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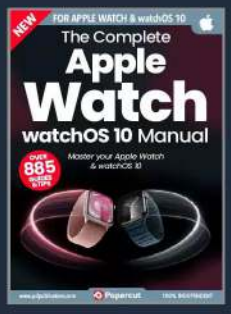

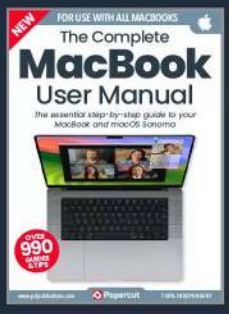

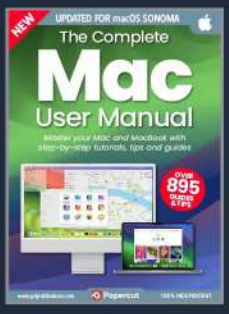

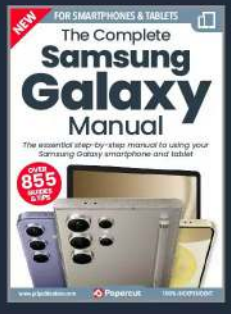

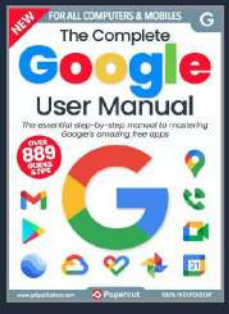

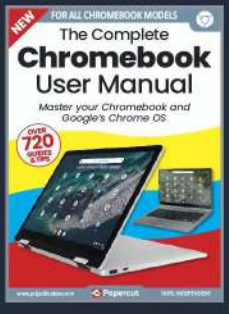

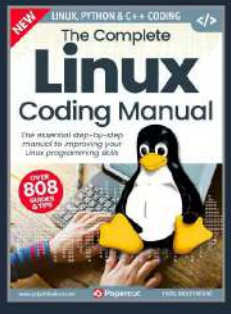

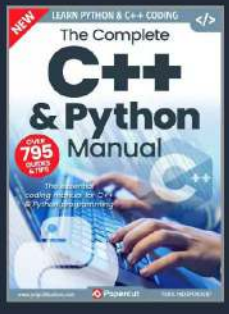

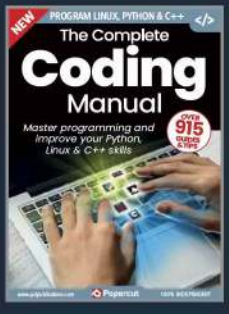

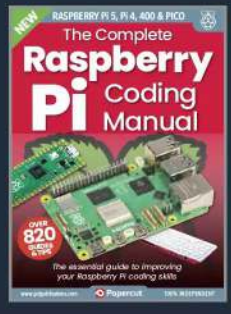

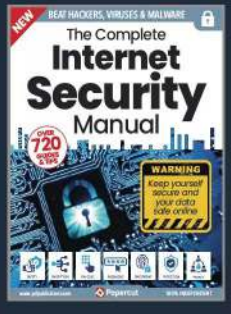

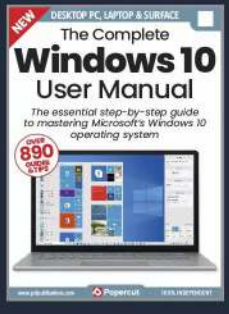

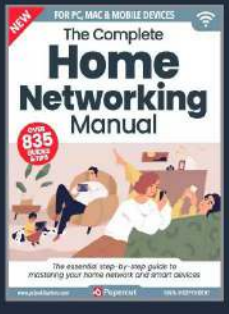

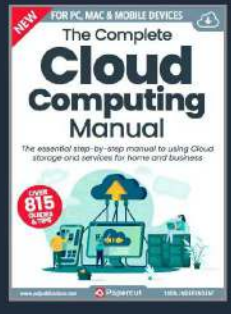

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The Complete Home Networking Manual

Your home network is constantly under pressure to serve volumes of data to your computers, smart TVs, games consoles and more. While most of the time they work without too much hassle and interference, there are times when the router will drop its connection to the Internet, or your Wi-Fi stops working altogether. These are the times when knowing a little bit more about how it all works will help save you a lot of headaches - mostly from other members of the family!

This book will help you get to grips with the technology involved in creating your network. What equipment is needed, and what it does, and how you can get the best from every piece of the networking puzzle. Inside you'll discover how best to setup a home network, how to improve it, and how to secure it. There are sections on protecting yourself online, how to avoid viruses and malware, how to encrypt your data, how to recover from a digital disaster, and how to become more Internet and social media aware and secure. There are in-depth guides on using a Virtual Private Network, advanced tips and tricks on Windows networking commands, and how to protect your data when out and about.

If you want to improve your networking, and digital security knowledge, then this is the book for you.

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HOME NETWORKING & SMART DEVICES

INTRODUCTION TO HOME NETWORKING

The home network can be as simple as a single router and computer, browsing the Internet and watching the occasional episode on Netflix and the like. However, most of us have far more complex setups, and we don't even realise it.

Along with a smart TV, there's usually a number of tablets, phones, laptops, computers, games consoles, AI devices such as Google Home and so on. Plus any number of security cameras, baby monitors, remote doorbells; the list of connected devices goes on.

We've increased the number of devices on our networks, but what do all these pieces of networking equipment do, and how to do they work? You'll find out in this chapter.

Your Home Network

Your home network is something most of us don't even consider when we power on our devices and computers and surf the Internet; however, there's more to it than you think. How do we get on the Internet? How do we print from all our devices? How does it all work? Let's have a look.

Consider the average user: they contact an Internet Service Provider (ISP), sign up for a broadband deal, and in a day or two they receive their router through the post. This they hook up to their existing telephone line, power up, then wait as the lights on the router turn a certain colour indicating that a connection is made. They can then turn on their computer or device, locate the Service Set Identifier (SSID, the router's name), enter the wireless password and connect to the Internet.

After that, they tend to forget all about the router and what's going on. Unless there's a problem, then usually a quick reboot of the router will solve the issue.

There is a lot more going on in the background though, and if you take the time to learn a little about how networking works, then you'll discover that you're able to get more out of your network. This includes better speeds, more capability – such as setting up a home entertainment system, better security, and you'll be able to quickly diagnose any problems should they ever arise. In short, creating and maintaining a good home network will make your digital and online life significantly better in the long run.

Getting the most from your network

While you may think your network is running perfectly fine, there are undoubtedly areas of improvement. These areas include surfing the Internet, online gaming, watching streaming video services, watching content on multiple devices around the home, being able to get access to your network from the extremities of your home or garden, and more. All these elements can be enhanced on, it's just knowing what to tweak and how to get the most from what you have available.

Before we begin to look at how to improve your network, it's worth noting that you do have a physical limit on what you can achieve. There's only so much bandwidth available to your home from your ISP, so while you can streamline your access to the Internet, you're not going to be able to increase that limit. Likewise, the data that moves around your home will also hit a physical limit. Most wireless devices will find the fastest possible connection to your router, and wired devices (using an Ethernet cable), and computers will communicate at either 100Mb/s or 1000Mb/s (or 1Gb/s). It's possible to improve the connection, but not increase the limits of the actual hardware. A good rule of thumb to always remember when networking, either on a home network, office networks or the entire Internet, is that the connection speed is only as fast as the slowest component on the network.

Of Bits and Bytes

Megabytes and megabits are two of the most commonly misused terms in computing talk. Both are measured units of computer data, but in terms of the capacities of hard drives and the amount of memory in our PCs we are referring to bytes; whereas in terms of the speed of our network, or Internet access, then we are talking about bits.

Basically, there are 8 bits to a byte, and a million of these bytes make up a megabyte, or 1 MB, which is used when we talk about hard drive storage or an amount of memory. Furthermore, a thousand megabytes (1000 MB), is 1 GB, or gigabyte and a thousand gigabytes makes a terabyte (1 TB). So when we say 'that hard drive has a huge capacity of 3TB', we mean it can hold three thousand gigabytes, or three million megabytes.

More accurately speaking however, there are actually 1024 bytes in a kilobyte and 1,048,576 (1024 x 1024), bytes in a megabyte (1 MB, again).

Hard drive manufacturers these days generally only refer to the single unit equivalent of GB or TB. With that in mind, it's interesting to note that the example we used earlier, of 3TB (three terabytes), is really 3,145,728 megabytes or 3072 gigabytes. So as you can see, using the simplified version makes life a little easier; although the purist may disagree.

Megabits, when we talk about data transfer rates, the speed of your Internet connection and so on are represented as Mb; note the lower case 'b'. To make things a little easier, in the world of telecommunications the Mb equals 1,000,000 bits. So 1 Mbps, which is a single megabit per second, is the same as 1,000,000 bits per second.

If you use the common byte size of 8 bits, then 1 Mb (megabit), is roughly equal to 0.125 MB (megabytes). So, if you're not foaming at the mouth by now, a decent broadband line advertised at 75 Mbps can transfer data to your PC at around 9.375 MB/sec (megabytes per second). And, your home network with a 100 Mbps switch will send data from one PC to another at around 12.5 MB/sec, whereas with a gigabit Ethernet switch and network ports on the PC, will transfer the data to and from one computer to the next at around 125 MB/sec.

As we said, these are only theoretical speeds, even those advertised by your ISP. In theory you can reach these speeds, but external factors such as cable quality, noise on the line and so on can have an affect on the total overall performance of the line.

Either way, we can still improve what we have, and ensure that our network is in as tip top shape as possible. If it's working well, then you'll have no complaints from the other members of the family.

Routers: How do they work?

Every Internet connected home, office, and multi-site megacorporation in the world uses a router to connect to the Internet. The router is the bridge that gaps your home network to the wider world of the Internet, as well as being the hub of all your connected devices.

A router is simply a piece of hardware that's designed to interconnect one network to another. They can be used to connect two individual office networks together, so the teams in each can share resources, but more specifically, in terms of the home user, they're used to connect all your devices to each other and ultimately the Internet.

Routers come in various shapes and sizes, offering many features; with some of the higher-end models offering more. Typically, a router, the one you'll receive from your ISP when you sign up to a broadband deal, will be able to do the following:

- Connect to the Internet
- Assign individual IP addresses to connected devices
- Form a layer of security to protect your home network
- Offer wireless connectivity to devices
- Have a built-in switch for multiple devices via Ethernet cables
- Network Address Translation (NAT)
- Resource sharing
- Parental or safety controls
- Port forwarding
- Upgradable Firmware.

So what do all these mean?

Connect to the Internet

Your router will function as a bridge between your computer and the Internet via the ISP's network. What this means is, your ISP has sent you a device that's configured to access their network, so when you connect it at home, it will begin to transmit and receive data to and from your computer and the ISP. The ISP itself will have its own connection to the Internet, a very big one, and will share that bandwidth out with all its customers. With you being a customer, you'll get a share of bandwidth equal to the broadband package you're paying for.

Assign Individual IP Addresses to Connected Devices

One of the router's primary functions is to allocate IP addresses. An IP address is a unique network identifier that allows communication across the network; every computer connected to the Internet has a unique IP address. These addresses work in much the same way as a postal address; they contain the information needed to get to where they're going and where to return.

There are two types of IP address, the first is IPv4: IPv4 uses 32 binary bits to create a single address on the network. An IPv4 address is expressed

by four numbers separated by dots. Each number is the decimal representation for an eight-digit binary number, also called an octet. For example: 192.168.1.150

IPv6 uses 128 binary bits to create a single unique address on the network. An IPv6 address is expressed by eight groups of hexadecimal numbers separated by colons, as in 2a00:23c7:c87:d101:e8a1:c3d7:ba7b:bd17. Groups of numbers that contain all zeros are omitted to save space when viewing the address, leaving a double-colon separator to mark the gap, such as fe80::46fe:3bff:fef6:d115.

Each of your devices at home will connect to the router, and the router will allocate an IPv4 and IPv6 address from its available pool of addresses. The router itself has its own IP address which it connects to the ISP with, of which the ISP will have purchased large groups of IP addresses from the IANA (Internet Assigned Numbers Authority).

Form a Layer of Security to Protect Your Home Network

Your router will contain a built-in firewall, which is designed to help stop unwanted access to the devices on your home network. For example, a hacker from the Internet will need to get past your router's firewall security before that can access your home network.

Offer Wireless Connectivity to Devices

Quite an obvious one this. The router will have built-in protocols and antennae to communicate and allocate IP addresses to any wireless devices that have cleared the password stage.

A Built-in Switch, so Multiple Devices can Connect via Ethernet Cables

Most routers will feature a four-port switch (more on switches later), that allows multiple wired computers and devices connection to the router. The switch will automatically sense the network speed of the device connected and communicate with it accordingly.

Network Address Translation (NAT)

Network Address Translation translates the IP addresses of computers in the home network to a single IP address. That single IP address is part of the ISP's range of addresses. Basically, NAT conserves the number of public addresses used within an organisation, and it allows for stricter control of access to resources on both sides of the router.

For example, a device inside a network makes a request to a computer on the Internet. Routers within the network recognise that the request is not for a resource inside the network, so they send the request to the firewall. The firewall sees the request from the computer with the internal IP. It then makes the same request to the Internet using its own public address, and returns the response from the Internet resource to the computer inside the private network. From the perspective of the resource on the Internet, it is sending information to the address of the firewall. From the perspective of the workstation, it appears that communication is directly with the site on the Internet. When NAT is used in this way, all users inside the home network access the Internet with the same public IP address. That means only one public address is needed for hundreds or even thousands of users.

Resource Sharing

As the router connects all the devices to the same network, they are all able to intercommunicate with each other, and therefore share resources. For example, all devices can print to your home's networked printer.

Parental or Safety Controls

More modern routers now offer better parental controls to help curb the amount of time younger people have access to the Internet. Also, they can be used to limit the websites that younger people can have access to.

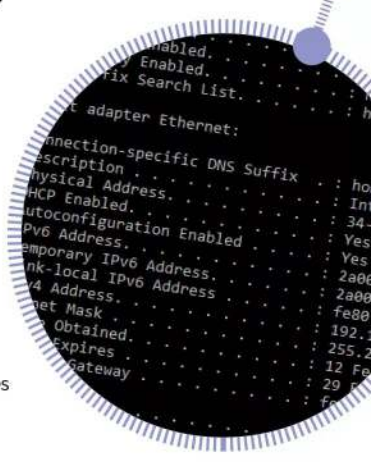
Port Forwarding

Port forwarding is another behind the scenes process that the router takes on. It intercepts traffic to and from home networked devices to the Internet and can redirect them to a specific device on the network.

All network connections include a port number, Port 80 is used for HTTP requests, and these ports define what the service is. For example, if you want to host a Minecraft server, you would need to allow outside Minecraft users access to your server. They would connect to your Router's IP address and the specific Minecraft port, which tells the router what computer is hosting the Minecraft server.

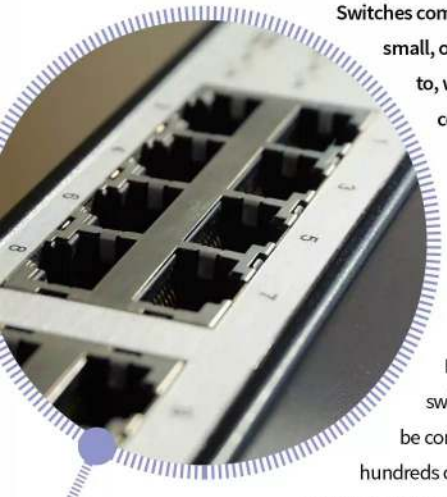
Upgradable Firmware

As telecommunications protocols advance, and as security flaws are discovered, an ISP has a responsibility to ensure that all the routers it has sent out to its customers are up-to-date. The ISP can do this by automatically upgrading the software on the router, called the firmware. The new firmware will contain updates, patches and upgrades to security, and will add new features and improvements to the router.



Switches: What are they, how do they work?

Most modern routers contain at least a four-port switch built into the back of the unit. These ports allow for physical, Ethernet connection to the router from networked devices. But what are they, and how do they work?



Switches come in many sizes. Some are quite small, offering just a few ports to connect to, while others, used mainly by companies, can have tens of ports. In the simplest terms, a switch enables multiple computers to connect to a network using a physical cable, called an Ethernet cable (or RJ45 cable).

Each computer is connected to the switch, and multiple switches can be connected to each other. This allows hundreds of computers, let's say on the floor of an office building, to be connected to the floors above and below, as well as to the company's servers and routers.

Switches also come with different backbone speeds, which is the physical limit the data can travel to and from each of the ports. These speeds range from 10Mb/s, to 100Gb/s. The most popular, and the one that's likely built into your router, is 1Gb/s; although 100Mb/s is still possible to find on some routers. While Ethernet is the primary connection port type, a lot of switches will also have fibre port connections too, which is much faster. This allows multiple switches to connect to each other and form a much faster bandwidth backbone connection.

The primary function of a switch is to transport data around the network, usually from areas of the network that are out of reach from its core. For example, you can have all your computers connected to your router's switch, but if you want the computers upstairs connected, you'll need to factor in a switch. You would purchase a switch with the required number of ports, use one of the ports for a cable that will run downstairs to the router's switch, then connect your upstairs computers to the new switch. You've now created a multi-switch network; the one upstairs is connected to the switch that's built into the router, and all the computers can happily gain access to the network and the Internet.

That's a very simplistic example, but it's not too different from how a real-world situation will work. In the office you would have multiple floors, teams, rooms and so on. Each of those probably has its own switch, which is in turn connected to the main switch that the company's servers are connected to. Naturally, depending on the size of the company and how

many computers, printers and so on are connected to the network, the setup can quickly become quite large, involving many switches across multiple floors and even buildings.

Managed Networks

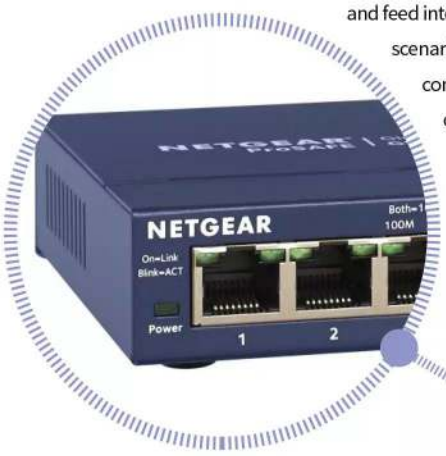
Another core function of a switch is to manage the network. This means that a switch is capable of building a map of its connected devices, and ensuring that the correct data is sent to the correct device in as little time as possible, and as cleanly as possible by the shortest route.

A good example is if computer A needs to send something to Computer B. Both computers are located in different parts of the network. A switch is able to monitor and deliver the data package from computer A directly to computer B without having to interrogate any other connected device on the system. Should computer A or B be moved in the future, the switch can intelligently alter its understanding of the location of the devices and change the route accordingly; building a map of the network for better efficiency and avoiding packet collisions on the network, which will greatly degrade the overall speed of the network.

The types of switches found built into routers are usually unmanaged, but this doesn't mean they don't manage the network to some small degree. An unmanaged switch will still automatically learn and map the network, avoiding collisions by routing data to its intended devices, they just won't feature some of more complex elements of a managed switch.

Switches at Home

If you have no wireless devices in your home, then using switches to connect all the computers on the network is your best bet. A switch could therefore be positioned upstairs, feeding to the built in switch in the router, another could be located in the garage, feeding to the router, and another could be in your shed at the bottom of the garden, again feeding into the router. The router will now be lacking in ports, so one more switch for the downstairs will satisfy any computers connected and feed into the router. In this scenario, everything is connected to each other and ultimately the router. They can all 'see' each other, as well as gain access to the Internet and other network resources.



Layers

Switches also offer different functionality in the form of layers. These layers perform different operations depending upon the layer type, and they generally gain in complexity the higher the layer number.

Layer 1

A layer 1 switch transfers data, but does not manage any of the traffic coming through it, an example is an Ethernet hub. Any packet entering a port is repeated to the output of every other port except for the port of entry. Specifically, each bit or symbol is repeated as it flows in. A repeater hub can therefore only receive and forward at a single speed. Since every packet is repeated on every other port, packet collisions affect the entire network, limiting its overall capacity.

Layer 2

A layer 2 switch is a multiport device that uses hardware addresses, the MAC address, to process and forward data at the data link layer (layer 2). A switch operating as a network bridge may interconnect devices in a home or office. The bridge learns the MAC address of each connected device. Bridges also buffer an incoming packet and adapt the transmission speed to that of the outgoing port.

Layer 3

A layer 3 switch can perform some or all of the functions normally performed by a router. Most network switches, however, are limited to supporting a single type of physical network, typically Ethernet, whereas a router may support different kinds of physical networks on different ports.

Layer 4

Layer 4 switches commonly offer Network Address Translation, improved Quality of Service (QoS) capabilities and may include a firewall, Virtual Private Network connection or higher-level forms of security gateways.

Layer 7

Layer 7 switches can distribute the data load based on the target Uniform Resource Locator (URL), and may include a web cache.

Wi-Fi: What is it, how does it work?

It's not that long ago when wireless communications across the network was akin to witchcraft. At the time we had coaxial cables networking everything, then Ethernet, and then Wi-Fi began to emerge, and it was utterly brilliant.

We take Wi-Fi and wireless connectivity for granted these days. The phone that most of us carry around, with its ability to connect to a network, or Bluetooth pair to another device, is simply an amazing piece of technology. As we said in the intro, it wasn't all that long ago when connecting to a network over a wireless setup was simply out of the question. While it has existed since the early seventies, as UHF wireless packet networking, it wasn't worth the exorbitant cost of installation, setup and maintenance. But Wi-Fi, which stands for Wireless Fidelity, has come a long way in a short time.

In essence, as you already suspect, Wi-Fi is wireless connectivity; the ability to connect to a network and therefore the Internet wirelessly. It's a set of protocols and data packet exchanges that enable a PC, laptop, tablet and so on, to connect directly to a router or other Access Point using a number of available radio frequencies.

These frequencies range from 900MHz, through to the 3.6GHz, 4.9GHz, 5GHz, 5.9GHz, and 60GHz bands; and are called channels. They use a set of protocols called IEEE 802.11, and split into standards such as a, b, g, n, ac and ax. These standards basically denote the age of the wireless device, where 802.11 was the first standard and created in 1997, 802.11a came next in 1999, then 802.11b, 802.11g, 802.11n, 802.11ac and finally 802.11ax. You can also get 802.11p and 802.11ad/ay, but these are reserved for higher rate communications.

Each of these standards connect to a wireless access point, such as your router, at different speeds. 2.4GHz is the most common connection channel and can offer up a theoretical speed of 54Mb/s. Dual-band Wi-Fi devices are able to connect on both 2.4GHz and 5GHz channels, and have a maximum throughput of up to 7Gb/s (although in theory, it's said it can hit 12Gb/s).

With Wi-Fi being constantly updated, there are frequent increases in the connection speed between wireless devices. Generally, an accepted improvement from one wireless standard to the next often means a performance increase of around 30 to 40% from the previous generation standard. There are other factors at work too, such as MU-MIMO (Multi-User, Multiple Input, Multiple Output), which increases the number of antennas in a router for transmitting and receiving data, thus improving the capacity for wireless connections.

Working with Wi-Fi

A Wi-Fi router works by converting the network communications signals into radio waves, then transmitting them around itself, creating its own small Local Area Network; which incidentally is why it's called WLAN, Wireless Local Area Network.

Devices that can pick up and receive the radio signal, such as a tablet or phone, are able to connect to the WLAN and decode the radio waves back into a readable form of network communications. The power of the router's Wi-Fi isn't very strong, and doesn't have a lot of range, but it depends on the frequency being used as to how far you're able to communicate with a router. For example, a 2.4GHz band can reach up to around 150 feet, and 5GHz can reach even further. However, as routers are placed inside our homes there's a lot of interference for the signal to get through. Walls, doors and even some furniture (no, Christmas lights don't affect your Wi-Fi), will rapidly degrade the signal, so while the theoretical distances sound good at several hundred feet, in reality you'll be lucky to get a good signal within thirty to forty feet of your router.

