsung's attempt to shake-off Google's Android OS, features a dual-core 1.2GHz processor, 800 x 480 screen resolution, 3.1MP rear camera, 4GB internal memory plus micro-SD slot, and dual-SIM support. With free access to Bollywood songs and movie for three months, plus non-stop video playback between charges of up to seven hours, this does actually sound like a nice little phone.



REVIEWS

P750W Label Printer

Don't stand still, or Michael will create a label and stick it on you

DETAILS

- Price: £167
- Manufacturer: Brother
- Website: www.brother.co.uk
- Required spec: Windows Vista or later, Mac OS X 10.7.5 or later

With a horses-for-courses approach, Brother has developed the P750W, a printer that makes use of thermal technology to produce labels that can be stuck on a variety of objects with minimal effort. It's about the size of two VHS tapes placed side-by-side; if you're not old enough to know quite what that means, it translates as 78 x 152 x 143mm. It weighs 884g so, while the P750W is not really suitable for slipping in a pocket, it can safely be considered portable.

Offering a choice of USB, wi-fi or NFC connectivity, needs to be fed its print media in a cassette format. Brother includes a cassette holding four metres of 24mm tape. The cassette slots into a windowed compartment on the side of the unit's body. Various width sizes can be handled ranging from 3.5mm to a maximum of 24mm. Printed labels are spat out from the front of the device ready to be placed in position once a back cover is peeled away.

The printer can be powered from the mains or via six AA batteries (not supplied). The battery compartment is located on the base of the unit, while the mains power socket and USB port are on the rear of the box. Running across the top of this printer are recessed



buttons. These buttons deal with power, cutter, wi-fi and Editor Lite features. The cutter feature apart, the remaining buttons are partnered with LED lights to indicate their current status. Half of the top area is given over to the NFC feature allowing mobile devices with the appropriate app (iPrint&Label or Mobile Cable Label Tool) to pair with the printer to produce labels.

application for creating labels on your computer. The P-touch Editor will automatically be linked to the P-750W printer.

The P-touch Editor allows you to work from a range of templates designed for specific types of job or create your own design from scratch. Labels can consist of a variety of objects. Text is to the forefront of course, and you

a frame, with offerings classified as Thin, Thick or Special.

When it comes to the actual printing of the label, you can opt for normal or high resolution. There are also options that include chain printing, mirror printing and an auto cut feature plus selecting the number of labels to be printed. Printing is almost instantaneous, and labels are ejected with some force from the front of the unit. A range of different coloured tapes with various widths and lengths are available. Prices for replacement tapes start in the vicinity of £11.

mm Michael Fereday

More useful for businesses than home users, as you'd expect

“ Printing is almost instantaneous, and labels are ejected with some force ”

The P750W comes with a folded sheet of instructions but these only really apply to setting up the printer with a USB connection. You will need to download other software from the appropriate Brother website (www.brother.com/inst) for full functionality. This software will automatically install the items including the P-touch Editor

use any of your available fonts and their attributes.

You can also add an image to your label, which can be sourced from an existing file, screengrab, symbol or one of the items of clip art that Brother has bundled with the product. There is also a selection of cartoon-style line drawings that can be altered in various ways. You can then add



Acer Iconia Tab 8 A1-840HD

Acer takes on Google, Amazon, Samsung and Tesco in the small tablet arena

DETAILS

- Price: £139 (Acerdirect)
- Manufacturer: Acer
- Website: www.acer.co.uk

The market for small Android tablets is rather full, if not overflowing (see this week's Component Watch for confirmation of this), so I was curious to see what Acer might bring to this party. The Iconia Tab 8, as the name suggests, is a 8" widescreen aspect tablet that's competing directly with a plethora of other small sub-£200 Android tablets.

This one, specifically, offers a 280 x 800 display, runs Android KitKat 4.4.4, has 1GB of RAM and 16GB of internal flash storage. Where Acer went in its own direction with the Tab 8, though, is in choosing Intel's Baytrail instead of using an ARM architecture. This tablet is built around a quad-core Atom Z3745 1.86GHz – an interesting choice but, given it's not aiming to run x86 code, a curious one.

Having used the Tab 8 for a few days now, that question remains largely unanswered, because this isn't the fastest small tablet I've used, and the battery life of 7.5 hours isn't close to what some other devices offer. I was, however, impressed by the display panel, which is very crisp and highly colour saturated. The Nexus 7 (2013) offers 1080p these days, but 720p is fine for most portable purposes. Similarly the sound output is surprisingly punchy, and the inclusion of a micro-SD card

slot negates the need to go bigger than the 16GB model.

For those who want a bigger picture, this is one of the very few small tablets that includes HDMI out port. Acer doesn't provide a cable for you to use it out of the box, though, which is a shame.

This feature, combined with its decent build quality, might attract some customers looking for something with which to tweet their indignation while watching reality TV. However, there are some things about the Tab 8 that are less compelling on closer inspection.

One of these is how many pre-installed applications Acer has put on it, using a good chunk of storage up before the device is even turned on.

I counted 23 apps, and you can't delete any of them. What's super-annoying is that many of them generate alerts, either trying to push products or asking for updates. If you want to be bugged to buy stuff, I'd recommend the Tesco Hudl or the Kindle Fire HD, as they're similarly priced and specified.

In the end, odd choice of Intel CPU aside, the Tab 8 is a decent enough Android tablet. Unfortunately it's operating in an environment where there are some exceptional ones already. The Tab 8 is about the same price as a 16GB Nexus 7, a tablet that doesn't come pre-stuffed with software detritus and is now running Android 5.0 Lollipop. While the screen might be smaller, I'd take the Nexus any day over this device.

The critical mistake Acer made here is treating the Tab 8 like it is a PC when, despite the hardware similarities, it most definitely isn't.

mm Mark Pickavance

A well-made tablet that suffers from an abundance of inherent, unavoidable, crapware



Seagate 2-Bay NAS 8TB

Seagate crashes the NAS party with a user-friendly dual drive solution

DETAILS

- Price: £390 on Amazon
- Manufacturer: Seagate
- Website: www.seagate.com
- Required spec: Wired network and client systems
- Part No: STCT8000200

A while ago we covered the Seagate Central, a simple NAS box that offers a single pre-installed mechanism for basic media sharing duties. In the summer Seagate gave me a presentation of its new NAS hardware, using a totally new embedded OS, and these products have now been released into the big wide world beyond the technology press.

These two- and four-bay NAS boxes use the NAS OS 4 (embedded Linux) operating system, based on a concept that Seagate subsidiary LaCie came up with, and it serves to

elevate its NAS range to the next level.

From the outside, Seagate's 2-Bay NAS has a clean and elegant design that allows the drives to be easily swapped out using tool-less plastic caddies. The review model came with two 4TB Seagate NAS HDD drives that can be configured as 4TB of failure redundant storage, or 8TB of unsecured space. Seagate sells the system as a diskless system (at about £125) or with 2TB, 4TB, 8TB and 10TB of installed drive space.

Two USB 3.0 ports provide a simple and direct means of extending this capacity even further. This can also be used for backing up the contents of the installed drives or uploading new files without occupying a PC in the transfer.

Computing power comes from an unnamed 1.2GHz ARM CPU that might be a Marvel-made dual-core chip, alongside 512MB of DDR3 RAM. However, as with any NAS configuration, it's more about how this power is being



used than the total available horsepower under the hood. With this in mind, on firing up the web interface, I was initially struck by how simple Seagate has tried to keep this product – and that the interface is identical to its high-end business solutions.

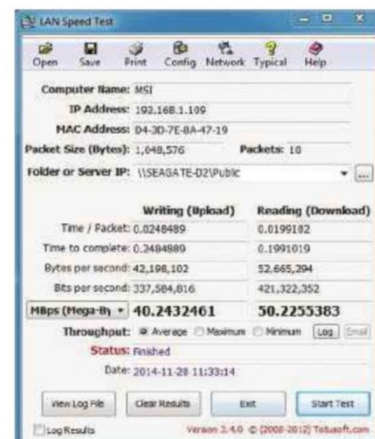
Initially you have access to just five tools: Device Manager, File Browser, Download

Manager, Backup Manager and App Manager. By using the last of these options you can add more functionality, should you desire, but these are early days and Seagate still has some significant work to do if it's to concern the likes of Synology in terms of its systems flexibility. Indeed, at the time of writing, there were just six apps available, which include

Specifications

- **Model and total capacities:** Two-bay: up to 10TB (2x 5TB drives).
- **Form Factor:** Small desktop.
- **CPU frequency:** 1.2GHz.
- **Memory:** 512MB DDR3.
- **Interface:** Gigabit Ethernet.
- **External Ports:** 2x USB 3.0, 1x 10/100/1000 Base-TX.
- **Hot-swappable HDD trays.**
- **Physical Dimensions L/W/D:** 120mm x 217mm x 172.5mm.
- **Weight:** 3.385 kg (drives installed).
- **Power Consumption**
 - Operation mode: 16W.
 - Power-saving mode: 7W.
 - WOL mode: 0.55W.
- **Operating system:** NAS OS 4 (embedded Linux).
- **Warranty:** three-year.





an anti-virus package and WordPress among their ranks.

As for inherent functionality that's a much more complete story. Administrators can define users, groups, shares, quotas and all the other important parts of any file serving solution. The services user can access cover those needed by Windows PC, Unix and Mac, along with more generic capabilities like FTP, SFTP, SSH, iSCSI and UPnP/DLNA. There's also an built-in BitTorrent client, iTunes server and support for Apple Time Machine and WebDAV. While none of this is especially

unique to this NAS box, it all works and includes a few services that aren't always provided. For example, a working Rsync-compatible backup service caught my eye as being a feature I'm happy to see they incorporated.

The hardware is workmanlike rather than anything spectacular, and the same is general true of the performance. Over a gigabit Ethernet link, it hit a rather low ceiling of about 50MB/s reading and 40MB writing. That's acceptable speed, even if you can get more from some competitor products.

Further experimenting revealed that marginally better speed could be achieved with iSCSI connections, though most home users won't be familiar with using this technology over CIF file sharing.

Less consistent results came from using the USB 3.0 ports, which seemed pedestrian when accessed as network shares. Oddly, when these are used by the Seagate Backup Manager they show an entirely different side. I transferred 9.4GB of data to a USB 3.0 external drive in just two minutes and 16 seconds, equivalent to 70MB/s. Perhaps, eventually, Seagate can squeeze more performance out through firmware updates and improve the performance of shared external drives.

The value proposition here is an easier calculation, because the two 4TB drives that Seagate pre-installed are worth at least £130 each. That's no significant financial advantage over buying the diskless and populating it yourself, other than perhaps the warranty covering the populated device.

What the diskless model does allow is for you to buy a single drive and then increase the capacity later with a

second mechanism. Those on a budget might appreciate that option, and because of that reason I'd probably recommend the diskless design over the populated ones, at this time.

With Seagate now pushing forward its NAS solutions to cover everything from entry-level to rack-mounted business solutions there are some good things in the pipeline. The 2-Bay NAS is a natural progression from the Central products to something more flexible, and we'd wager there are many users that will be interested in exactly that.

mm Mark Pickavance

A workmanlike, low-cost NAS box for home and small office use



Magix Fastcut

Too busy doing something dangerous to edit your GoPro footage? Magix has you covered

DETAILS

- Price: £40
- Manufacturer: Magix
- Website: www.magix.com/uk
- Required spec: Dual-core 2GHz processor, 1GB RAM, 2GB disk space and a DVD drive for program

Magix has developed and sold video and image editing software for many years, yet it's not that often that it introduces a brand new product. Now, though, it's launching Fastcut, a video editor designed specifically for editing footage from the fast expanding range of action cameras (in particular the GoPro, which I guess is currently the most popular).

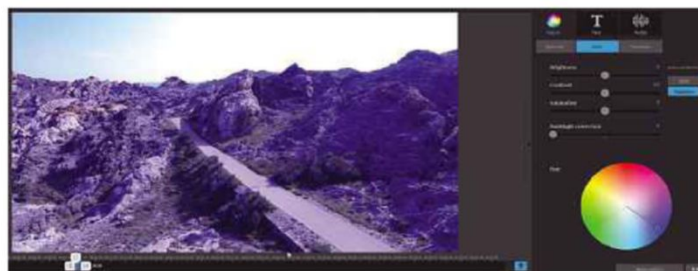
Clearly you could use any video editor, but Fastcut is optimised for speed of use and includes templates designed for the sort of action movies produced by GoPro users. Let's see if it can live up to the task.

Unlike many other editing products, FirstCut is quick to install, and it also has a much cleaner interface. In fact, the lack of tools by comparison is at first rather alarming. Yet once you get into the methodology behind the program, it's quite a capable product. Magix has obviously studied the mindset of action camera users, who want instant action and instant results – and Fastcut does exactly what its name implies.

While other editors have to convert GoPro video files before they can be edited, Fastcut doesn't; you can import them directly. You can also use an LRV (low resolution version) during editing, which can make the



▲ The program comes with a good range of templates



▲ You can make exposure and colour corrections with a single click



▲ Choosing and inserting clips from different locations

editing process a lot more fluid and, consequently, less time consuming. In fact, because most of these cameras use high definition SD cards to store video files, it's even quicker if you use a card reader, because Fastcut will edit directly off the card, so there's no delay while you import the (sometimes huge) video files to your PC.

The interface borrows a lot from the company's Movie Edit Pro product, which is not really

surprising. If you have a tried and tested formula, why change it? Where they differ is in the tools and sometimes overwhelming effects you get with the more comprehensive editors. Initially, I thought the lack of these features could make your videos quite repetitive in style. However, I have to admit there are quite a number of action templates provided, offering various changes of pace and different music to accompany each

particular style – and, to be fair, the program uses these to good effect, automatically creating quite upbeat videos with very little input from the user. Having said all that, if you chose to edit using the alternative manual mode, then Fastcut opens its toolbox to reveal many more options that are initially hidden, so for those who like to get more involved, the tools are all there.

If you let Fastcut do what it's designed for, then creating a video can be done in about four mouse clicks: choosing the files and template, adjusting the exposure and outputting the finished video. You could do it in less, but I found the Fastcut exposure correction was a worthwhile click on most video clips, making a marked improvement on the output.

There's a lot more you can do to improve the footage, such as editing out any bits of uninteresting or superfluous bits. You can also make your own colour corrections, choose different transitions, add titles or captions, but the idea is to create a video for YouTube, or perhaps your own blog as quickly as possible, and it does very well.

mm Joe Lavery

A new video editor from Magix that makes short work of video editing



ViewSonic VG2438SM

What you see is what you get with this new monitor

DETAILS

- Price: £215
- Manufacturer: ViewSonic
- Website: www.viewsonic.co.uk
- Required spec: Supports both Windows and Mac systems

The VG2438SM is part of ViewSonic's latest refresh of its product line-up. This particular model, as the 'G' part of its title might indicate, is aimed more at the graphics enthusiast rather than other models in the Professional, Edutainment and Value ranges.

The VG2438SM is a 24" TFT active matrix LCD screen with a slightly unusual 16:10 aspect ratio. The screen's optimum resolution is 1920 x 1200 pixels with a viewing angle of 178° by 178°. When setting up this monitor you will need to attach a solid oval-shaped stand to an adjustable arm fixed to the rear of the display. The adjustable arm gives plenty of flexibility when positioning the monitor on your work space. You can adjust the height of the screen

by 100mm, tilt it between -5° and +37°, swivel it through 360° and pivot it by 90°.

As well as flexibility in positioning, this monitor offers a range of connectivity options arranged along the rear of the unit. Along with the standard power and D-Sub options, there are sockets for HDMI display, DVI, audio in, USB 3.0 Up and USB 3.0 down. Tucked

away on the stand unit you will also discover an audio out socket. ViewSonic includes a collection of leads, covering power, HDMI, D-Sub, audio and USB 3.0.

The screen is surrounded by an 18mm bezel that has a wood-like finish I found a little off-putting, especially when trying to locate the display controls. I knew where the buttons were positioned but, more often than not, I needed to use a torch to identify their precise location in the lower-right corner. There are touch sensitive buttons for power, up, down and 2 and 1.

The button labelled 1 brings up an on-screen menu while the up and down buttons provide navigation with the button 2 is used for selection. While the on-screen menu provides the means to adjust features such as contrast, brightness, input

method, audio and colour, there are also a number of preset profiles that can be used for specific types of viewing. These profiles have been designated Text, Game, Movies, Web and Mono.

To help avoid problems such as headaches and eye strain that some users can suffer from, brought on by prolonged viewing sessions, ViewSonic has built a couple of features into this monitor. According to the company, the use of its Flicker-Free technology will eliminate screen flicker at all brightness levels, and you also get its proprietary Blue Light Filter, which allows you to adjust the amount of blue light emitted from the screen while still retaining a good colour balance to reduce eye strain even further.

I will have to take ViewSonic's word as to how successful these features are as I do not tend to suffer from headaches and the symptoms of eye strain. I was, however, impressed by the overall quality of the display presented by this monitor.

mm Michael Fereday

A bright, clear display with good adjustability and eye-saving features



ViewSonic VG2438SM Specifications

Panel type	TFT Active Matrix LCD/AS
Panel size	24"
Aspect ratio	16:10
Brightness	250 cd/m ²
Contrast ratio dynamic	50M:1
Contrast ratio typical	1000:1 (CR)
Display area	518.4 (H) x 324 (V)
Viewing angle	178 (H) / 178 (V)
Response time	5ms
Maximum resolution	1920 x 1200
Colours	16.7M
Backlight	WLED light bar
Backlight Life	30,000 hours (Min)



Outdoor PowerBank

Michael Fereday checks out a battery charger designed for outdoor use

DETAILS

- Price: £54
- Manufacturer: Sandberg
- Website: www.sandberg.it

While a portable battery charger can prove useful in certain indoor circumstances (a similar product recently proved useful to me during a prolonged hospital visit, for example), this type of kit is more likely to come into its own in outdoor environments, when there are no power sockets available to charge your mobile devices.

A battery charger like this can also act as a power source substitute, and it is this rationale that is behind Sandberg's latest portable battery charging device, the Outdoor PowerBank, which offers the user a fairly substantial 10400mAh of available power.

As befits a device designed specifically for rugged outdoor usage, the Outdoor PowerBank comes rated at IP54 standard with regards to its dustproof and waterproof casing. It should be emphasised that immersing this product in water is a no-go area, though. With dimensions of 75 x 125 x 25mm (W x H x D) and weighing 271g, the Outdoor PowerBank has a khaki-coloured casing, which is then overlaid by a camouflage decorated vest-like design (one wonders, though, whether camouflaging such a product is not an unwise choice, because for the vast majority of its

potential buyers, stealth is not a priority and simply makes it easier to lose). Ridges along each side of the PowerBank's body enable the user to firmly grip the unit when setting up the device for power transfer.

All the various connection points, consisting of two standard USB ports for output and a single micro-USB port for input, are arranged across the top of the unit's body. Providing some protection from the elements are rubberised labelled flaps covering the ports. The central flap, covering the micro-USB port, is labelled 'In' – indicating that this is the port to be used for feeding power to the device. When receiving power, either from a computer or the mains, the Outdoor PowerBank's input current is rated at 1000mAh. This means a full charging session can take up to 24 hours when using a computer as the power source. Switching to a mains power connection will reduce the time required by half.

This central flap has a circular cut-out opening through which a torch beam can appear. This torch beam feature is turned on and off with a two-second press of the unit's power button and could prove useful in an emergency. The other two flaps, labelled OUT1 and OUT2, can be opened to reveal standard USB ports for charging smartphones and tablets. The left port delivers power at 1.0A while the right port increases power output to 2.1A for when dealing with more power hungry devices. This arrangement allows you to charge two mobile devices simultaneously.

Providing feedback as to the current battery level available from the Outdoor PowerBank are four LED lights. When initially connected to a device waiting to be charged or following a quick press of the power button, these buttons will briefly glow in increments of 25% before turning

themselves off in order to save on power.

The PowerBank's output charging is rated at 3100mAh. Using the 2.1A USB port, it took two hours 49 minutes to bring a Fire HD 7-inch tablet's battery from 33% up to 100%. As a result of this power transfer, the PowerBank's battery took a 25% hit with just three LEDs glowing rather than the full four lights.

mm Michael Fereday

A well-built battery charger for lovers of the great outdoors



Swann Pan and Tilt Camera

A new concept in wi-fi video surveillance cameras from Swann

DETAILS

- Price: £150
- Manufacturer: Swann
- Website: www.swann.com/uk/swads-446cam



Not long ago, a high-resolution surveillance camera would set you back many hundreds of pounds. Only recently have prices dropped to a level that most home or small business owners can afford. This is not the first camera I've looked at like this, but the ADS-446 SwannCloud HD Pan and Tilt Wi-Fi Security Camera with Smart Alerts has features that I've not encountered before.

I guess the clues are in the rather long name: you get cloud access, HD, Pan and tilt, wi-fi and smart alerts. This means that the camera has a resolution of 720p, built in motor control, is fully wireless and capable of alerting you if it detects any movement. Notice I said 'briefly'; that's because it's actually more sophisticated than that.

It actually has four different methods of detection: 'Intrusion' detects movement from a defined direction, 'Motion' will detect movement from any direction, 'PIR' measures infrared light radiating from an object and 'Facial' would be useful if you're monitoring the front entrance to a house (or perhaps an outbuilding). These detection methods are all available, but are individually exclusive and shouldn't be mixed.

Setting the camera up is fairly straightforward, particularly for use via wi-fi. You simply mount it using the supplied bracket, switch on the power and add

the camera to your new account using the Windows SwannCloud Web App. This will ask you to enter your broadband name and password, which will generate a QR code. At the same time the camera will start emitting a high-pitched beep every five seconds, signifying that it's ready to pair. You simply point it at the QR code on the screen until it beeps twice, which means that it's read the code. Once that's done you'll see the output from the camera and you can adjust all the settings from the application. This includes the detection type, sensitivity and video settings; however, at the moment, you can't pan or tilt the camera from the web interface. I understand, however, that this is likely to be an option in the future.