On top of that, the signal will become weaker the longer the distance, and it'll start to drop in power very quickly too. Due to this, your router needs to have several antennae in order to transmit and receive the signal, and they need to be powerful enough to push that signal as far as possible, before it naturally starts to drop.

Interestingly, one of the key features of keeping the signal as clean as possible was created as a by-product of a failed experiment to detect exploding mini black holes the size of an atom particle; and was invented by an Australian radio astronomer called Dr. John O'Sullivan, together with his colleagues Terence Percival, Graham Daniels, Diet Ostry and John Deane.

The Future

In 1929, Nikola Tesla theorised the 'World Wireless System', and he said. "We shall be able to communicate with one another instantly, irrespective of distance. Not only this, but through television and telephony we shall see and hear one another as perfectly as though we were face to face, despite intervening distances of thousands of miles; and the instruments through which we shall be able to do his will be amazingly simple compared with our present telephone. A man will be able to carry one in his vest pocket."

Tesla may have had his own personal demons to battle, but you have to admit the man was pretty much on the ball. But what does the future hold for Wi-Fi?

It's been long thought that the future of Wi-Fi will be tighter frequencies, but with extraordinarily boosted power. This extra power will be able to cut through most of the obstacles that face current Wi-Fi frequencies, and through the use of more secure roaming hotspots, we'll be permanently connected to a Wi-Fi network as we move around.

There are even concepts being worked on by communications companies to eventually remove wired telephony, and instead our home routers will communicate directly via Wi-Fi to the ISP.

Of course, all that is some years off. Until then, we'll enjoy the ever increasing speeds of Wi-Fi and its ease of use in our homes.

Powerline Adapters: Extend Your Network

If your home network doesn't reach the furthest corners of your house, maybe because some rooms are too far from the router, or a thick stone wall blocks your Wi-Fi signal, powerline adapters are a potential solution. But what are they, and how do they work?

There are many reasons why your home Wi-Fi network doesn't reach into every part of your house. The router's wireless signal might not have the range to get to the furthest rooms, or the walls might be very thick and heavy, which makes it difficult for Wi-Fi to penetrate. So maybe you need to make a cabled connection to one of the router's Ethernet ports, but don't want to trail Ethernet cables through the house. Powerline adapters are a potential solution for extending both your wireless and cabled network, using your home's electrical cabling as data cables.

A powerline adapter kit comes with at least two plug adapters, which are small devices that plug into your electrical sockets. They usually have at least one Ethernet port, and they might also have Wi-Fi access points and 'through ports', whereby you can plug an electrical device into the adapter, and thus use it without losing a socket. One of these plugs should be fitted near your router. Plugs with through-ports are very useful here, as you can plug the powerline device into the mains, then plug the router into the powerline adapter. An Ethernet cable – which should be supplied with your powerline adapter kit – should be used to connect the adapter to the router. The second powerline adapter should be positioned elsewhere in the house, somewhere your current home network can't reach. A little more setting up might be necessary, probably using free software supplied by the powerline adapter's manufacturer. When you're done, the two powerline adapters communicate with each other and can transfer data between them, using the household electrical cabling as data cables. If the adapter that's not connected to your router offers a Wireless Access Point, a Wi-Fi enabled device can connect to it and get online (and also onto your local network, of course), by connecting wirelessly to the powerline adapter. This adapter then connects to the router's powerline adapter, through the house's electrical cables, and thus to the router. It sounds complicated, but it isn't. It just works.

Cabled Connectivity

While most Internet devices connect to your router using Wi-Fi, for some things, you might prefer a cabled connection. A games console, for example, might benefit from the additional stability offered by Ethernet, and if your TV shows regularly buffer due to congested wireless networks, plugging in an Ethernet cable might solve your problems. If your router is close enough to the device in question, there's no problem; simply connect the two with an Ethernet cable. Unfortunately, this is often not the case. The console or Smart TV might be a long distance from the router, quite possibly in a different room entirely. This is where powerline adapters come in handy.

Instead of trailing Ethernet cables through the house, and drilling holes in the walls to pass them through to the next room, you can use a powerline adapter setup. With an adapter connected to your router, you simply need to plug the second unit near the device you want to connect through

Ethernet. You then connect the console, TV, video streamer or other such device to the nearby powerline adapter with another Ethernet cable. Your house's electrical cables are used as a continuation of Ethernet, and your device enjoys a cabled connection to your router.

Wireless Connectivity

Problems with wireless networking are common, and are usually caused by the router not reaching the furthest corners of your house, creating blindspots. In older houses, heavy brick walls might reduce the router's wireless reach. Whatever the reason, if you need wireless connectivity in a place where your Wi-Fi network is weak, or even absent, you can use powerline adapters to get around the problem.

With a powerline adapter that offers a Wireless Access Point, you can make a Wi-Fi connection to the adapter, which reaches the router through the other powerline adapter and your household electricity cables. Data is sent between the adapter connected to your router and the one positioned in a Wi-Fi blackspot, in any room in the house. If your powerline adapters offer mesh Wi-Fi, it's completely seamless. There's no need to disconnect your wireless device from the router and reconnect to the powerline adapter's Wi-Fi as you move around the house, as it's done automatically.

Adding More Adapters

Having set up your first two powerline adapters, one on the router and the other somewhere else in the house, you can add more if you wish. They all connect to the router, and to each other, through your home electrical cables. Some powerline adapter packs contain more than two adapters to begin with, but if yours doesn't, you can always buy more units and add them to your network if needed.

In the early days of powerline adapters, almost all devices conformed to the HomePlug AV standard. You could therefore mix and match adapters from different manufacturers, as they were all compatible with each other. This is less true today, as all sorts of different standards have sprung up. We recommend, therefore, that you stick to the same brand when adding more plugs to your powerline adapter network.

A Typical Powerline Adapter

There are many brands of powerline adapter available. This one is by devolo, but other manufacturers' devices are of a similar design.

1 Start by plugging the powerline adapter into a mains socket. This one's a British three-pin plug, but adapters with EU and US plugs are available.

2 This particular model has a through-port, so you can plug in another electrical device. This means you can use the powerline adapter without losing an electrical socket.

3 This particular device has two Ethernet ports. Some models have more, and powerline adapters that are only wireless extenders might have none at all.

4 As you can see from the 'Magic WiFi' brand and the wireless button, this device offers a wireless access point as well as Ethernet connectivity.

How Wi-Fi Mesh Works

If your router's Wi-Fi network doesn't cover the whole house, powerline adapters that offer Wireless Access Points are a solution. First, plug the base unit into the mains (the dotted blue line), and connect it to the router using an Ethernet cable 1. You can then add Wi-Fi adapters anywhere in the house 2, by also plugging them into the mains. They greatly extend your wireless reach by creating a 'mesh' with the router's own Wi-Fi signal 3.

The same passcode allows you to connect to the network anywhere within this mesh. If you move from room to room, maybe with your phone in your hand or to use your laptop elsewhere in the house, you don't have to disconnect from one access point and log into another.

As most adapters come with Ethernet ports, you can also use them for cabled connections; the solid blue lines 4.

Network Extenders: What are they, how do they work?

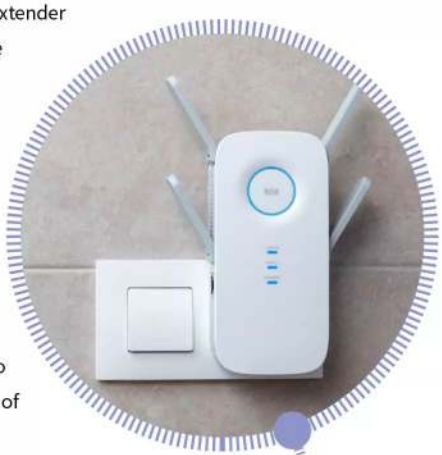
If the cabling option, together with powerline adapters, doesn't work for you, then you can easily expand the reach of your Wi-Fi network by utilising wireless extenders. They're cost-effective and easy to setup.

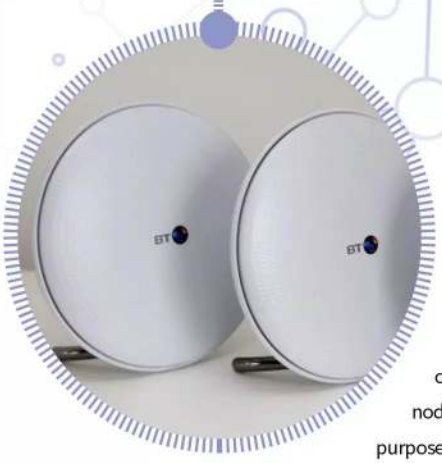
Network extenders fall under different names, depending on who you talk to or what company is selling them. They can be called wireless extenders, signal boosters, Wi-Fi range extenders and so on, but effectively, they all do the same thing: extend the signal of your available Wi-Fi network.

Most houses will have one or more dead zones, where the Wi-Fi signal from the router drops to the point of being virtually useless. As we've mentioned previously, the Wi-Fi signal is a slave to its environment and can be affected by walls, furniture, microwave ovens and all other manner of objects we regularly use throughout the home. If you have your router in the front room of your house, for example, then the upstairs back bedroom may prove to be one such dead zone, due to the Wi-Fi signal having to get through several walls and a floor.

A network extender can solve that issue by acting as a bridge between the devices needing access, and the router's ever-weakening Wi-Fi signal. There are different forms of network extender available, but the vast majority are similar to that of a powerline adapter: a plug-in device.

You need to plug the network extender into a free electrical socket, use its accompanying software to locate it and connect it to your existing Wi-Fi network - and away you go. While it's powered up and the network is up and running, it will extend your Wi-Fi signal by as far again as the router's signal, thus giving you access to even the most obscure corners of your house and property.





Mesh

Mesh is a term that's now being used together with a lot of Wi-Fi routers. Many routers these days come with an included Mesh node – which is to all intents and purposes a Wi-Fi network extender.

Mesh is a network topology that's designed around interconnecting nodes. These nodes can be switches, routers and so on, that are directly connected to as many other nodes as possible and cooperate with each other to pass data across the network in as effective way as possible. They're able to manage workload and bandwidth, and alter the routes for data to take should any of the nodes fail and drop off the network.

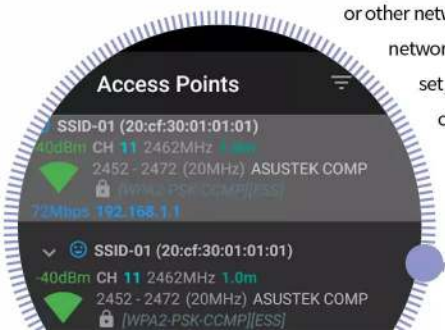
A wireless Mesh network works the same way, but exclusively uses Wi-Fi signals to form the network. A lot of ISPs have now adopted the term Mesh into their products, and will include a Mesh disc, or node, with their router.

These nodes can be placed in dead zones around your home and property and connect directly to the router. The end result is a very large Wi-Fi signal range for a single network, extending throughout the home and well into the garden and surrounding property.

The beauty of this setup is that any laptop or other Wi-Fi device can be moved around the Mesh signal range and quickly jump from one node to the next without any indication of a loss of signal. In fact, the user probably won't even notice that the device is hopping from one node to the next.

Multiple users are also catered for, as the Mesh setup allows for effective load balancing across all the available nodes. If a single node is having to deal with a lot of bandwidth and users, then other nodes can quickly take charge and take the strain off the first node. Of course, this is providing the other nodes are within range of the users.

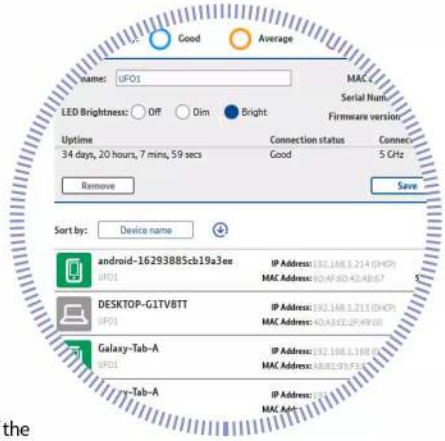
Guest networks are also easy to setup in such a configuration. A user could create a free-to-use mini network that allows access to the Internet or other network services. The guest network can have certain limits set, such as connection times or bandwidth caps; it's all up to the user who is setting it up.



Effective Setup

When setting up a wireless network extender you need to consider its placement for best effect. For example, having your router in a corner of the house isn't a very effective setup, as half the Wi-Fi signal will be broadcast outside. The perfect place for a router is somewhere in the centre of the house, where the signal is spread out through the house and not wasted outside.

Of course we can't always help the location of the router, since they generally need to be placed at the main telephone port. What you need to do in these circumstances is download a Wi-Fi analyser for your phone or tablet.



A Wi-Fi analyser will indicate the signal strength of the connected Wi-Fi network as you move around the house and surrounding property. Where the signal begins to drop, and any dead zones you find, you can mark and place a network extender or Mesh node.

After some thorough analysing of the Wi-Fi network, you will end up with a wireless local network that doesn't have any dead zones and is being effectively boosted at the appropriate locations. You can always review the placement from time to time, and add or take away nodes and extenders as your network and its devices change.

Get Extending

If you've got more wireless devices on your network than wired ones, then investing in a set of network extenders makes good sense. Your network will be better managed in terms of use and bandwidth, and you won't have the inconvenience of having to move to another location in the property for a better signal.

GETTING THE MOST FROM WI-FI

Wi-Fi is much like electricity, you don't think much about it until it's not available. There's a lot you can do with a good wireless network, so this chapter will look at how you can get the maximum potential from your Wi-Fi, from creating a wireless network plan, to surveying your home to find Wi-Fi dead zones.

Want to discover how to secure your wireless network, while also extending it to the outer reaches of your home and property? Then this chapter will help you become more Wi-Fi knowledgeable.

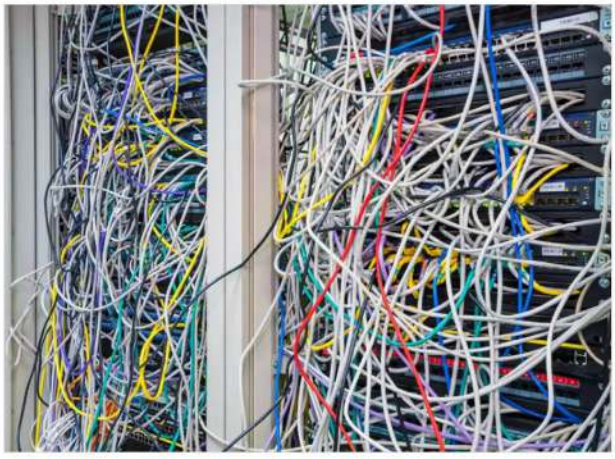
Benefits of a Wireless Network

As most routers these days come with a Wi-Fi setup and perhaps several Mesh nodes out of the box, it's easy to assume that the whole world wants you to go wireless. For those of you who are wary of Wi-Fi, though, here's ten good reasons to consider wireless over wired networks.

BENEFIT 1 **EASY SETUP –** The beauty of a wireless network is that it's remarkably easy to setup. Once you've got your router and any network extenders you need, it's a simple case of pairing everything up with the router and you're up and running.

BENEFIT 2 **EASILY MAINTAINABLE –** In addition to an easy and quick setup, maintaining a wireless network is a similarly easy process. If you find any dead zones, through using a network analyser, then you can fill the gaps in the signal with another extender. And you can revise your setup without too much effort.

BENEFIT 3 **NO MESS –** One of the main benefits of going wireless throughout is the fact there's no ugly wires dangling, or stuffed behind the equipment. Setups like a home entertainment system can be networked with just the power cables for the devices themselves, and not lengths of Ethernet cables.



BENEFIT 4 **INCREASED MOBILITY –** Having a good wireless setup means you can work from any location within your signal range. Naturally you can still sit at the computer, but you're free to roam the house; perhaps even do a spot of work while lounging in the sun in the

BENEFIT 5 **INCREASED SCALABILITY –** As an element of the maintenance and setup benefits, increased scalability of your wireless network means you can expand and extend the signal as your needs arise. If you want to include the shed at the bottom of the garden, for example, it's a reasonably easy job to get the Wi-Fi beyond the home.

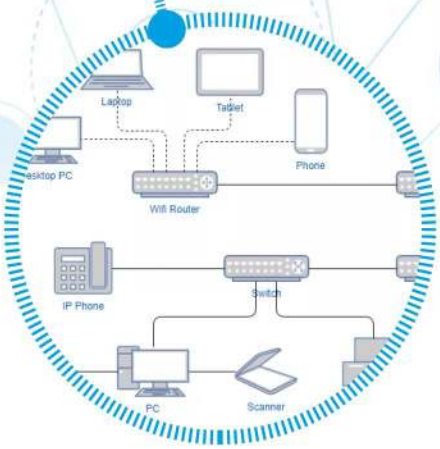
BENEFIT 6 **DECREASE SCALABILITY –** And on the flip-side of the previous benefit, should you wish to downscale your wireless network – perhaps the kids have finally moved out and there's less devices on the network – then it's a similarly easy job to remove elements of the network and shrink the signal.

BENEFIT 7 **IMPROVED TECHNOLOGY OVER TIME –** The technologies behind Wi-Fi are ever-improving. Each year brings a new router or extender with more features, better signal strength, more bandwidth and so on. If you go all wireless for your network, then you're going to benefit in the long run from better tech.

BENEFIT 8 **COST SAVINGS –** In general, most wireless networking equipment costs less than wired equipment. Mostly, though, the cost savings are due in part to the need for less networking equipment to get all the devices on the network. Consider the number of switches you may need to connect ten computers. The same can be done with a single Wi-Fi extender.

BENEFIT 9 **EASY REPLACEMENT –** Should you decide to change ISP, or replace your ISP provided router for a more feature-rich model, then all that's necessary is to change the access for each of the extenders and devices on the network.

BENEFIT 10 **SECURITY –** While a Wi-Fi network is prone to more attacks than a wired setup, the security benefit is that you're able to see what devices are connected to your network by name. If you name all your devices logically, then should something you don't recognise appear on the network, you can assume it's someone trying to gain access.



Making a Plan

Before you purchase any number of wireless network extenders and other such technology, it's best that you begin by making a plan of action. Where do you want your Wi-Fi signal to reach? How many extenders will you need?

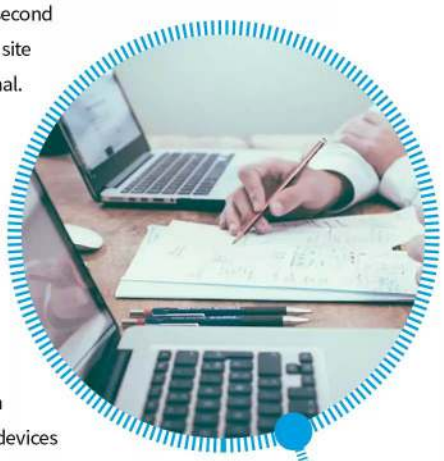
Let's assume you're building your Wi-Fi home network from scratch. You've received the router from your ISP, and you're ready to begin the setup process. It's best not to dive in and set everything up, without first planning what you're going to do. You may reach a point in the setup process where you need to alter something, sending you back to square one.

Making a plan saves a lot of problems later on, and once you have your network setup and ready, and operating to its maximum, you can easily extend it when you need to, without having to pull equipment apart or rearrange devices.

Planning

The first item you should put on your plan is router position. At this point in time you're not able to effectively conduct a wireless site survey with a network analyser, since the router isn't up and running. The router is the core of your wireless network, so it makes sense that it's going to be located somewhere in the middle of your home.

The ideal placement for a wireless router is usually downstairs, as close to the centre of the house as possible, so that the signal is beamed throughout the house and not lost to areas outside. While it's not always possible to position a router in the middle of the house, due to the positioning of the master telephone socket, you can opt for a telephone extension cable, or ask a telephone engineer to relocate the master socket.



Once the router is in place, the second item on the plan is to conduct a site survey of the current router signal. Download a network analyser from your device's app store, and start it up. As you move around the house, make a note of all the locations where the signal is dropping to the point of virtually no connection, or very low. Compare these dead zones with where you're going to be using devices

– for example, a dead zone might be in a closet, so logically speaking you won't be needing to use any devices while in there.

Once you've got a map of where the dead zones are, you can begin to start planning what network extenders are going to be needed. Don't forget to include any outbuildings in your survey, and areas of the garden where you're likely to sit on nice days and possibly work, or just use a Wi-Fi device.

With regards to network extenders in your plan, it's always best to buy extenders that operate at the best possible bandwidth speeds, while still being compatible with your router's Wi-Fi technology. The information that comes with the router and the extenders should provide you with everything you need to know.

Next item on the plan is the installation of the network extenders. As you plug in each extender to cover a dead zone, and extend the network to otherwise unreachable areas, take the time to set them up, and test the coverage with the network analyser. Once all the network extenders are in place and connected, it's time to include one more site survey. This final survey is there to ensure that your network is reaching the places you need it to, such as the garage and other outbuildings.

Next on the plan should be a working test of your newly setup wireless network. Grab a tablet or laptop, and find some bandwidth heavy content – such as a 4K YouTube video. While you're playing the video, move around the house and into the previously surveyed dead zones. Take it outside and ensure that the video is still being streamed while you move around the property and outbuildings.

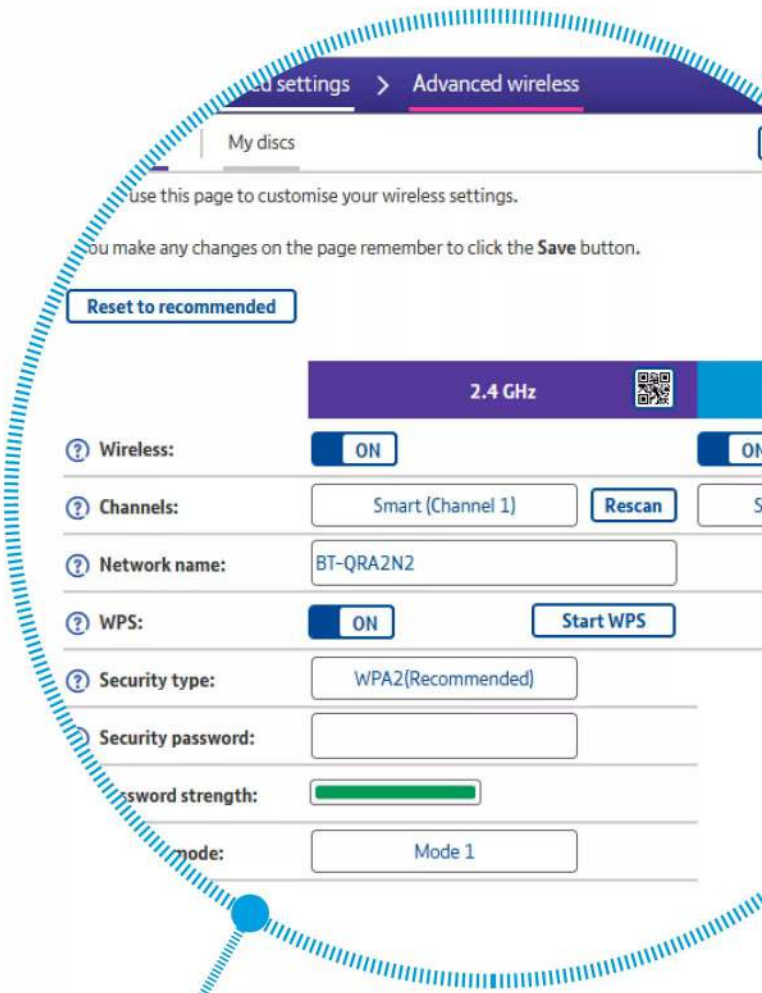
Now that the connectivity is working well, it's time to review the security of your wireless network. Log into the router, and make sure that you're using the latest security method; which is currently WPA2 for most home routers. Also check that the Wireless Mode is set to 1 (providing your router uses Wireless Modes). The Wireless Mode option allows connected devices to utilise the best performance and security features of the router.

Ensure that the security password for accessing the wireless network is strong. It's also recommended to rename all your devices that will connect to the network, so you can easily identify them when you're looking at the connected devices page on the router. If you see a device you don't recognise, then you can quickly isolate it and deny it access until you find out who or what it is.

When you're satisfied that your wireless network is up to scratch, you can finally start to enjoy using it. It's recommended that you take a survey every couple of months to make sure that the signal isn't being degraded over time, due to a faulty device, and that it remains working in tip-top order for you.

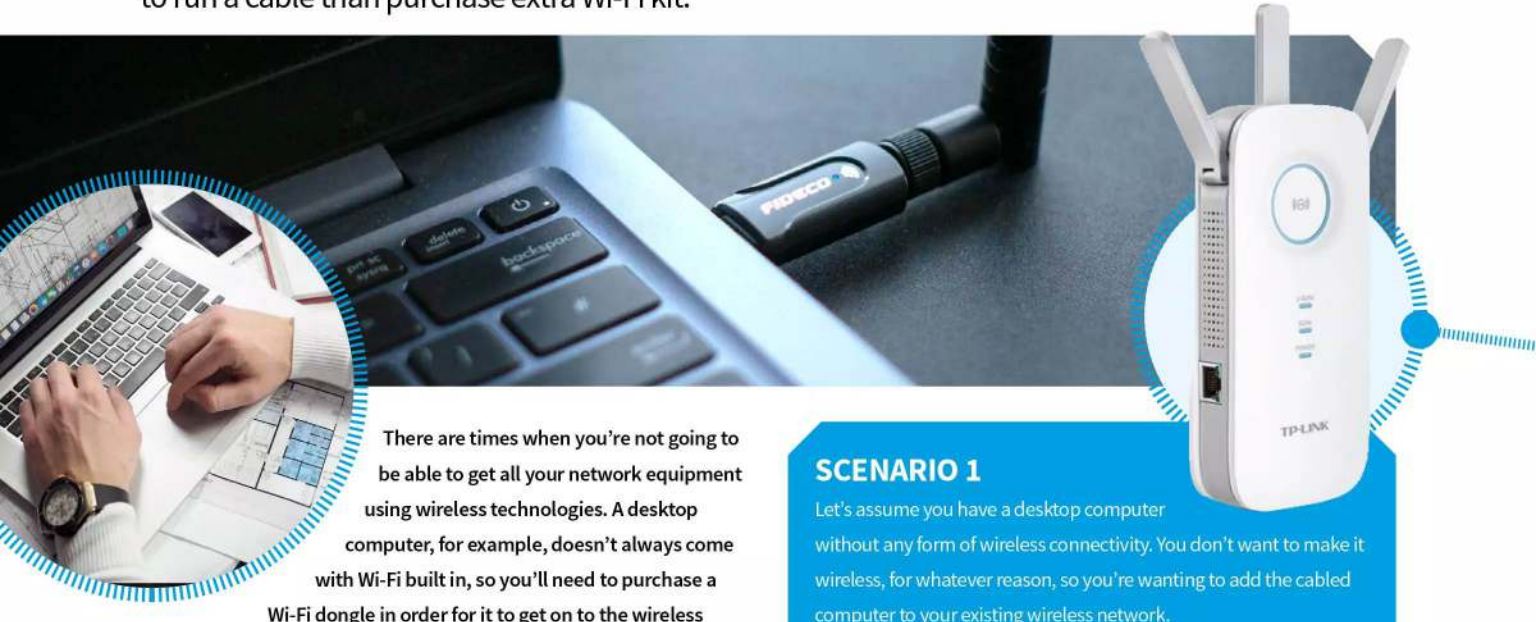
Dynamic Plans

This is, or course, a very simple plan. Your plan may contain other elements that you want to include on your network, such as individual user access, guest access and maybe even separate networks for different devices. The plan is unique to you and your setup, so take your time and make a note of everything you think you'll need to cover.



Wireless to Wired and Back: Creating a Wireless Backbone

While having every component on the network communicate via Wi-Fi, it's not always possible or an effective way to work. Some devices work best when using Ethernet, sometimes it's just easier to run a cable than purchase extra Wi-Fi kit.



There are times when you're not going to be able to get all your network equipment using wireless technologies. A desktop computer, for example, doesn't always come with Wi-Fi built in, so you'll need to purchase a Wi-Fi dongle in order for it to get on to the wireless network. If you use some older equipment, such as an older laser printer, it may only have an Ethernet or USB port available. The same goes for Network Attached Storage (NAS) drives, most of these only come with Ethernet support due to the high bandwidth they tend to use over time. In such cases, you have no choice but to go wired.

Best of both worlds

There's nothing wrong with having wired elements on your wireless network. Essentially, the backbone of the network, the communications to and from the router, will be handled by wireless extenders or Mesh nodes, it's just the odd piece of equipment that will need to have some Ethernet cables run to it. Let's look at some scenarios, and how best to set them up.

SCENARIO 1

Let's assume you have a desktop computer without any form of wireless connectivity. You don't want to make it wireless, for whatever reason, so you're wanting to add the cabled computer to your existing wireless network.

The best bet here is to opt for wireless extenders that include one or two Ethernet ports. A good example of one such extender is the TP-Link AC1750 Wi-Fi Range Extender. This is a three-antennae device that can operate at 450Mb/s on 2.4GHz and 1300Mb/s on 5GHz channels, and it features a single gigabit Ethernet adapter. It costs in the region of £50, depending on where you shop, but will allow any wired device access to the wireless network.

All you need to do is plug in the TP-Link AC1750 extender, configure it to connect to your Wi-Fi network, then plug the computer's Ethernet connection directly into the available port on the extender.

SCENARIO 2

What if you have a few pieces of equipment that can only be cabled up, and very few available electrical plug sockets?

A good choice would be the Linksys RE6700 Dual Band Wi-Fi Range Extender, offering both 2.4GHz and 5GHz channel connection, with a data transfer rate of 867Mb/s. It also features a gigabit Ethernet port, and an electrical pass-through, so you don't lose a plug socket and it costs around £85.

While there's only one Ethernet port available on the extender, thanks to the pass-through, you'll be able to add a multi-plug gang together with a five-port (or four-port), switch – such as the TP-Link TL-SG105 5 port Gigabit Switch (priced at around £15). It's then an easy job to cable up the equipment to the switch, then use one of the ports on the switch to feed to the Wi-Fi extender. In this case, anything that's attached to the switch will be able to access the wireless network via the extender.

SCENARIO 3

Getting a NAS drive onto the wireless network can be done in much the same way as the previous scenarios, but a NAS is slightly different.

NAS drives (or NAS units, if you prefer), are essentially mini-file servers. They hold many terabytes of data that's available to all the users on the network to access; simultaneously if necessary. The kind of files that are accessed can be anything from a few word-processed documents, to a 20GB 4K media file. They're also used as backup locations for the computers on the network, so essentially you could have several devices backing up photos and work to the NAS drive at once.

This level of bandwidth usually requires a better connection than normal. In such circumstances as these, it's usually best to directly connect the NAS drive to the router's gigabit Ethernet port. This means there's very little lag between the NAS and the core element of the network. If you were to place the NAS on to a switch, then to a wireless network extender, you're creating two extra hops to the NAS, whereas direct connection to the router minimises the number of networking elements between devices.

Naturally, if it's not possible to get the NAS near the router in order to directly connect it, you'll need to find the fastest possible wireless network extender, with a gigabit Ethernet port, and only connect the NAS to it – nothing else. That way you'll ensure the maximum amount of bandwidth to the NAS.

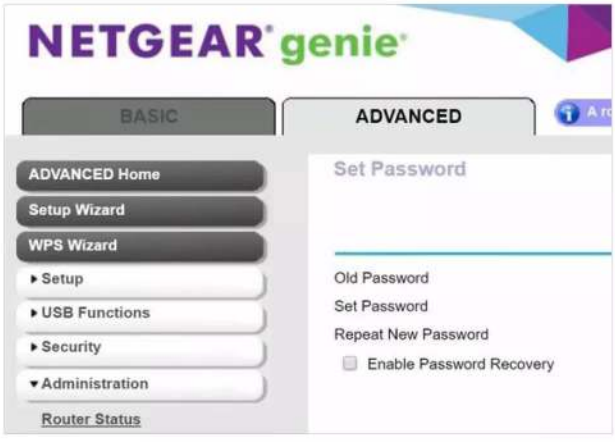
Back to the Plan

Going from wireless to wired and back isn't as complex as it sounds, but it can be troublesome from time to time, as there's a lot of bandwidth going through a single point of network contact. That's why you need to plan out your network accordingly, and see what devices are going to need to be wired and which can be wireless. In some cases, if possible, it might be best to connect the wired devices to a router or switch (depending on how many there are), that's connected to the router. As long as the Ethernet connections are gigabit, then you'll have the maximum bandwidth to and from the router, to your device.

Improving Wi-Fi Security

Most routers from an ISP have a reasonable amount of protection enabled by default, however, as with most things of a technical nature, it's possible to improve this further. Here are our top ten tips on how to improve your Wi-Fi security.

TIP 1 **CHANGE ROUTER PASSWORD –** The default password from the ISP to the administrative layer of the router can be quite good, depending on the ISP. Some though are terrible and use the likes of admin/admin as the username and password. If yours isn't up to scratch, create your own strong password using numbers, letters and special characters.

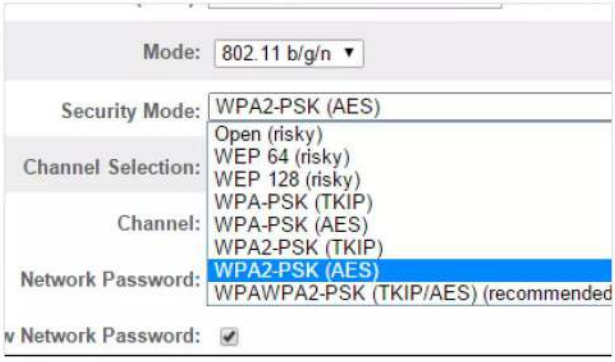


TIP 2 **LIMIT ACCESS –** Although you might find it awkward to do, you should consider saying 'no' when someone asks you for your password. Passing friends of the kids, the neighbour who needs to check something, anyone in who's doing work on the house… the list goes on. Don't give out your password, and it'll remain secure.

TIP 3 **KEEP CHANGING PASSWORDS –** If you want to remain secure, then routinely change your router's access password. Perhaps keep a list of password reminders to hand, that mean nothing to anyone else, so you can easily pick a strong one to change it to.

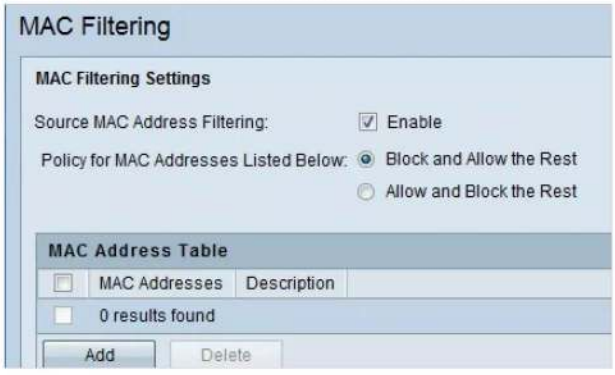
TIP 4 **CHANGE SSID –** The Service Set Identifier (SSID) is your router's wireless network name. It's broadcast with the router's signal, so you can find it and connect devices to it. But if you can see it, so can others. Consider opting for the Hide SSID option in your router's configuration (if it's available), otherwise you can use a single underscore with spaces to lessen its presence (_).

TIP 5 **ENCRYPTION –** WEP, WPA and WPA2 are all encryption types for wireless networks. WEP is the weakest, so ensure that your router is trafficking data on its network with the strongest possible encryption - WPA2. Don't be tempted to go for less to support older hardware.

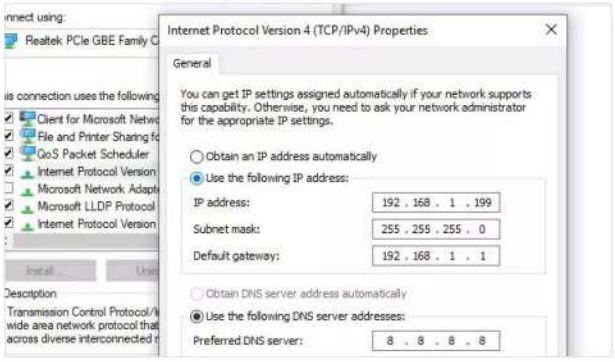


TIP 6 **TURN IT OFF –** If you're not at home, or you're away for a while (maybe on holiday), then turn off your router. If it's not needed, such as remote access to the heating controls or security cameras, turning it off is the best form of security; since no one can hack something that isn't powered on.

TIP 7 **USE MAC ADDRESS FILTERING –** Every network interface has a unique identifier known as a MAC (Media Access Code) address, regardless of whether it's a computer, tablet or games console. If your router supports MAC filtering, you can obtain the MAC addresses for each device and enter them into the router. Only those devices will be able to connect.

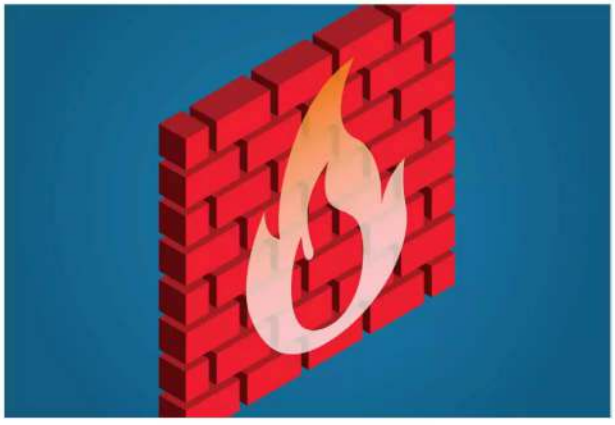


TIP 8 **STATIC IP ADDRESSES –** By default your router will allocate IP addresses to any connecting device out of an available pool. If you remove this feature, and use your own addresses, then anyone trying to gain access won't have an IP address to see the rest of your network.



TIP 9 **ROUTER POSITION –** Router position isn't just for the best possible signal. Limiting the router to the middle of the house will benefit not just your wireless network broadcast, but it will also limit access to the signal from beyond the walls of your home.

TIP 10 **MONITOR YOUR FIREWALL –** It's a good idea to keep tabs on what's being added to your router's and computer's firewalls. It's not easy, but not impossible for malicious content to secretly add a route through a firewall for hackers to gain entry to a network.

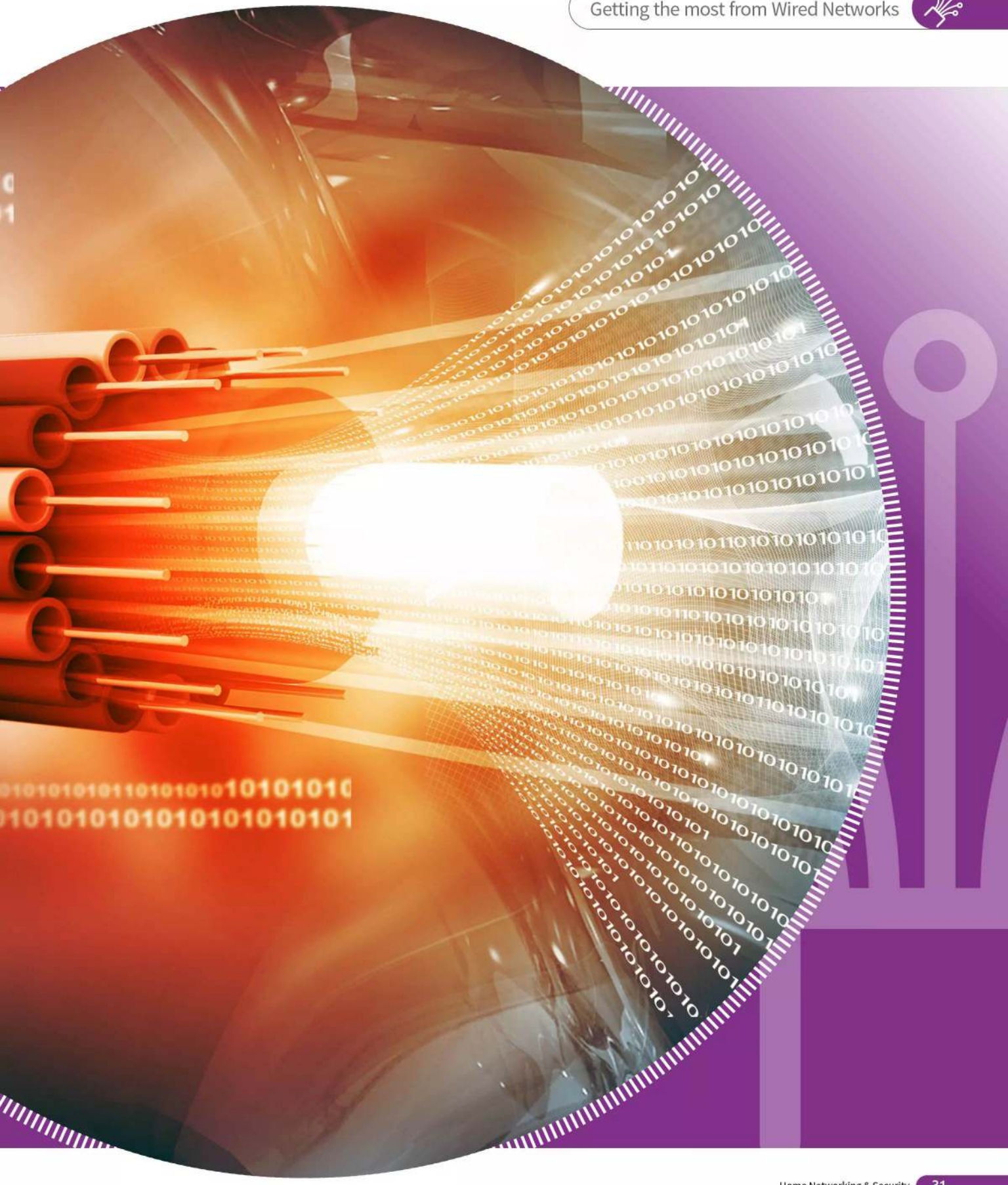


GETTING THE MOST FROM WIRED NETWORKS

While Wi-Fi is great, it's not as dependable or as stable as a good wired network setup. A wired network is on the whole faster, more durable and not subject to range or obstacles. However, it does come with a few caveats.

Wires can be messy, so you'll need to plan out your wired setup, and you might need to learn how to make your own Ethernet cables, using specialised tools. However, with this chapter you'll learn how to deal with all these elements, and more.

From planning, to cabling, we'll help you get the most from your wired network setup.



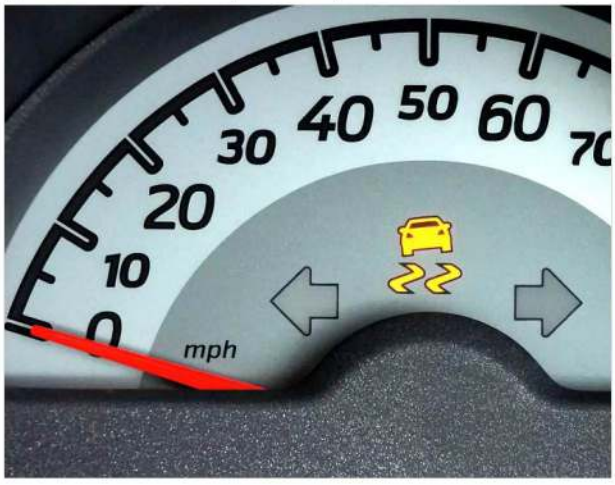
Benefits of a Wired Network

Wireless is a much simpler and neater process to opt for when setting up your network, however, wired networks offer just as many benefits. Here are ten good reasons as to why wired may be better than wireless.

BENEFIT 1 **RELIABILITY AND STABILITY –** When configured and setup properly, a wired network is incredibly dependable. Although wireless technologies are always improving, you'll probably find a wired network more stable and reliable over time.

BENEFIT 2 **NO INTERFERENCE –** Wireless networks always have to contend with other elements in its environment, such as walls, other wireless networks, mirrors and even water in a fish tank. A wired network doesn't have those issues. True, you wouldn't run the cable through a body of water – but it's possible with the right cabling.

BENEFIT 3 **SPEED –** Overall, wired networks are faster than wireless. Wireless components on a network may be advertised at speeds faster than 1Gb/s, but other factors have a negative affect on those speeds. Wired Ethernet can operate at 1Gb/s from one computer to the next.



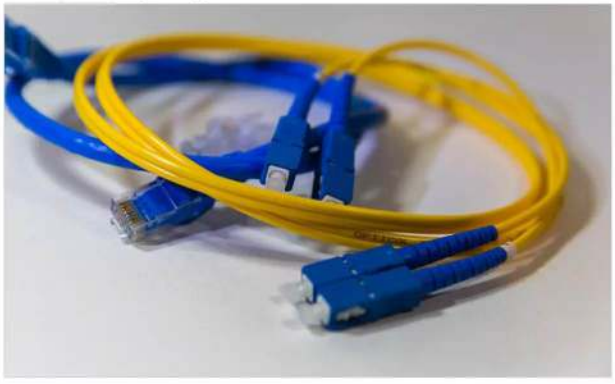
BENEFIT 4 **SECURITY –** A wireless network could potentially have someone nearby quietly hacking into your network. With a wired network, they would need to be physically plugged in to the network in order to gain access to its resources.

BENEFIT 5 **SECURITY –** A wireless network could potentially have someone nearby quietly hacking into your network. With a wired network, they would need to be physically plugged in to the network in order to gain access to its resources.

BENEFIT 6 **PoE -** Power over Ethernet is a benefit that's often overlooked with wired networks. PoE is the ability for the switch to carry an electrical supply to a device on the network, such as an access point, security camera and so on.

BENEFIT 7 **UPGRADEABLE –** With a wired network, any switches, powerline adapters or the router can easily be upgraded without the need to visit every component on the network to reconfigure it. This saves a lot of time on the part of the user.

BENEFIT 8 **INCREDIBLE BACKBONE SPEEDS –** If you wanted, you could install a wired network that has a backbone speed of up to 10Gb/s, using fibre channels. This speed is incredible, but the downside is that it can cost you an arm and a leg. However, second-hand fibre switches are always being sold somewhere.



BENEFIT 9 **LONGER DISTANCES –** Wired networks can be setup over longer distances than wireless networks. A single Ethernet cable has, roughly, a working limit of 100 metres. So you can have two switches, 100m apart, and the network is sound. To do the same for wireless would take countless extenders and nodes.

BENEFIT 10 **BETTER CONTROL –** With a wireless network you could quickly find there are countless devices having access to your network. With wired, though, you have better control as to what has access, and when it can access the network.

Tools and Equipment Needed

If you're considering going down the wired networking route, then you'll need a number of tools and equipment. Some of these are essential if you're making your own cables, others not so much, but still handy to have around should you need them.

TOOL 1 **CABLE –** You're best off purchasing Cat6 (Category 6), Ethernet cable instead of Cat5 or Cat7. Cat5 is fine, but Cat6 offers better shielding against electromagnetic disturbances. Cat7 is unnecessary at the home networking level. Around 100 metres of Cat6 can be purchased for around £35, depending on where you shop.

TOOL 2 **CAT6/RJ45 CABLE ENDS –** Cable ends are certainly necessary, since you can't plug anything into the Ethernet ports without an Ethernet end on the cable. The prices do vary from place to place, so have a shop around, but expect to pay somewhere in the region of £5 for a bag of ten RJ45/Ethernet cable ends.

TOOL 3 **RJ45 CRIMP TOOL –** In order to clasp the cable end to the cable, to make a good connection, you'll need an RJ45 Crimp Tool. Again, prices do vary, and don't always go for the cheapest model as they can break quickly. However, they're not expensive and can be picked up for around £8.