The free SwannCloud Mobile App for smartphones and tablets has the full range of facilities, however. So you can log in and check for any detected events from anywhere in the world. It also provides full control, so you can change the detection type, pan the camera up to 350° horizontally and tilt it up to 100° vertically and more. Obviously, this makes it versatile and able to cover a wide field of view – something a static camera is incapable of.



▲ This shows the web interface

► A shot taken of my smartphone screen, showing the events remotely recorded

Incidentally, the camera will also send you a notification by text if its detection system is triggered. Naturally, you'll need some form of internet connection – either wi-fi or a 3G/4G service you get on your mobile device.

The camera supports two types of connection: either wi-fi (as I've mentioned) or wired using a traditional RJ45 network cable. There's also a connector block on the back to add the camera to an existing alarm system, in which case any detection would also trigger your household alarm.

The camera has another socket for a micro-SD card, which I understand will eventually be used for recording events directly, though currently this has no function. Finally, there's a mini-HDMI output so you can connect it to a HDMI input on your TV or monitor.

At the moment any video events captured and stored on the SwannCloud are free, but it's not yet clear whether this cloud storage will remain the case.

mm Joe Lavery



A very impressive camera, with very few drawbacks



GROUP TEST

4K Monitors

No so long ago 1080 HD monitors were the bee's knees, but these days the modern enthusiast can opt for something that's four times better.

4K may be something that's bandied about without any regard to what it actually means, but once you see the difference it's really quite astounding.

David Hayward has been looking at six examples this week.

4K Monitors

Acer CB280HK

DETAILS

- Price: £299.98
- Manufacturer: Acer
- Website: goo.gl/WobPIV

The common denominator with ultra-high definition 4K monitors appears to be extraordinarily high price. You could argue that you get what you pay for (in this case, the latest and greatest in visual technology), but nearly £400 plus for a single screen is still extravagant.

Acer, however, has put the cat among the pigeons here. Rather than charging the king's ransom that most other manufacturers ask for 4K wonderfulness, it put its latest screen on the market for a more reasonable £300.

The Acer CB280HK is a 28" twisted nematic film LED monitor capable of displaying resolutions up to 3840 x 2160. If that wasn't enough to pique your interest, then the 1ms response time, 100,000,000:1 contrast ratio, DVI, HDMI, DisplayPort and Mini DisplayPort may tantalise you even further.

It's surprisingly adaptable too, with adjustable height and tilt angles, plus there's MHL (Mobile High Definition Link) on one of the connections, so you can hook up your smartphone and enjoy the whole office in your pocket thing, with the added bonus of having a large, ultra-HD screen.

The quality throughout is generally good. The large-ish bezel is a little off-putting to begin with, but that soon becomes a background annoyance which you'll gradually get used to. The base, though, doesn't feel all that good; it does the job it was



▲ The Acer 4K monitor is an okay example of UHD, but there are better available

designed for well enough, but it feels a little flimsy and perhaps a little too plasticky. Saying that, we didn't hear any creaks and cracks and sounds of plastic

from a 1080 HD variety, then you'll love the extra quality this monitor will offer. If, on the other hand, you're more used to what 4K can offer,

“ If you're used to what 4K can offer, then you'll find the Acer somewhat lacking ”

under stress as we moved the screen around when making tilt and height adjustments.

Naturally, the screen quality is the element that will ultimately draw in the crowd. Once you've experienced true 4K viewing and gaming, you can begin to appreciate just how amazing it really looks. Sadly, though, we found the Acer CB280HK a little washed out.

The colours were good – probably better than anything we've viewed in 1080 HD – but next to the other 4K monitors on test, this Acer just didn't quite hit the mark. That's not to say the clarity and sharpness of the screen was poor; it's just that it wasn't as good as the other monitors we've used this week past.

However, if this is the only 4K monitor you've come across, and you've upgraded

then you'll find the Acer somewhat lacking.

Overall, then, while the Acer CB280HK isn't the best 4K monitor we've ever had the privilege of testing, it's okay and will certainly suffice for a newcomer to the 4K world. Bonus points, of course, are awarded for the pricing, but for a few pounds more you'll get a significantly better product.



Philips Brilliance 288P6

DETAILS

- Price: £439.98
- Manufacturer: Philips
- Website: goo.gl/c0FAez

While most manufacturers are trying to keep their products as low cost as possible to entice customers into spending their hard-earned cash, Philips has instead taken a slightly different approach with its 4K Brilliance range of monitors.

The Brilliance 288P6 isn't the most expensive 4K monitor available, but whereas the Acer manages to come in under £300, this example can be found for around £440. The main reason for this is that Philips hasn't cut back on anything and has opted for a far more capable screen, as well as high-quality parts rather than cheaper plastics.

This is a 28" W-LED backlit TN panel with a maximum resolution of 3840 x 2160 and a Smart Response time of 1ms. There's a 50,000,000:1 contrast ratio, 300cd/m2 brightness rating and support for 1.07 billion colours, which is rather a lot.

The connectivity on the Philips 288P6 is excellent, with VGA, DVI, DisplayPort and HDMI/MHL-HDMI for the video inputs. Plus there are four USB ports (of which two are USB 3.0 with fast charging), PC audio-in and headphone out.

There are a pair of 3W speakers built in, which are surprisingly good for a set of standard monitor speakers. Naturally, you won't get the deep bass and more clear frequencies you'd experience from a set of dedicated



▲ The Philips 4K monitor is exceptionally good

desktop speakers, but if you have limited space on a desk, these are certainly adequate and deliver a reasonably good level of output.

Build quality is superb, as we've already suggested. The

clear, sharp and crisp, with some of the best colours we've ever seen on a monitor. Needless to say, 4K video and gaming content was an absolute joy to behold, but normal, everyday duties were



▲ The quality is amazing, and it's well built too

“Amazingly clear, sharp and crisp, with some of the best colours we've seen”

large base and screen itself are solidly designed, and the screen will pivot and tilt without any hint of plastic stress whatsoever. The heavy base is ideal for a large monitor and helps keep everything stable, while still providing height adjustment and the other aforementioned ergonomic benefits.

The picture quality is similarly excellent. Philips has done a magnificent job of crafting a panel that really shows off the ultra-high-definition quality of 4K resolutions. It's amazingly

also a pleasure, with a superb clarity on the standard Windows desktop that was gentle on the eyes for longer periods.

There are a few preset picture settings available, the best being the Philips SmartImage feature, which will auto adjust the various levels according to what's being presented on the screen. You can also opt for a custom user setup, should the SmartImage setting prove to be not to your tastes.

As you can imagine, we were pretty impressed with

the Philips Brilliance 288P6. It's an exceptionally good monitor and one that we can quite easily see being adopted into our current setup. Incidentally, we also tested the Philips 288P6 with a Mad Catz M.O.J.O. Android micro-console, and although there isn't any touch-screen capability here, the overall picture quality and the additional USB hub proved it to be a fantastic console gaming screen.

For £440, the Philips is well over a hundred pounds more expensive than the previously reviewed Acer, but it's certainly worth every penny.



4K Monitors

AOC U2868PQU

DETAILS

- Price: £389.99
- Manufacturer: AOC
- Website: goo.gl/SvsluN

AOC shares many similarities with Acer. Generally, it offers excellent value for money while still adopting the latest technologies, and they have roughly the same level of quality.

The AOC U2868PQU therefore, was expected to be much the same as the Acer: good but not the best. Happily, though, we were quite wrong.

The AOC U2868PQU is a 28" TN panel, with a 3840 x 2160 resolution, at a smooth 60Hz, with a 1ms response time. It's from the Pro-Line range of AOC monitors, so it's quite businesslike its design.

This means there are height adjustment, pivot and swivel features to help you get that perfect position, and there are four USB ports on the side, two of which are USB 3.0 and fast charge enabled.

Connectivity comes in the form of HDMI, DVI, VGA and DisplayPort, with MHL over the HDMI port to mirror mobile content. There's also the same 3W speaker setup that we saw in the Philips model, although for some reason they actually sound a little better on the AOC model.

Build quality is excellent, as it was with the Philips monitor. Whatever concerns we had about the quality being roughly the same as the Acer model were soon put to rest. The base, stand and panel are all well constructed, making it

easy to manoeuvre the screen while still keeping it stable.

As with all the monitors so far reviewed, the base contrast ratio is 1000:1. In this case, the dynamic ratio hits a decent 80,000,000:1, which is enough to produce a high level of detail in both brighter and darker images. The colour, sharpness and clarity are all exceptional and prove that 4K really is the impressive beast that high-street electrical salespeople harp on about.

Our gaming tests left us with a very good impression, as did the UHD 4K content, and even normal office duties looked fantastic. The built-in speakers helped too, and although they're not as good as a set of dedicated speakers, they did a decent job of belting out the throaty roar of a Spitfire in our gaming test.

We were as impressed with the AOC U2868PQU as we were with the Philips model, and the beauty of this monitor



▲ We liked the AOC 4K monitor, an excellent blend of quality and price

“ The colour, sharpness
and clarity are all
exceptional ”

is that it's slightly cheaper than the Philips one and less than £100 more expensive than the Acer. In other words, if you're after a 4K monitor and you're tied to a restrictive budget, then the AOC is the one to get. If you can afford a little more, then Philips will do the trick. If it's a dual-screen setup you have in mind, why not sample the best of both and have both the AOC and the Philips?



Dell UP2414Q

DETAILS

- Price: £529.17
- Manufacturer: Dell
- Website: goo.gl/8M7lbc

Dell was one of the first companies to launch a 4K monitor, with the UP2414Q. In terms of technology, this example is getting a bit long in the tooth, since it was released nearly a year ago. Bearing this in mind, you might well expect it to be one of the cheapest 4K displays on the market, but you'd be quite wrong.

The Dell UP2414Q is a 23.8" IPS LCD panel, with a maximum resolution of 3840 x 2160 and an 8ms response time. The typical contrast ratio is 1000:1, with a dynamic ratio of just 2,000,000:1, which is rather small compared to the rest of the monitors on test.

What it may lack in contrast numbers, though, it makes up for in connectivity. There's HDMI, mini DisplayPort, full-size DisplayPort, four USB 3.0 ports (one of which is fast charge enabled) and an SD media card reader tucked away near the power port.

The keen-eyed among you will have no doubt noticed the lack of VGA and DVI ports. It's not a huge issue, but it does rule out any use of legacy-type connections you may want to run. There is, though, another issue with the video input connections, in that the HDMI port is only version 1.4, not the usual 2.0. This means you'll only be able to achieve UHD 4K resolutions via the HDMI port at 30Hz,

▲ *The Dell standard monitor type is looking its age these days*



▲ *It's incredibly expensive for what you get*

instead of the usual 60Hz that most 4K monitors offer.

As with the other monitors on test, and because this is from the more business-oriented line of Dell monitors, there's a good set of physical adjustment features (tilt, height and pivot). Moving the

monitor around its angles and heights proved to be perfectly fine, as did the rest of the construction of the bezel, stand and panel.

Dell has a particular formula for how a monitor looks, and it's sticking to it. This means that the



UP2414Q looks pretty much like every other Dell business monitor going, so the same design problems apply. For example, why does it insist on positioning the ports, including the USB hub ports, in reverse and up and under the bottom of the panel. This makes it extremely awkward to plug or unplug anything, because you're required to pull the screen to one side and tilt it to see where you're going. If you have a few cables plugged in and the power is limited by the desk and the one opposite, as in most offices, then things can get a little confused.

As for the image quality, we weren't all that impressed. The 4K resolution looked great as a static image, but with moving images (games, movies and so on), there was a serious amount of lag, and the screen suffered greatly as a result. We also noticed significant screen tearing and some pixelisation around the edges of the image – something we didn't come across with the other monitors. Also, there seemed to be some pretty terrible backlight bleed too.

It's astonishing that Dell is charging more than £500 for this, because frankly it's probably not worth half that amount. If it's 4K you're after, look elsewhere.

4K Monitors

Samsung U28D590

DETAILS

- Price: £385.99
- Manufacturer: Samsung
- Website: goo.gl/ehZXyc

Samsung generally comes up with some pretty decent everyday monitors, but it's the more elaborate and higher-tech models that get the most attention. As you can imagine, then, a 4K monitor from Samsung is certainly cause for excitement, but can it live up to its expectations?

The Samsung U28D590 is classed as a gaming monitor, with a 28" TN panel and a 1ms response time. The maximum resolution is, as usual, 3840 x 2160, and there's the standard typical 1000:1 contrast ratio. Interestingly, the dynamic contrast ratio is a little difficult to mention. Every time we tried to get an actual number, we were presented with a dynamic contrast ratio of 'mega', whatever that means. Needless to say, we imagine it's quite a lot.

We were quite surprised by the lack of connectivity from this Samsung model. There are just a pair of HDMI ports and a DisplayPort, with an audio output port located in between. Again, as with the Dell unit, the HDMI ports are version 1.4, so the only 60Hz 4K images you'll see are all going to via the DisplayPort, and you'll also lose the ability to connect a VGA or DVI cable without some sort of conversion. There's also no built-in USB hub or speakers either.



▲ The Samsung 4K monitor left a lot to be desired



▲ For roughly the same price, there are other better examples available

Build quality isn't all that great, which again we were quite surprised by, considering Samsung is usually quite stringent when it comes to design and manufacturing. We didn't much like the glossy plastics on the bezel, which felt a little too cheap for a monitor of this price. It also offers a limited range of movement,

namely the tilt, which was extremely stiff and decidedly poor in comparison to the other monitors here. One more design oddity: around the back of one corner is a small joystick, a bit like the sort you'd find on a game controller, which used to navigate the OSD. While it seems like a good idea, it's actually quite a nuisance and

feels horribly cheap and on the verge of breaking.

The image and picture quality, though, are very good but not quite on a par with the Philips or AOC monitors. The colours are bright and vibrant, and the image sharp and perfectly clear, but it lacks the depth that the other 4K monitors have. Thankfully, though, we didn't see any of the lag we experienced with the Dell 4K monitor, which we were half expecting, given that the Samsung is roughly the same age and has the same HDMI port version.

The Samsung U28D590 has a good 4K screen to boost its score, but the let-down elements are the poor quality design, as well as a lack of connectivity and extras such as USB and speakers. For gaming, which it's designed for, the Samsung does a reasonable job, but so do the other monitors on test (except for the Dell).

Considering this costs £385.99, we can confidently state that your money is better spent on the AOC 4K monitor, which is only about £4 dearer.



Asus PB287Q

DETAILS

- Price: £487.49
- Manufacturer: Asus
- Website: goo.gl/rCqbX6

Asus, much like Dell, was one of the first companies to offer 4K monitors to the masses as long ago as late 2013. Back then, though, the screens were going for around £4,000, so only those with extremely deep pockets ever managed to sample UHD before the rest of us.

Clearly, Asus has some experience in the 4K arena, and the model we have here was launched last year to much applause and high praise, especially as it was so reasonably priced at that time, so we were expecting something rather good.

The Asus PB287Q is a 28" TN panel, with a 1ms response time and a dynamic contrast ratio of 100,000,000:1. There are a pair of HDMI ports (both of which are of the v1.4 30Hz variety) and a single DisplayPort running at 60Hz. You'll find a pair of 2W speakers, but sadly there's no USB hub.

Build quality for the Asus is okay, and it offers tilt, pivot and height adjustment, as well as VESA wall mounting. While it doesn't feel like a cheap plastic unit, we found the movement a little stiff, and there were some creaks and groans from the casing as we moved the screen around.

Screen quality was good, though, and there were no instances of lag or pixelisation when we viewed 4K media or



▲ The Asus 4K monitor has a reasonably good screen, but there's not enough connectivity to make it great



▲ There are much better examples on the market

played the games we tested at 3840 x 2160. Generally, the image was sharp, as you would expect from a 4K monitor, but it wasn't quite as good as the Philips, AOC

used to plugging USB sticks into the side of the monitor as opposed to conducting some back-breaking yoga move to locate the port on our PC.

are loyal, then this is a better than average 4K monitor that is perfectly adequate for gaming, watching UHD and HD content, as well as everyday office duties. It's worth considering the other examples on test, though.

“ The second most expensive monitor on test, and it's not really worth it ”

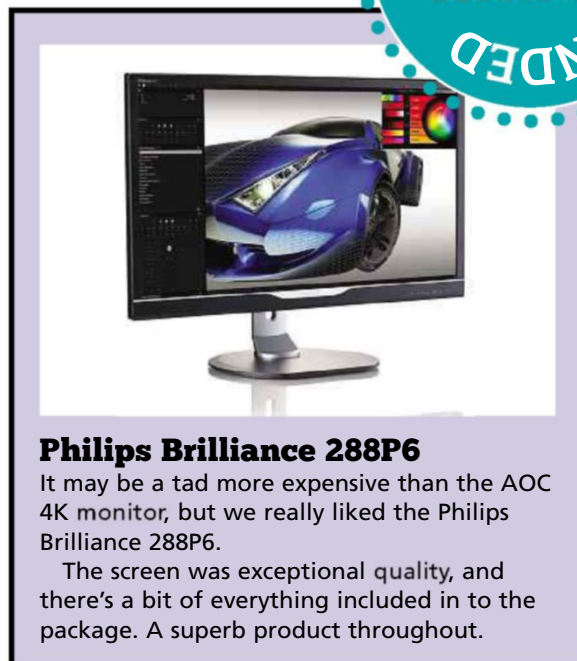
or the Acer examples we'd previously tested. In truth, it was probably about as good as the Samsung model which, as we said, was okay but not the best.

It would have been more of a benefit to have included the option to connect DVI and VGA; some users still rely on these types of connection for other equipment and hardware. And of course, the lack of USB is a bit of a pain, especially since we're now

While the Asus PB287Q is a reasonably good monitor, it just doesn't have that 'wow' factor of the other displays in this group test. It'll certainly deliver ultra-high-definition gaming and video to your desktop, and it looks good enough as a company front to the public. But it's the second most expensive monitor on test, and ultimately it's not really worth it.

Having said that, if Asus is a company to whom you





How We Tested

Each 4K monitor was hooked up to a GeForce GTX 970 4GB graphics card, via HDMI and/or DisplayPort. We tested a number of YouTube 4K videos, as well as some full HD movies. For games we ran *War Thunder*, *Elite: Dangerous*, and *Sniper Elite 3* in the highest resolutions possible.

	Acer CB280HK	Philips Brilliance 288P6	AOC U2868PQU	Dell UP2414Q	Samsung U28D590	Asus PB287Q
Price	£299.98	£439.98	£389.99	£529.17	£385.99	£487.49
Screen Size	28"	28"	28"	23.8"	28"	28"
Response Time	1ms	1ms	1ms	8ms	1ms	1ms
No HDMI Ports	1	1	1	1	2	2
No DVI Ports	1	1	1	0	0	0
No VGA Ports	0	1	1	0	0	0
No DisplayPort	2 – 1 mini	1	1	2 – 1 mini	1	1
USB	0	4	4	4	0	0
Height Adjust	Yes	Yes	Yes	Yes	No	Yes
Tilt	Yes	Yes	Yes	Yes	Yes	Yes
Pivot	Yes	Yes	Yes	Yes	No	Yes
Weight	9.4Kg	8.04Kg	10.95Kg	10Kg	5.65Kg	7.9Kg

Tech Origins

Cloud Computing

David Briddock examines the development of centralised computing services

What's the origin of the term cloud computing? There's no definitive answer, but cloud-like shapes have been used throughout computing history to denote telephony network schematics.

Mainframe Era

Shared central resources, the underlying concept behind cloud computing, dates back to the 1950s. At this time large-scale mainframe machines were seen as the future of computing. Academia and companies allocated slots of expensive mainframe resources to users operating simple terminals (also known as thin clients) that had no internal processing capabilities of their own.

This centralised computer processor allocation became known as time-sharing and was, for many years, the accepted practice for systems supplied by large vendors such as IBM and DEC.

The 1990s

The cloud computing technology we recognise today arrived in the 1990s. At this time telecommunications companies, who'd previously only offered dedicated point-to-point data circuits, began offer low cost virtual private network (VPN) services. Switching technology advances allowed them to balance out server usage and so utilise the network more efficiently.

About the same time, cloud symbols began to appear on diagrams to show the demarcation point between the service provider and users. In true cloud computing this boundary is extended to cover all servers as well as the network infrastructure.

For efficiency and costs reasons these service providers built ever larger

server farms, with rack upon rack of inter-connected computer modules, constructed from readily available off-the-shelf PC components.

Public Awareness

One of the most significant events happened in 2006 when Amazon opened up its internal Elastic Compute Cloud technology, the foundation for its highly successful open-source Amazon Web Services (AWS). Later that year Eucalyptus used AWS to deploy the first business-centric private cloud platform (where access is restricted to a tightly controlled list of users). The same year OpenNebula released open-source software for both private and hybrid clouds (a hybrid combines the benefits of both private and public cloud services).

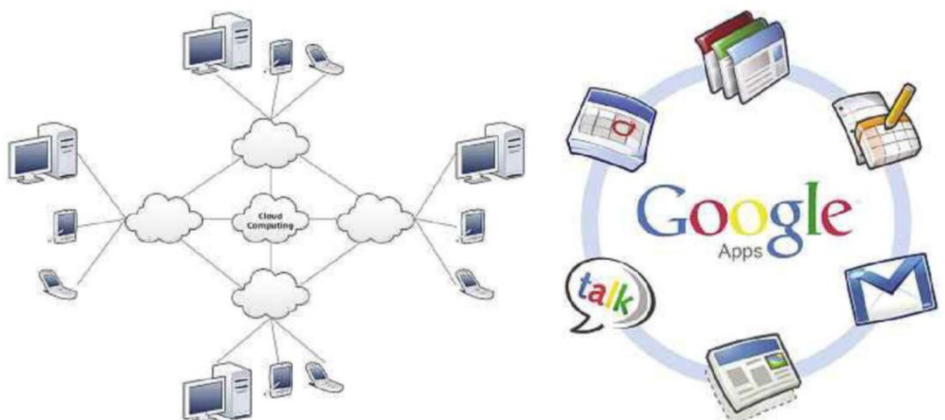
Also in 2006 Google enhanced its own cloud platform with the release of Google Docs, which delivered Microsoft Office-like document tools. Docs became an integral part of Google's free-sign-up public web service, which also includes GMail and Google Calendar.

On A Roll

By now business intelligence organisations like Gartner, saw an opportunity for cloud computing to drive an upsurge in consumer-centric web services growth. This vision was, in part, fuelled by long talked about Web 2.0 services, which were finally starting to show some promise. Also known as 'Web as a Platform' technology it allowed web site designers to optimise data presentation while restricting the need for continual page refreshes. With its more efficient data communications and much-improved web browsing experience, Web 2.0 was a boon to the fast growing online shopping domain.

In July 2010 Rackspace Hosting and NASA jointly launched the OpenStack project. This project offered open-source cloud-computing services hosted on standard PC hardware, with code from NASA's Nebula and Rackspace's Cloud Files platforms.

As momentum gathered Microsoft announced its Windows Azure platform, followed soon after by the IBM Smart Cloud framework and the Oracle Cloud. **mm**



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Apple Watch

Destined For Failure?



David Briddock compares the Apple Watch with previous Apple failures

In spring 2015, we'll see the first Apple Watches adorning customers wrists. First announced in October 2014, it's Apple's first brand new product line for many years.

As always, the novelty of a new Apple product means initial sales are likely to be strong. But over the longer term, will the Apple Watch be a hit with consumers?

No Magic Formula

Every new product launch is a leap into the unknown. Success certainly isn't guaranteed.

It wouldn't be the first time Apple has built the wrong product, released it at the wrong time or sold it at the wrong price. And in case you are wondering, some of Apple's previous mistakes did indeed have Jony Ive's fingerprints all over them.

Let's investigate some of Apple Watch's shortcomings and compare them with previous Apple product failures.

Design Over Function

The Apple Watch incorporates a number of novel innovations. There's a custom-built operating system; a scratch-resistant sapphire multi-pressure touchscreen; a side-mounted digital crown, which aims to simplify user interaction without obstructing its tiny display, and haptic vibrations gently 'tap' you on the wrist to signal notification alerts. It's also packed full of sensors, like the heart rate detector and accelerometer. Plus the whole thing can be customised with a range of designer face surrounds and straps.

As for software, it offers multiple watch faces, Siri voice interaction, the new Apple Health app and Apple Pay integration for card-free purchasing.

It's no surprise, then, that on launch day Tim Cook proclaimed, "The list of features is a mile long."

But how many functions does a watch really need? Especially if you're already carrying a smartphone and maybe a tablet



▲ Puck mouse

or laptop too. More importantly, will consumers spend many hundreds of pounds on a product that has loads of features they might never use?

Design over function is a classic Apple mistake – one that's been repeated many times before. Take the Apple III, for example. Steve Jobs imposed ridiculous demands on the design – in particular, case dimensions that were too small for all the components, plus a power supply enclosure with no ventilation or cooling fan (because Jobs thought them too noisy and inelegant). As a result the motherboard got hot and warped, which loosened the soldered chips and led to system malfunctions. Apple is reported to have replaced 14,000 bad Apple IIIs.

Another example is the unloved Apple Puck USB mouse. Its circular shape and small size was unpleasant to hold and tricky to orient. Even worse, the Puck mouse had a very short cable of just two feet in length. And it appeared when the Mac USB port was relocated from its central rear position to the left hand side. Consequently, right-handed mouse users had to buy a cable extension or a USB-to-ADP adapter, before using their brand new Mac!

Then there's the Twentieth Anniversary Macintosh (TAM), launched in 1997. Jony Ive's spec included a new feel shape, metallic green-gold paint job, TV and FM tuners and a massive Bose subwoofer. But on sale at an eye-watering \$7,499, it was hugely overpriced (a similarly specified PowerMac 6500 was \$2,999). The TAM was discontinued in 1998 and the price slashed to \$1,995.



▲ Twentieth Anniversary Macintosh

Immature Hardware?

The Apple Watch battery life is likely to be limited. How limited? Well, we don't yet know. The fact that we still haven't seen the actual figures is itself a strong pointer to potential problems.

So far, Apple has declined to respond to requests for more information on battery life. However, one Wall Street Journal reporter says he was told by an spokesman that the Apple Watch will have to be charged once a day. That's a big disappointment, as expectations were for at least two days on a single charge.

Sure, there's the fancy MagSafe magnetic-connection charger, which Apple says will make, "Apple Watch easy to charge in the dark without looking while being only partially awake." But is that enough compensation for having to charge it every single night?

“ Every new product launch is a leap into the unknown ”

Research into graphene and other nano-scale technologies offers the promise of much longer battery life. And a company in Israel has already announced a super-fast charging battery technology. But unfortunately these are years away from commercial reality.

Should Apple have waited for a leap in battery technology first? There's no doubt Apple felt under pressure from shareholders, industry analysts and consumers for new innovations. Did this pressure ultimately force its hand too early?

Past Apple products have also been hampered by immature hardware.

Take, for example, the Macintosh Portable. Despite its name, at over 7kg in weight the Macintosh Portable wasn't very portable. One of the reasons was the Portable's car-like lead/acid battery, which alone weighed around 1kg – or nearly as much as a modern Apple MacBook Air laptop. But that still left 6kg for the chassis, drives, black-and-white LCD display, keyboard and so on. Far too much for most people to lug around.

Remember the Apple Newton MessagePad? It was meant to be your carry-everywhere personal digital assistant (PDA), but with chunky dimensions and at almost half a kilogram in weight the



▲ Macintosh Portable



▲ Newton MessagePad



▲ Technology Hype Chart

Newton couldn't really be considered pocket-size. In addition, the non-backlit LCD screen had poor contrast, which made it especially difficult to read outdoors. Released in 1993 for \$700, it was discontinued in 1998.

Immature Software

In January 2007, the iPhone was initially launched with a limited selection of Apple-supplied apps. In fact, the hugely successful iTunes App Store didn't appear until July 2008. But you couldn't launch a new mobile platform that way today.

Gone are the days when looks and hardware specifications alone are enough to guarantee sales. Today, software in the form of low-cost apps are a vital ingredient, so any new mobile technology platform must have a well-stocked store full of exciting, useful, novel, fun and engaging software creations.

“ But how many functions does a watch really need? ”

Yet the Apple Watch apps bandwagon hasn't started to roll. We have no idea how many coders are fully focused on Apple Watch development or what to expect in terms of quality in the first batch of apps. Consequently, it's impossible to gauge how successful these apps will be in attracting Apple Watch customers.

Software problems also dogged the Newton MessagePad. Built-in handwriting recognition was one of its most attractive capabilities. Designed to convert the owner's scribbling into computer-readable text, in the original Newton, handwriting recognition was often wildly inaccurate.

Subsequent software updates eventually improved the accuracy of the handwriting recognition, and it eventually lived up to its earlier claims. But its reputation could not be salvaged. It was another 14 years before a modern take on the Newton MessagePad appeared – namely the iPhone.

Immature Market

Wearable technology is seen as new and cool. In practice this means wearables are positioned right at the top of the peak of exaggerated and unrealistic expectations on the classic technology

hype chart (see diagram). Wise consumers patiently wait for the third generation.

Yet it seems there's already a market for reasonably priced fitness and health bands. That's not too surprising with a constant public demand for gadgets that might make fitness activities fun – especially at the start of a new year. The recent surge in popularity of sporty pursuits like running and cycling has also helped sales of wearables.

But to be fair, sports bands and health-centric wearables have already gone through a number of generations. And the prices have tumbled too, with quite a few now on sale for well under £100.

We've seen something similar before. In 1993 there wasn't really a market for something as ground breaking as the Newton MessagePad. In the end, smaller, simpler and much cheaper PDA products focused on everyday tasks won out.

And do you remember the Apple Pippin? It was an open-source platform for gaming and multimedia content. Yes, you read that correctly, an Apple-promoted open-source platform. Why did it fail? Apple decided to let partner organisations come up with commercial ideas, which would be marketed under the Apple brand, but at this time, the marketplace wasn't ready for such an idea.

iPhone Companion

There's no doubt the Apple Watch is a powerful device in its own right, and with an estimated cost of \$350 or more, it should be. But – surprise surprise – to get the most from your expensive purchase, you'll also need an iPhone.

Even though there are three separate models – Apple Watch, Apple Watch Sport and Apple Watch Edition – rather surprisingly, none has a built-in GPS chip. So if you hope to synchronise your fitness data with location information, you'll need to connect the Apple Watch to an iPhone via Bluetooth.

Is the lack of a GPS chip simply a case of Apple trying too hard to maximise profits? Or is it that omitting a power hungry GPS chip is a sensible choice for a device that already has a battery life problem?

Whatever the reason, this expensive-accessory scenario is a key reason why the Apple Watch might not appeal to the masses. It's no real surprise, then, to see initial optimistic forecasts from analysts of 30 million sales in 2015 have been slashed down to between five and 20 million. Yet it does still represent a huge fall in confidence.

One reason for this pessimism is that there's already a large and growing choice of smart watches and bands. Examples include the diverse range of Android-powered watches and cross-platform products like the new Microsoft Band with its extensive sensor array.

A lower-cost Apple Watch might hit a consumer sweet spot, but unless sales completely ground to a halt, it's unlikely Apple would consider reducing the price or offer other kinds of incentives.

Once again, this has occurred in the past

At around \$3,500 the flawed Apple III simply couldn't compete with the much cheaper Apple II models and was soundly trounced by sales of the Apple Plus, Apple IIe and even the semi-portable Apple IIc.

Sales of the expensive Newton MessagePad also ground to a halt. Nevertheless, its advertising campaign did kickstart the PDA marketplace, which was soon dominated by the more affordable Palm Pilot range, which had a usable handwriting recognition solution of its own.

And, as we've already noted, the Twentieth Anniversary Macintosh was reduced from \$7,499 to \$1,995 to clear the shelves of stock.

Identity Crisis

Arguably Apple Watch's biggest problem is that it lacks an obvious core function, the overriding reason why you'd strap it to your wrist all day and maybe throughout the night too.

For comparison, let's consider the iPhone. At its core, the iPhone is a mobile communication device, a device that's now carried by virtually everyone and often singled out as the item they'd least want to lose.

Despite its high cost, some iPhone owners chose to rely only on this core capability and the basic pre-supplied Apple apps. Others transformed their iPhone into a video editor, games console, sketchpad, musical instrument and much more by downloading third-party apps from the Apple's iTunes App Store.

Arriving late to the smartphone party wasn't a problem for Apple. The iPhone's revolutionary touchscreen, smart apps, elegant design and overall quality was unmatched. Right from launch day, the iPhone was the most desirable phone on the market, and it wasn't until many years later that competing smartphones offered similar touchscreen technology and a rival collection of downloadable apps.

What's the official line as to the Apple Watch's core indispensable feature? Well, there doesn't appear to be one, which begs the question of what type of consumer the Apple Watch is aimed at.



▲ Apple Pippin

Video Links

- Newton MessagePad advert: goo.gl/cboQTc
- Twentieth Anniversary Macintosh: goo.gl/cvrrVV
- Apple Pippin: goo.gl/xiyild
- Microsoft Band: microsoft.com/microsoft-band

alert device? An always available iPod substitute? A replacement for your debit/credit card stack via the new Apple Pay service. Or maybe, despite the lack of GPS, some kind of flexible fitness accessory?

Most of the existing watch/band products are marketed by focusing on one particular overriding application. Yet they will still perform the sort of notification and fitness-related tasks people are likely to be most interested in. And in virtually every case they are cheaper – often substantially so.

“ Why would someone consider the Apple Watch an essential buy? ”

Some of the Apple failures we've previously mentioned also had an identity crisis. Prime candidates include the Apple Pippin and the Newton MessagePad.

Over To You

Why would someone consider the Apple Watch an essential buy? There's a growing suspicion even Apple doesn't know the answer, so it appears the decision will be left to others.

Yet to make such a decision, we'll need to know more about the final release specification, and more about its practicality (will it be waterproof enough to go jogging in the rain?), more about real-world battery life (does it need a nightly recharge?), more about the Apple Watch specific App Store (what app range and quality can we expect at launch?) and the final launch price, especially for non-US consumers.

It's possible the ingenuity and creativity of app developers may help create a deep desire for Apple's latest innovation. But in the final analysis, it's the buying public that will decide the future of this product. And if they decide that it's nothing more than a cool but expensive toy, the Apple Watch could be Apple's latest failure. [mm](#)



▲ Apple III



SO YOU WANT A REAL MEDIA CENTRE?

The Linux Build

In the last part of this series, Leo Maxwell looks at a Linux based HD media centre solution

Last week, we looked at using a PC with Windows and MediaPortal to build a media PC. This week, we look at the same hardware running a free operating system with a media application called MythTV.

Hardware

Although not absolutely all hardware is well supported under Linux (or all versions of Windows, for that matter), most common standard-definition DVB-TV cards are supported 'out of the box', as are most motherboards and video cards. HDTV solutions are more challenging. Before spending your hard-earned beer tokens, it's advisable to spend some time researching the make and model.

“ MythTV can function as a media server or a back-end for multiple front-ends running on other devices ”

Lists of compatible hardware are available at: www.mythtv.org/wiki/Video_capture_card and elsewhere on the internet.

DVD And Blu-ray:

If you want to play DVD or Blu-ray discs, in addition to a suitable optical drive, you will need a TV or monitor with a HDMI, DVI or DisplayPort connector, plus a display card that outputs a HDCP-compliant signal through one of these ports and that is capable of driving an HD screen. The copy protection on some DVDs can cause playback problems, and Blu-ray support in Linux is at best experimental.

The Software

Networked media software comes in two parts: the back-end, which controls the tuners, recordings and other media files, and the front-end, which is the user interface.

There are several alternatives for Linux TV back-ends and front-ends. OpenElec is a minimalist pre-compiled distro for media management, and it will happily run as a TV front-end. XBMC is a media front-end, which is available for most platforms and has

plug-ins for many TV servers. TVHeadend is a dedicated TV back-end for Linux. By far the most complete and accomplished solution is MythTV. MythTV offers both back-end and front-end capability. It is a mature open-source project for Linux, which is unparalleled in the scope it offers, and it keeps growing. If all you want to do is watch a few TV shows on your desktop, it's definitely overkill, but if you want the ultimate in media convergence and total control for free, there is nothing to touch MythTV.

As with most such packages, installation and configuration can be a daunting task.

However, there are Linux distributions that do most of the work for you, and as long as you choose compatible hardware, the experience is nowhere near as stressful as it once was.

I will be referring to the Mythbuntu release based on Ubuntu 14.04 LTS Trusty Tahr throughout this article. Unlike some other

MythTV Features:

As with last week's list, this is the 'out of the box' feature list:

- Themeable and extremely configurable 'ten foot interface'.
- Powerful and extremely flexible PVR, support for multiple tuners, multiple channels from a single multiplex.
- Configurable electronic program guide.
- Extensive intelligent scheduling, profiling, prioritisation, recording management and conflict resolution.
- Timeshifting – pause live TV.
- Remote control, scheduling and media streaming using a web browser from any platform.
- Support for multiple remote 'front-ends' and 'back-ends', including live CD front-ends, Diskless front-ends and front-ends for Windows, Linux, Mac, BSD, Android and iOS.
- RSS news feeds, web browsing, audio and video streaming from the internet.
- Audio replay of most audio file types, CD play and CD ripping, CDDb access, various shuffle modes, playlist support, etc.
- Video replay of most filetypes, DVD replay, archiving and transcoding to DivX, AVI, DVD, including generation of menus, scene selection, commercial removal, multiple simultaneous transcoding jobs, cut-lists, etc.
- A wide range of plug-ins and extensions.



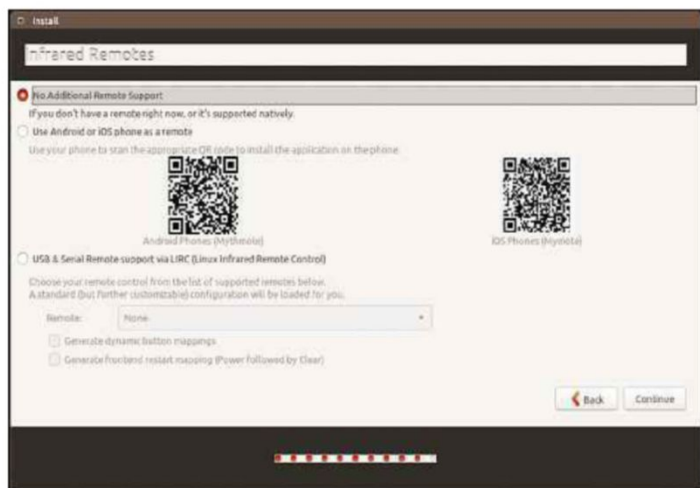
▲ The boot screen from the Mythbuntu CD. Here you can choose to run from the live CD or to install



▲ Partitioning, the simplest option is to use the entire disk



▲ Choosing the installation type. Standard is best for a stand-alone machine



▲ **Optional remote control setup.** You can also set up an Android or iOS phone using a QR code



▲ **This is the first screen you see after a reboot.** Using the 'Esc' key, you can exit and configure your new setup

Ubuntu flavours, Mythbuntu only tracks LTS (long-term support) releases. These are supported for a minimum of two years.

Mythbuntu uses the XFCE window manager, which is simple to use and light on resources.

It's best to dedicate a PC to Mythbuntu. Dual booting with Windows is not recommended, and a PVR really needs to be on 24/7. Although it's possible to divide up the hard disk to keep media files on a separate partition or use multiple hard disks, the default configuration is installation on one big Linux partition.

MythTV can function as a media server or back-end for multiple front-ends running on other devices. You can also have multiple back-ends. MythTV even has the ability to serve the front-end to diskless workstations via network boot. This allows you, for example, to watch TV on a networked device that does not have a TV tuner or even a hard disk.

This article is limited to the comparatively simple task of installing and configuring a single PC with the back-end and front-end running on the same host.

Database

All PVRs use a database to store settings, program listings and information about recordings. MythTV and other media centre packages also store information about music, pictures and videos etc., such as the location of the file, the size, when it was last accessed and so on.

MythTV has 'intelligent scheduling'. It will not record the same episode of a series twice (unless you tell it to), and it will pick the

best combination of times to avoid conflict with other recordings or live TV. It will also use the minimum number of tuners to meet the requested schedules. It can even run multiple slave 'back-end' servers, each with multiple TV cards.

MythTV uses MySQL, a free database, which runs in the background and ensures that scheduled recordings are made on time. The system automatically backs up the database on a regular basis.

There are a wide range of recording options. For example, 'record at any time on any channel' will seek out one copy of every episode of a program and keep on doing so, even after the current series has finished. You can allocate priorities to a group or single programs, for example, to ensure the latest episode of *The Great British Bake Off* is not missed because of some silly football game or to allow deletion of lower priority recordings if disk space becomes low.

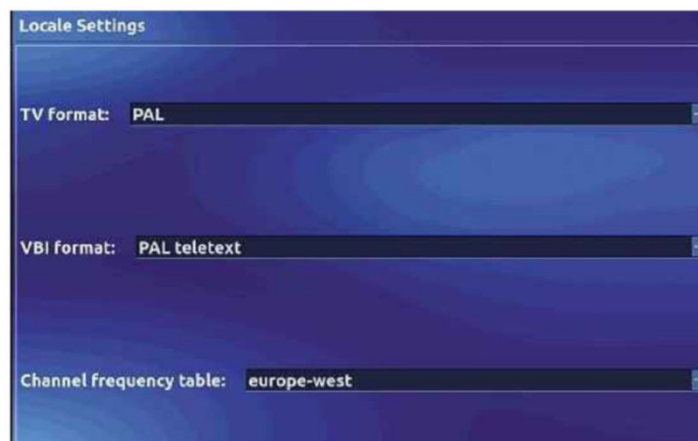
The TV Card

I chose a TBS TV card, because I wanted a dual-tuner HD unit, and TBS offers Linux drivers.

There are other HDTV cards available, some of which are not supported, such as the BlackGold models. There are also some USB single-tuner units, including the Pinnacle PCTV209e, which is natively supported, and Avermedia's AverTV Volar Black HD, which is not.



▲ **MythTV Backend setup.** start at the top and work down



▲ **The second screen in the General setup, showing settings suitable for the UK.** No other screens in the general section need to be changed for now

As I explained earlier in the series, digital channels are transmitted in multiplexes so that, for example, your local transmitter may transmit BBC1, 2, 3 and 4 on one multiplex. The tuner downloads all of them *simultaneously*, so it's possible for the software to separate them and record more than one.

Playing HD content is more demanding, and the open-source driver for the AMD APU seems a little lacking in that respect. However, the AMD closed-source driver delivered smooth HD video.

“ Some people still think that Linux is difficult, rather than just different ”

The LIRC (Linux Infrared Remote Control) package is built into the Linux Kernel. It supports many IR remote controls, and it has tools to help in configuring them. LIRC allows you to use the remote control with many other programs, not just MythTV. You can even set up separate function lists for different remotes or configure one of the many multifunction remotes on the market.

The Installation

ISO images for Mythbuntu are available from www.mythbuntu.org/downloads. I used 14.04 LTS, which will be supported until April 2019.

There are several options, x86 files are 32-bit, and x86_64 files are 64-bit images; 'desktop' is the normal release, and 'alternate' is a non graphical 'safer' installation for older hardware that may cause problems.

Once you've downloaded the image file, you'll need to burn it to a DVD (it's too big for a CD) or create a live USB stick. For this, I used the UnetBootin program, available from unetbootin.sourceforge.net, but there are others such as Rufus or Lilli. Booting from the DVD or USB stick, we're offered the choice of trying Mythbuntu or installing it.