TOOL 4 **CABLE TESTER –** Although not strictly necessary, a cable tester can save you a lot of bother in the long run. A decent RJ45 cable tester will set you back around £15, but there are far more expensive models available.

TOOL 5 **SWITCH –** The switch you pick will depend on the number of ports you're planning on using. Most will suffice with four or five ports, but eight ports or more might be necessary. However many ports you decide on, ensure it's a gigabit Ethernet switch you're buying. For example, an 8-port Netgear gigabit switch can be had for around £35.

TOOL 6 **POWERLINE ADAPTERS –** Extending a wired network to other areas of the home can be achieved easily with a powerline adapter. Make sure it's as fast as possible, with at minimum a 1Gb/s Ethernet port. A power pass-through is a great feature to have, and will save you a plug socket. Expect to pay around £25 for gigabit powerline adapters, with a pass-through.

TOOL 7 **WI-FI/ETHERNET EXTENDER –** Sometimes it's not possible to run cable, or the powerline adapters may be on a different electrical circuit. In these cases, it's best to extend your wired network via Wi-Fi. You can pick up a Wi-Fi extender with an Ethernet port for around £50-£60; but ensure the Wi-Fi is dual-band, and as fast as possible, and the Ethernet port is gigabit.

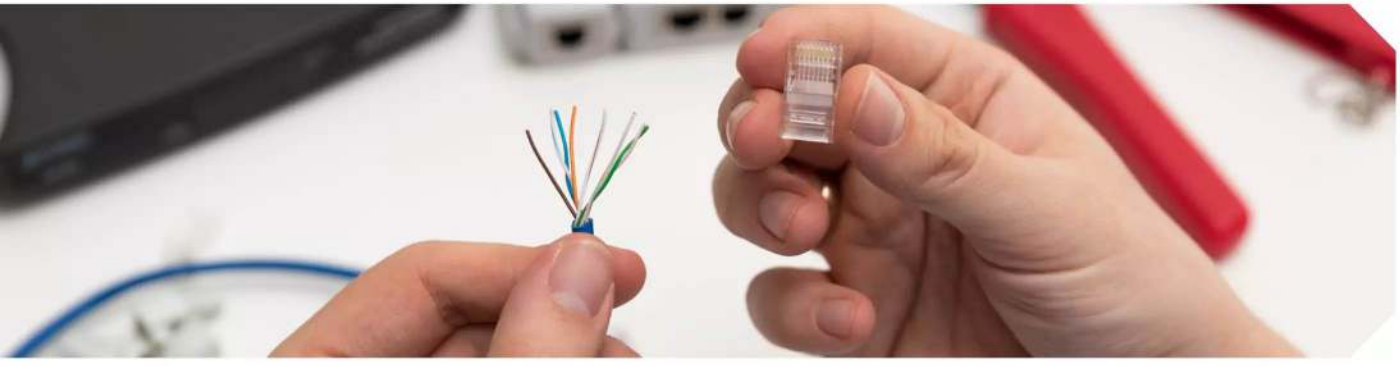
TOOL 8 **TRUNKING –** To neaten up the cabling in your home, consider opting for wall-mounted trunking to hide the cable and create network and power faceplates. Prices vary wildly, from £5 per metre, to £15 per metre, depending on the quality of the trunking. Self-adhesive is the easiest option, though.

TOOL 9 **FACEPLATES –** Faceplates are like plug sockets for networking. They contain one, two or four network sockets that you'll plug your device's Ethernet cables into. Behind the scenes, the Ethernet cable runs through trunking from one faceplate to the next, creating a house-wide network. Expect to pay around £4 for a double-socket faceplate.

TOOL 10 **POWER OVER ETHERNET –** If you're wanting to run the network to something like a security camera, or weather sensor, then you'll need Power over Ethernet. PoE switches offer gigabit connectivity as well as a small amount of power supply for the equipment in question. Expect to pay in the region of £50.

How to Wire an Ethernet Cable

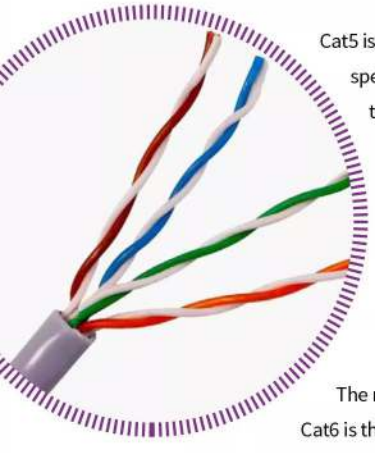
Although you can buy Ethernet cables of differing lengths, there may come a time when you need one that's a specific size. Similarly, if you ever come across a cable with a broken end, you'll need to fix it. Here's how to wire up an Ethernet cable.



Thankfully, you don't need to be a qualified electrician to be able to wire up an Ethernet cable, but you will need some tools at hand before you start. Before we get into the nitty-gritty of wiring, we need to take a look at the types of Ethernet cable available.

Cats

There are two types of Ethernet cable that you'll come across when you're cabling: Cat5 and Cat6. These are Category standard cables types, specifically standard 5 and standard 6. They are both used for networking and feature the same wiring inside the cable.

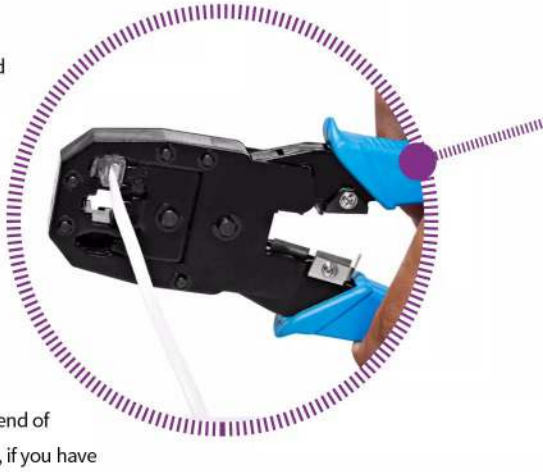


Cat5 is an older standard, but can still transfer speeds to and from switches and routers up to 1Gb/s – although it does have a bit of an issue with holding those speeds over time. Cat6, however, is the newer of the two, and fully supports 1Gb/s speeds over the network, and has the potential for up to 10Gb/s, although that would be pushing the cable's abilities to the maximum.

The main difference between Cat5 and Cat6 is the reduced Crosstalk. Electromagnetic signals that come from Ethernet cables can cause what's known as Crosstalk, when multiple cables are close to one another within a network. The interference caused by cables being too close to each other can slow speeds and also degrade the overall quality of the connection. Increased errors can result from Crosstalk, as well as lost packets. Through the incorporation of a new twisted cable design, and by improving the shielding of the cable, the likelihood of Crosstalk between Cat6 cables is greatly reduced, and therefore a better option.

Cabling

To begin with you'll need to make sure you have enough Ethernet cable, a set of RJ45 cable ends (or plugs, connectors), plastic cable boots, an RJ45 Crimping Tool and, if possible, a cable tester.



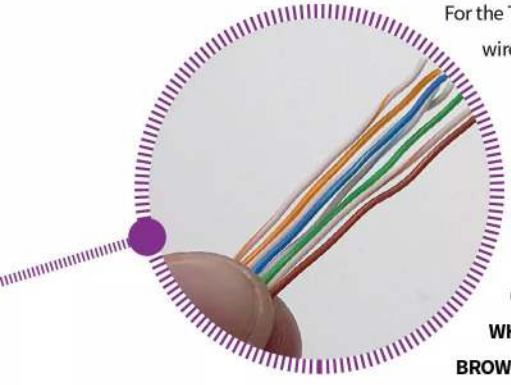
Begin by laying out one end of your Ethernet cable and, if you have one, place the rubber boot over the cable.

The rubber boot isn't important, it will protect the cable end clip from being snagged and broken. Strip off about two inches of the Ethernet cable's plastic sheath. Inside the Ethernet cable you'll see four pairs of wires, twisted into pairs – which is why Ethernet cable is also called Twisted-Pair.

Also, under the cable sheath, you'll notice a thin piece of plastic called the Rip Cord (or Dental Floss, depending on where you are). If you pull this, it will cut through a section of the sheath, allowing you to fold it over and around itself. This will help you cleanly cut away the plastic sheath without damaging the wires underneath. You won't need to use the Rip Cord to slice away much, around half an inch. When you've folded back the plastic sheath, cut it off (called Fluting), and cut the Rip Cord.

The four pairs of wires are broken up into colours: A blue pair, orange pair, green pair and brown pair. Individually they're called white blue/blue, white orange/orange, white green/green and white brown/brown.

There are two standards of Ethernet wiring: T568A and T568B. Most companies and engineers will use the T568B standard (as we understand the US Government requires type A when used for wiring done under federal contracts, however). In short, as long as both ends match, and any wall sockets you plug them into match, then it really doesn't matter.



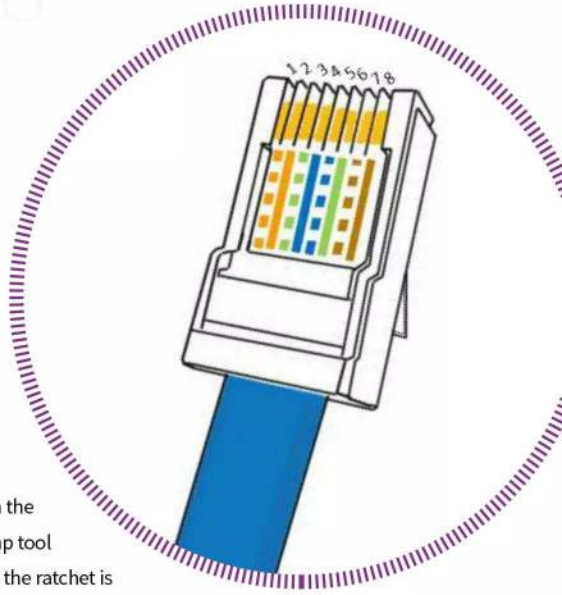
For the T568B standard, untwist the wires into the following order:

WHITE/ORANGE
ORANGE
WHITE/GREEN
BLUE
WHITE/BLUE
GREEN
WHITE/BROWN
BROWN

Now you will need to grab one of the RJ45 cable ends and identify Pin 1. To do so, hold the cable end with the clip facing away from you. Pin 1 is the first pin on the left.

Snip the cable until there's about 1.5-inches free from the edge of the plastic Ethernet sheath. Hold the wires, and arrange them in the order shown above. Firmly insert the wires into the cable end until the copper wire at the centre of each wire is touching the back of the cable end, and ensuring that the following colours match the pins:

PIN 1: White/orange
PIN 2: Orange
PIN 3: White/green
PIN 4: Blue
PIN 5: White/blue
PIN 6: Green
PIN 7: White/brown
PIN 8: Brown



Once the wires are in place, grab the crimp tool, and place the cable end in the appropriate slot in the tool. Squeeze the crimp tool all the way down until the ratchet is released (if it has a ratchet function).

Run the rest of the Ethernet cable out to the desired length, giving yourself a few extra inches in case you mess up one of the ends, and repeat the process to crimp another end on to the cable.

Grab the cable tester, and check your ends. If all's gone to plan you should have a length of Ethernet cable that's good for networking with.

The Extra Mile

You can of course go the extra mile with your cabling, to make it look neat and tidy. But you will need to plan this out carefully.

With your wired network plan, ensure that you've measured the distances to and from the equipment on the network to the router. You can then opt for trunking that will fit to the walls and ensure the cables are neatly hidden, along with having network and power points mounted on the walls, for ease of use.

Remember, you might also need to ensure that you can drill through the floor/ceiling to run the cables to the upper or lower floors of your home. In some cases, it's best to opt for good cabling on each floor, with a very good powerline adapter between the floors to extend the network.

Installing Your Wired Network

With everything now ready, tools in place and equipment ready to go, it's time to install your network and get it up and running. Take the time to plan a few preliminary steps, and have everything at hand to ensure it's as easy a setup process as possible.

STEP 1 **PLAN AHEAD –** Take a moment to get a plan together. Where are you going to start, what is the route you're going to take, check the house for potential obstacles you're likely to come across when you're cabling. Have you got powerline adapters and extenders ready?

STEP 2 **CABLE ENDS –** If you're plan is looking good, and you've got a route ready, then lay out your cable and start making up the ends. If you're using trunking, make sure it's all cut to size and ready to stick/drill on to the wall.

STEP 3 **SWITCHES –** With the cables all planned out, and the ends being made, make sure that the switches are in the right place, and that there's enough ports to feed the number of devices that are going to connect to them.

STEP 4 **POWERLINE AND EXTENSION –** Finally, make sure that the powerline adapters are in place, plugged in and talking to each other. Plus, ensure that any Wi-Fi to Ethernet extenders are in place, and again, talking to the router's Wi-Fi signal.

The Installation

If you've got a good plan, then the rest of the process should go relatively easily. Be prepared, though, for the inevitable hiccup here and there. The golden rule to networking is: keep it as simple as possible.

If you've taken the time to cable up your own ends, it's always worth just double-checking that they're in good working order. Test the signal with a cable tester, and give the ends a little tug to make sure they're crimped on the cable tightly enough, and won't fall off should you catch them with your feet when under the desk.

When cabling, it's always best to secure it in small lengths. If you've measured the distance to and from one network location to another, such as from the router to a living room switch, then take the time to lay the cable and pin it to the edge of the room (or within trunking), every couple of feet. It might seem like overkill, but it'll keep the cable as neat as possible.

When you run each cable to its switch, or device, it's best to test that device or check the port on the switch to make sure that the connection is working. There's nothing worse than spending all day running several metres of cable only to find you've snagged it somewhere along the line and it's now no longer working. Which means you'll need to trace the cable back and see where it went wrong. If you got loads of cable, then it's even more difficult.

Powerline adapters and Wi-Fi extenders can be the worse offenders when setting up a network. Often they're working perfectly fine one minute, then stop talking to each other when you've completed everything. This happens usually because you've moved something in the way of the signal, in the case of Wi-Fi, so you may need to do a quick Wi-Fi survey again to test the signal strength. As for powerline adapters, they don't often stop working, but they can un-pair with each other when there's another couple of adapters on the electrical wiring. It's a simple case of powering off all the powerline adapters, then powering pairs back up again. They will eventually all 'see' each other and the network will be back up and running.

If you've run cable outside to any outbuilding, make sure that you've marked the location of where the cable goes into the ground, where it's laying and where it comes out. If it's not under the ground, then make sure it's marked where it lies. You don't want to lose connection in the summer due to digging up the garden.

Finally, have fun. Wiring up the house for a home network is a great project. Yes, it can be a bit of a headache at times, and it doesn't always go quite to plan, but it's going to be a solid, and dependable setup when you're done and everything is working.

NETWORKING HOME ENTERTAINMENT

Most of our home network setup is geared towards creating an amazing entertainment system. From 4K smart TVs, with Netflix and other streaming services, to the latest games consoles; and let's not forget the new addition to our homes: AI assistants, such as Google Home.

The home network can be under a lot of strain, so you'll discover how to get the most from them in these coming pages. From the best advice on setting up your home network for entertainment, and what equipment to use, through to setting up and using Google Home, and even Google Stadia.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Networking an Entertainment System

One of the most common setups when it comes to networking is the all-important home entertainment system. This can be as simple as a smart TV and the latest console, or as complex as an entire home theatre setup with AI integration.

Someone's home entertainment system is a very personal setup. While most will have a smart TV, some form of Blu-Ray or DVD setup, and perhaps a games console, others will opt for more exotic components such as Wi-Fi speakers, Google Home automation integration (or some other AI assistant), multiple consoles, a retro games setup via emulation on a Raspberry Pi and much more.

It's impossible to target just one specific setup, but we can make some educated guesses and suggest the best possible way forward for those wanting to get all their entertainment equipment online and talking to each other.

Main Setup

Before we go into depth regarding the individual components, it's worth looking at the base installation first. By this we mean the main networking component that will feed all your entertainment equipment. For most people, the obvious choice is placing the router in the same room as the home entertainment kit – such as the living room. Nine out of ten homes will have a living room that takes up most of the downstairs floor, so having the router near the entrance to the living room will place it as near to the centre of the house as possible. Of course, if you're the tenth house, then your setup will need to be altered.

With a router in the living room, you're in easy reach of its built-in switch ports, as well as having access to a good Wi-Fi signal. You're also cutting down on the amount of networking equipment between the TV, for example, and the router itself.

If you can't have the router in the living room, then in our opinion using a combination of a powerline adapter and a switch is the best option. In this scenario you're able to cable up all the necessary equipment to the switch, which can then feed into the powerline adapter, and in turn can feed into the router via its paired partner. There are other components that may require more networking kit, so let's break some of them down.

TV

All TVs sold now are smart enabled, which means they have the capacity for going online and streaming content. This of course means they'll come with either an Ethernet port or Wi-Fi, or even both. The TV is where a lot of bandwidth is going to be heading, so it makes sense to connect the TV to a gigabit switch – despite the fact that most, if not all, TVs only have 100Mb/s Ethernet ports built into them (despite the manufacturers claiming you need Cat7 cables for the best connection!).

100Mb/s though is perfectly fine for transferring the data needed for 4K and even 8K content, as the TV itself isn't doing anything else other than sorting the data into a viewable image and sound – and its processing can handle the hard work there. For the TV then, an Ethernet cable into

a switch, fed into a powerline adapter is the perfect setup. If not, try and get it working on the 5GHz channel and have it as close to a good wireless network extender as possible.

Games Consoles

The three main games consoles: Playstation, Xbox and Switch are all capable of using Wi-Fi, but only the Playstation and Xbox have an Ethernet port. Surprisingly, all the consoles don't require a fast connection to the home network. Even though there's a lot of data to shift when gaming online, the requirement can easily be met by connecting all the consoles to the wireless network. However, if you want to squeeze the last drops of performance from your connection, then we'd recommend connecting the Playstation and Xbox to the wired network. This leaves the Switch using wireless, which will cut down traffic.

Media Computers/ Retro Emulators

There's a growing number of people who have opted for a media computer as part of their living room entertainment kit. These are often smaller, subtle base units, like the Raspberry Pi, that fit in nicely with the rest of the under-TV equipment, but can still run Windows, Linux or even macOS. These media centres can be used for streaming content from a local device, such as a NAS unit, or via the Internet. They're good for watching YouTube content, gaming and any other duties you'd expect from a computer.

The Raspberry Pi is also great as a retro emulation console, enabling you to play arcade, console and home computer titles from the last forty-plus years. With regards to these, we'd say put them on the wired network, since they're going to use a lot of bandwidth for the content, as well as updates to the OS. As for the Raspberry Pi, again, we'd say wired network, as we've always found the Pi's Wi-Fi lacking when it comes to streaming content. Other new releases such as the Sega Mega Drive Mini are mainly Wi-Fi enabled, and will work seamlessly on a wireless network.

AI Assistants

Most TVs and other entertainment equipment can be controlled with one of the AI assistants, such as Google Home. The AI assistants are all Wi-Fi enabled, and this is perfectly fine. What you're best doing is ensuring that there's a good 5GHz Wi-Fi network extender near to where the AI assistant is located. This will cut down on the traffic on the other channel and improve the bandwidth of the unit.

Blu-Ray/DVD units

While a lot of people use their games console as a Blu-Ray/DVD drive, there are some who either don't have a console or prefer the advanced features a specialised unit can offer. With these units, the connection to the network isn't as important as the connection to the TV, so while they may have Ethernet connections, Wi-Fi will suffice (unless they don't have Wi-Fi access, of course).

NAS

One final element to the home entertainment setup is the addition of a NAS unit. These mini-servers are ideal for storing movies and TV shows, game files that a retro emulator can access and storing a lifetime of digital photos. In an ideal world, you'd have the NAS connected directly to the router's switch, so all traffic to it has the maximum bandwidth. However, if it's not located near to the router, make sure it's connected to a gigabit switch.

Powerline Adapters/Network Extenders

If you're stuck for which one to use for your entertainment equipment, we'd say opt for the powerline adapter (as fast as you can get), and a gigabit switch. The equipment that requires Wi-Fi is probably within reach of the router's signal, and if not, you can add a Wi-Fi extender elsewhere in the room and it'll feed the wireless kit under the TV.

Anything Else (such as a Roku etc.)

Assess the needs of its bandwidth, if it's going to be using a lot of traffic online or on the network, try and connect it to the wired network, otherwise go for Wi-Fi and the best channel/speeds you can.

The Google Home Collection

There are now six different Google Home devices to choose from, including the tiny Home Mini and the new Google Home Hub. The specification and size varies greatly, so if you are not yet sure which Home speaker is best for you, check out all of the details here.

Google Home Max

Key Features: Meet Google Home Max, he helps you to hear every note as the artist intended and feel every beat with heart pounding bass. It's the ultimate speaker, made for your music. The advanced hardware delivers deep bass and crisp treble in stunning stereo sound. It analyses, tunes and updates itself automatically, so all you need to do is listen. The far-field voice control allows Max to hear you across the room, even while the music's playing.
Final Thoughts: The best audio-only based product in the Google Home range.

Dimensions
- Width: 13.2" (336.6 mm)
- Height: 7.4" (190.0 mm)
- Depth: 154.4 mm
- Power cable: 2 m

Weight
- 11.7 lbs (5,300 g)

Colours
- Chalk, Charcoal

Materials
- Acoustically transparent fabric
- Rigid polycarbonate housing
- Silicone base

Supported audio formats
- HE-AAC, LC-AAC, MP3, Vorbis, WAV (LPCM), Opus, FLAC with support for high-resolution streams (24-bit/96 KHz)

Wireless
- Wi-Fi • Bluetooth
- 802.11b/g/n/ac (2.4GHz/5Ghz) Wi-Fi for high-performance streaming
- Chromecast built-in
- Bluetooth® 4.2

Speaker
- Two 114 mm high-excursion (+/- 11 mm), dual voice-coil woofers
- Two 0.7" (18 mm) custom tweeters
- Sealed rigid housing
- Acoustically transparent fabric

Mics
- Far-field voice recognition supports hands-free use
- 6 mic array

Processor
- Quad-core ARM
- 1.5 GHz 64 bit quad-core ARM® Cortex™ A53

Sensors
- Capacitive touch sensor
- Ambient light sensor
- Accelerometer

Power
- AC Power 100-240 V, 50/60 Hz

Ports & Connectors
- USB-C™ • 3.5 mm jack
- USB-C1
- 3.5-mm jack with analogue audio input

AC power
- 1USB Type-C and USB-C are trademarks of USB Implementers Forum.

Operating system
- Android • iOS

Other
- Multi-room audio

Google Home Mini

Key Features: A powerful little helper; Google Home Mini keeps you informed and up to date with instant news, weather and commute updates without lifting a finger. Master the kitchen; Google Home Mini helps with timers, step-by-step recipes, and conversions and substitutes. Start your smart home; it's always improving with seamless connections to the latest compatible smart lights and thermostats.
Final Thoughts: The budget range of Google Home offers a great product for the price.

Dimensions
- Diameter: 98 mm
- Height: 42 mm (1.65")
- Power cable: 1.5 m

Weight
- Device: 173 g
- Power adaptor and cable: approximately 75 g

Colours
- Chalk, Charcoal, Coral. Aqua

Materials
- Durable fabric top
- External enclosure made from 20% post-consumer recycled plastic
- Non-skid silicone base

Supported audio formats
- HE-AAC, LC-AAC, MP3, Vorbis, WAV (LPCM), Opus, FLAC with support for high-resolution streams (24-bit/96 KHz)

Wireless
- Wi-Fi • Bluetooth® support
- 802.11b/g/n/ac (2.4 GHz/5 Ghz) Wi-Fi
- Chromecast and Chromecast Audio built-in
- Bluetooth® 4.1 input support

Sensors
- Capacitive touch

Speaker
- 360 sound with 40-mm driver

Mics
- 2-mic array
- Mic switch

Power
- 5 V, 1.8 A

Ports & Connectors
- Micro USB port

Operating system
- Android • iOS

Google Nest Hub

Key Features: See your life in one view and get things done hands-free. Google Nest Hub helps you make the most of moments at home. With Voice Match, get your calendar, commute, reminders and more right on the home screen, for example "Hey Google, show me my calendar. " You can even get the news, make a shopping list and place calls to friends, family and local businesses. Voice-control compatible lights, cameras, TVs and more from a single dashboard.
Final Thoughts: Entry-level, video based addition to the collection.