I would recommend trying it in 'live' format (i.e. without installing) in the first place, as that will give you the chance to explore it and check hardware compatibility before committing to an installation.

During the initial stages, you will be asked for your location, and to set the time, choose keyboard and language, etc. The defaults are usually correct.

MythTV Plug-ins

There are various MythTV plug-ins, which add functions to the core system. Some are installed and enabled by default, but others need to be installed, and others are still in development. The main ones are:

- **MythGallery:** Digital picture frame. Browse pictures, run slide-shows etc.
- **MythMusic:** Browse and play music, playlists, etc. (can be run in background with other modules, e.g. MythGallery as a slideshow).
- **MythVideo:** Browse and watch video files.
- **MythGame:** Supports several arcade game emulators; play games within MythTV.
- **MythWeather:** Check the weather forecast.
- **MythNetvision:** Simplifies adding internet video sources.
- **MythWeb:** Control your MythTV box remotely or stream media from it.
- **MythBrowser:** Browse the web from within MythTV.
- **MythArchive:** Can be used to transfer recorded video to DVD or transcode to other formats, such as DivX or PSP etc.

There are other plug-ins, some officially supported by MythTV and some not.

Then you will be asked how you want to partition the disk. This can become quite complicated if you want to dual boot with Windows, but the simplest option is a single boot using the entire hard disk.

Next you'll be asked for a username and password. It's important that you create a user and use a password, as they'll be required to start and manage the PC. A blank password will not work in some applications.

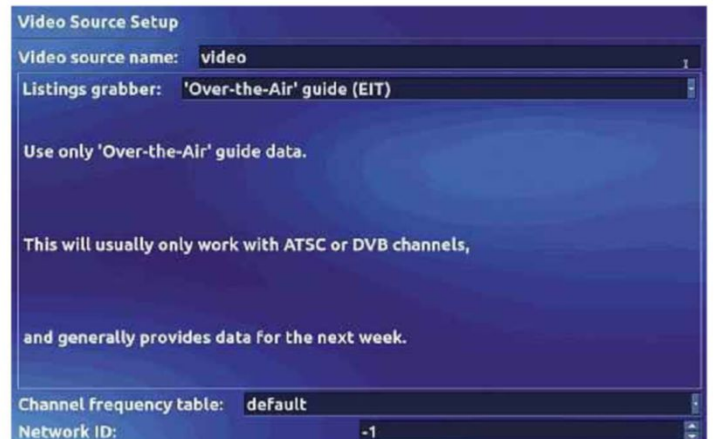
The next question is about how the PC will be used; the default is a combined back-end and front-end unit.

Then you're given the opportunity to configure a remote control, after which the installation proper will begin. A fairly modern PC can copy the files and configure the OS in about 15 minutes.

At the end of the installation, you should see a screen telling you to restart the PC, after which it asks you to remove the installation media and hit **enter**.



▲ Add all of your tuners here



▲ The video source screen, where you set up the listings source (satellite, Freeview and so on)

HDTV Tuner

One point that Windows currently scores on is support for HDTV cards. Although most SDTV cards work in Linux without drivers, there are not many HDTV cards on the market, and not all of them support Linux.

The one I chose, the TBS6821, has a driver for Linux, but TBS only supplies the source code and instructions, which means that the modules have to be compiled and installed by the end user.

This is not as difficult as it might sound, but it needs a little preparation.

Note: I will be posting these commands on the Micro Mart forum in the magazine section, if anyone would like to be able to cut and paste them into a terminal.

Compiling The Drivers

After installation, first run the software updater, which will install all the latest bug fixes and patches.

Then we need to install some tools.

The easiest way to do this is to open a terminal and type the following command, entering your password when prompted:

```
sudo apt-get install p7zip-full
build-essential linux-headers-generic
linux-headers-$(uname -r)
```

This installs the p7zip file extractor, the GCC+ compiler and tools, and the correct header files for your installed kernel.

Download the latest TBS driver archive from the TBS site at www.tbsdtv.com/download and save it to your home directory. At time of writing this is the package named:

tbs-linux-drivers_v141019.zip

You will probably want to make a folder for the drivers to extract to (I called mine 'tvdriver'. It is important not to have a space in the name).

Move the downloaded file into that folder.

Then you will have to open a terminal and move into the folder

```
cd tvdriver
```

Extract the files by with zip and then tar:

```
unzip tbs-linux-drivers_v141019.zip
tar xjvf linux-tbs-drivers.tar.bz2
```

You will then have a directory containing several firmware files and two folders named 'linux-tbs-drivers' and 'readmes'.

Move into the new driver folder:

```
cd linux-tbs-drivers
```

You then need to configure the driver files for the architecture that you have chosen:

For any 32-bit installation of Linux:

```
sudo ./v4l/tbs-x86_r3.sh
```

For any 64-bit installation of Linux:

```
sudo ./v4l/tbs-x86_64.sh
```

You should then see this message:

TBS drivers configured for x86_64 platform.

Now you can build the driver.
The command is:

```
sudo make
```

This can take some time, as it builds all of the v4l (Video 4 Linux) modules for every currently available device (over 500 of them), so this is a good time to have a tea break. Once that has completed, you need to enter:

```
sudo make install
```

This should install the driver modules.

When that is complete, you will need to reboot to initialise the driver.

Unfortunately, if the Linux kernel is updated, (which happens now and again), you will have to reinstall it. It may be a good idea to check for any kernel updates before running updates, and deselect them. That way you can postpone the process until you have the time to do it.

If your system does not need internet access, updates can be postponed almost indefinitely, unless you have a problem with the system.

Make sure that you have the right version of the linux-headers package for your kernel installed before reinstalling, otherwise you will get a file not found error. These can be installed with the following command:

```
sudo apt-get install linux-headers-$(uname -r)
```

Sometimes when updating, there's a conflict with old driver modules. This can be solved by deleting the contents of:

```
/lib/modules/(your_kernel_
version) /drivers/media before
compiling the drivers.
```

After rebooting, you'll be faced with the default MythTV front-end GUI.

I recommend that on a full installation you exit at this point using the Esc key and install the latest updates using the 'Software updater' application in the system menu before continuing.

If, like me, you have chosen a tuner that needs a proprietary driver compiling, you'll also need to do that before continuing (see 'HDTV Tuner' boxout).

Another useful tool in the system menu is the 'Mythbuntu control centre', which simplifies a lot of configuration. Here you can add proprietary drivers, configure remotes and 'restricted' codecs such as MP3, DVDcss, etc.

Setting Up The Back-end

Once updated and with the driver installed if required, you will need to run the MythTV back-end setup, which is where you configure your tuners.

This is accessible from the system menu.

Because it's intended for use with a remote control, in MythTV the mouse is almost impossible to use, as the mouse pointer is invisible by default. You can use your remote control buttons for up, down, select and so on. It's possible to do most things in MythTV this way, but I prefer to use a small wireless keyboard. The arrow keys or the Tab key are used to move up and down, left and right to scroll options, Enter or the spacebar will select an option, and Esc is for back or exit.

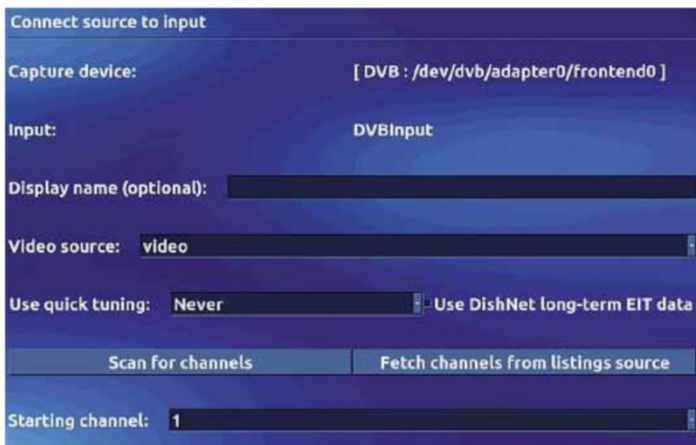
“ **Media Portal and MythTV are both complex packages and sit on different underlying operating systems, so any direct comparison is difficult** ”

that do not affect the back-end or OS, whereas in MediaPortal even minor changes require a front-end restart.

Media Portal's feature list compares very well with MythTV, but the reliance on Microsoft software means that some things have to be installed separately, whereas Mythbuntu installs the OS and most of its packages in one neatly tailored operation.

MediaPortal and MythTV are both complex packages and sit on different underlying operating systems, so any direct comparison is difficult. I have hardly scratched the surface of either one in these articles. Both developer communities are to be lauded for their efforts, and the fact that these projects are open source means that they are not subject to the decisions of a single individual or company.

I've used MythTV for some time, and it suits my needs admirably. However, some users will prefer to stay in their comfort zone and opt for the familiarity of Windows. [mm](#)



▲ Connecting a video card to the video source



▲ The MythTV front-end main menu, showing the MythMediaStream theme

In the back-end setup, you start at the top option and work your way down, adding the TV card, then the video sources (TV listings), then connecting them as input connections so that you can then scan for channels.

Once it has all been set up, use Esc to exit, and you will be asked if you want to run mythfilldatabase. This program stores all of the settings and channel information and retrieves the electronic program guide.

On rebooting, you will be faced with the MythTV front-end, which is largely self explanatory, and any front-end settings can be changed in the setup section.

There's plenty of documentation in the MythTV wiki.

Comparisons And Conclusions

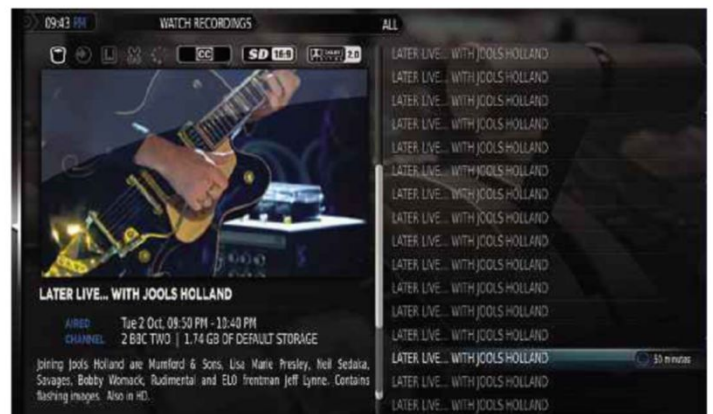
Some people still think that Linux is difficult, rather than just different.

Comparing these installations from the point of a 'bare metal' starting point, Mythbuntu is undeniably easier and quicker to install. The only complication is the need to compile the drivers manually for HD cards.

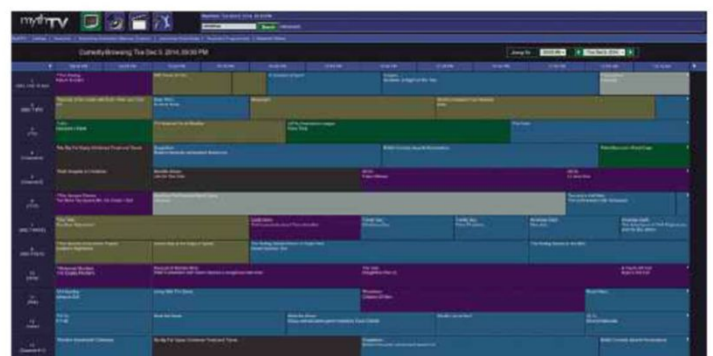
The version of Linux that Mythbuntu uses is less complex and demanding than Windows and is stripped down to run only what is required, improving multi-tasking and reducing resource requirements.

Depending on download speeds and hardware, a fully up-to-date working system can be achieved in an hour or two, whereas the Windows and MediaPortal installation from last week took over eight hours using the same broadband connection and hardware.

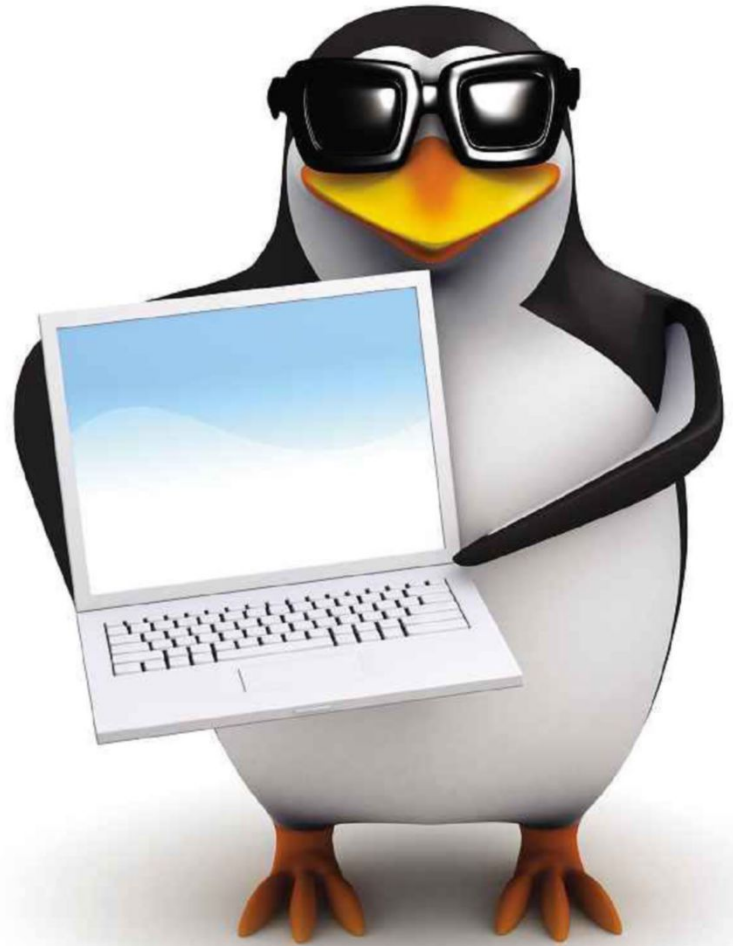
MythTV is also easier to configure 'on-the-fly', not needing to stop the client and run a separate configuration utility for changes



▲ The MythTV recordings menu (MythMediaStream theme)



▲ MythWeb listings page



Expanding The Chromebook

Running Linux on a Chromebook isn't hard, as Chris Salter demonstrates

Introduced in 2011 by Google, the Chromebook was designed as a thin client to run Google web services, such as Google Documents. Chromebooks are low-cost laptops that run Chrome OS, a modified version of Linux with the Chrome browser installed on top. The devices have Google Drive installed on them, allowing users to create files using the offline Google Document editors and have them sync back to Google Drive when connected to the web. Additional apps and extensions can be installed to the Chromebook from the Chrome Web Store that allow the Chromebook to run a variety of programs online and offline. Chromebooks could therefore be viewed as something of a cross between a standard laptop and tablet – the laptop form factor but a restricted number of programs that can be run.

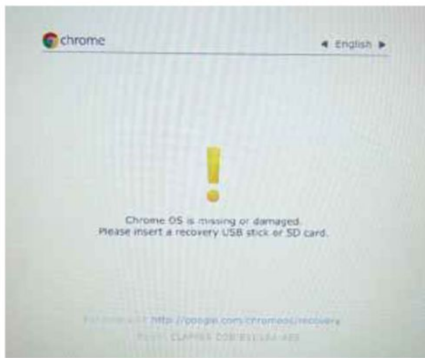
However, because Chromebooks run Linux as an underlying operating system, they can be hacked to run a full version of it too. By doing so, you can expand the Chromebook to run a full

desktop Linux operating system. This allows you to run any program you want that runs on Linux, depending on the Chromebook you have (some of the Chromebooks have ARM-based processors and therefore run programs compiled for those rather than x86 chips, the standard CPU type for desktops). This includes running Dropbox or a desktop email client, so you can use the machine exactly how you might use a standard Linux installation.

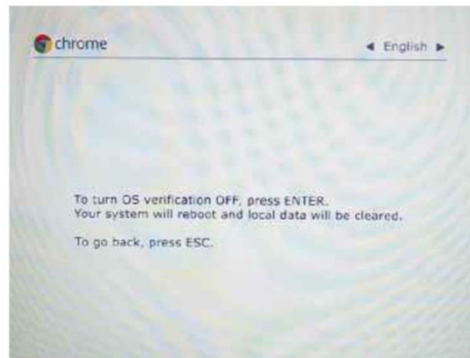
Most Chromebooks have a reasonable specification and price, so this method allows for a cheap Linux laptop that will allow you to perform any task you want. This guide explains how to download and install Linux on your Chromebook.

Installing Linux

Chromebooks can boot quickly – from switching on to a fully working desktop in under ten seconds. Part of this is achieved by



▲ Chrome OS complains, it's damaged. It isn't!



▲ Turn off OS verification



▲ Once rebooted, the Chromebook will complain that OS verification is off. This is for security purposes

not including the standard BIOS screen that you might see on a laptop or desktop machine. However, due to this, it's not simply a case of selecting a boot device and installing Linux alongside or over the top of the Chrome OS. Yet there are workarounds, as Chrome OS itself is built on Linux.

Chromebooks are designed to be secure. Google is keen to extol the secure nature of the Chromebook and the ease and simplicity of any updates that it might need; everything is done automatically and the user doesn't have to update manually. While this is the case for the Chromebook in its standard mode, they can be switched into a developer mode. By doing so, this allows you greater flexibility to edit the software of the Chromebook itself, as it disables checks on the security of the software and allows you access to programs such as the command line (or terminal) and programs that you wouldn't normally be allowed access to as a standard user. Developer mode has to be enabled for the installation of Linux on the Chromebook.

“ Chromebooks can boot quickly – from switching on to a fully working desktop in under ten seconds ”

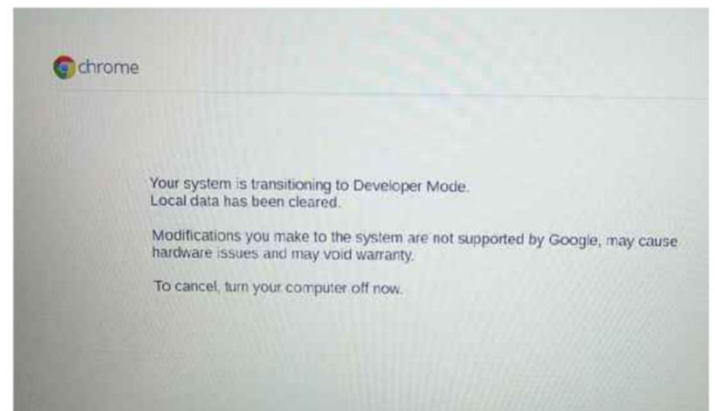
There are two ways to run a full Linux desktop. The first is to dual boot the Chromebook, running a version of Linux from a USB stick or SD card attached to the system. This will boot a version of Linux from the device, and you have to choose to boot either Linux or Chrome OS on start-up, although this is done by selecting the operating system using keyboard shortcuts, as there isn't a boot menu like GRUB to select which operating system you want to boot. To select the operating system you want to use, you need to shut down the Chromebook and restart to choose.

The other method is to run Linux within a 'chroot' environment. This means that Linux will run alongside Chrome OS, in a vaguely similar way to that of a virtual machine (see boxout). The chroot can be opened and started at will, so you boot into Chrome OS as normal and then open Linux while within Chrome OS. This means you still benefit from the quick start-up of the Chromebook and don't have to reboot to use a full Linux program.

Instructions

This guide will use the chroot version of installing Linux – it's a bit less involved than dual booting and can be done fairly quickly. Note that this will wipe everything from your Chromebook, so make sure all your downloads are saved (as Chrome OS backs up your settings and documents to the cloud but not the Downloads folder). One thing to note is that even though this chroot runs in Chrome OS, it isn't synced to Google Drive or the cloud. Therefore, anything within the chroot remains only on the Chromebook itself (unless you install a file syncing/backup program at a later date within the chroot itself).

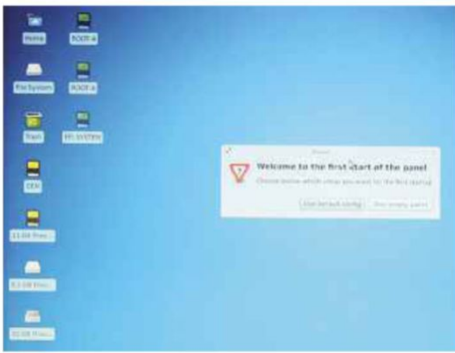
1. Firstly, you'll need to put the Chromebook into developer mode. This can be done by holding the Esc+Refresh keys and



▲ All data on the Chromebook is wiped to put it into developer mode



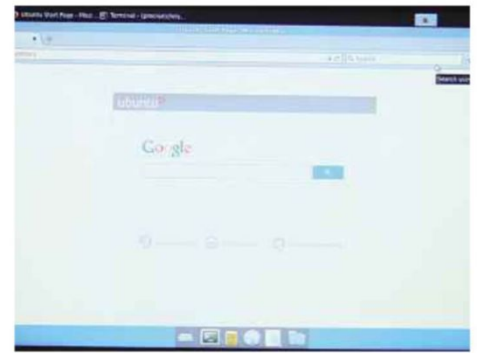
▲ Linux files are downloaded when the Crouton script is run



▲ Successfully installed Ubuntu with the XFCE desktop



▲ Running a terminal on the Chromebook showing disk free space and RAM usage



▲ Firefox running on a Chromebook

pressing the power button. This will bring up a screen saying that Chrome OS is missing or damaged (it's not, but just ignore it). Press Ctrl+D, and this will tell you you're about to turn off OS verification. You need to do this. It'll then warn you that OS verification is off and to press Space to enable. Unfortunately, this screen will appear every time the machine boots up now (until you turn developer mode off, but you'll need this on at all times to run Linux). This boot process stays here for 30 seconds, but the screen can be skipped by pressing Ctrl+D again. This is a security feature so people can't use compromised Chromebooks without knowing. The Chromebook then formats the device and sets up the developer mode.

2. Boot up the Chromebook. You'll be asked to sign in as if it was a brand new installation.

3. Download the Crouton script. This can be downloaded directly from goo.gl/fd3zc. Keep it in the downloads folder, as this is where the rest of the tutorial will expect to find it.

4. Open the command shell. This is done using Ctrl+Alt+T, which brings up the Chrome Developer shell. However, to run Crouton, we need to then type in shell to open the Linux Bash shell that runs underneath Chrome OS.

5. With the shell open, you can then run Crouton. It supports a number of Linux distributions. You can see the full list by running the command 'sh ~/Downloads/crouton -r list'. You can choose any from this list. For example, you would then run the command to create a new chroot with the argument '-r wheezy' to install Debian Wheezy.

6. As an example, I'll install Ubuntu with the XFCE desktop. This can be done by using the command 'sudo sh ~/Downloads/crouton -t xfce'. This will install the default Linux distribution, which is Ubuntu Precise Pangolin (12.04) with the XFCE desktop environment. You can change the desktop environment by changing the target – a list can be seen by using the command 'sudo sh ~/Downloads/crouton -t list'. This will let you select what environment to install. Selecting Unity will install the default Ubuntu with the standard Ubuntu Unity environment. To install a version of Debian, you would use 'sudo sh ~/Downloads/crouton -r wheezy -t x11'. This guide will use XFCE.

7. This then runs and downloads the information for Linux from the web where needed. Depending on the speed of your internet connection, this could take a while. Grab a cup of tea (or two) while it does its thing.

8. It'll ask for a username and password for the Linux you're installing. This will be the super user for the chroot installation and can be used later within the Linux installation to download further programs from the repository.

9. Once that's done, the Linux installation is able to be started. It'll print on the screen the command for starting the chroot. If you only have one chroot installed (you can have more than one), simply put in the command to start the desktop manager of your choice. In this instance, we'll use the command 'sudo startxfce4'. If you installed Ubuntu with Unity, this would be 'sudo startunity'.

“ **Note that this will wipe everything from your Chromebook** ”

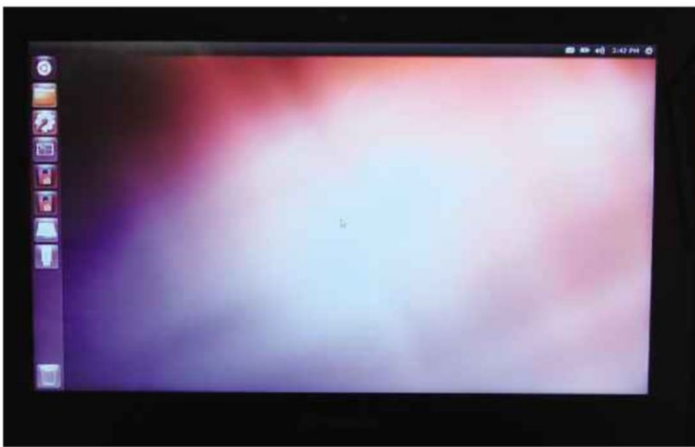
10. The installed Linux chroot should pop up and let you use it just like a normal Linux installation. If you have an Intel x86 powered Chromebook, you'll be able to install any software available in the repositories and any other software you find. For example, you can happily installed Dropbox (or any other backup/sync service that works on Linux) on the Chromebook to download your files! Likewise, if Chrome isn't your cup of tea, then you can happily download and install Firefox and browse using that. You can update the downloaded Linux through the normal means on this system, and the default Chrome OS will update normally.

11. If you don't like having Linux about and just want to reset your Chromebook, it's simply a case of restarting the Chromebook and selecting to re-enable the disk verification. This will reformat the machine, wiping all the changes and putting the Chromebook back into a factory fresh condition.

The downside to installing Linux into a chroot like this is that the chroot doesn't have access to the root file system. However, you shouldn't need to access this while in the Linux chroot, as doing so could potentially damage the Chrome installation. However, the one folder that Linux does have access to is the Downloads folder of Chrome OS. This provides a handy method of sharing data between Chrome OS and Linux.



▲ *Dropbox on the Chromebook!*



▲ *A standard Ubuntu with Unity install*

Most Chromebooks only come with a small internal drive; the one used in this tutorial only has a 16GB solid-state drive. After installation of the Linux chroot alongside Chrome OS, there's approximately 7GB left of storage space. Obviously, attaching a small USB stick can increase the space available for data, but you might have to keep an eye on the drive space if you're downloading a lot of large programs. If you're heading out to buy a Chromebook specifically for installing Linux on, it might be worth finding one with a larger hard drive; this will give you more flexibility when you download. However, these are likely to be hard drive rather than SSD Chromebooks, so you'll sacrifice some speed.

As the chroot is running using some of the same files as Chrome OS, there isn't a performance hit as if you were running Linux on a virtual machine on a computer. The resources of both operating systems are shared between each other, so Linux should actually feel as smooth as if it was installed on a normal machine. It should mean that it'll run on older Chromebooks without as much RAM as the current models.

Conclusion

By installing Linux onto a Chromebook in a chroot, you open up the ability to install and run any software alongside the default Chrome OS installation. For example, you can even download Wine and run Windows programs on the Chromebook (assuming you have an x86-based Chromebook). This means that you can benefit from the low price of the Chromebook and install Linux, knowing that you shouldn't have any problems with the hardware and software. You're also not paying for

Chromebook

The Chromebook used for this article is a Lenovo N20P. This is a 11.6" Chromebook with Intel Celeron N2830 CPU (2.16GHz), 4GB RAM and 16GB internal storage. This uses an Intel processor so therefore runs the x86 instruction set. It also has a touch-screen, which works perfectly on the XFCE installed chroot described here.

Chroot

Wikipedia describes a Chroot as:

"A chroot on Unix operating systems is an operation that changes the apparent root directory for the current running process and its children. A program that is run in such a modified environment cannot name (and therefore normally not access) files outside the designated directory tree. The modified environment is called a 'chroot jail'."

This essentially means that by installing Linux as a chroot on the Chromebook, the Linux installation won't be able to access most of the Chrome OS files (some locations, like the Chrome OS downloads folder, are still accessible).

Offline Files

Chromebooks have a version of Google Drive installed – files can be made available for offline use and edited locally. Changes are synced back to Google Drive when connected to the internet. This is an odd move on behalf of Google, as a Linux version of Google Drive isn't currently available for general download.

If you want access to Google Drive on Linux so you can work on the same documents as on the Chrome OS partition but sync automatically to Google Drive, it's worth checking out Insync (www.insynchq.com), as this syncs data to your Google Drive storage. In fact, it's worth checking out on Mac or Windows as a Google Drive replacement, as it offers benefits over the default Google Drive client, such as supporting multiple accounts and support for symlinks and external drives.

Chrome Extension

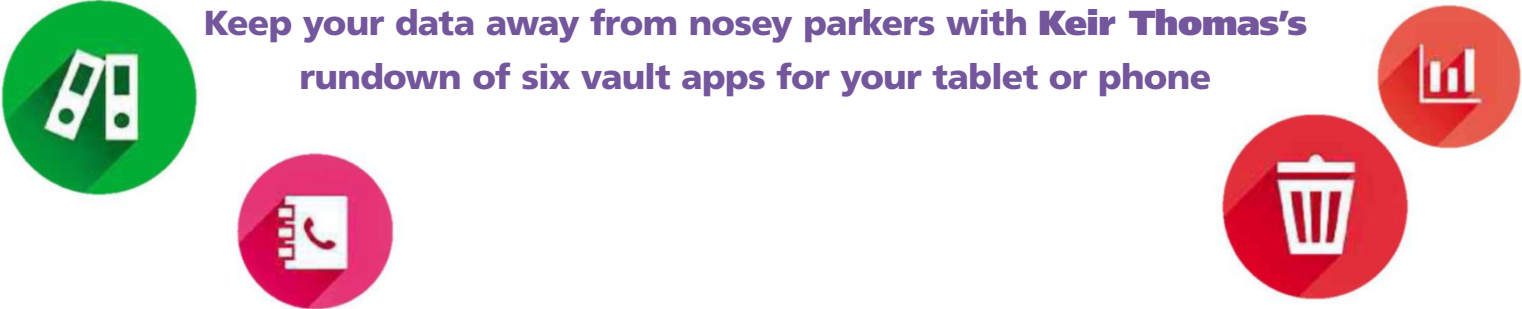
While the chroot is separated from the Chrome OS in terms of file access, it is possible to share the clipboard between the two devices. This can be installed on your Chrome browser by visiting goo.gl/OVQOEt and downloading the extension from the app store. When building your chroot, you'll need to specify the extension within the target (so `sudo sh ~/Downloads/crouton -t xfce,extension` would install the XFCE Ubuntu with the extension support built in).

a Windows licence that you might not use if you wanted a complete Linux laptop but had to buy one off the shelf; not many manufacturers market new laptops without an operating system.

Hopefully this guide will have instructed you through the steps necessary to install Linux on your Chromebook. Crouton is in constant development to keep up with the releases in Ubuntu, so it's worth checking it in the future to see what changes have been made and what distributions are supported. [mm](#)



Secure Vault Apps For Android



Keep your data away from nosey parkers with **Keir Thomas's** rundown of six vault apps for your tablet or phone

Keeping data private is a uniquely modern concern. Most of us loan our tablets or even phones to others every now and again, until pretty soon everybody around us knows our device lockcodes and passwords.

Secure vault apps offer an additional level of security – a way of keeping data secure on a device that might already be considered secure to all intents and purposes. These apps let you lock away data such as passwords or in fact any kind of text or file, behind a PIN code that only you know.

Below we look at six examples that are freely available in the Google Play store. As usual, each was tested on a phone and tablet running Android 4.3 Jelly Bean.

Note that the apps below may store passwords, but we'll be looking at dedicated password manager apps in a future group test.

Master Lock Vault

Storing sensitive data in the cloud brings with it security questions that arguably haven't yet been satisfactorily answered. Typically, companies encrypt data but maintain a master key that lets them decrypt it. So when an app like Master Lock Vault boasts cloud storage of your data in order to enable cross-device support, you won't be alone if you start to get sweaty palms. Can they be trusted with bank account details or account passwords?

Setup for the app involves visiting the Master Lock website, entering a few personal identifying details and creating an eight-digit PIN in order to provide a lock for your account. Subsequently logging in via the app involves entering a username and this PIN, although you can also access your vault through the website, and this is a good place to initially upload files you might want to store in it.

The app works on both phone and tablet, but treats tablets as nothing more than large phones and thereby forces portrait orientation at all times.

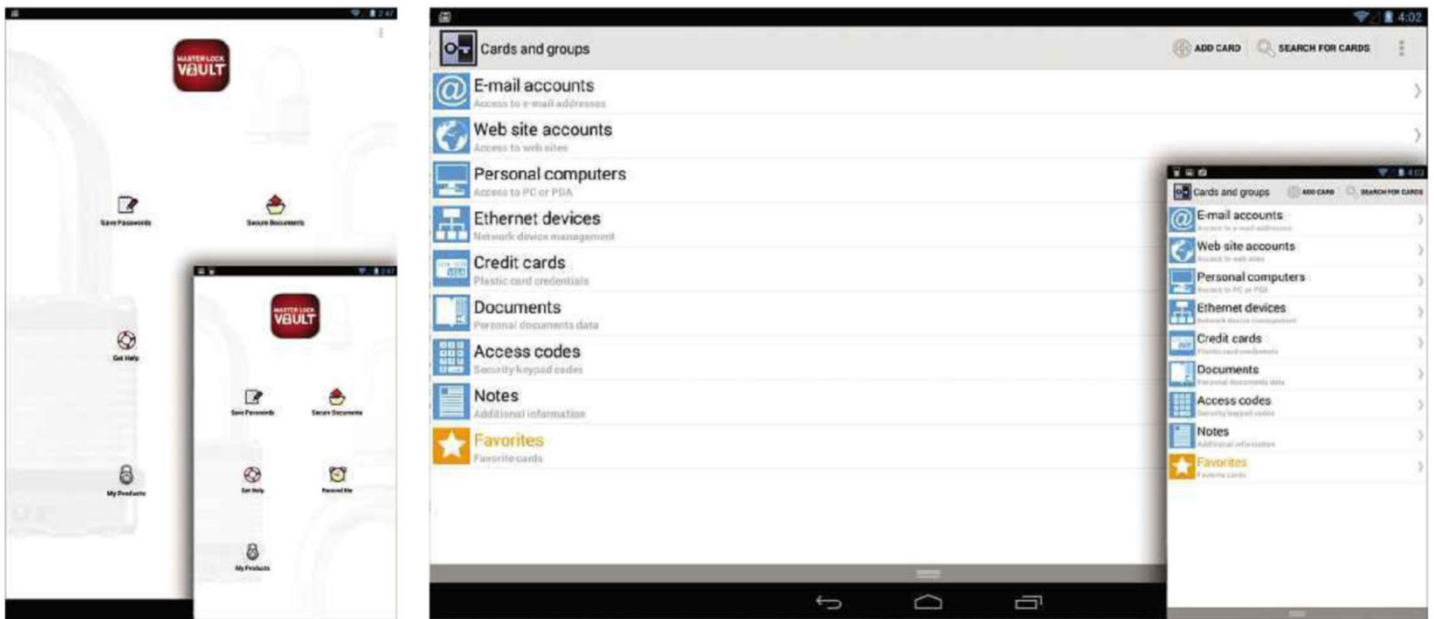
Master Lock Vault holds two kinds of data: passwords and documents. **However**, the password data is freeform and unformatted; there's simply a field to type whatever you want, rather than the user being forced to type a username and then password, for example. In other words, the app is really more about storing secure notes. Each note can be added to a category to aid categorisation, and you can also enter keywords to aid use of the search tool. Entries can also be favourited, which adds them to a special heading, which again aids finding them in future.

Adding secure documents is done in almost exactly the same way, except there's an Add Files button when you're entering the data. This opens to show the Android share system, allowing access to your photos or to the system file manager.

A third rather unusual component of the app is the ability to create reminders and appointments. There's nothing here you won't find elsewhere (you can set reminders to repeat, for example), but the ability to lock these details in a secure app behind a PIN could be useful for those clandestine meet-ups.

A fourth perhaps redundant feature is the ability to store your dialSpeed codes within the app. Don't know what they are? Nor do we. Put **simply**, this aspect of the app can be ignored. (For the record, dialSpeed appears to be an electronic padlock system.)

Master Lock Vault lacks the sophisticated feature set of other secure vaults. On the other hand, we're not sure this is genuine reason for criticism; concerns about cloud storage aside, some people may welcome the simplicity of the app, and it does what it sets out to do



▲ Utilising the cloud, Master Lock Vault lets you securely store passwords, files and appointments across different devices

▲ A clunky interface and 10-entry limitation means Secure Vault Lite isn't a serious contender

efficiently and without fuss. Above all, Master Lock Vault is entirely free of charge and not supported by ads, so what is there to dislike?

Secure Vault Lite

This app boasts of storing personal data only on your device and, of course, the Android system of permissions provides a way to verify this: when the app installs via Google Play, it asks only for access to your photos and files and nothing else. However, you can optionally synchronise your encrypted backups with cloud storage services like Dropbox and Google Drive.

“ Storing sensitive data in the cloud brings with it security questions that arguably haven't yet been satisfactorily answered ”

Rather worryingly, when the app starts, it doesn't walk you through setting up a passcode. By default, the app is entirely unlocked. This is explained in one of three pages of introductory text, but those not used to apps like this might assume their vault is automatically protected using the Android device passcode.

Setting up a passcode isn't easy either; you must open the menu, tap Service Operations, then tap Change Master Password (even though, technically speaking, you're creating and not changing it).

The app defaults to an alphanumeric password which it forces you to type via an on-screen keypad, rather than the usual on-screen keyboard. You're then told of the strength of your password and the number of guesses theoretically required to stumble across it – a nice touch. Unfortunately, we couldn't find a way to set a pattern passcode (i.e. a zig-zag pattern), as is boasted of in the Google Play description.

Not only is no password set by default, but the feature that locks the app should you switch away is set to a one-minute delay

– easily enough time for somebody to grab your phone after you've put it down somewhere and access your vault. This delay can be brought down to 15 seconds, but there doesn't appear to be any way to lock the app automatically should you switch away from it.

In other words, to use this app is to ensure some borderline crazy app design decisions.

Key to how Secure Vault Lite works are cards, which are designed to contain formatted data. The email account card contains fields for your username and password, for example, as well as for technical details such as port numbers. A total of seven card templates are available, but you can create more reasonably easily by selecting the option on the Settings menu.

Of course, by using a simple template, you can also store unstructured data too, such as notes.

Unfortunately, if the data you want to input doesn't fit in an existing template, then the card creation system becomes very clunky indeed and involves adding custom fields. We found ourselves wishing certain obvious fields were simply already present on all cards, such as a freeform text entry area. After all, we don't have to use spare fields, but their presence by default makes life a lot easier.

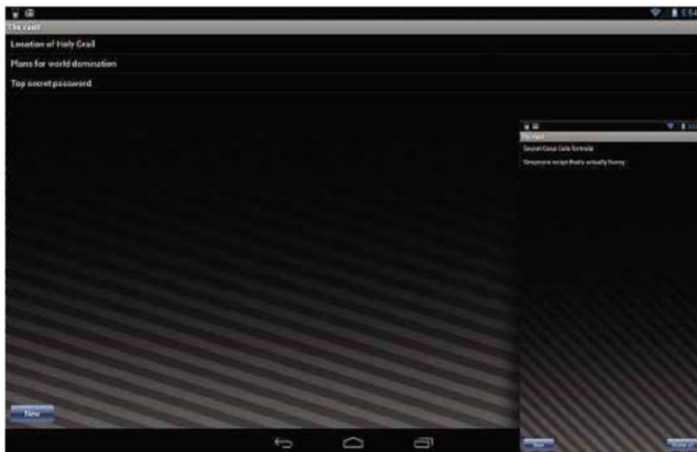
Files can be attached to cards, but there's no dedicated document storage component within the app (the Documents heading you might see in the screenshot is actually there to store information about real-life documents, like passport data).

As the name suggests, this is a 'lite' version of a £2 app and is limited to storing just 10 data cards. Additionally, without paying up you can't restore from a cloud backup, and other features such as printing of your data for paper backup are also not present.

Even before the meanness of storing only ten cards is considered, this app is just too clunky for everyday use. Apps should make things quick and easy, but this seems to go out of its way to make things that bit more difficult.

The Vault

Certainly the simplest app reviewed here, and among the simplest apps we've ever seen, The Vault keeps things so basic that initially we wondered if the app had a bug.



▲ *The Vault is about as simple as apps come, although is backed up by reasonably meaty 128-bit encryption*

Put simply, The Vault is a secure note-taking app. On start-up, it asks you to create a password that locks the app, which is presumably used to create the AES 128-bit encryption key.

Following this, clicking the New button lets you create a secure note entry. All you'll see is a Title and Description field, and indeed this is all you get. There are no templates here, nor the ability to create structured fields. The Title identifies the note in the list within the main app window, and the Description field is where you must type what you want to store: a username or password or phone number or just about anything. By default, the field is one line in size, but it expands when you type, allowing you to enter paragraphs or even pages of text without having any cropped off the side of the screen.

Click the Save button to create your note and... Well, *that's* about it, *actually*. The new note will appear in a list alongside the others, and tapping one opens it for viewing or editing. A Delete button appears so you can eradicate it if you wish, and there's also a Delete All button that lets you remove every single note in one fell swoop.

Tap your device's menu button, and nothing will happen, because there aren't any settings to tweak. It's here the simplicity becomes a hindrance, because it appears there's no way to change the three-minute time-out that locks the app automatically should you leave it open. This again means that pretty much anybody can pick up your phone or tablet and access your vault within three minutes of you closing the app. Friends and family might know the passcode for your device, but the point of a vault app is to hibernate data securely. With the inability to lock the app on switching to *another*, apps like this simply don't allow that.

It's possible to export and import data to and from an SD card, and after ten unsuccessful login attempts all data is automatically wiped (and again there's no way of altering this).

Criticisms aside, The Vault has two things in its favour aside from simplicity: it's free, and there are no ads in the interface. If your needs are truly simple and you just don't want to take a more complicated approach, then it's certainly worth checking out. Just remember to manually quit the app every time you've finished with it.

AVG Vault

An offering from the same computer security giant responsible for the popular anti-virus software, one of the first steps on installing AVG Vault is – unsurprisingly – to create an account with AVG. Outside of marketing purposes, this requirement is baffling because AVG doesn't offer cloud storage of your data, as you'll discover in the very next step when you're asked if you'd like to use Dropbox or



▲ *AVG Vault is professional and secure, which makes for a good feeling that your data is in safe hands*

Google Drive for this purpose. There really isn't any need to make contact with the mothership.

One of the few apps to be designed with both tablets and phones in mind, the professional approach of AVG Vault is apparent as soon as the app starts. This is a well-designed and attractive app. The vault can hold credit card details, site login info, ID info, secure notes and also files (including pictures that you can either take there and then or import from the main gallery). Each is encrypted with 256-bit AES and, *unusually*, whenever you create or edit an entry you're shown the encryption process taking place. Reassuring!

However, unlike the other apps reviewed here, tapping the Add button at the top right and selecting the different forms of data to input is about more than merely filling in preformatted fields. Choose to enter credit card details, for example, and in addition to fields for the numbers and CVN, you can also take a photograph of the card, with photograph fields for both the back and the front of the card. It's similar when entering ID card information, and you start to get the feeling that somebody has really thought about how this app should work. *That's* a nice feeling to have. When adding photographs, the option appears to delete the original. Again, this proves the people behind the app have actually used it!