Dimensions
- Depth: 67.3 mm (2.65")
- Width: 178.5 mm (7.02")
- Height: 118 mm (4.65")
- Power cable: 1.5 m

Weight
- 480 g (16.9 oz)

Colours
- Sand, Aqua, Chalk, Charcoal

Display
- 177.8 mm (7") LCD touch screen

Speaker
- Full-range speaker

Microphones
- 2-mic array

Sensors
- Capacitive touch

Connectivity
- Wi-Fi and Bluetooth® support
- 802.11b/g/n/ac (2.4 GHz/5 Ghz) Wi-Fi
- Bluetooth® 5.0 support

Power
- 15 W power adaptor

Ports
- DC power jack

Google Home

Key Features: Simplify your everyday life with the Google Home, a voice-activated speaker powered by the Google Assistant. Use voice commands to enjoy music, get answers from Google and manage everyday tasks. Google Home is compatible with Android and iOS operating systems, and can control compatible smart devices such as Chromecast or Nest.
Final Thoughts: Perfect for the first time user, features a host of abilities.

Dimensions
- Depth: 67.3 mm (2.65")
- Width: 178.5 mm (7.02")
- Height: 118 mm (4.65")
- Power cable: 1.5 m

Weight
- 480 g (16.9 oz)

Colours
- Sand, Aqua, Chalk, Charcoal

Display
- 177.8 mm (7") LCD touch screen

Speaker
- Full-range speaker

Microphones
- 2-mic array

Sensors
- Capacitive touch

Connectivity
- Wi-Fi and Bluetooth® support
- 802.11b/g/n/ac (2.4 GHz/5 Ghz) Wi-Fi
- Bluetooth® 5.0 support

Power
- 15 W power adaptor

Ports
- DC power jack

Operating system
- Android • iOS

Google Nest Mini

Key Features: Meet the second generation Nest Mini, the speaker you control with your voice. To play your favourite music from Spotify, YouTube Music and more, just say "Hey Google". It sounds bigger and richer with 40 percent stronger bass than the original Mini. Ask your Google Assistant for help and get the best of Google – weather, news, or almost anything. Hear your personalised schedule, commute and reminders. Set timers and alarms and even turn on the lights. Nest Mini is compatible with hundreds of smart devices, such as lights, thermostats and TVs.
Final Thoughts: The latest and best version of the Google Home range.

Dimensions
- Diameter: 98 mm (3.85")
- Height: 42 mm (1.65")
- Power cable: 1.5 m

Weight
- Device: 181 g

Colours
- Colours, Chalk, Charcoal, Coral, Sky

Materials
- Durable fabric top made from 100% recycled plastic bottles External enclosure made with at least 35% post-consumer recycled plastic

Connectivity
- Wi-Fi • Bluetooth® support
- 802.11b/g/n/ac (2.4 GHz/5 GHz) Wi-Fi
- Bluetooth® 5.0
- Chromecast built-in

Power and ports
- 15 W power adaptor • DC power jack

Speakers
- Google Assistant built-in
- 360-degree sound with 40 mm driver

Mics
- 3 far-field microphones
- Voice Match technolog

Sensors
- Capacitive touch controls
- 3 far-field microphones

Processor
- Quad-core 64-bit ARM CPU 1.4 GHz
- High-performance ML hardware engine

Operating system
- Android • iOS

Google Nest Hub Max

Key Features: Make your smart home even smarter. Nest Hub Max works with hundreds of smart home devices, including lights, TVs and thermostats, allowing you to easily control them all from one place. You can also control compatible TVs, speakers and game consoles from Nest Hub Max with your voice or from the screen. Turn them on and off; control the volume, play, pause and search.
Final Thoughts: Adds video based features to the Google Home, a must!

Camera
- 6.5 megapixel camera with 127-degree wide field of view and auto-framing
- Face Match technology
- Quick Gestures
- Mic + camera switch

Dimensions
- Depth: 101.23 mm (3.99")
- Width: 250.1 mm (9.85")
- Height: 182.55 mm (7.19")
- Power cable: 1.5 m

Weight
- 1.32 kg (2.91 lb.)

Colours
- Chalk, Charcoal

Display
- 10" HD touchscreen (1280x800)

Speakers and mic
- Stereo speaker system
- Google Assistant built-in
- Stereo speaker system (2 x 18 mm, 10 W tweeters, 1 x 75 mm, 30 W woofer)
- Far-field microphones
- Ultrasound sensing
- Voice Match technology

Sensors
- Ambient EQ light sensor

Connectivity
- Wi-Fi and Bluetooth support

Wi-Fi
- 802.11b/g/n/ac (2.4 GHz/5 GHz) Wi-Fi
- Bluetooth® 5.0 support
- Chromecast built-in
- 802.15.4 (at 2.4 GHz) thread support

Power
- 30 W power adaptor

Ports
- DC power jack

Operating system
- Android • iOS

Google Home First Time Setup

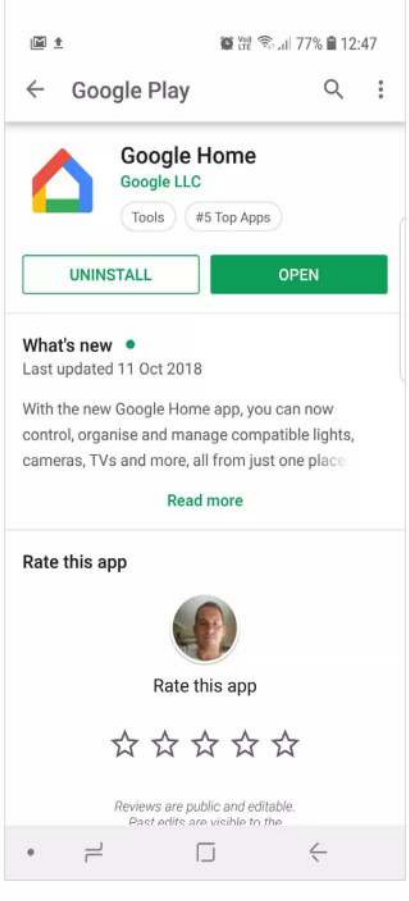
Setting up your Google Home device properly for the first time will make using it much easier, so take the time to get things right. You will need to have the speaker, an Android device, a Google account and a working Wi-Fi connection that both Android and Home devices can connect to.

Setting Up Google Home

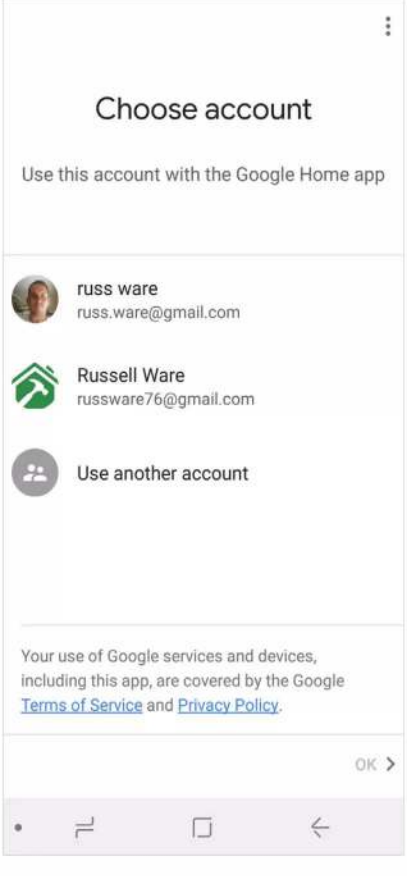
All of the setup for your Google Home speaker is done through the Google Home app for Android. Use this app for future access and changes to the settings.

STEP 1 Plug in your Google Home device and wait for the audio cue to show it is ready to be set up. Make sure that the switch that controls the microphone is set to "On". If you accidentally turn the microphone off on your speaker, the device will inform you accordingly.

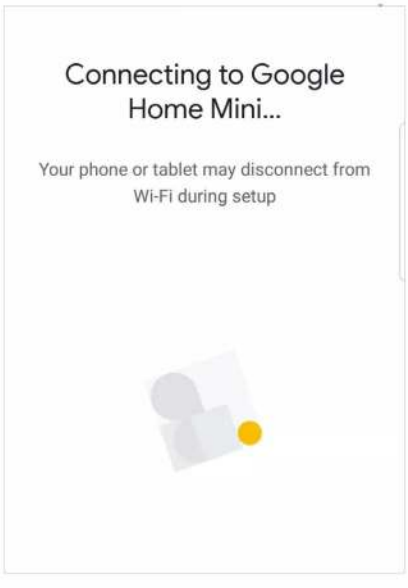
STEP 2 Currently, Google Home is only available for Android devices, and most have it pre-installed. If you don't already have it, find the app on the Google Play store, download and install it on your mobile device (phone or tablet). Once installed, open the app.



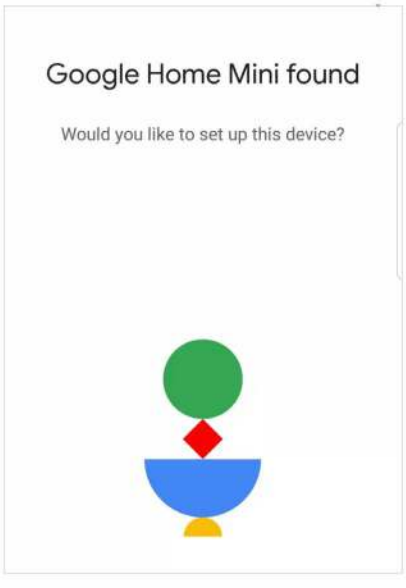
STEP 3 You will need to make sure that your mobile device is connected to the same Wi-Fi network you intend to use for the Google Home speaker. It won't work if you are using a 4G network to connect. Once connected, open the Home app and confirm which Google account you will use to log in.



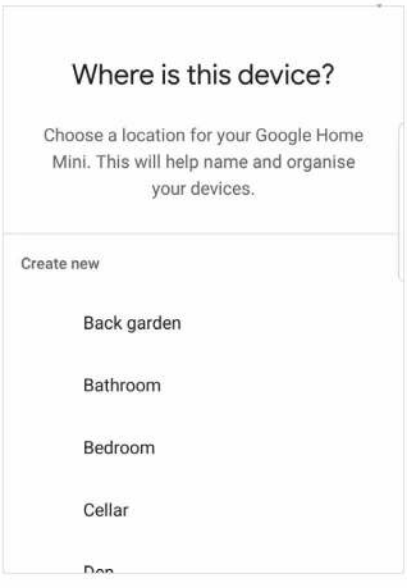
STEP 4 The Google Home app scans for nearby devices that are plugged in and ready to set up. If no devices are found, and you're setting up a device, tap Yes. Make sure that you're near the Google Home device that you're setting up and it's plugged into a wall socket. Then tap Next.



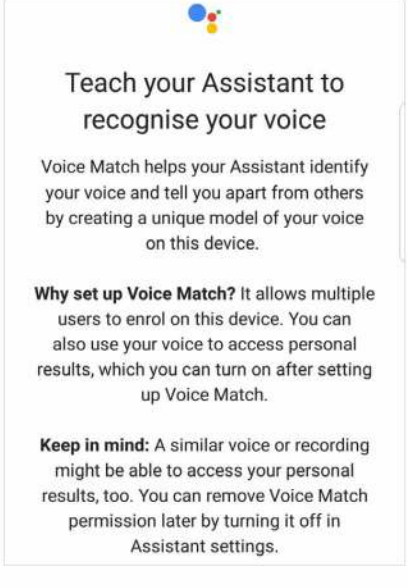
STEP 5 Hopefully your device will be found by the app, displayed on screen and you can then tap Next to continue. If you are setting up multiple devices, select the one you want to set up first, and then tap Next. The app will now connect your phone to your new Google Home ready for configuration.



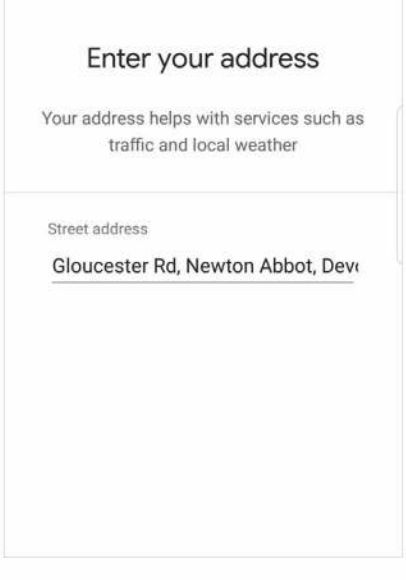
STEP 6 You should hear a sound on your speaker to show it is connected. You can now continue the setup by selecting the room it will be in (this is just to identify the speaker), choosing your region, and setting the assistant language you want to use. Once done, you will need to connect to your Wi-Fi network.



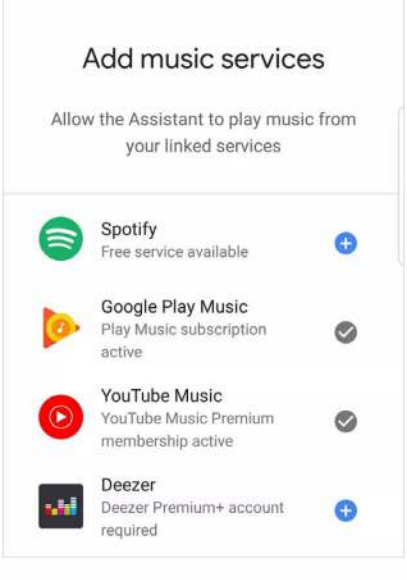
STEP 7 Next, to improve your Google Home experience, set up Voice Match. Voice Match allows multiple users to use the same device and get personalised results. Follow the prompts on screen to teach Google to recognise you. You can remove Voice Match settings later if you wish.



STEP 8 The Google Home app will ask for access to use your location to pre-fill your address. This is the address where your device is located. If you allow access, your address will be pre-filled; otherwise, you will need to enter it manually. When your address is entered tap Next.



STEP 9 You can now add your favourite services, for example music. Spotify, Google Play Music, YouTube Music and Deezer are just some of those available. If you add more than one, you will need to choose a default music service. Follow the further on-screen prompts to complete the setup.



All About Google Stadia

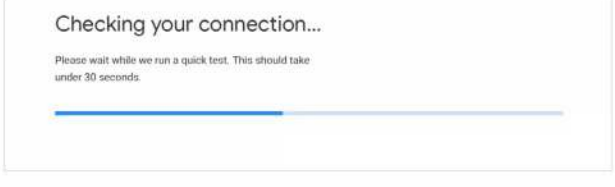
With their Stadia project, Google hopes to revolutionise how we play games in the home and on the move. Their vision for the future is one where it is possible to play games on virtually any hardware without the need for expensive consoles or high-end desktops. Let's take a look at the hardware and explain how it works.

Stadia Speed Test

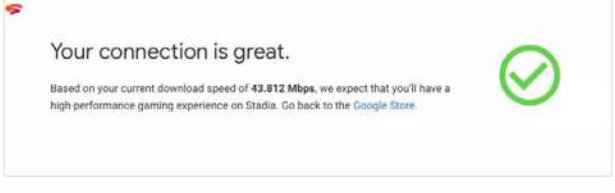
Before you begin your Stadia set-up, you need to ensure that your Internet connection is fast enough. Google has provided an online tool to do just that.

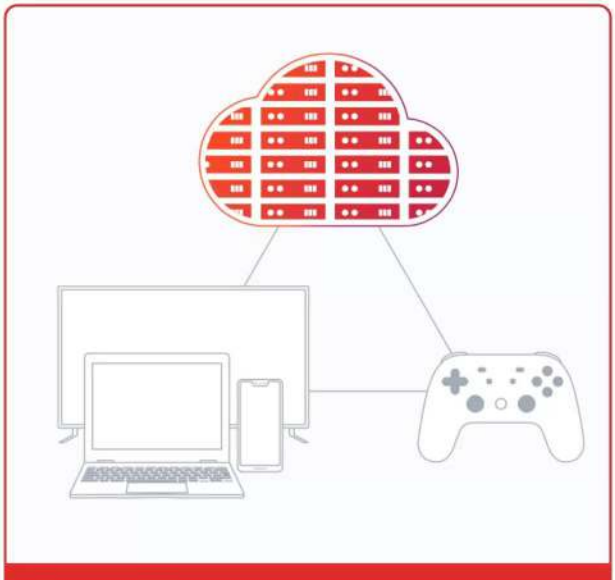
STEP 1 Open a web browser, preferably on the device with which you intend to use Stadia, and enter the following URL: projectstream.google.com Before you start testing your Wi-Fi speed you are advised to limit web traffic, such as downloads or streaming.

STEP 2 Once your Wi-Fi connection is free of other users, and clear of apps, tap the blue Check Now button on the left side of the web page. This activates the process, so you can simply sit back and wait for the results to appear.



STEP 3 When your Internet connection test is complete, it displays the results; this should take no longer than 30 seconds. These come in the form of a green tick for a pass and a red cross for a fail. A fail essentially rules out Stadia compatibility.





How Stadia Works

Google Stadia is a hardware-free, game streaming service that enables users to play a catalogue of game titles on a large variety of devices. All you need to play is the official Stadia joypad, a Chromecast, a screen and an Internet connection.

Stadia allows play on existing desktops/laptops computers, Smart TVs, tablets and smartphones. Play is enabled via the Stadia controller, which may indeed resemble a traditional joypad, yet is much more than that. Such unique features, exclusive to the joypad, include the ability to capture and share your gaming footage directly to YouTube.

So basically get your device online, connect your joypad and press play, that's it!

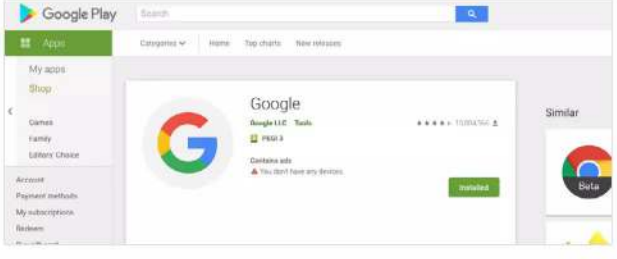
Getting Started with Stadia

Are you ready to play some games? Let us take you through the set-up of your Google hardware with your monitor or TV so you can press Start with Stadia.

STEP 1 Using a mobile device (smartphone or tablet), you need to open the App Store on iOS, or Google Play on Android, and download the Stadia application. At this point, enter the invite code that was emailed to you at purchase.

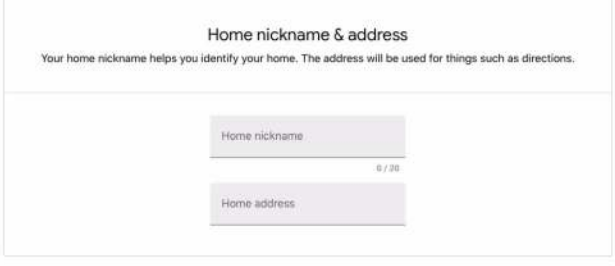
STEP 2 If you wish to use your Google Stadia on your TV, you need to set up your Google Chromecast Ultra first. NOTE: You need an Android or iOS mobile device to complete setting up Chromecast.

STEP 3 On your Android device, you need to download the latest build of the Google Home App. Sign in using your Google account and then connect the Chromecast to your TV via the HDMI input and USB for power.

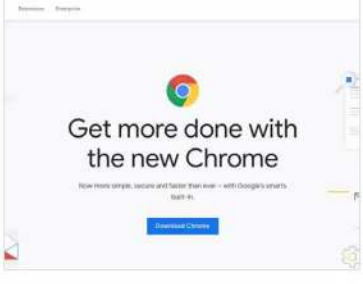


STEP 4 Ensure your Android mobile device connects to the same Wi-Fi network you want to link to your Chromecast Ultra. Open the Google Home app and, from the home screen, tap Add +>Set up device>Set up new devices.

STEP 5 Find your Chromecast Ultra from the list of new devices. Once selected, follow the instructions and the Google Home app pairs your device to your home network, thus enabling Stadia streaming via your Chromecast.



STEP 6 Finally, if you wish to play games on your desktop or laptop, you need to open a web browser on the video device you wish to use and visit: google.com/chrome and download the latest build of the Chrome browser.



What's in the Box?

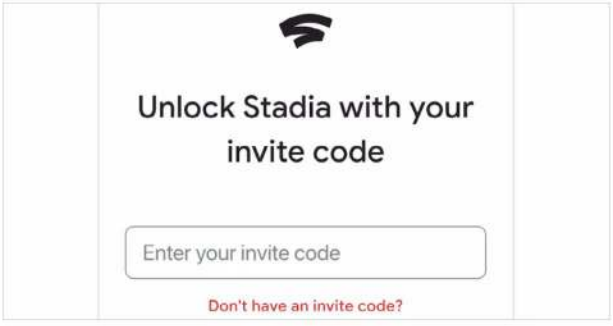
Having confirmed Wi-Fi compatibility, let's start unboxing your Google Stadia. Here's what's in store when you peel back the lid of your Stadia Premiere Edition.

- A Single Google Stadia Controller
- A Chromecast Ultra
- A Mains Charging Cable
- Three Months Subscription to Stadia Pro
- Documentation

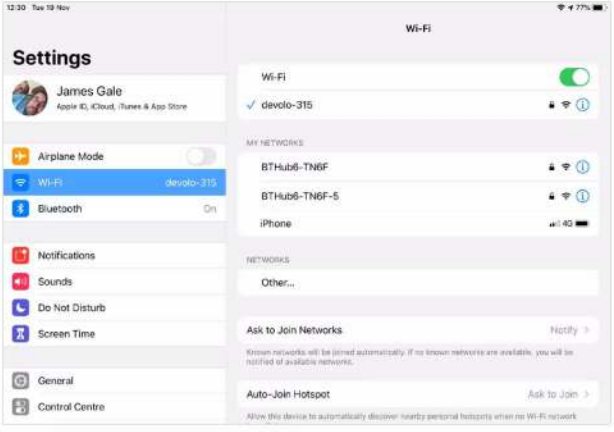
STEP 7 Now let's turn our attention to the Google Stadia Controller, once out of the box you need to ensure that your device is fully charged before you start setting up the controller itself.

STEP 8 Once the device is fully charged, unplug the power cable. Press the Stadia logo button on the controller for two seconds to turn it on. A vibration confirms that you have powered up the device.

STEP 9 Switching to your mobile device, open the Stadia app, using your invite code (if required), and tap the Controller icon to the top right, you may need to enable Location access first. Select your controller from the list of devices.



STEP 10 Your Stadia controller starts to vibrate to confirm connection and then, when prompted, tap Yes on the mobile app. Now tap Connect to your network using the same account as your mobile device.



STEP 11

You need to enter your Wi-Fi password and then tap Connect to Wi-Fi to complete the process. Your controller may automatically install an update, if it is required, and then you are ready to play.

Google Stadia Controller Controls Explained

With Stadia, the controller is the console, so understanding how this all-in-one device works is going to be essential to your gaming experience.

Understanding the Status Light

Blinking White: Your controller is charged and ready to access your network via the linking code.

Solid White: The controller is powered on, linked to a screen and ready for use.

Blinking Orange: The controller needs connecting to a Wi-Fi network.

Solid Orange: The controller is charging, when complete, the light turns off.

Capture and Share Footage

If you have a YouTube channel, or simply want to share your gameplay footage via social media, you can capture gaming using this button. Press once to take a screenshot or hold to capture video.