Once a secure note or entry has been created, it's added as an icon in a grid that fills the screen. There are three pages of these, and you can swipe between them as you would when choosing app icons on the main launcher screen. Photo entries use a thumbnail, but other entries have simple icons reflecting their content. Each has a snippet of text to identify it, but perhaps one criticism is that this might not be enough to identify the entry, especially if you enter more than a handful of similar entries.

The app can be set to lock after a predefined time and also to lock should you switch away to another app. Locking is via a PIN that you're invited to add when the app first starts, and it's not possible to set an alphanumeric passcode or to use pattern matching (e.g. a zig-zag login).

Other nice features include the ability to lock the app immediately by tapping the lock icon at the top right – useful if anybody starts looking over your shoulder – and the ability to be notified whenever anybody attempts to access the app by guessing your PIN.

All in all, AVG Vault is about as good as these kind of apps get and comes highly recommended.

Private Vault - Private Diary

Some app user interfaces make your eyes squeak, and sadly Private Vault – Private Diary is one of them. Coupled with the rather loose use of English throughout (the developer appears to come from the Indian

SECURE VAULT APPS FOR ANDROID



▲ **Private Vault – Private Diary** features some useful tools, but a truly awful app design makes it virtually impossible to use



▲ **Personal.com Data Vault** lets you store a wide variety of data but you can't lock the app when switching away

subcontinent), within 30 seconds of installing the app we were starting to regret it. However, Private Vault – Private Diary boasts quite a hefty feature list that's worth investigating.

Setting up the app involves giving it your name, as well as creating a username and password. In future, when the app starts, it'll greet you by name before requesting the latter two credentials. Very polite, we reckon!

Once logged into the app, you'll find you can add website username details, bank accounts, credit/debit cards (referred to as 'Plastic Money'), wi-fi passwords, contacts and also create a private diary. Missing from that list is the ability to add photos or files. Private Vault is all text only.

Each type of data entry comes with ready-made fields to type in the necessary info (the wi-fi input screen demands the network name, encryption protocol, identity and password, for example), but it isn't always necessarily to fill in every single one. For example, all you need to input to create an entry for wi-fi is the network name.

Contacts must be entered manually, and sadly there doesn't appear to be any way to import them from the main Android contacts book.

The diary component features only two fields: one for providing a name for the entry and another a larger text area where you can type. There's nothing inherently limited to creating diary entries here, and in fact this is really a secure notes tool by a different name. Pretty much any kind of data can be entered.

Tapping the menu button does nothing, and it doesn't appear there's any way of configuring the app, which is a shame because we really would've liked to have turned off the garish background. Aside from reasons of aesthetics, this also meant that the text within the app became virtually illegible because of the severe colour clash.

We're not too sure about the security level of the app either. It boasts the data is "encrypted via SQLite", but to the best of our knowledge this is a database technology, rather than encryption. A quick Googling reveals that it is possible to add in encryption to SQLite, but we don't know if that's the case here (and we suspect not). The use of SQLite might be why only text can be stored in the vault and not files.

Coupled with the fact that the app runs on a tablet but in a way that indicates it's really designed for a phone, along with full-screen

ads appearing here and there, and it's sad to say that our initial suspicions were proved correct. This is one app to avoid.

Personal.com Data Vault

Ostensibly a companion app for the auto-completion app Fill It, there's no reason why Personal.com Data Vault can't be used on its own as a secure data store. Entries within the vault are known as gems and are synced automatically with the Personal.com cloud, allowing you to use the app across various devices such as a phone and tablet – although with the same security concerns as mentioned earlier. Setup involves creating an account, which is subsequently used to lock and provide access to the app.

Data Vault is all about storing structured data, such as password and username details or credit cards. In fact, of all the apps here, Data Vault offered the most ready-made templates for inputting new data, including everything from driver's licences to recording allergy details, and even including recording details about any motorbikes you own. Files and pictures can be added to some gems you create too, although this isn't really an app built around storing files.

Once a gem has been created, it's added to the main list that appears whenever the program starts. Viewing a gem allows you to copy any data field simply by tapping it.

The app treats a tablet like a large phone, which means that it forces portrait orientation, but other than this limitation, everything seemed to work just fine.

A unique feature of the app is the ability to share gems. Those whom you share with must also be Persona.com/Fill It users, though, and any data you share only sticks around for seven days if it isn't 'claimed'.

Although a Settings menu is offered, there isn't much control over how the app works, and we noticed that we were able to switch out of the app and then switch back into it without being prompted for our password. There did appear to be an automatic lock after a few minutes of inactivity, but again there didn't appear to be any control over how long this was.

There's a neat set of features within Personal.com Data Vault but some of the design decisions feel lazy. With more thought, this could have been one of the best apps reviewed here. As it is, we suggest you take a look, but AVG Vault is simply a better choice. [mm](#)

GEM

David Hayward recalls the desktop that could have been king

Before most of us had PCs, the vast majority of computer users had evolved from their aging 8-bit machines and were then sampling the delights of the 16-bit home computer era.

The Atari ST and Amiga were the two 16-bit machines that dominated the scene in the latter part of the 80s. And if you generally didn't have one, you had the **other**, with some playground rivalry between the two respective owners of the computers – much like the Spectrum and Commodore to some degree.

Both machines had their good points, as well as their bad. **Personally**, I was an Atari ST **owner**, and its TOS (The Operating System) was the first GUI I ever encountered. I fondly recall trying to get the hang of a mouse for the first time one Christmas morning.

The Atari ST TOS, though, was a port, in a sense, of a more historic environment known as GEM, the Graphical Environment **Manager**. This wonderful looking desktop environment existed before Windows and somehow managed to survive well into the 90s in one form or **another**. It has quite a fascinating lineage, and should things have not gone quite as well with Microsoft, there's a good chance we'd all be looking at a GEM desktop these days instead of waiting for Windows 10 to **appear**.

Its History

GEM started life in the late 70s, to provide an straightforward and visually effective way to interact with the CP/M-80 and CP-

M-86 as well the early IBM PCs of the time.

It was designed by Lee Jay Lorenzen and was known at that time as GSX (Graphics System eXtension), to help introduce the ability for users to create graphical programs such as graphs and charts.

Eventually, though, GSX evolved into GEM VDI (Virtual Device Interface) by Digital Research for the early 8086 machines, with GEM Desktop being made available to the public in February 1985, which beat the first version of Windows by about six months.

GEM really was made up of multiple parts, much in the same way as a modern desktop is. For example, there was the device driver modules that could initiate CGA and EGA display cards, then there were other drivers for printers or the mouse. On top of that were the programs, such as a word **processor**, drawing and art programs, graph creation utilities and a programmer's toolkit.

As time marched on and the PCs became more powerful, GEM evolved too, taking into account the then new VGA displays and more capable graphics, processors and other peripherals. However, while this was happening, the beast that was Microsoft had grown exponentially. Digital Research simply couldn't fight such a behemoth, and in late 1988, the last ever commercially available version of GEM was released.

It didn't die there, though. GEM lived on through many different ports and custom versions. There was a version developed

for the Apricot Computers F-Series, which found favour in schools at the time. Another port called ViewMAX was made available for DOS users, and finally FreeGEM became an open-source project that's still around today from Deltasoft.

The Good

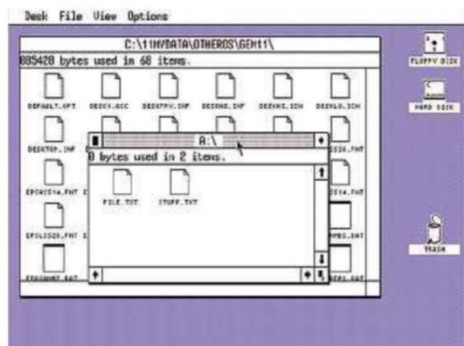
GEM was an extraordinarily quick interface for the PC of the time, and it didn't look too bad either.

The Bad

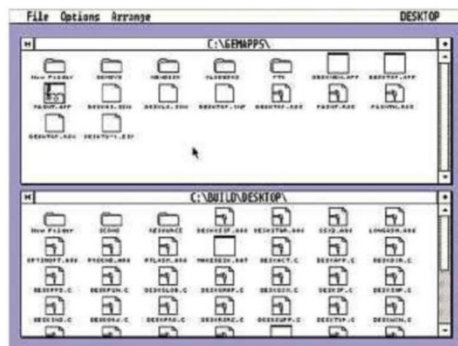
The drivers didn't always load into high memory areas so well, and you often ran out of conventional memory rather quickly, thus stopping the GUI from being loaded.

Did You Know?

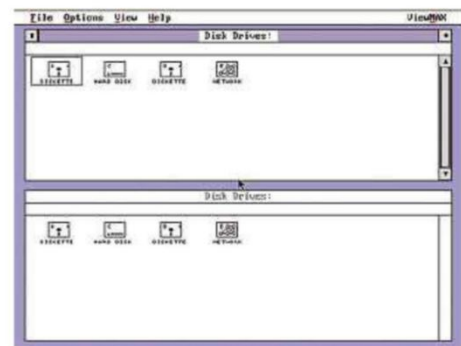
- If you bought a PC in the late 80s, then you'll no doubt have got a free copy of GST Timeworks – GEM5, a custom version was used in Timeworks.
- The whole GEM3 could be squeezed onto a floppy with DOS. A portable GUI OS then.
- Some early thin clients used a version of GEM to connect to the network resources.
- Digital Research was sued by Apple, as GEM looked a lot like Lisa – despite being released earlier.



▲ **GEM 1, the original.** *There's something simple, but effective about this*



▲ *GEM3, the last commercially available GEM desktop*



▲ ViewMAX version 2 was a sleek port of GEM, with networking support too

The Things That Frustrate Us About... Firefox

Mozilla's browser has long been a popular alternative to Microsoft's Internet Explorer, but don't you sometimes get annoyed with it?

Once upon a time, you didn't have to think much about web browsers: first there was Netscape, then there was Internet Explorer or Safari if you used a Mac, and that was about it. When Firefox came along, things changed; suddenly, there was a real choice. You didn't have to be locked into one browser; you could choose the one that worked best for you. Now there are loads of browsers around now, and most of us probably have at least two on every device we use. Firefox is likely to be one of your options – it's fast, customisable, and based on open source software, which means it's open to community input. What's more, the Mozilla Foundation is a non-profit organisation that you don't have to feel guilty for supporting, unlike some of the mega corporations behind the other commonly used browsers. Like everything, though, Firefox has its flaws...

Argh! Memory Issues

Ever noticed your computer slowing down when you're trying to browse the web using Firefox? As good as it can be, Firefox can also be a menace when it comes to memory

consumption. Using add-ons can exacerbate this, but even with all the extras disabled, you might find it demanding more than its fair share of your system resources.

Fix it: First, make sure you're running the most up to date version of the browser, since there have been some fixes implemented in newer incarnations. If you're finding your computer slows down a lot (or crashes often) while you're running Firefox, try disabling your add-ons to check they're not causing the problem. If you're still having trouble, there are several fixes you can try detailed on this Mozilla support page: mzl.la/1o3ysJo.

Bah! Missing Xs

If you're anything like me you have literally dozens of tabs open at any given time. Sometimes, admittedly, I don't need them all, but sometimes it's genuinely necessary to have that many tabs open at once. So it's a bit annoying that, once you've got more than about six tabs open, the little X that lets you close tabs disappears. Firefox seems to have removed it for space, but it means you have to click into each tab in order to close it. Which is irritating.

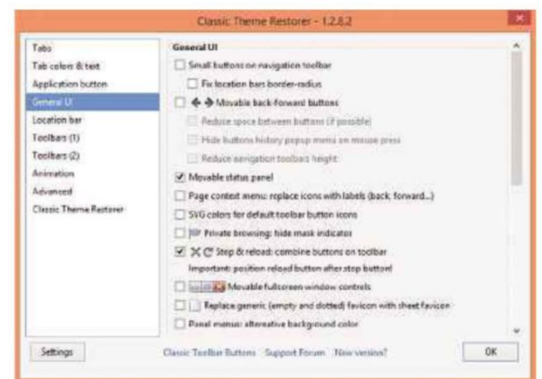
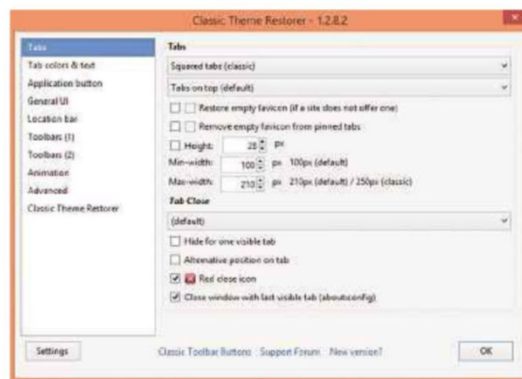
Fix it: The Classic Theme Restorer (mzl.la/1ghJi9M) can help; in the settings, you'll find an option to put a red close icon on all your tabs.

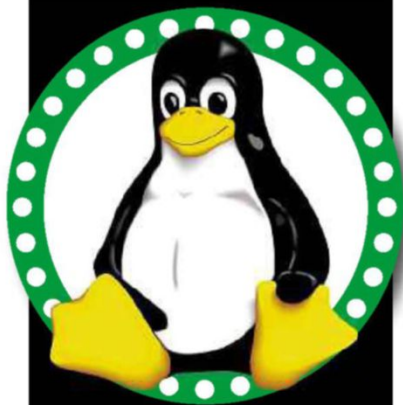
Wait, Where's Refresh?!?

This is really minor, but in the latest version of Firefox, the refresh button is tucked away on the right side of the navigation bar – and you can't move it. You used to be able to drag and drop various buttons on the task bar, so if you were used to the refresh button being over to the left of the screen, you could put it there. Now you can't. It's a minor irritant but it's one of those things that's really annoying when you go to hit a button that just isn't where you thought it was.

As an added bonus, the star button for adding bookmarks is in the wrong place too, shunted to the right of the search bar, rather than being in the navigation bar where you'd expect it to be. Bah.

Fix it: This is another job for Classic Theme Restorer, which will let you hide the button on the right and put back the button on the left. Phew.





A Couple Of Letters

Some help and a recommendation this week from a couple of readers

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

Linux

In response to the help I asked for a few weeks ago regarding a space issue and the removal of old kernels and so on, I've had an email from Terry Sims, who gave some excellent advice.

Terry talks about using different partitions for personal data that wouldn't be affected by the main operating system or by any upgrades. This way, he can essentially upgrade to an entirely new and different OS, should he wish, without losing any data, and the personal data wouldn't interfere with the amount of space left available for any of the system's files either.

However, since he started to move onto Linux Mint, he improved his previous setup and opted to create several more partitions. "When I moved to Linux Mint, I adopted the same approach, but with Mint's six-monthly update cycle I went one further by having three partitions of about 15GB each for OS installations plus a swap. That meant I could have three completely separate Mint

systems, always installing the latest over the oldest, with the Data partition mounted in the Home partition of each."

He then goes on to say, "When I put in the latest Mint version, I just copy over the profile files for Thunderbird and add a line to the fstab file to mount the Data partition. Easy peasy! Given that a fresh installation is always preferable to upgrading an old one, and with such a frequent upgrade cycle, why make life more complicated?" Why indeed. After all, computing shouldn't be too taxing or headache inducing, should it?

As Terry mentions, he's covered a number of bases and created an almost fail-proof setup of several versions of Linux Mint. "So, theoretically, if I have a problem, I always have two earlier working installations available."

He finishes off by saying that Linux Mint has proved to be stable, so nothing has gone wrong – touch wood.

It's an interesting setup and one that I may start to

adopt myself. Thinking about it, it's quite obvious and I'm kicking myself for not having it on my home machine. I did have something similar in a work setup some years ago involving hot swap drives, but the administration ended up becoming a little too time-consuming for the everyday server checks.

Replacement OS For XP?

Going back several weeks, I asked if anyone had any other recommendations for a Linux distro that can cater to the Windows XP refugee. John Gray emailed me the other day telling me about his experiences with Vector Linux 6.

Vector Linux is a distro I've not used that much. I did try a version a few years ago, and I recall having all sorts of problems with it. But John seems to like it, saying that it's "The best I've found so far."

He has successfully managed to get his devices working, wi-fi and such, and is exploring the Vector software shop/centre as I write. Hopefully he'll back to me with an update on how it's all beginning to come together as a fully fledged and working desktop OS.

Anyway, if you have any distros that you've come across and you want mentioning, please send me an email.



◀ *Vector Linux could be a good choice for former Windows users*

Auditory Augmentation

Sven Harvey returns with more Amiga news

Amiga Remix

It had been a huge wait, but just before Christmas there was a massive update to Amiga Remix (followed by a smaller one very quickly afterwards to clear the submission queue for the year). With over 50 new tracks to go through, as you can imagine, there was a lot of music to check out at www.amigaremix.com!

One thing I will point out with this update is the fact there is a huge glut of music that has been remixed countless times, such as *Shadow of the Beast*, *Turrican* and *Lotus*, but these are all iconic pieces of music from the heyday of the platform, so it has to be expected.

Beast

One huge part of the main update was the release of a whole slew of tracks from 'pinozulpo' who has remixed not just the soundtrack from one but from all three *Shadow of the Beast* games on the Amiga, and almost every piece of music from each game at that (in fact, it's only the game over themes that appear to be missing, though messing with Jan Hammer for one track doesn't seem worth it!). With each game having the level themes, opening/intro theme and title theme all covered, that's ten tracks from the original *Shadow of the Beast* (plus an additional alternate version of the Eerie Forest music), 11 tracks from *Beast II* and eight tracks from *Beast III*.

The most well known pieces of music are the intro, title (Beast and the Plains) and initial in game music (Eerie Forest) from the first game (in part due to the trailer/rolling demo that was disseminating throughout retail in

1989) and the initial tracks from *Beast II*, in the form of the Title Intro and Level 1 Part 1, which were played across the land as the game was demoed wherever Amiga 500 Screen Gems packs were on sale.

It wouldn't be accurate to say that these tracks are all perfect, but they certainly very much embody the spirit of the original music while presenting the tracks differently.

Special mentions must go firstly to pinozulpo's remix of the main title theme from *Shadow of the Beast III*, which is a hauntingly beautiful piece of music that has reached far fewer ears than the music from the other games.

Next is the second version of Eerie Forest (v2), which strays further from David Wittaker's original than the first version but, in all honesty, results in a fantastic aurally expansive version of the track that is my favourite of the set from pinozulpo.

However still with *Beast*, there is a further oddball remix from Gareth Wood

of the intro/title theme from *Shadow of the Beast II*. The panpipe-type instrument that leads the track on the original game melds rather perfectly with a single that reached number one in the UK charts in January 1991. Listed on AmigaRemix as 'Shadow of the Beast II (Enigmatic Remix)', I think Mr. Wood may have missed a trick by not calling it Sadness of the Beast II myself. It appears Gregorian chanting and a steady beat suits the music in this rather wonderful sonic standoff between Engima and CoLD StORAGE!

▼ *It's a forest that is, indeed, eerie in the first Shadow of the Beast*



Out Of The Shadow...

There was more to the huge update than just Sony's IP, and a few tracks are simply highly recommended to check out, if not 'must haves' if they tickle your cochlea the right way.

'daXX' work their usual magic on the track Enigma from Phenomena's demo of the same name with 'Enigma – The Final Hyperbase Remix' which, while straying from the original arrangement and instrumentation a little, produces a powerful track, which I have enjoyed hugely. Similarly, the same rearranger has brought the *Street Fighter 2* intro theme way past up to scratch.

It would also be remiss of me to not mention Dr. Future's remix of Bjorn Lynne's 'Echoing', which was used in at least one if not more of the releases from Infinite Frontiers, who produced 'The Final Frontier' diskzine and 'Holodeck' slideshows for the Amiga in the 1990s.



Sven Harvey has been our Amiga specialist for over 15 years drawing on his 24 years retailing computer and video games (25 Christmases, no less) and even longer writing about them.

Amiga



New Year, New Gear

Ian McGurran finds the best mobile tech at CES 2015

Ian McGurran 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

Mobile

We are barely into 2015 but the technology world isn't one to hang about. Early January saw the 2015 Consumer Electronics Show in Las Vegas, and with it comes many, many shiny things being revealed for the first time, with some even making their way to our shores this year. While mostly dominated by audio visual gear (if you didn't have a 4K TV with a whole new display technology, you were nobody), there were a fair few nuggets of mobile and tablet joy.

Dell Venue 8 7000

The tablet most widely acknowledged to be the best on show at CES didn't come from Samsung or even Sony, but from PC box-shifter Dell. Not that Dell is a stranger to tablet computers, as it's been in the Android phablet game since the

Streak 5 in 2010 and is currently purveyor of some rather excellent Windows 8.1 tablets. Unlike many of the company's good-but-dull enterprise products, the annoyingly titled Venue 8 7000 (the significance of 7000 isn't clear) is actually not only a powerful device, it's also genuinely gorgeous, with barely any bezel round its 8" frame, save a bar at the base of the device, as well as being only 6mm thin.

Inside is a 2.3GHz quad-core Atom CPU, 2GB RAM, 16GB storage, micro-SD and a 4G/LTE option. Topping this off is a show-stopping 8.4" 2560 x 1600 OLED screen – if you've seen the same screen on the Galaxy Tab S 8.4, then you'll know just how breathtaking it is. Unlike the Galaxy Tab S, however, the Venue 8 7000 looks to have vanilla Android KitKat, which, coupled with the better processor, could well leave Samsung's beautiful but stuttery device in its wake.

The Venue 8 7000 is due in Q1 2015 and is currently listed in the US at \$399, meaning we may well see it for around £249-299, depending on the wind direction.

Saygus V2

The name above may come as a surprise to you, but then CES isn't the traditional launchpad of many big-name phones (save the LG Flex 2). This does mean, however, that some of the more innovative devices can grab some time in the spotlight, and one such device is the V2 (well, V squared) from US newbie Saygus.