Stadia Official Specs

Weight: 268g

Dimensions: 163mm x 105mm x 65mm

Internals: Custom 2.7GHz hyper-threaded x86 CPU with AVX2 SIMD and 9.5MB L2+L3 cache. 16GB of RAM with up to 484GB/s of performance. SSD cloud storage

Colours: Clearly White, Just Black, Night Blue & Wasabi

COMBAT NETWORK ISSUES

There's a lot that can be done in the background to keep your network in order, and in this chapter you'll learn some of the best tools to help you combat network issues and performance lag. We look at some of the most used, and not so well known, commands for both Windows and Linux users, that can trace packets across the Internet, or just connect to an old school Bulletin Board Service.

There's also great troubleshooting tips, tricks and advice. Keep these pages handy, as they'll come in useful for those times when something on your network stops communicating with everything else.

Windows Networking Command Cheat Sheet

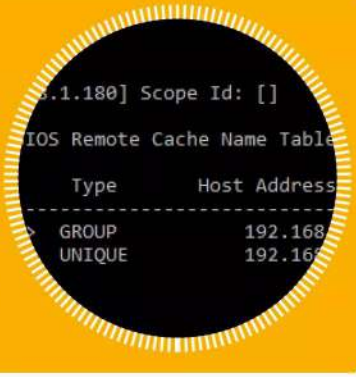
Windows contains numerous built-in commands for networking. These utilities and tools will help you discover problems with your network, as well as help you improve performance and monitor what's going on.

.: Telnet

This is a command that can be used to connect to another computer, or manage a router or switch. You can send and receive files, send commands and much more. With Telnet you're also able to connect to active Bulletin Board Systems. For example, enter: telnet bbs.balcos.net

.: NbtStat

The nbtstat command is a diagnostic tool for NetBIOS over TCP/IP. Its primary design is to help troubleshoot NetBIOS name resolution problems. It will display the human-friendly names of devices on the network along with their IP addresses.



.: Hostname :.

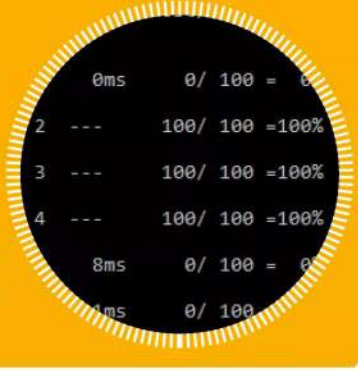
If you dicover that you are struggling to find the name of a Windows computer you've got on your network, simply enter the hostname command and it'll display the computer's local name.

.: Arp

Stands for Address Resolution Protocol and displays and modifies entries in the ARP cache, which contains one or more tables that are used to store IP addresses and their resolved Ethernet or Token Ring physical addresses.

.: Pathping

This is a handy command that combines the best elements of Ping and Tracert. It will display the latency and packet loss between one computer and another (either locally or on the Internet), and after 300 seconds display a detailed report.

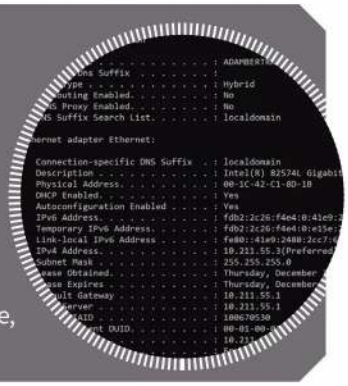


.: Ping :.

Ping is probably the most familiar of networking command line tools. With it you're able to send an echo request to a device locally, or on the Internet, and receive a reply.

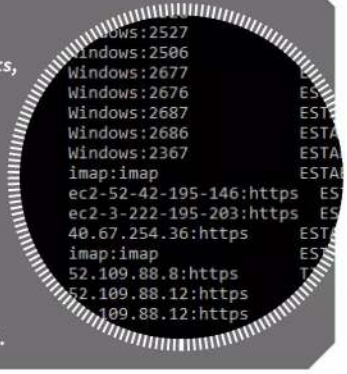
.: Ipconfig

Probably one of the most used networking commands in Windows. Ipconfig will display information on the local computer's network interfaces, such as IP addresses (both IPv4 and IPv6), Hostname, gateway and so on.



.: Netstat

Stands for Network Statistics, this command will display connection information, routing tables and so on. Entering the command will display what's going on while you use the network and Internet. Use netstat -e for interface stats.



.: Netsh :.

This is a complex command that, when entered, will put you into a different shell, the Network Shell (netsh). It's capable of displaying and configuring information regarding a computer's networking setup.

.: Tracert

Stands for Trace Route will examine the path to a remote computer, either locally or on the Internet. For example, entering tracert google.com will display the hops taken over networking devices to get to one of the Google servers.

.: Nslookup

This tool can be used to look up and diagnose the Domain Name System (DNS), of a location on the local network or Internet.

.: Getmac

Every network interface has a unique Media Access Code assigned to it. Some routers are able to limit connection to the network by only allowing user-entered MAC addresses in. You can get the MAC address of a Windows computer by entering getmac.

.: Route :.

The Windows Route command allows you to view the device's routing tables. To do so, simply type Route Print. This will print the network interfaces, IPv4 and IPv6 route tables.

Linux Networking Command Cheat Sheet

Linux has many networking commands available to it. Some are built in to the OS, whereas others will need to be installed; but all are great in their own special way.

.: HTTPie

This is a single HTTP command that's designed for debugging and interaction with HTTP servers and other web services. There's lots of support, and it features a great looking UI.

.: Ping

One of the most used networking commands for troubleshooting and testing network connectivity. Ping works by sending Echo Request packets to a user-specified IP destination, and waits for a reply.

.: Wget :.

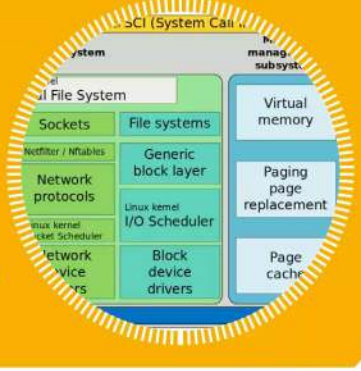
This is a handy command that combines the best elements of Ping and Tracert. It will display the latency and packet loss between one computer and another (either locally or on the Internet), and after 300 seconds display a detailed report.

.: cURL :.

cURLStands for Client URL, and transfers data to or from a network server using one of many supported protocols. It's perfect for shell scripts, as it can be used without user interaction.

.: Tc

Is used to configure traffic control, such as limiting the bandwidth use of a particular service to simulate Internet connections.



.: Ifconfig :.

Stands for Interface Configuration, and is used to display and configure the local network adapter. With ifconfig, you're able to view a computer's IP address, gateway and so on. Can also be used to setup a network port.

.: Whois

The whois command is able to process and display information about a user-specified domain name. For example, enter: whois google.com, for information on the Google.com domain.

.: Route

This command is used to show and manipulate the IP routing table for a Linux computer. With it you can setup static routes to specific hosts or networks.

.: Traceroute :.

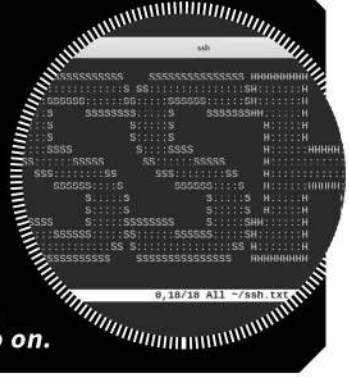
A tool used to diagnose and display the route of packets to and from user specified locations. It's great for finding slow areas of a network, so you can tweak any network extenders that the packets hit on their way to the location.

.: Nload

Can help you keep an eye on your network traffic and bandwidth usage in real time. It monitors incoming and outgoing traffic, using graphs, and provides additional information on the total transferred data and network use.

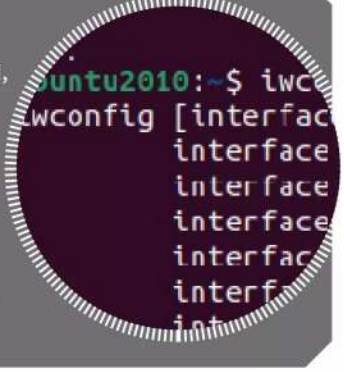
.: SSH

Provides a secure, encrypted connection between two devices on a network. With it, you can connect to other computers and run commands, transfer files and so on.



.: Iwconfig

Like the ifconfig command, but iwconfig is exclusively designed to work with wireless network interfaces. You can set parameters, such as SSID, frequency and so on.



.: Tcpdump :.

A famous networking tool that's a packet analyser to display TCP/IP and other network packets that are being transmitted to and from a Linux computer.

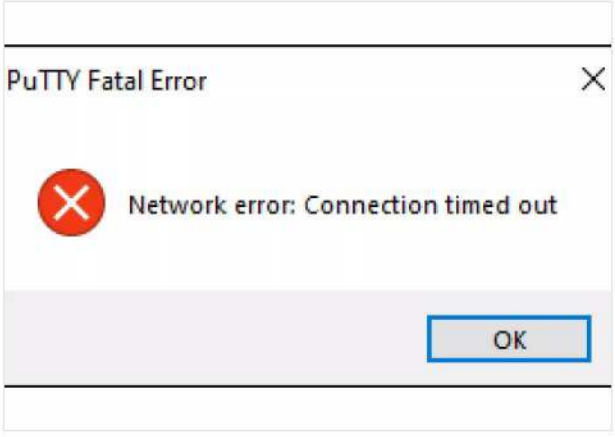
Troubleshooting Your Wi-Fi Network

Wired networks are often a lot more sturdy compared to a wireless network, but they're not bulletproof. Thankfully, problems can easily be fixed, so here are our top ten troubleshooting tips for solving wired network issues.

TIP 1 **SLOW OR NO ACCESS IN SOME ROOMS –** There's a good chance that the room in question has become a bit of Wi-Fi dead zone. Load up a network analyser and check the signal output in the room in question. If needs be, reboot any network extenders and the router.

TIP 2 **SLOW INTERNET –** This could be one of two things: a problem with the router and your network, or a problem with the ISP. Test the connection by directly plugging a device into the router's Ethernet ports. If the problem persists, then call your ISP. If it's okay, then turn off all your networking equipment and one-by-one power them up, while testing to find the culprit.

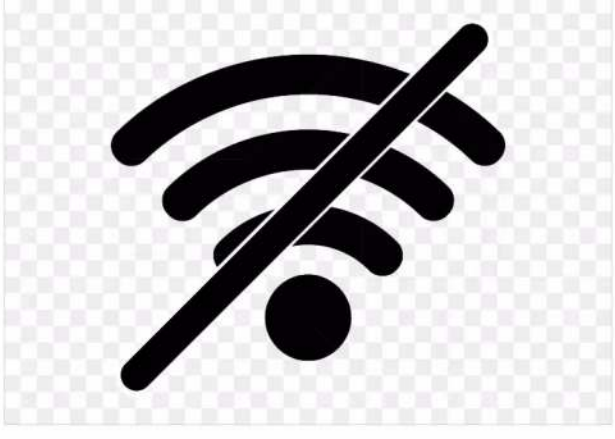
TIP 3 **REFUSAL TO CONNECT –** Occasionally, there's a device that will refuse to establish a connection with your wireless network. First thing to try is a physical Ethernet connection (if it has one). If it works, try re-installing the Wi-Fi drivers on the device. If that's not possible, try another Wi-Fi network; it could be a problem with the device's Wi-Fi card.



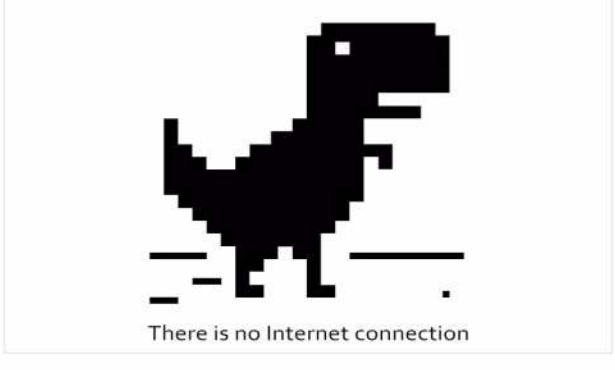
TIP 4 **RANDOM LOSS OF BANDWIDTH –** First check is to establish a pattern. Does it happen when you power on something else in the house, if so, it could be causing interference with the signal. Does it happen when a certain device is connected? Check the device, as it could be downloading a huge file, or it could have some form of malware.

TIP 5 **UNKNOWN DEVICE DISCOVERED –** If you maintain an orderly network, and you've just spotted an unknown device on your network, then you need to act quickly. If possible, drop the connection via the router's web interface, then change your access password. Check all devices for malware, ask other family members if they know who it could be. Worst case, change all passwords.

TIP 6 **WI-FI IS COMPLETELY GONE –** If nothing is connecting to your Wi-Fi, then the problem is likely with your router. Check the router, if you can access its web interface, and check the access logs and check for any recent updates (an update from the ISP could have damaged it). If a reboot doesn't fix it, contact your ISP.



TIP 7 **EVERYTHING WORKS, BUT NO INTERNET –** Check the indicator lights on the router, if the Internet LED is off, then reboot the router and wait for a connection. If the LED is on, but still no Internet, try installing a VPN and seeing if you can connect; it could be an issue with the ISP's DNS entries.



TIP 8 **FORGOT THE WI-FI PASSWORD –** If you've forgotten your Wi-Fi password, then you may need to factory reset the router. Use a paperclip and locate the tiny pin-hole (usually marked Reset). Poke the paperclip in for 30 seconds. Reboot the router. It should be reset back to its original settings and password.

TIP 9 **OVERALL POOR SIGNAL –** Providing your router is working well, check with a wireless device while standing next to the router. If it's okay, then the problem is likely a poor signal spread. Try and reposition the router, but don't put it in a cupboard, and see if that helps. If the signal is poor while next to it, there could be a problem. Try rebooting, otherwise contact your ISP.

TIP 10 **SPEEDS AREN'T AS ADVERTISED –** If your network extender or router isn't performing at the speeds it was advertised as, try the following. Ensure that the router's configuration is setup for maximum signal strength. If it has external antennae, move them around to change the signal spread. Reboot the router and any Wi-Fi extenders. Reposition the router and extenders for a better signal through walls and such.

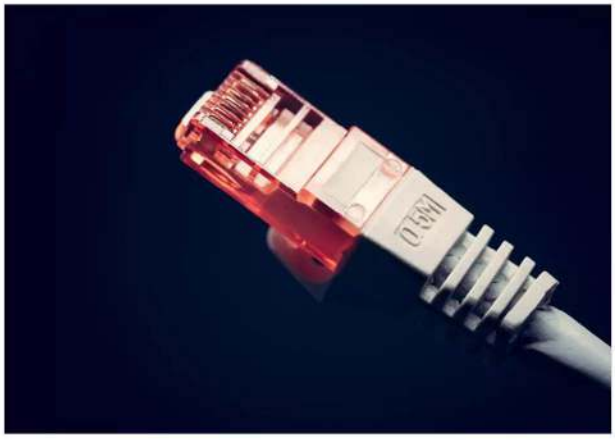
Troubleshooting Your Wired Network

Wired networks are often a lot more sturdy compared to a wireless network, but they're not bulletproof. Thankfully, problems can easily be fixed, so here are our top ten troubleshooting tips for solving wired network issues.

TIP 1 **NO CONNECTION (ONE PC) –** If your computer is reporting no connection, it's time to get behind the machine and double-check the Ethernet port. Check that the cable is fully inserted, as they can get caught by feet and pulled slightly. Check the cable end isn't damaged. If there's still no connection, check other machines (a router reboot may be needed).

TIP 2 **NO CONNECTION (ALL PCS) –** If all your computers and other devices aren't connecting, check any switches that they're connected to. Switch plugs, and even powerline adapters, can blow a fuse. Check your router's switch connection LED is lit up, if not try a different port. If all else fails, try direct connection to the router, as it could be faulty.

TIP 3 **CONNECTION KEEPS DROPPING –** One of the main reasons as to why wired connections keep dropping is a damaged, or poorly created network cable end. Check the cable with a cable tester, check the ends by giving them a pull. If they're loose, or the cable test fails, then replace the ends or the cable itself.



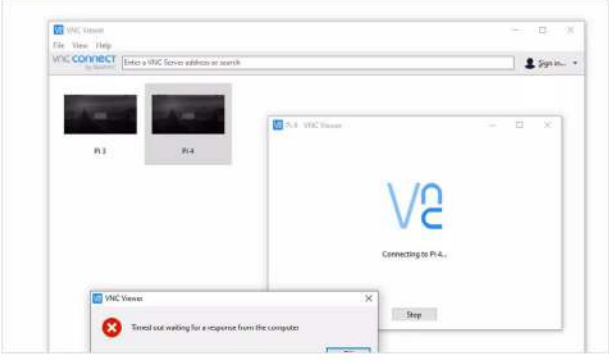
TIP 4 **POOR SPEEDS –** A main culprit of poor wired network speeds is the cable is too long. If the cable is over 100 metres (300 ft), then the signal will begin to drop significantly. If your cable is coiled up behind furniture, or in the loft space, try to shorten its length and check the connection speed.

TIP 5 **POOR CONNECTION, OR NO CONNECTION, BETWEEN POWERLINE ADAPTERS –** Often powerline adapters will lose their connection with each other. When this happens, power off both adapters, then power up one and after a few seconds power up the other. Wait for a few more seconds to see if the connection is okay. If it fails, try pin-hole resetting the adapters.

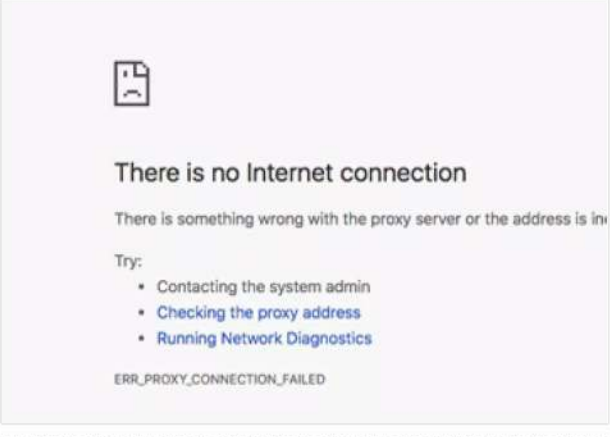
TIP 6 **POWERLINE ADAPTERS WON'T PAIR –** Sometimes powerline adapters won't pair with each other if there is already a set of powerline adapters already on the network. Turn off the existing powerline adapters, then power up the new pair. After a connection has been made, power up the existing pair.

TIP 7 **SOME PORTS ON A SWITCH CONNECT SLOW –** If you discover that some of the ports on your switch appear to be operating at 100Mb/s instead of 1Gb/s, then check the following. Ensure that device connected to the port has a 1Gb/s Ethernet port (some smart TVs don't). Check that the switch has more than one 1Gb/s port – some are 100Mb/s with a 1Gb/s uplink port.

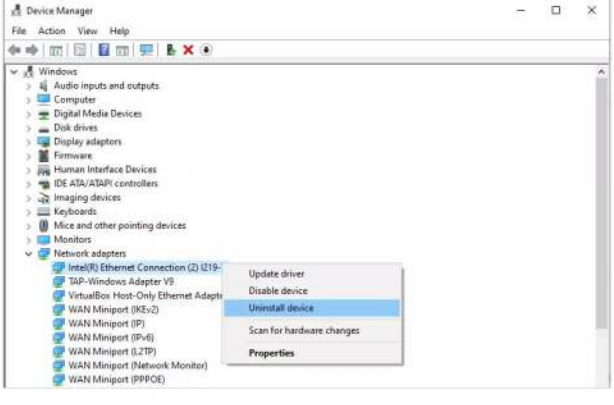
TIP 8 **CAN'T CONNECT TO ANOTHER PC –** If you're unable to connect to another PC on your network, check both connections to the router, on both PCs. Also, check that the PC you're connecting to isn't blocking your connection via the firewall.



TIP 9 **NO INTERNET CONNECTION –** No Internet connection usually means there's something going on with the router, so that should be your first port of call. Check the router's LEDs, if the Internet is off, try and reboot, otherwise use a phone to check the status of the ISP's services.



TIP 10 **PC WON'T CONNECT VIA ETHERNET –** This could be one of several things. First check the cable going into the Ethernet port; use a different cable if necessary. Check the drivers by opening Device Manager and locating the network device. Right-click and select Update Driver. Also, try Uninstall Device, then Search for New Devices.



HOW TO PROTECT YOURSELF

Being able to recognise a scam or virus is one thing, but you'll need to be able to protect yourself against possible attacks. We'll look at the top Internet security packages, from Bitdefender, Kaspersky and McAfee, as well as what encryption is and how to make it work for you.

Using a Virtual Private Network is an excellent way to improve your Windows security. We'll look at how a VPN works, what the best VPNs are and how to install and use one on your PC.


PAYMENT
OFFICE
SERVICE
EXCELLENCE
INDUSTRIAL
IDENTIFICATION

Types of Security Risk

There are more security risks for your computer than just the common, run-of-the-mill virus. The amount of digital use the average person has over the course of a week has increased significantly in just a few years, and with it comes a legion of security related issues.

Here Be Dragons

This isn't a definitive list of the possible threats available for the Windows user but here are ten modern risks that you face every time you power up your PC.

01 Viruses

Viruses have been around for as long as computers. They've moved on from simply displaying the name of the coder on the monitor, a kind of virtual vandalism, and now can disable and wipe the data off a hard drive in mere seconds.

02 Ransomware

Earlier in the year the UK was gripped in the clutches of the WannaCry ransomware infection. This particular infection exploited a vulnerability in Windows, and quickly spread throughout the NHS and other organisations, locking and encrypting the data on a computer until money was sent to those who unleashed it to the world.

03 Worms

Although a worm is a type of virus, it behaves differently in that it's goal isn't to alter or destroy system files. Rather, it's designed to replicate itself continuously until all the resources and space on the system are consumed. A bit of a nightmare for the system administrator.

04 Trojans

The Trojan horse, as the name suggests, is a program that masquerades as a legitimate application but in actual fact contains code that allows a hacker remote access to your computer. Like the legend of the wooden horse the Greeks used to gain access to Troy, once inside your computer it opens and creates an opening for the hacker.

05 Spyware

Spyware invades computers usually through freeware or shareware downloads, which is why you should always download a program from a reputable source. The intent of spyware is to collect information about the user and report it back to those who wrote it.

06

Adware

Adware is very similar to spyware, in that one of its goals is to monitor the user. However, adware usually goes one step further and bombards the user with Internet pop-up advertising, usually when they open their browser or a new tab. The advertising can be tame, such as gardening equipment, or it can be extremely offensive.

07

Hacking

While Hollywood would have you visualise the lifestyle of a hacker as something that's quite alluring, in truth it's quite the opposite. The average user is generally under the radar where a hacker is concerned. They're mostly after the corporations, or famous people, but you can have your computer hacked by a neighbour, for example.

08

Social Engineering

A relatively modern term in the history of computer security, social engineering will have the user deceived into giving away personal information or allowing a scammer into their systems. The recent spate of calls from people claiming to be from the likes of Microsoft or a security firm are a prime example.

09

Phishing

Much in the same vein as social engineering, phishing is the act of obtaining sensitive information (bank details usually) about a user by being disguised as a trustworthy source. Phishing on social media sites such as Facebook, Twitter, etc. is on the rise.

10

Rootkits

Rootkits are virus-like programs that are activated before the computer's anti-virus and security suites are started when booting Windows. They can change the way a security suite looks at files, allowing a virus to hide in plain sight and not be detected by the system's security measures.

Hackers and You

We're probably all familiar with the term 'hacker', and what it suggests, but do we really know what a hacker wants from us? More to the point, how are we perceived in the eyes of a hacker? Let's have a look at what the modern hacker wants from the average user.

Being on the end of a successful hack has been likened to having your house robbed. There's a

> ***"You've been hacked!"***

feeling of invasion, that someone has rifled through your personal belongings and stolen what's yours.

Monetary Motivation

As with most hacks the world over, money is the driving force behind an attack. A hacker will want to enter your system through various means and obtain your bank or credit card details in order to get access to your money. It's plain and simple theft.