The V2 itself is, in design terms, not actually that eye-

catching and would often be overlooked, especially being from a company barely known in the industry. It has a trick up its sleeve, however: the V2 is a completely open device, no root needed and, importantly, it has a totally open bootloader. In practice, this means that the V2 can not only host its own Android 4.4 OS, but it be swapped out easily for another and even run two different operating systems on the same device. Fancied trying out Firefox OS or even Windows 8.1 on your phone without wiping your day-to-day OS? The V2 may well be for you.

In terms of hardware, you're not cutting corners here either with a 5" 1080p screen, a Snapdragon 801 quad-core CPU, 3GB RAM, 64GB storage, 21MP rear and 13MP front cameras, a huge 3100mAh battery and, in a first for a phone, dual micro-SD card slots. This may seem odd, but when you learn that you can boot from the cards, the idea becomes clearer.

Okay, so the CPU may be lacking and the design perfunctory, but the V2 seems to be a device that's taking a chance and is built with the modding and hacking community in mind. There's no set price yet, though the smart money is pointing towards \$500, and there's little chance it'll be available in your local Carphone Warehouse. But the chances are that if you've widened your eyes at the prospect of the V2, something like getting hold of one won't



Glassed Out

Andrew Unsworth gives his view on Google's decision to drop its Glass wearable technology

Nothing lasts forever, not even curry stains on a rich man's slacks, and it is with great sadness that I was reminded of this axiom this week. As of the time of writing, Google Glass, the Android-powered eyewear, is no longer available.

I know, I know, it's impossible to see someone wearing Google Glass without it setting off your Tourette's something chronic, especially if they're also riding an electric unicycle down Charlotte Street while sipping on a skinny flat latte, yet Google Glass was one of the most practical wearables I've seen, and the one I'd be most likely to use. This is mostly because I often wear specs anyway on account of me being longsighted, so wearing Google Glass wouldn't bother me, but it's also partly because the temptation to ape the T-101 when commuting and select overly aggressive rail users for passive-aggressive termination would be irresistible. Also, there's no doubting that the ability to find my way around town without having to stare at an outstretched phone would be a definite boon too.

Google Glass was always going to be the preserve of walking haircuts and professional beards, but there was an awful lot to like about it. Not only does it project a 640 x 360 image on your eyeball which, unless you're

Kevin Warwick (www.kevinwarwick.com), is the closest thing to being a cyborg a normal person is likely to get, it also has 16GBs of storage, a five-megapixel camera capable of recording 720p video and everything you need to discern which way you up you are and in which direction you're travelling. At £1,000 it was, admittedly, very expensive.

Read any tech title and much will be made of wearable technology that's supposed to make your life more fun, efficient and stylish. Manufacturers are falling over themselves to make them, mostly in the form of watches, and slowly but surely the general public is warming to the idea of a smartwatch. Would I buy one? Certainly not at the moment, mostly because it would involve buying a new phone that'll work with one, although I am seriously tempted, especially by the LG G watch R, but

none of them are sophisticated enough to make me forget or stop using other pieces of tech. I know smartwatches are intended to augment our smartphones, but I can't help thinking that Google Glass would be a better fit for me.

There's no doubting the future ubiquity of wearable technology, and it's certainly something to be welcomed. Sure, Google Glass hasn't been a massive hit, and I'm sure few people outside of the IT sector ever saw one, but it was never supposed to be a massive seller. It was an experiment, a prototype to prove the concept of a new technology, and I certainly hope it's quickly followed up with a device that's benefitted from Glass's criticism and is more suited to the mass market.

What do you think about wearable tech? Have you adopted it, and if so, why? Write in and tell us your opinion on the matter.



Andrew Unsworth has been writing about technology for several years, he's handy with a spanner, and his handshaking skills are second to none

Hardware



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*

Gaming

From Here To Eternity

From Obsidian and the designers of *Icewind Dale* and *Baldur's Gate* comes the isometric RPG, *Pillars Of Eternity*, due out this March

This week, Ryan checks out Obsidian's spiritual successor to *Baldur's Gate*, and takes a look at the controversy surrounding Sony's survival MMO, *H1Z1*...

Plug & Play

Series like *Elder Scrolls*, *Dragon Age* and *Skyrim* may be pushing the RPG into ever more sophisticated, sprawling new realms, but there's still an enormous amount of affection for the isometric titles of the past – games like *Baldur's Gate* and *Icewind Dale*, for example. In 2012, Obsidian Entertainment discovered just how popular a game in the mould of those classics could be; the studio's Kickstarter campaign for something called *Project Eternity* was a huge hit, garnering just under \$4m.

There was a good reason for that rush of support: Obsidian is, of course, a studio formed from the ashes of Black Isle, the team behind those Infinity Engine-powered gems mentioned above. This makes *Pillars Of Eternity* (as it's now called) the spiritual successor to things like *Baldur's Gate*, reviving its high fantasy setting and isometric viewpoint; director and designer Josh Sawyer even worked on games like *Icewind Dale* and *Baldur's Gate: Dark Alliance*, while studio founder and industry veteran Chris Avellone (*Fallout 2*, *Icewind Dale*) is one of its co-writers.

Just over two years later, and *Pillars Of Eternity* is tantalisingly close to completion, and Obsidian

have been allowing the covers to come off their anticipated project. On Twitch, Sawyer streamed a live demonstration of the game in action (you can see a recording of it at bit.ly/1INbWdK), and what we've seen points to a pleasing mix of classic gameplay and modern design.

The first striking thing is the detail worked into the visuals; its party of five adventurers, sent on a dungeon crawl with a click of Sawyer's mouse, are smoothly animated and full of character. *Pillars'* aesthetic is also pleasingly dirty and medieval-feeling; this isn't the day-glo, brash fantasy world of *World Of Warcraft*, but a grimy, bloody world of broken cobblestones and guttering candles.

Sawyer also gave a brief tour of a typical Stronghold – a base from which the player can head off on adventures. At the start of the game, your Stronghold is broken down and seemingly abandoned, but you can restore it and install useful facilities over time (a garden, for example, is the perfect place to grow the ingredients for spells). The stronghold will also come under attack, or maybe you'll receive a visit from a character with a mission for you to complete. It's a pleasing twist on the familiar hub world concept, and the range of

things you can do within it could prove to be as absorbing as the world waiting outside.

Pillars Of Eternity is a rare example of a classic style of game made with current-day, seven-figure production values. For those still itching for an experience on a par with *Baldur's Gate*, it could provide the something of a panacea upon its 26th March release.

Online

When zombie survival MMO *Day Z* went from an *Arma 2* mod to two million-selling standalone hit, Sony was clearly taking note: its free-to-play MMO *H1Z1* offers a similar concoction of undead ghouls, bleak landscapes and perpetual scavenging.

On the 16th January, Sony took the unusual step of putting *H1Z1* on Steam Early Access, where eager early adopters could spend £15 (or £30 for a deluxe version) on an unfinished build of the game. As if paying to sample a free-to-play game didn't seem strange enough, the MMO was the target of a swift and sharp online backlash; its first day of alpha testing was plagued with overloaded servers and login issues, and worse, a growing number of complaints about the 'pay to win' aspects of its gameplay.



▲ The alpha build of Sony's survival MMO *H1Z1* has sparked a player backlash over its 'airdrop' mechanic. Some users argue it ruins the balance of the game

The complaints surround airdrops: a microtransaction component allowing vital supplies to fall from the air in armoured boxes. It was an element of the game announced several months ago, but back then, Sony Online Entertainment boss John Smedley wrote on *Reddit* that the contents of those boxes would be restricted to cosmetic items; "We will not be selling guns, ammo food, water," Smedley said. "That's kind of the whole game and it would suck in our opinion if we did that."

When *H1Z1*'s alpha phase began, however, it emerged that airdrops could contain such resources as guns, food, and so forth – which defeated, many players argued, the point of a game about scavenging bits of detritus from the environment and making weapons.

For its part, Sony has argued that the airdrops add an extra layer of competition to the game: while players can pay for these item drops, the contents of the boxes is random, and there's no guarantee they'll actually get their hands on it in any case: they could be killed by nearby zombies or even other players.

The pay to win accusations refused to die down, though, with users taking to *Reddit* and other gaming sites to complain; as one commenter on Eurogamer wrote, "If it's random drops, then is this not just a slot machine with zombies?"

The backlash was such that Sony offered a refund for players who "feel like the airdrops are an issue." John Smedley, meanwhile, remains adamant that *H1Z1*'s airdrop mechanic is a valid part of the game – and

further, that they'll remain in the game's final build.

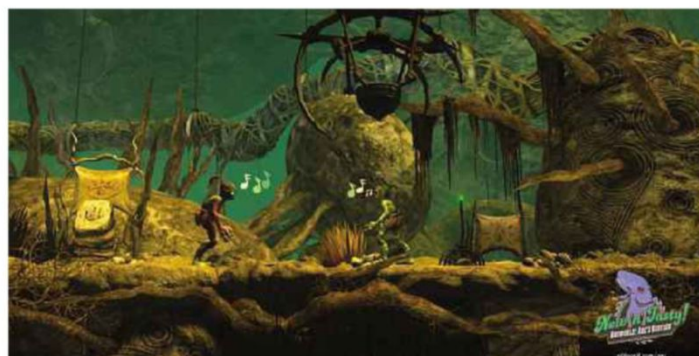
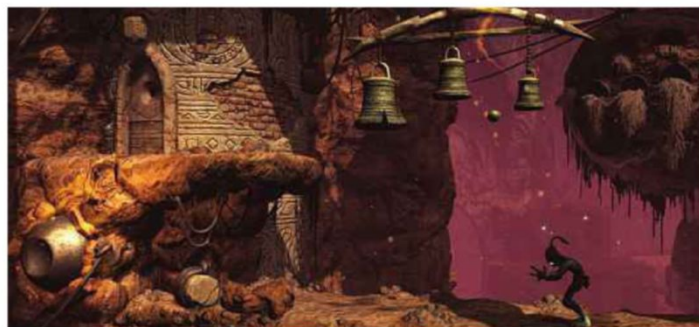
"We have made the decision to allow paid for airdrops into the game with things like guns," Smedley wrote. "We're making them highly contested and building a whole set of rules around this."

It does look as though the way airdrops work will change based on player feedback, though, with guns appearing in boxes less often. We'll have to wait and see how well Sony can balance the gameplay; on one hand, guns could give players with deep pockets an unfair advantage, but on the flipside alleviate the frustration of paying to have vital supplies drop from the sky, only to have a rival player bash you over the head and take them... You can find out more at H1Z1.com.

Incoming

Oddworld: Abe's Odyssey is one of those games that is so quirky that it's impossible to forget about. First emerging in 1997, it was a platform-puzzler unlike any other, with a colourful alien world and a likeably childish streak of humour. Eighteen years later, and *Oddworld's* back with *New n' Tasty*, a remake that retains the side-scrolling platforming of the original, but dressing it up with smoother, Unity-powered graphics. Clearly made with care and affection for its 90s predecessor, the new *Oddworld* has garnered universal praise, both as a sensitive update and a great game in its own right.

Released last year for PS4, the *New n' Tasty* PC port arrives on Steam on the 25th February.



▲ Quirky 90s platform adventure *Oddworld: Abe's Odyssey* returns in style with the remake, *New n' Tasty*, out on the 25th February

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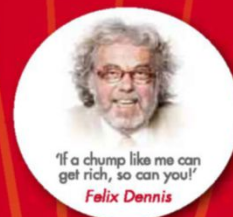
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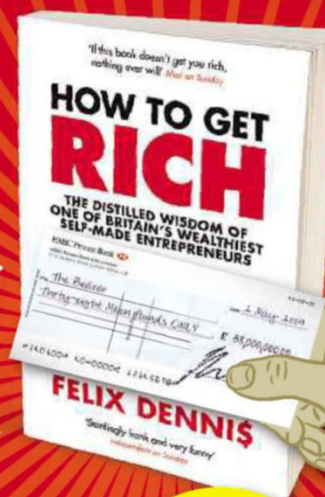
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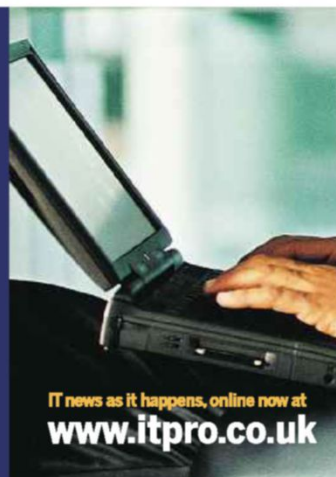
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Aaron

Ram Mia

I recently found I was getting 'hard fault' memory errors. When I turn on my system there are several minutes where it is unusable. Once it has done that, it operates as normal. My start-up processes are trimmed down to the bare minimum.

I believe hard faults are caused by Windows running out of memory and using the swap file. I am using Windows Vista (32-bit) with 2GB of RAM. So I went on to the Crucial website and ordered another 2GB. Once installed, I found it made no difference! I tried swapping the modules over but no joy.

Speccy reports 4GB. Windows View basic Info reports 4GB. All other utilities also report 4GB. But Windows Task Manager only reports 2GB (2046), which is what it was before I did the upgrade!

Is there a registry hack to fix this?

Dave

There are a few possible reasons why Task Manager may not show the actual amount of RAM you have installed in your PC, so let's look at a couple of them to try and narrow down your problem.

It's possible that the two RAM modules you have aren't fully compatible with each other, and Windows cannot properly use them, despite showing the full amount of RAM elsewhere. As the motherboard you're using (Foxconn G31MX, as shown in your supplied screen grabs) has only two memory slots, there's no reason to worry about position, however, so I'd double-check this, and ensure you have compatible modules.

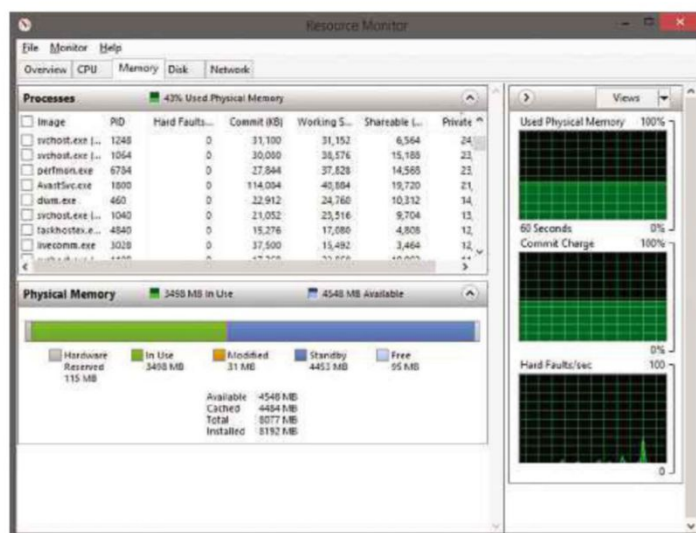
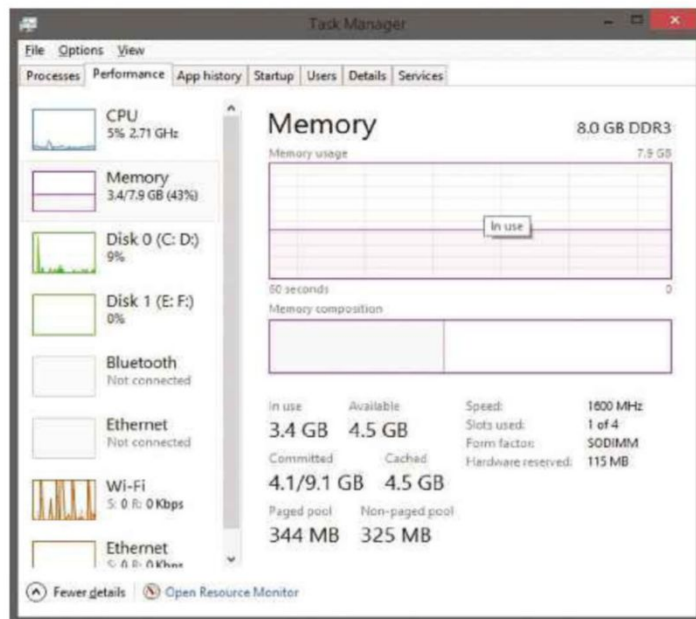
It's entirely possible that you have the 4GB of RAM, but Windows is using a

portion of it, so only half is available. 2GB could be assigned to cache memory or reserved for hardware (such as on-board graphics) and is therefore unavailable for other uses. You can check this by clicking the Resource Monitor button in Task Manager and then selecting the memory section. You'll see here your memory use, as well as cached memory, and how much is actually available. You'll also see if any is hardware reserved.

If your system is using on-board video (the Foxconn G31MX has Intel GMA 3100 on-board graphics), a portion of the RAM may well be

assigned to that (denoted by hardware reserved, as above). Check the BIOS for this, and ensure this isn't where the extra RAM is going. If you don't need that much power for the GPU, dial it back. I'd say this is the most possible cause of your problem.

▼ **Windows and the system BIOS can reserve memory for specific uses, such as on-board video, and you can check this in Resource Manager**



Start-up Lockdown

My all-in-one Asus PC has decided to stop working all of a sudden. It's an E2 Vision model and has worked well for a while, but ever since I installed the latest Trend AV update, it's stopped working. When I boot up the system, it gets to the clock screen and freezes. I can do nothing with it, only move the mouse cursor around. There's power to the keyboard, but nothing works, and I cannot click anything or move on to the login screen. It does this every time, and is totally unresponsive.

As far as I know, there aren't any other programs that have been installed recently, and I've installed no new drivers or hardware, so I have to assume it's the anti-virus update that's caused the issue somehow.

I'm willing to remove Trend and start again, but as the PC isn't booting up and not letting me into Windows, I cannot do this. Do you have any suggestions?

Marlene

If the only thing that's changed about the system of note is the AV update, I'd certainly start there, although it's possible you've also been hit with some sort of virus or malware. As the system is stuck, unable to boot into Windows, however, it's hard to know, so we need to look at how we're going to get the system up and running again. For this, I'd suggest a system refresh.

A system refresh will reset the PC back to defaults, but will retain your own documents. Programs you've downloaded or installed will be removed, however, as the system will be reverted back to its initial state, and this includes any anti-virus updates. If this is the cause, your problem should be solved.

To refresh the system, you need to get to the boot menu, which should appear after two or three problematic Windows boot and shutdowns. If you have a Windows disc or recovery boot device, you can also use these. Once at the boot menu, pick the Troubleshooting option and then Refresh the PC.

Follow the on-screen prompts here, and your PC will be refreshed, back to a working state. Once this is done, it should boot up as normal, and you should be able to use it, reinstalling programs and so on.

As the Trend AV software may have caused you problems, you may want to consider using an alternative, or at the very least, contact Trend and see if there are any known issues.

▼ **A system refresh is a great, and easy way to solve problems with unbootable Windows installations**



Sound Advice?

I'm currently in the process of shopping for a new PC and have been into a number of stores asking about various deals, and I have a question that I'm hoping you'll be able to provide an unbiased answer to.

Basically, as a relative newcomer to the PC world, I'm concerned that I'm being taken for a ride by store salesmen who always advise that I buy extended warranties and add in anti-virus software and things like MS Office. When I'm talking to them, they make it sound like a great deal, but I get the feeling that they're trying to steer me into spending more money.

When I'm buying a new PC, is there really any need to spend more money on security software and warranty offers, or is this is a case of simply hitting sale targets and earning commission?

Jason

When it comes to selling PCs, many stores do have their own ways to make ends meet, and there is certainly an element of pushing for extra purchases. In PC retail, most store managers will tell you that very little in the way of profit is made on actual computers and hardware. The real money lies in attached sales, such as warranties and software, as well as any additional plans the vendor may have, such as rent-to-buy options where they can hike up the overall price with interest.

Most salesmen on the shop floor will be earning a flat wage and will also get extra money with commission, hitting sales targets and so on, and the store manager will also have goals to hit. This makes for a very focused sales strategy, one that the store has to succeed in if it's to stay afloat.

As the end user, however, these additional costs can be avoided, but you may want to weigh up your options, as they can also be beneficial, even if it costs more money. For example, an extended warranty is often a good idea with PCs, as so much can go wrong. Having more time in which you can get replacement parts or a full, new system can be worth the added cost. On the other hand, if you're technically adept, you may well be able to fix problems yourself and find needed parts cheaper than the overall cost of the extra warranty coverage.

As for software, it's often better to avoid this cost in my opinion. Not only are there free options for things like security software and office suites, but most stores will only carry one or two packages, which greatly limits your options. You may want to go for something like Norton, for example, and the store may only carry McAfee. In this case, don't be pressured, and stick to your guns. You can get the software anywhere, at any time.

Other options like rent-to-by or pay in instalments really depend on your financial

situation, and they almost always benefit the store. Splitting a payment into smaller monthly amounts will usually add interest, so the store makes more money in the long run. However, if you can't afford one lump sum, it's a good way to buy an otherwise unobtainable system. Just be aware of the added cost, and make sure you shop around.

Above all, know that the power is no longer with the retailer, as it once was. Major competition, both on the high street and online, has given customers far more power, so always use this to your advantage. Don't be afraid to inform a store if you find the same system elsewhere cheaper. Many will try to match the price, as they just can't afford to lose customers.

▼ **Stores like PC World make money from attached sales, but as the customer, you have more power than ever before**



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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30 Cleveland Street
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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

Going Nowhere?

I'm putting together a new PC and it's based around an Asus Z97-P motherboard. I'm quite new to system building, so firstly: is this board any good? Secondly, I notice it has an M.2 socket, which I understand to be an alternative connection point for an SSD. Should I use it, or should I stick to a normal 2.5" SSD? What are the advantages of the M.2 socket?

D. Yardley, Gmail

The Z97-P is a super board, it costs only around £67 but has Socket 1150's flagship Z97 chipset and all the important features and technologies. This includes M.2, which is the replacement for the short-lived mSATA, and effectively a small, internally mounted PCI-E slot. It's an advancement over the PCI-E Mini socket found in laptops (which M.2 is now replacing).