Personal Information

Personal information can be extremely valuable to a hacker. Those who manage to obtain information about you, from date of birth, address, social security number and countless other trivial details, can then use your identity to open bank accounts, start a loan and so on. In the end, it is your name that's linked to the fraud.

Parasitic Infection

Sometimes a hacker will use you to get some other target. Perhaps you work at a bank, or something similar, the hacker will then identify you as a target that can be used to transfer a program from your laptop to the work's server. You unwittingly become the carrier of malware, allowing a hacker to gain access to your work.

Exploitation

Exploitation is becoming a common theme among modern hackers. In this scenario a hacker will gain access to your personal information and hold it to ransom. They can then demand anything from money, to more personal acts.

Stealing Bandwidth

Rather than targeting a user purely for financial gain, or something else, a hacker can also want to use your home bandwidth. Generally speaking, the hacker doesn't need to be on the other side of the world, they could be a neighbour who's using your Internet connection to download copyright material.

Access to Your Webcam

Webcam hacking has become more popular in recent years. What happens here is, a hacker manages to gain access to your computer and activates the webcam in order to view what you're doing; and as long as the computer is up and running, they can see everything the webcam can, and they can do so without you even knowing.

Access to Your Microphone

To expand on the previous hack, along with a webcam hack an attacker can also activate a computer or device's microphone. Doing so will allow them to listen in on anything that's being said, so perhaps it's worth covering up your microphone during any future meetings.

Zombie Apocalypse

There are instances whereby you become the target of a larger scale hack. In this case the hacker isn't targeting you specifically, they're simply using your computer as a zombie, a collection of machines connected to the Internet that runs malicious programs against a target. Zombies are often used to conduct DDoS attacks.

Cyber Vandalism

Often you can be the target of an attack that doesn't seem to make any sense. The hacker doesn't want money, they don't want your personal information either. It's just a case of cyber vandalism. Perhaps the hacker wants their name known in the wider world, or just likes to see chaos reign. Who knows why they do it?

Distributing Illegal Material

Finally, a hacker can use your computer as a source or a node for the distribution of illegal material. You won't even be aware of the fact but your computer is successfully trafficking illegal material together with others on the Internet.

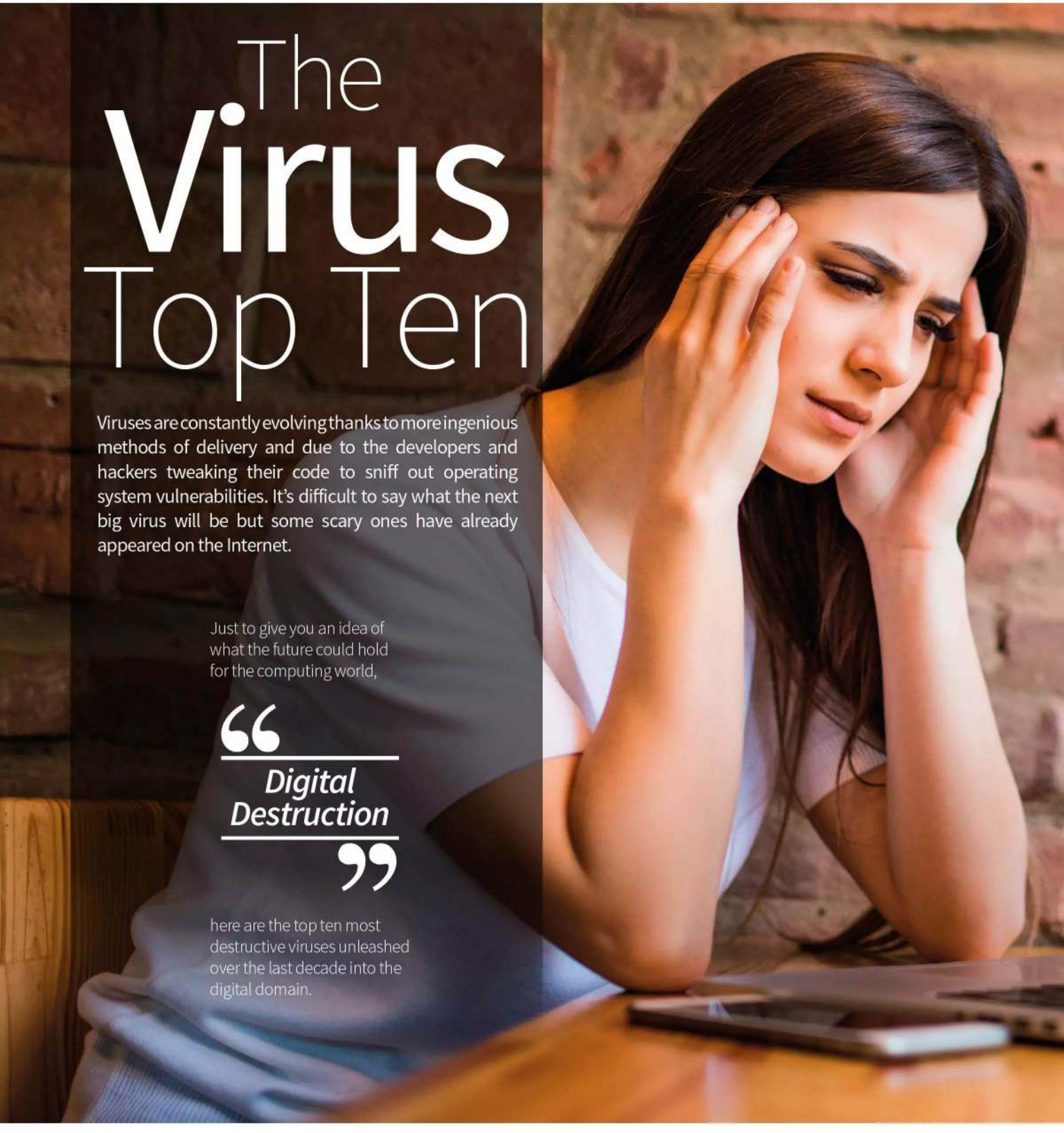
The Virus Top Ten

Viruses are constantly evolving thanks to more ingenious methods of delivery and due to the developers and hackers tweaking their code to sniff out operating system vulnerabilities. It's difficult to say what the next big virus will be but some scary ones have already appeared on the Internet.

Just to give you an idea of what the future could hold for the computing world,

> ***Digital Destruction***

here are the top ten most destructive viruses unleashed over the last decade into the digital domain.



1 Storm Worm

Storm Worm was released in 2007 and was rumoured to have hailed from Russia. It came in the form of an email link, usually with an important headline to grab the victim's attention. When the victim clicks the link the code is inserted and payload with a backdoor into the system is opened. It infected over 10 million computers worldwide.

2 Conficker

Conficker was a 2008 worm that infected an estimated 15 million Windows computers worldwide. The French Navy, UK Ministry of Defence, hospitals and local police forces were affected. It was spread via Facebook, Skype and mail services, and infected networked computers with a keylogger that the hacker could use to record your keyboard strokes.

3 Daprosy Worm

2009 saw the release of the Daprosy Worm whereby an estimated 20 million computers were infected with a keylogger. What made this such a dangerous virus was that it remained active in Windows Safe Mode, so it was very difficult to remove.

4 Stuxnet

Stuxnet was rumoured to have been a US Intelligence created virus that was designed to infect Iranian nuclear power plants, thus stopping them from potentially creating weapons grade material. Whether you believe that or not, it was one of the worst viruses to appear in modern times.

5 Duqu

Duqu was released in 2011 and shared many characteristics with Stuxnet. However, Duqu had different roles: it would work as a keylogger, to steal digital certificates, gather information about an infected PC, or completely wipe the contents of any connected hard drives. Interestingly, parts of the Duqu code were written in an unknown high level programming language.

6 Shamoon

Shamoon was discovered in 2012 and developed to infect the Windows kernel, the core code of the operating system. It successfully managed to wipe the contents of millions of hard drives and was rumoured to be used in cyber espionage in the energy industry.

7 CryptoLocker

CryptoLocker is a ransomware infection that first appeared in 2013. As with most ransomware code it locks and encrypts your entire hard drive and offers to unlock them if the victim pays up to $300. Remarkably, the code was able to delete itself whilst still keeping the files encrypted and locked.

8 Regin

2014's Regin virus was spread via fake websites and infected tens of millions of computers. Rumour has it that it was a joint US and UK intelligence created virus for global digital surveillance but we'll leave that for the conspiracy theorists to argue over. Nevertheless, it managed to send information of the victim's computer back to an unknown location.

9 Rombertik's Endless Loop

Rombertik's Endless Loop is an interesting, if somewhat deadly, virus to have sprung up in 2015. When infected, the virus will alter and delete key boot files for Windows computers then force them to reboot. With the boot files missing or altered the Windows PC will continually boot and reboot itself until you re-install the OS.

10 Tiny Banker

Tiny Banker is an information and packet sniffer virus that will record any online banking details the victim enters in their computer. That information is then sent back to several servers which the hackers can then use to access your bank accounts. It's estimated that hundreds of millions were stolen in 2016 thanks to Tiny Banker.

Be Smart

We've looked at some of the many varied ways in which you can be compromised by a digital attacker and some of the ways in which you can help protect yourself. However, it's often more beneficial to be able to recognise the signs of a digital security issue.

Weakest Links

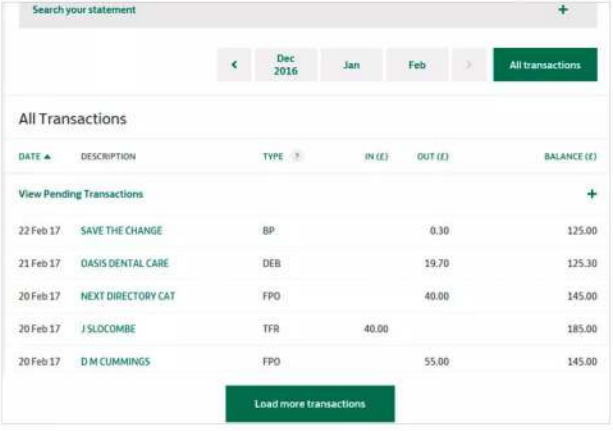
In terms of digital security, you're only as strong as the weakest link in your security chain. You can tick all the security boxes but if you don't know what to look for in the first place you're still vulnerable.

PASSWORD CHANGE

A good sign of a breach in your digital security is the sudden changing of a password. It can be for a random site, webmail or just something small to begin with. Sometimes a hacker with a keylogger in place will test the water before accessing your bank, in which case you need to virus scan your PC immediately.

BANK ACTIVITY

If you check your bank activity regularly and you've noticed some odd, small transactions that you fail to identify, then your account could already be hacked. Sometimes hackers will take small amounts or purchase inexpensive items to check the validity of an account before emptying the vault as it were. Contact your bank immediately.

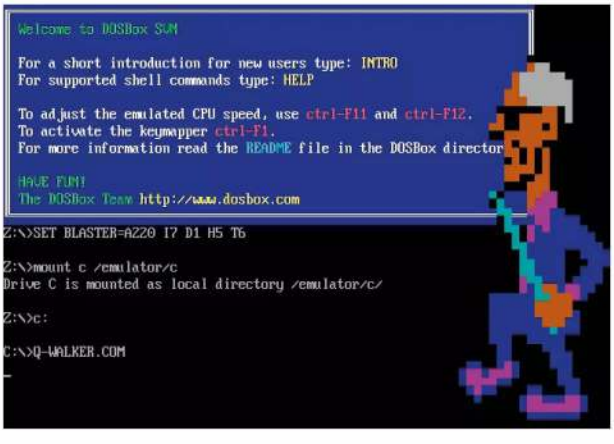


PERSONAL SPAM

We all receive spam emails of some form or another. However, if you suddenly start getting emails of a more personal nature, then you need to look at where that information could be coming from. The details could be your full name, date of birth, knowledge of any children or even a recent accident you may have been involved with.

SLOW PC

One of the many signs of your computer being infected by a virus is the sudden slowing down of the overall system. Most operating systems, Windows in particular, slow down over time but if you power up your computer one day and it's noticeably slower than usual we'd recommend you run a virus scan.



SLOW BROWSER

In relation to the previous tip, a browser slow down can also indicate that something is potentially going on. Browser hijacking can adversely affect the speed at which pages load, as it's sending information to a remote source. Naturally it's not always a digital security issue but to make sure, check your system.

POP-UPS

Furthering the browser issue, if you suddenly notice a lot more advertising, pop-ups or similar, then it's usually a good sign that you're infected with some form of adware or Trojan tracker.

INFECTED CONTENT

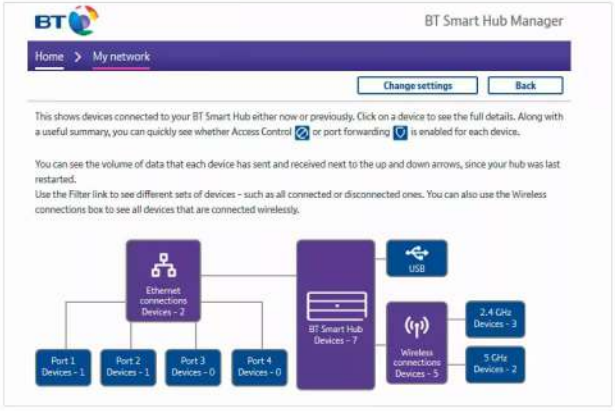
Viruses want to be spread from one computer to another and they can infect your email or social media platforms. If you suddenly have your friends asking you why you're posting adverts for pharmaceutical enhancements, then there's a good chance you're infected with something.

RANSOMWARE WARNING

In the case of a ransomware attack, you don't often get much warning that something is about to happen. Generally speaking, a sudden and inexorable slowing down of your computer will be a key element, as the ransomware is frantically encrypting your files in the background.

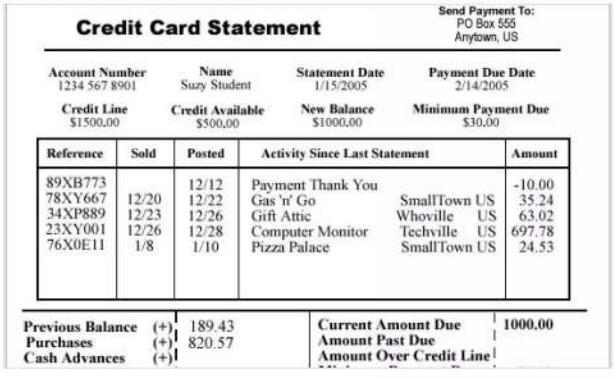
ROUTER LOGS

It's always recommended to check your router's logs frequently. Although hackers are generally anonymous groups or individuals on the other side of the world, often a hacker could simply be a neighbour leeching your broadband connection. Check the logs for any unidentifiable computers attaching to the router.



BANK STATEMENTS

Keeping an eye on your credit card statements will reveal any compromising security leaks. Just as with bank statements, small transactions are usually the first indicator, then once the hacker knows the card is valid they can then blitz it until you've run up a huge debt. Always check your statements and mark any suspicious transactions.



Credit Card Statement

Send Payment To:
PO Box 555
Anytown, US

Account Number	Name	Statement Date	Payment Due Date
1234 567 8901	Suzy Student	1/15/2005	2/14/2005

Credit Line	Credit Available	New Balance	Minimum Payment Due
$1500.00	$500.00	$1000.00	$30.00

Reference	Sold	Posted	Activity Since Last Statement		Amount
89XB773		12/12	Payment Thank You		-10.00
78XY667	12/20	12/22	Gas 'n' Go	SmallTown US	35.24
34XP889	12/23	12/26	Gift Attic	Whoville US	63.02
23XY001	12/26	12/28	Computer Monitor	Techville US	697.78
76X0E11	1/8	1/10	Pizza Palace	SmallTown US	24.53

Previous Balance	(+)	189.43	Current Amount Due	1000.00
Purchases	(+)	820.57	Amount Past Due	
Cash Advances	(+)		Amount Over Credit Line	

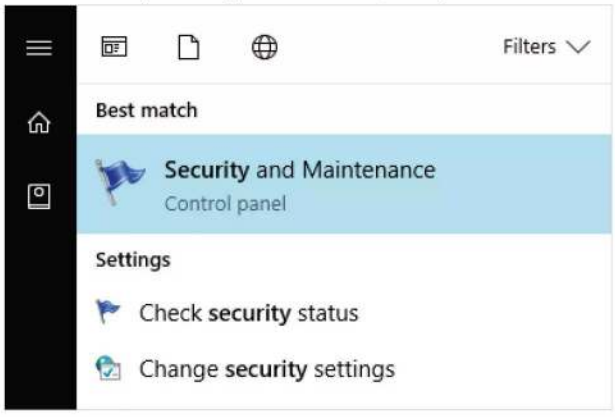
Setting Up Windows Security

Before we dig deeper into the many levels of Windows security features, it's worth taking a moment to check that the initial security features are in indeed up and running, and doing what they're supposed to.

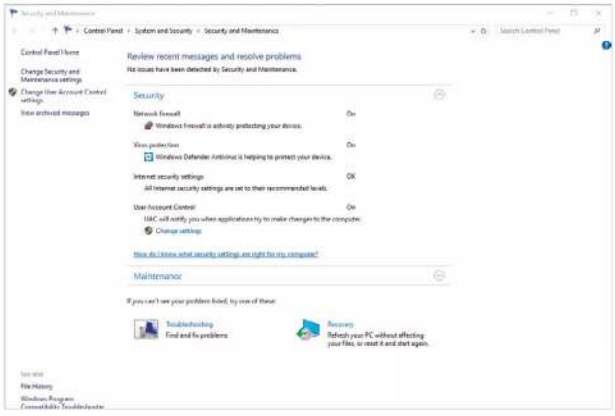
Are You Secure?

Remarkably, despite having an antivirus client installed, some users aren't even aware of the default Windows security features. Here's a quick ten step process to check everything is working as it should.

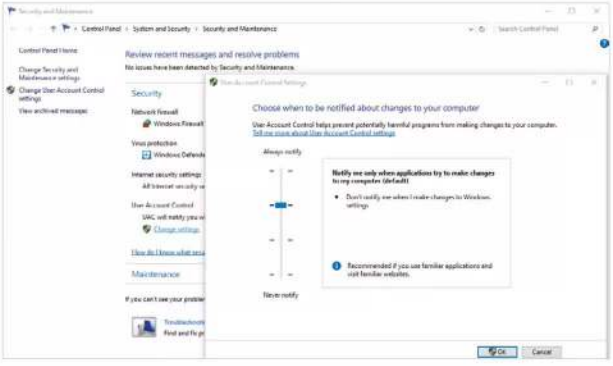
STEP 1 Start by clicking on the Windows Start Button or pressing the Windows key on your keyboard. Enter security into the search bar and click the first option that appears in the results, Security and Maintenance.



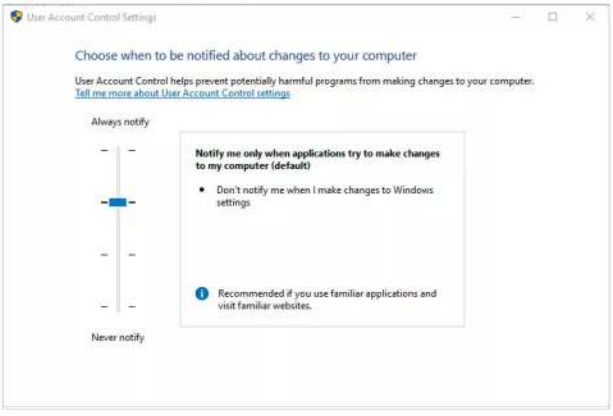
STEP 2 This will open the Security and Maintenance section of the Control Panel. There are two main sections within this page, click on the Security section to expand it. Ideally all the options within the Security section should be displaying On, with the exception of Internet Security Settings which will display OK.



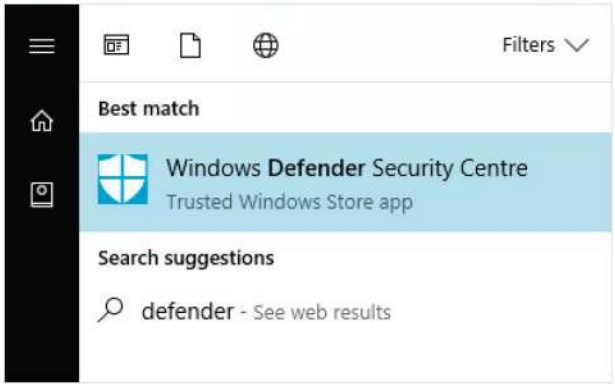
STEP 3 Should any of the options display No, then you'll need to check the setting relating to that particular feature. For example, if your User Account Control (UAC) is set to Off, click the Change Settings link under the UAC option. The other features can be found via a search from the Windows Start Button.



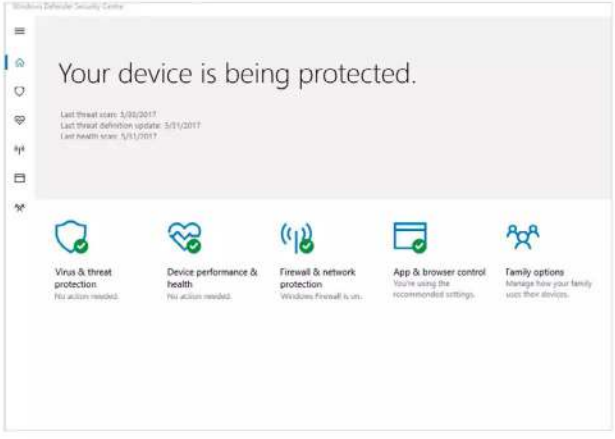
STEP 4 UAC will warn you of any attempt to access a system critical file. If any malware wants to alter a file, then you're asked if you want to proceed; obviously you don't, so you can say no and investigate the issue. There are various settings to choose from but the second step down from the top is the recommended.



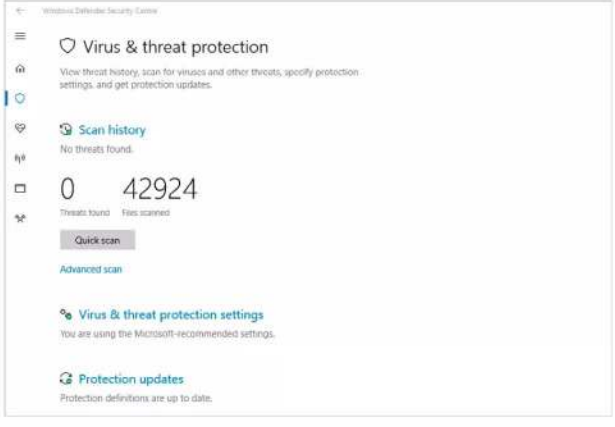
STEP 5 Close down the Security and Maintenance window, then click the Windows Start Button and search for Defender. Click the resulting Windows Defender Security Centre option.



STEP 6 If you're not using a third-party security and AV suite, then you need to make sure that Windows Defender is activated and working. There are numerous options available in the new-look Creators Edition Windows update of Defender. Each can be selected with a mouse click and viewed separately.

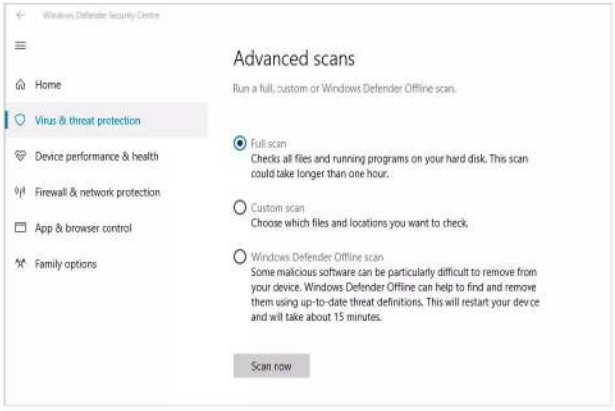


STEP 7 Click the Virus & Threat Protection option. This will open a new window allowing you to perform a Quick or Full Scan of the system that details the number of threats found and the number of files scanned.