It's come into being mostly because conventional SSDs are now needlessly big, holding back the design of Ultrabooks and other thin-and-light PCs. Whilst a 2.5" SSD is typically 7mm or 9.5mm thick, 70mm wide, and 100mm long, an M.2 SSD is typically 3.5mm thick, 22mm wide, and 60mm or 80mm long (though M.2's specs allow for a variety of sizes). You'll see M.2 cards with labels such as '2260' and '2280' – which, with this in mind, you can no-doubt work out the meaning of.

Every M.2 socket has a 'key', this is a notch or break in the line of contacts. There are twelve keys – A to M but excluding I – and each one defines the number of connected PCI-E lanes and the available bus types (SATA, USB, audio, and so on). On the desktop, you only need to worry about the M key. This provides SATA Express via PCI-E x2 or x4 (two or four PCI-E 2.0 or 3.0 lanes combined), and there's also a pass-through for standard SATA 3.0 (as contacts, not as a plastic port). See **bit.do/YkmW** for more details.

An M-keyed M.2 socket using PCI-E 3.0 x4 grants a bandwidth of nearly 4GB/s. That's impressive, but the snag is that PCI-E 3.0 lanes are currently a feature only of CPUs, not of chipsets, and Socket 1150 CPUs have merely sixteen of them to begin with. * Splitting four off for M.2 means a motherboard's graphics slot gets downgraded from x16 to x8 (assuming the M.2 socket's populated). It also means just four lanes are left for distribution across any other PCI-E slots, which could put the stoppers on SLI or CrossFire. PCI-E 3.0 lanes are expensive to implement, too.

For these reasons, most Socket 1150 boards wire the M.2 socket into the PCI-E 2.0 lanes coming off the chipset – and usually only as a x2 configuration. This grants a bandwidth of just 1GB/s (usually expressed as 10Gbit/s, the raw data-rate). Even so, 1GB/s is a handy improvement over the 600MB/s provided by SATA 3.0 – or it would be if all commonly available M.2 SSDs weren't simply conventional 2.5" SSDs mounted on cards. As such, their read and write speeds top out at around 550MB/s, so they just use an M.2 socket's SATA 3.0 pass-through. The SATA Express interface is ignored.

Buying and fitting one of these SSDs on a desktop is utterly pointless, in my view, especially as they carry a 25% or higher price premium. What we all want is Samsung's new

SM951 (128GB, 256GB, and 512GB). This reads at up to 2,150MB/s and writes at up to 1,550 MB/s (oddly, it operates not over all-new NVMe – see **bit.do/Yny9** – but over good old AHCI), speeds that can only be realised with PCI-E 3.0 x4.

So, what's the price? Well, I wish I could tell you, but it's only available to OEMs, for installation in end products. Very expensive end products, I expect.

What you can buy is Samsung's XP941, the previous model. That's a little over half as fast and can run full-tilt over PCI-E 2.0 x4 or PCI-E 3.0 x2 – but it would still be bottlenecked by most M.2 sockets in the mainstream, including the one on the Asus Z97-P. Also, the 512GB model weighs in at around £375, which is double the cost of a top-flight 2.5" SSD with the same capacity.

* The following CPUs typically have forty PCI-E 3.0 lanes: Ivy Bridge-E and -EP (Socket 2011), Ivy Bridge-EX and Haswell-EX (Socket 2011-1), and Haswell-E and -EP (Socket 2011-3). M-keyed M.2 sockets on corresponding motherboards often have the full-fat PCI-E 3.0 x4 configuration. Sadly, AMD is well behind the curve, with PCI-E 3.0 (sixteen lanes) currently limited to its Kaveri APUs (Socket FM2+).

▼ The aim is for SSDs to move out of SATA ports and into PCI-E M.2 sockets, but will the idea take off?



Cell Theory

In issue 1,345, in response to Karen Gill's suggestion that another reader's motherboard woes could be the result of a flat CMOS battery, you noted that a replacement CR2032 lithium button cell was 'about the size of a 10p piece and costing the same'. True, but lithium's quite a nasty substance. Under certain conditions it can explode. Cheap CR2032s also tend to have short lives. In my view, it's best to stick to the known brands: Rayovac, Maxell, Duracell, and so on.

Alan Cox, Gmail

Point taken, Alan. I'd be unwise to recommend against it. For the sake of balance, though, I think it's worth detailing my own experiences.

I wrote in my reply to Karen that a pack of ten CR2032s could be bought for as little as 99p (including delivery). I've bought many such packs, and I'll readily admit that one or two cells per pack are often as flat as your hat. Given the price, I've never worried about that, and the

working cells have never, ever given me cause for concern. Whilst I've no doubt the charge life of branded cells is superior, I've found cheap ones last quite long enough.

Ultimately, dear readers, you'll need to decide for yourself. Please do bear Alan's words in

“ Perhaps buying cheap really isn't worth the hassle? ”

mind, though. A twin-pack of CR2032s from Duracell can be had for just £1.99 (again, including delivery), so even the best cells needn't cost more than pocket change. Perhaps buying cheap really isn't worth the hassle and risk?

➤ **Cheap and nasty, or just cheap?**



Safe Or Sorry?

I bought a second-hand Galaxy Note II a couple of weeks ago, and I think it may have a problem. A few days after I got it I took it out of my pocket and noticed it was in 'safe mode'. I rebooted it and it appeared to be okay, but today, the same thing's happened again. What are your thoughts?

Will, Gmail

Safe mode on Android is similar to its namesake on Windows. On Windows, however, only a limited set of drivers are loaded, whereas on Android a device remains fully functional, but without any of the apps installed since it was first taken out of the box. Effectively, safe mode runs a device in its factory state, though all personal data remains available.

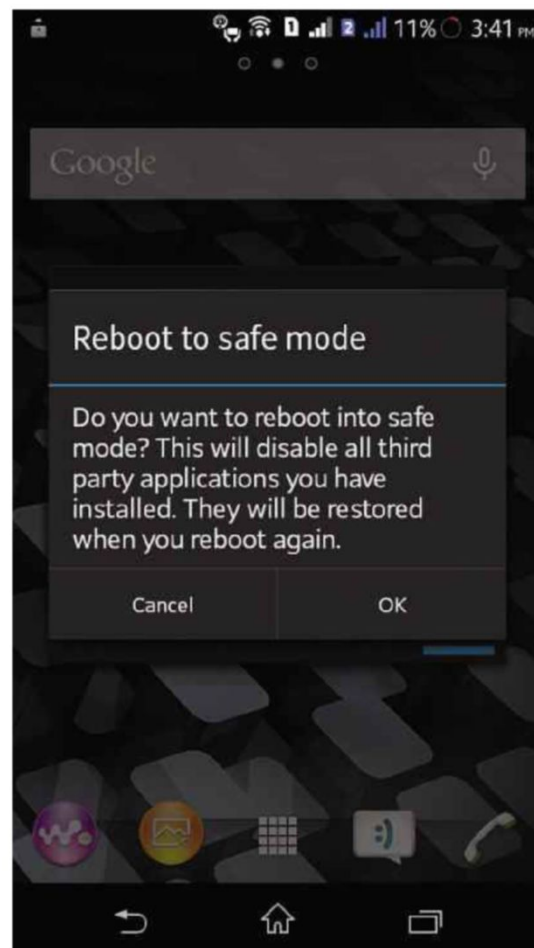
The method for entering safe mode depends both on the device and the version of Android. The commonest method is to proceed as if turning the device off as normal – hold down the power button for a second or two. When the shutdown menu appears, however, the 'Power off' option needs to be long-pressed, not merely touched. This will bring up the 'secret'

safe-mode option. When the device now boots, any custom wallpaper will be gone and 'Safe mode' will appear at bottom-left.

*On the Note II, Will, that method's no good. Instead, the technique is as follows (and this has, no doubt, been done totally by mistake whilst the phone's been in your pocket): boot or reboot as normal but keep the volume-down button pressed in the whole time (or at least from when the Samsung splash screen appears). There's no secret safe-mode option, but ultimately you'll still see 'Safe mode' at bottom-left. If you don't, try again, but this time press in both volume-down and volume-up (yes, it *is* possible, even though the buttons are on a rocker).*

The main use for safe mode is in weeding out rogue apps. If a device starts misbehaving, but operates fine in safe mode, you can rule out faulty hardware and usually viruses. A non-stock app must be the problem. You can then remove recently installed apps one by one – either in safe mode or when running Android normally – until you uncover the troublemaker.

➤ **Safe mode on Android? You betcha!**



Crowdfunding Corner

This week, a pair of mobile accessories you didn't know you needed. At least, not until you saw them

KiiTAG 2

Like a Swiss Army Knife, the idea behind the KiiTAG 2 is that it combines multiple handy features into a single, pocket-sized device, so that you've always got the kit you need when you need it. Specifically, it's got a battery pack with a two-hour charge, a flash drive of variable capacity, a built-in USB-to-microUSB/Lightning cable, an LED flash light, a pair of built-in Bluetooth buttons for four-function remote triggering and a key-finder so that you can find it if you lose it.

Crucially, it also comes with a dedicated app that allows you to configure the Bluetooth buttons, opening up a variety of additional features: it can cause your phone to make a noise so that you can find it, trigger a remote sound effect, even fake an incoming phonecall. An anti-theft and anti-loss feature allows the device to set off an alarm if the phone and KiiTAG go out of range. There's also a community search that networks with other KiiTAGs to see if yours is in range.

The flash drive comes in 8- or 16GB models, and the KiiTAG itself is available in black or white, with gold, silver and 32GB models as stretch goals. Early backers can get an 8GB model for Android or iOS for just \$40 + \$10 shipping (£33) or a 16GB version for \$50 + \$10 shipping (£39). Full price if you miss the early bird tiers is \$60 + \$10 shipping for the 8GB model or \$70 + \$10 shipping for the 16GB model, so £46 and £52 respectively. Quite good savings to make if you get in early, then!

URL: kck.st/158QH7c

Funding Ends: Saturday, March 21st 2015



PUMP And OMG Headphones

Creating the best headphones seems to be a particular obsession of audiophiles, and a common theme on Kickstarter – and it's no surprise why, given the variable quality of even the most expensive earphones you come across. Might this UK-based company, which believes it's created "the Worlds greatest sounding in-ear headphones" be the one that gets it right, then?

The specs given for the headphones that have already been made are pretty much manna for the hardcore 'phone freak: a 16–24,000Hz frequency range, 102dB sensitivity, passive noise isolation, multiple-sized earbuds for comfort, specially tuned drivers, a 3.5mm gold jack, in-line microphone, water resistance, aluminium casing for greater durability – and to cap it all off, a five-year full replacement warranty.

That, we think you'll agree, is a pretty convincing list of features. The Kickstarter is designed to grow the business further, you can already get your hands on the headphones at special Kickstarter pricing, so there's no chance of coming up empty handed. You can get a set of OMG Audio headphones (they come in one of four colours: for £27, or a PUMP Audio in one of four colours for £32. It's a long way to go until the funding goal is reached, but either way it's worth looking at the project. You've got nothing to lose by trying, either, as the company is offering to refund unhappy customers!

URL: kck.st/1sXYEHB

Funding Ends: Tuesday, February 3rd 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

Bitdefender Adware Removal Tool

Nasty malware infections? Let the BART help

Malware, adware and other kinds of nasty-ware are the bane of the modern PC user. Even though you may be the most careful of surfer, there's still a chance that something digitally unpleasant could find its way on to your system and cause untold havoc.

It's not often that happens, thankfully. Most of us already have an adware, malware barrier in the form of a decent security and AV suite. But some of us have instead opted for a free AV client, which although does a reasonably good job, isn't the best at keeping the naff-ware at bay.

Thankfully, though, Bitdefender have come to the rescue with its latest free tool to help those who suspect they have an infection of a sorts or those who just like to make sure that nothing nasty slips in.

Naff-ware, Be Gone!

Bitdefender is something of a favourite here at Micro Mart. We've never had any problems with the products that come from this Romanian company, and there's a high degree of care and attention to detail that accompanies everything it lay its hands on.

Therefore, we were quite impressed with what the Bitdefender Adware Removal Tool had to offer.

First off, BART is a downloadable, free, installation-free program that's about 47MB in size. All you need to do is look up [goo.gl/GjBKLF](#) and double-click the executable followed by ticking the licence agreement. When the BART interface appears, click on the Start button and it'll scan your system looking for invasive apps, browser toolbars, adware and other such programs that are designed to hijack your system or cause the usual amount of vandalism these things tend to do. If it finds any, it'll then display them in the main window and offer you the ability to remove the infected files, along with some brief details as to what the file is and where it's located.

Bitdefender products are well designed, and the same level of quality can be found in this free tool as well. The interface is clean, using the same kind of look and feel as the main AV security suite, and it's incredibly fast too, scanning our entire Windows 8.1 laptop test system in a little under three minutes. Our Windows

7 system, which is fully loaded with all manner of installations also took just under two minutes, which is far quicker than competing adware removal tools.

Conclusion

The Bitdefender Adware Removal Tool is a handy program to have in your digital toolkit. It's quick, effective and can keep your system clean should you suspect something has found its way past whatever protection you already have running.

All in all, a worthwhile download and one that will no doubt stay on our system for the foreseeable future.

Features At A Glance

- Free.
- Small footprint.
- Fast and effective scanning engine.
- No installation required and can be executed from a USB stick.



▲ The Bitdefender Adware Removal Tool is a quick, easy and effective malware removal solution for the modern PC



▲ Bitdefender once again prove to be worth keeping an eye on

Logging Off

A couple of weeks ago, mainstream support for Windows 7 ended. If you didn't realise, then please take deep breaths, trying not to hyperventilate or develop uncontrollable spasms.

I say these things entirely in jest, because this was probably the biggest non-news event of the past 12 months, even if some people online treated it like Microsoft had publicly announced the end of days.

This bemused me, because all support for XP stopped last year, and despite a whole barnyard of Chicken Littles clucking

uncontrollably, the sky is still firmly in place across most of the planet.

So what is the true significance of this predetermined milestone in the Windows 7 lifecycle? Hardly any, unless you just can't resist the urge to panic.

Service pack 1 came out for Windows 7 in 2011, and six years later it is now entering 'extended support phase' as Microsoft likes to call it. That should reasonably last another five years, maybe longer, because there won't be an SP2.

Therefore, all those new and enhanced versions of the tools and applications that came with Windows 7 will stop. The problem is that if you discount IE and some other .NET junk, there hasn't been any significant app update or new releases for Windows 7 for some considerable time already.

When was the last time Microsoft added a game or fixed Media Center, added a playing mode to mines or a sidebar or desktop gadget?

If you're unsure, the answer is that it never does, because like themes, Microsoft launches these features with great fanfare and then can't actually be bothered to allocate any resources to extend them. Or in the case of gadgets, Microsoft introduced them not considering that they inherently introduced a 'serious vulnerability' and so completely removed them from Windows 8. Admittedly that would be only on the machines owned by people who use them so little that they hadn't already disabled all that junk when they first got their Vista or Windows 7 system.

By definition, therefore, it is more likely that Microsoft might release a patch for Windows 7 to take things *away*, rather than add anything useful. Yet users' ability to read all manner of impending doom into these announcements is legend, because there aren't enough things in their lives to worry about, *presumably*.

While it is mostly their fault, Microsoft plays its small part in trying to encourage by information those customers to move to Windows 8

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now, so it can panic them into buying Windows 10 later on.

The problem is that most Windows 7 customers, and I include myself in this group, are perfectly happy with this OS, irrespective of its recent change in support status.

That's a major snag. And it's my estimation that at least half the 100,000 or so people Microsoft employs are sat at their desks this minute thinking up plans to get us to ditch it for something newer.

The only question in my mind is whether that inducement will be of a carrot or stick persuasion. Windows XP demonstrated ably that the often wielded sticks of support curtailing and feature denial (DX10) don't work, so maybe this time it might try a carrot approach.

Nah, what am I saying? This is Microsoft. A stick it will be, then!



Mark Pickavance

LAST WEEK'S CROSSWORD

Across: 7 X-Ray Astronomy, 8 Escrow, 9 Mustek, 10 Candela, 12 Angle, 14 Jpegx, 16 Pillory, 19 Tesoro, 20 Kaveri, 22 Solvay Process.

Down: 1 Iris, 2 Hybrid, 3 Ostwald, 4 Crimp, 5 Unison, 6 Impeller, 11 Appleton, 13 Bilkers, 15 Groove, 17 LiveCD, 18 Nonyl, 21 Rasp.

DISCLAIMER

The views expressed by contributors are not necessarily those of the publishers. Every care is taken to ensure that the contents of the magazine are accurate but the publishers cannot accept responsibility for errors. While reasonable care is taken when accepting advertisements, the publishers cannot accept any responsibility for any resulting unsatisfactory transactions. Facebook, for all its many problems, sometimes redeems itself. Yes, it's like a vast vacuum cleaner for private information, and it attracts hoax stories and scams like a flies to a cowpat, but sometimes you can learn something truly wonderful from it. Well, to be precise, from other users, whether they're your close friends or just acquaintances. This

week, for instance, someone drew to our attention the 1.5 billion pixel image of space that Nasa has just produced, which requires 4.3 GB disk space. Truly, this is a wonderful thing to behold, and it's proof that, once in a while, technology can produce objects of genuine beauty and that the internet is a great way of sharing such information. Sadly, Facebook was also the source from which we learned about a young man trying to raise £1,300 via crowdfunding site Indiegogo so he can go on 13 dates with whoever might be stupid enough to give him money. Also, he has a big stupid beard and he writes terrible poetry. Call us old fashioned, but we remember when work-shy men with copious facial hair were usually found huddled round fires next to train tracks, not touting themselves as god's gift.

THIS WEEK'S CROSSWORD

Across

7 An unvarying or habitual method or procedure. (5,8)

8 Filled with horror or shock. (6)

9 The amount of three-dimensional space occupied by an object. (6)

10 A brand of portable loose-leaf notebook for recording appointments, addresses and notes. (7)

12 The way something is, with respect to its main attributes. (5)

14 Now defunct operation created after Secretary of War Henry Stimson requested the US National Academy of Sciences in 1941 to review the feasibility of biological warfare. (Abbreviation) (5)

16 A basis for comparison or a reference point against which other things can be evaluated. (7)

19 A solution having an excess of hydrogen atoms – having a pH of less than 7. (6)

20 .pa TLD. (6)

22 Using of a large diffuse group of people to work on a task, with or without payment, especially by use of the internet. (13)

Down

1 Under the Vox brand name, it also manufactures guitar amplifiers and electric guitars. (4)

2 Music played in the style of a fugue, but not in strict or complete fugal form. (6)

3 Dodgy software from Synchronys, which claimed to 'double' the available memory in Windows without the need for a hardware upgrade. (7)

4 A research operating system developed by Microsoft Research to explore verified end-to-end type safety and memory safety. (5)

5 An input device that allows one to hand-draw images and graphics, typically by moving a pen over a special pad. (6)

6 An instrument for measuring the distance travelled by a wheeled vehicle. (8)

11 Computers not adequately protected from attack. (8)

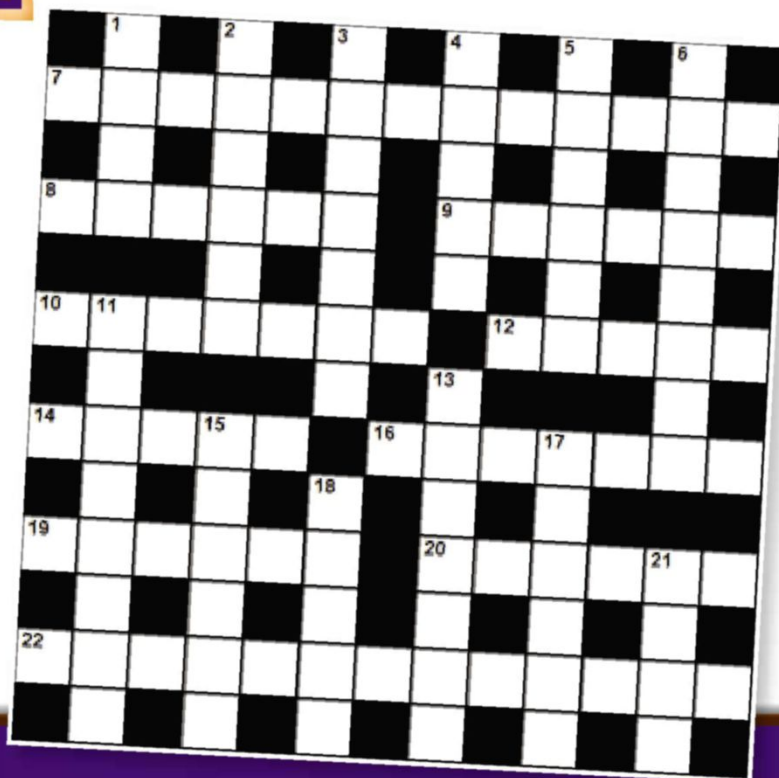
13 Google's new 'talk to an expert' service. (7)

15 In printing, single last words or lines carried over to the next page or column. (6)

17 Musical sounds artificially produced or reproduced. (6)

18 Ready money held in electronic form – e.g. for transactions on the internet or stored on a card for making small purchases. (1-4)

21 Where legal tender coins are manufactured. (4)



In Next Week's Micro Mart*

- Choosing the right performance laptop
- Net neutrality and the future of TV
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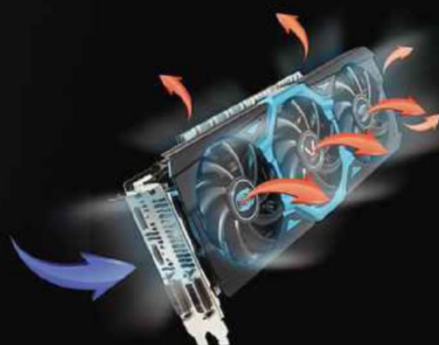
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