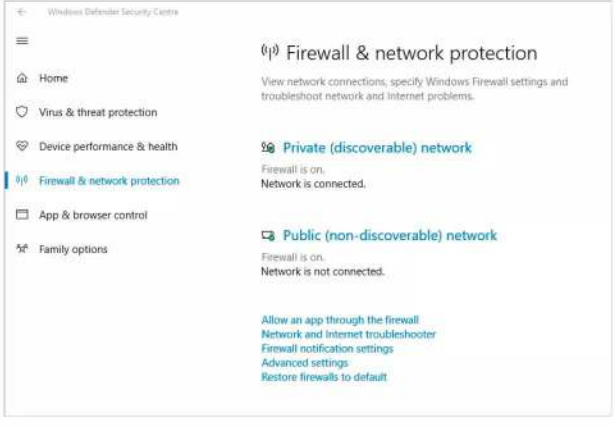


STEP 8 If you click the Virus & Threat Protection Settings option, you can further opt to improve the system protection. Make sure that all the sub-options are set to On and scroll down to define the program's default Notifications.

STEP 9 Returning to the main Virus & Threat Protection page, you can click the shield icon from the strip to the left of the screen; then click on the Advanced Scan link, located under the Quick Scan button. Within are options to run a Full System scan, a Custom scan (of a network location, for example) or an Offline scan.



STEP 10 Lastly, click on the Firewall & Network Protection from the icon strip to the left. Again, if you're not using a dedicated, third-party security suite, make sure that the Private and Public Firewalls are set to on, thus protecting your system from unwanted intrusion.



Why Updating is Important

Continual updates, rebooting after an update has been installed, then the inevitable second reboot straight after the first to apply the update: it's little wonder people stray from the regular update checks. Whilst it can be a pain though, keeping things up to date is a top priority.

Update, reboot, update, reboot

Updates may well be the bane of the modern computer user but they are there for a reason. It's not the 8-bit era anymore, we need those updates to help protect our security. Here are 10 reasons why they're important.

PATCH VULNERABILITIES

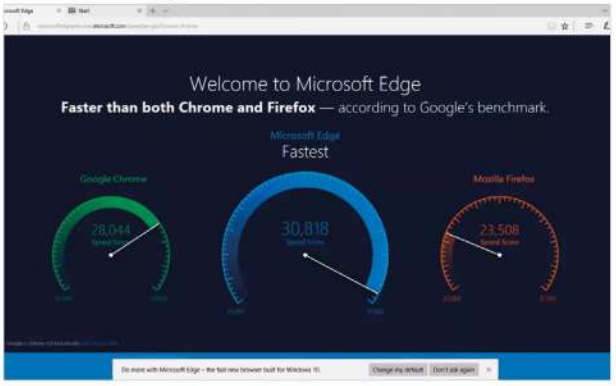
Windows updates patch recognised security holes in the core system. Many of the viruses around today exploit a vulnerability in the Windows code that hasn't been fixed yet. So when an update comes along, that potential flaw will be ironed out.

EXTRA SECURITY

In addition to potential security glitches in the code, often an update can contain an extra level of security that's been programmed in by the developers. For example, the code that handles remote desktop requests has had a security patch but another code that handles the authentication is hardened as a result.

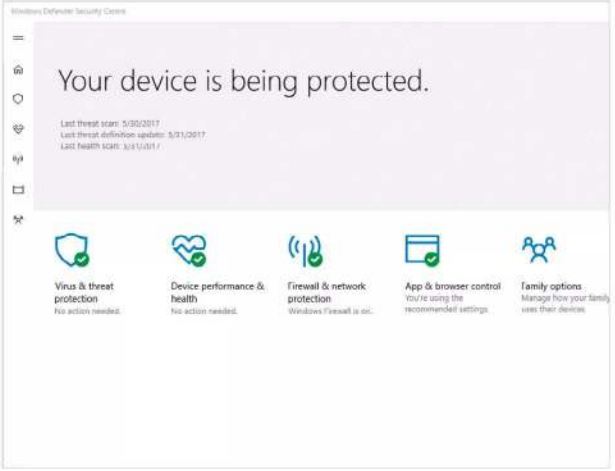
BROWSER UPDATES

Windows comes with many different programs to make it a more appealing environment. They include Internet Explorer and Edge browsers. As a part of Microsoft, these will need to be in tip-top working order to help prevent any modern Internet-borne viruses from entering the system. Daily update checks will keep things in shape.



DEFENDER UPDATES

Windows Defender and its other security elements will require at least one update a day to keep up with the latest virus definitions. This is a much needed aspect of updating, as even if you only go online once every so often, being protected from locally spread malware (USB drives etc.) is equally important.

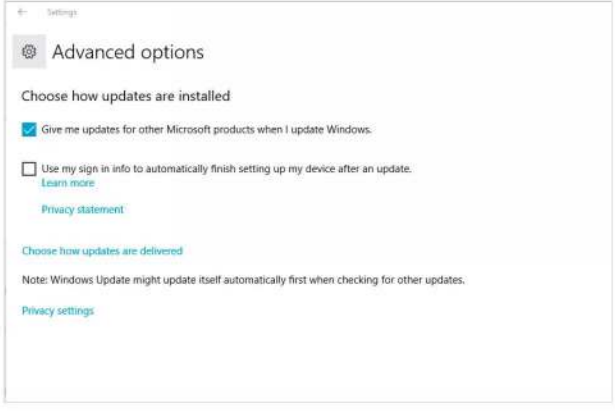


FIREWALL UPDATES

To expand the last reason, the Windows Firewall is one of the first layers of security on your system. With it, access to your computer from another source is monitored and even blocked, stopping potential threats before they even hit the virus defence layer. Updates make sure that the Firewall is up to scratch for the job.

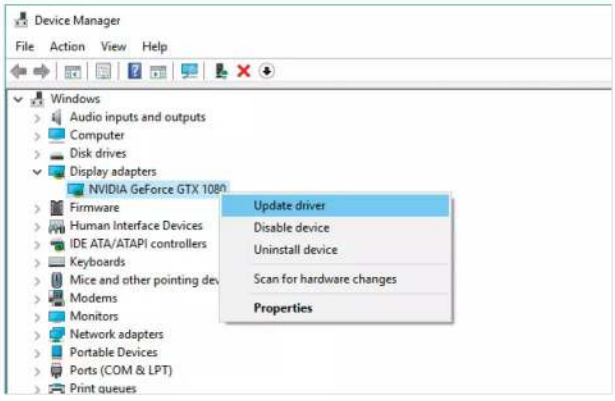
OFFICE PATCHING

It's not just the Windows core files that require regular updates, if you use Microsoft Office that can be a part of the overall Windows update schedule. There are vulnerabilities in Office too, which when exploited can allow malicious code in the system. Tick the Give me updates for other Microsoft products box in Windows Update's Advanced Options.



SIGNED DRIVERS

As well as Office, Microsoft provides base-level drivers for most of the hardware available today. These drivers are signed and verified as safe, so any new piece of hardware installed will work and will be safe according to the driver protection engine.



GENUINE SOFTWARE

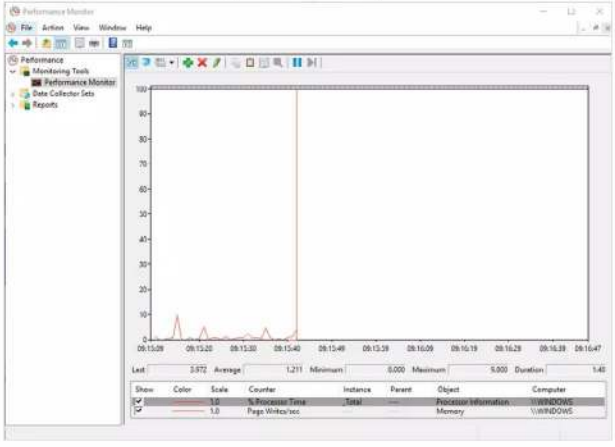
Non-genuine copies of Windows have been a thorn in Microsoft's side since illegal file sharing on the Internet gained popularity. These days the act of downloading something illegal is rampant. Windows updates ensure that you're using a genuine copy of the OS, which will ultimately secure you PC against threats from pirated copies.

FUTURE UPDATING

Microsoft has big plans for the future of Windows, it's often mentioned that this will be the last full version of the OS as they will be running Windows as a service as opposed to different versions over time. This means it will be a constant update cycle with adding or removing of features. Updates ensure you're running the latest versions.

STREAMLINING CODE

Updates not only patch any vulnerability, they can also free up system resources by improving the code and streamlining the available resources. In short, if your computer is performing better, then it can easily handle background virus and threat scans without affecting what you're doing.



What to Keep Updated and How

Discussing updates is one thing but how do you go about making sure that you have the latest updates and that all the necessary components are being updated correctly? Thanks to the improved update process of Windows, this is surprisingly easy.

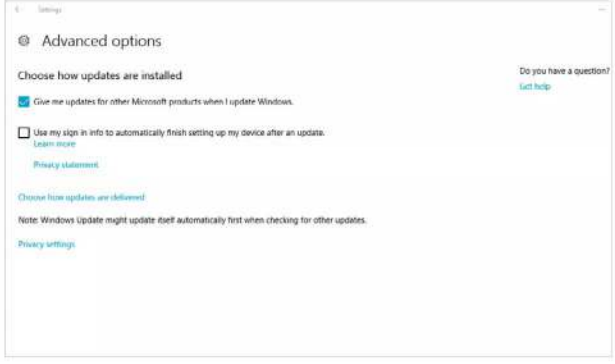
Keeping Up To Date

Whilst it's easy to update Windows, there are elements that can be missed. We've already mentioned that it's not only Windows that needs updating but also software and drivers.

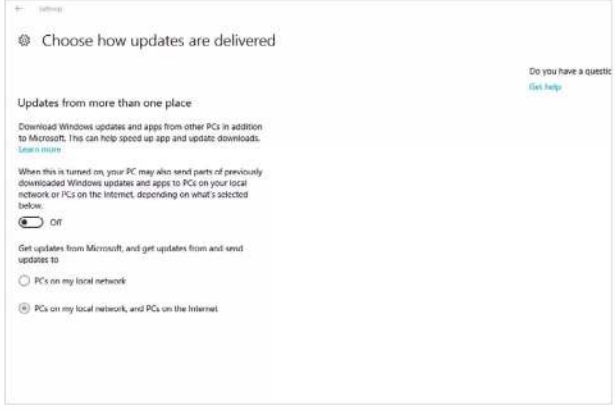
STEP 1 The first port of call is undoubtedly Windows Update. Click on the Windows Start button followed by Settings, the cog icon just above the power icon on the strip to the side. This will open the Windows Settings interface, locate the last entry, Update & Security and click it.

STEP 2 By default Windows Update will automatically check for, download and install updates for the core Windows files. You can check for any on the spot by clicking the Check for updates button; and you can see what's already been updated by clicking the Update history link under the update button.

STEP 3 If you click on the Advanced Options link under the Update Settings section, you can then tick a box that enables Windows to automatically check for updates for other Microsoft products, such as Office and so on. It's recommended to make sure the box is ticked, for better security and protection.

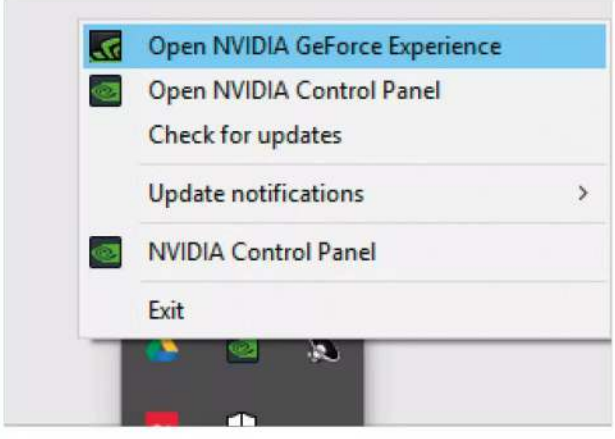


STEP 4 Within the Advanced Options page click the link for Choose how updates are delivered. This page details the way Windows updates can be pushed to other computers on your network, or even the Internet. Whilst it's a grand idea, there are concerns over privacy from some factors of the community. It's your choice but we prefer this option is Off.

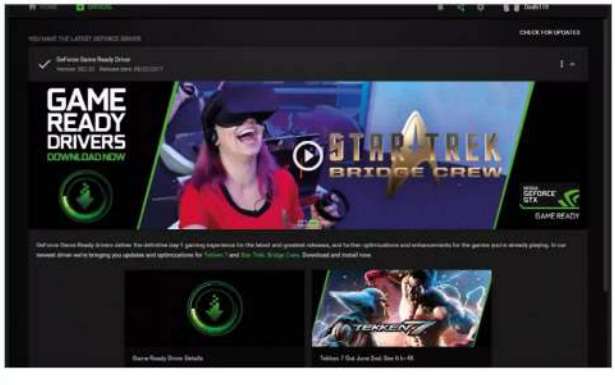


STEP 5 Hardware drivers are usually automatically updated by Windows Update but whilst signed by Microsoft the drivers themselves aren't always the latest versions. Therein lies a problem: even though signed, the MS drivers won't utilise the hardware as well as the driver developed by the hardware manufacturer.

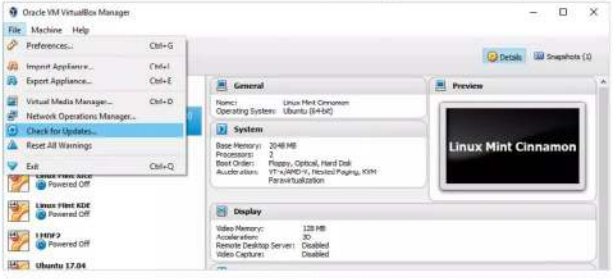
STEP 6 In such cases it's often best to use the hardware manufacturer's driver, as this is more up to date and features security patches as well as performance updates. For example, if you own an Nvidia graphics card right-click the Nvidia icon in the taskbar and select Open Nvidia GeForce Experience.



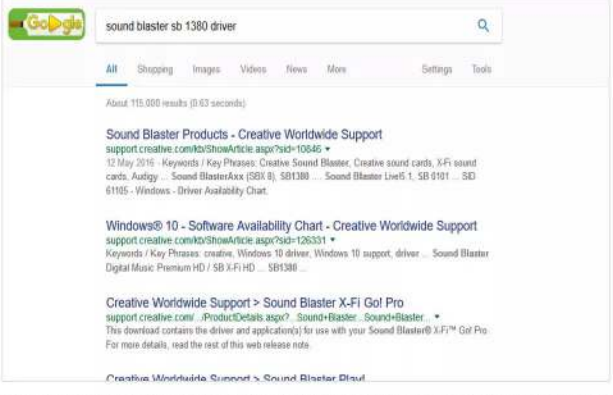
STEP 7 The Nvidia GeForce Experience allows you to improve in-game graphics and check for the latest drivers. Usually this is done automatically, and you are notified of any available drivers. However, If you want to check manually, click on the Drivers tab followed by Check for Updates.



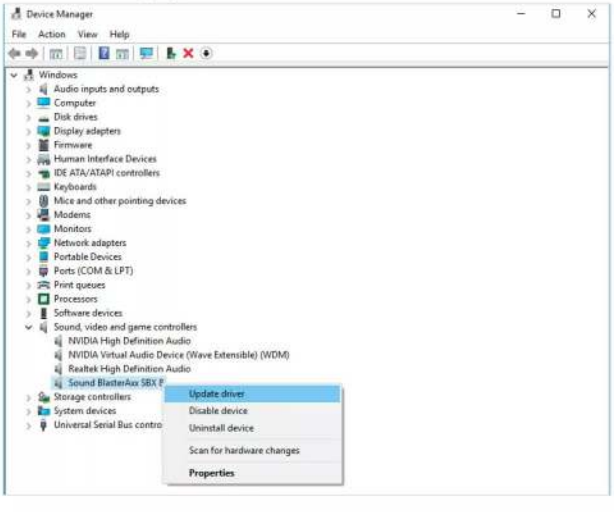
STEP 8 Third-party programs and applications also require regular update checks. Again, this is usually done automatically; when you launch the program in question it often checks for the latest version. If not, look for links such as Check for Updates or similar, usually in the Help, About or even under the File menus of your favourite app.



STEP 9 If you've attached some hardware and Windows hasn't been able to load a driver for it, and there isn't any documentation detailing the driver (this often happens with hardware purchased from eBay and the like), then you'll need to hunt one down. Start by locating the device's product name and number and enter it into a search engine.



STEP 10 You can often force Windows to locate a driver by right-clicking the Windows Start button and choosing Device Manager from the menu. In the Device Manager window, select the hardware you want updating, right-click it and select Update Driver.



How to Secure Your Web Browser

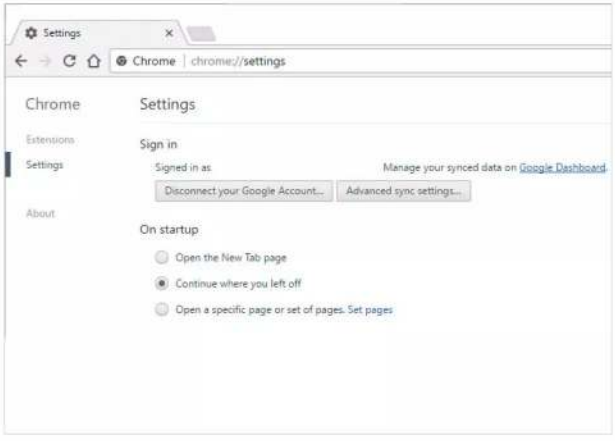
The web browser is possibly the weakest link in the entire security chain. It's the software product that's on the front line, the one that will inevitably bear the brunt of any Internet attacks and as such, attackers focus a lot of effort on making the browser a portal into your system.

Safer Surfing

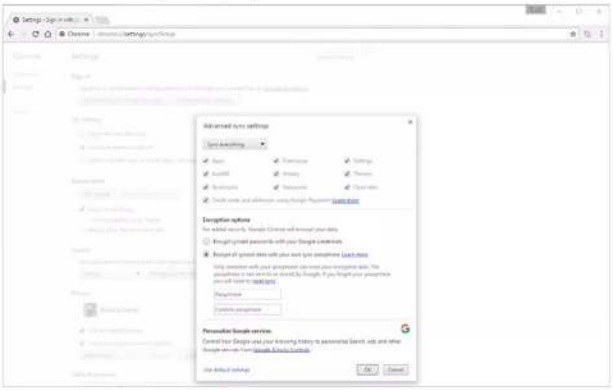
Securing your web browser isn't too difficult. There are plenty of options available, including some third-party add-ons you can use to improve security. For this tutorial, we're using Chrome.

STEP 1 Start by opening Chrome and clicking on the three vertical dots in the top right of the browser window. This is the link to the available options; from the list choose Settings.

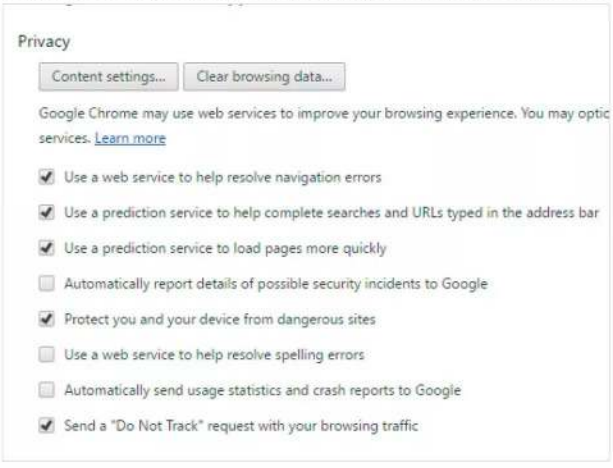
STEP 2 It's generally recommended that you sign into Chrome using a Google account, as this can greatly improve the overall security of the browser. For example, when you sign in, under the Sign In section in Settings, click on the Advanced Sync Settings button, the first option available.



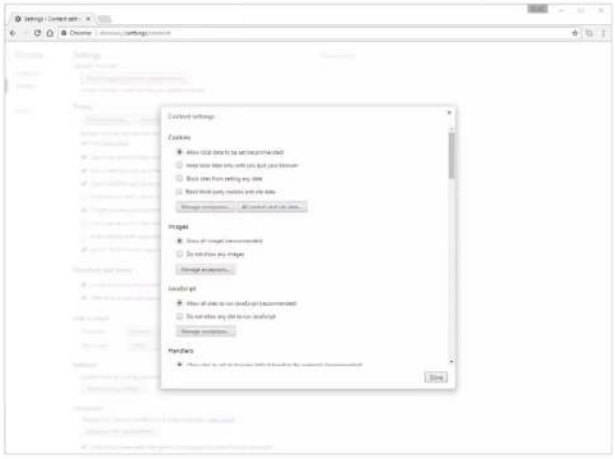
STEP 3 With the Advanced Sync Settings box open, select the option for Encrypt all synced data with your own sync passphrase. Enter a secure passphrase you can remember in the boxes provided and this will enhance the security of all data synced between Chrome and the Internet.



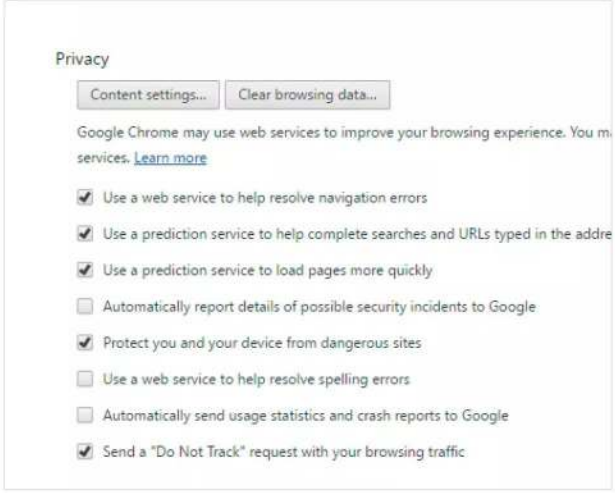
STEP 4 Look to the bottom of the Settings page and click the link for Show Advanced Settings. The first new section to appear under the Advanced settings is Privacy. Start by clicking on the Content Settings button.



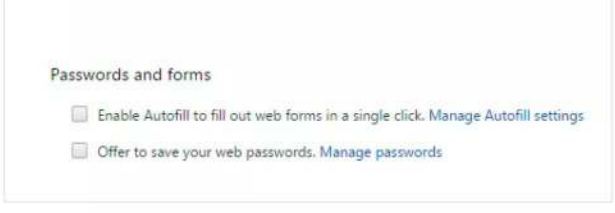
STEP 5 Content Settings allows a greater degree of control over Cookies, JavaScript, Flash, Pop-ups, your computer's microphone and even the webcam. It's an extensive list so we can't go into all the options within this limited space. For maximum security, disable JavaScript and Flash and make sure the mic and webcam are protected too.



STEP 6 Click the Done button when you're finished with Content Settings, to return you to the Chrome Settings page. Within Privacy still, ensure the last option, Send a "Do Not Track" request, is ticked. This will stop any tracking elements from monitoring your browsing activities.

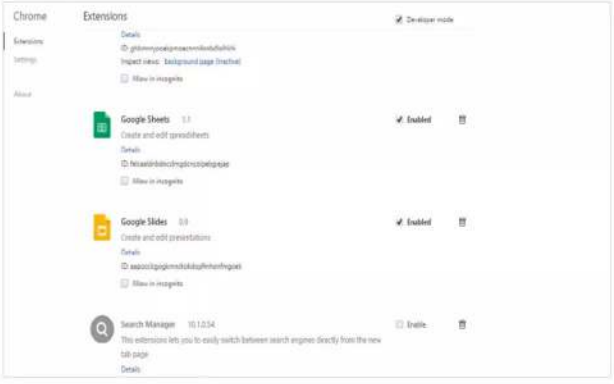


STEP 7 Just under the previous step's tick box, it's also recommended to untick the two Passwords and Forms boxes that offer to enable Autofill and Save your Passwords. Whilst it's a pain to constantly enter passwords, this will stop any hijack Chrome attacks from gaining your usernames and passwords.

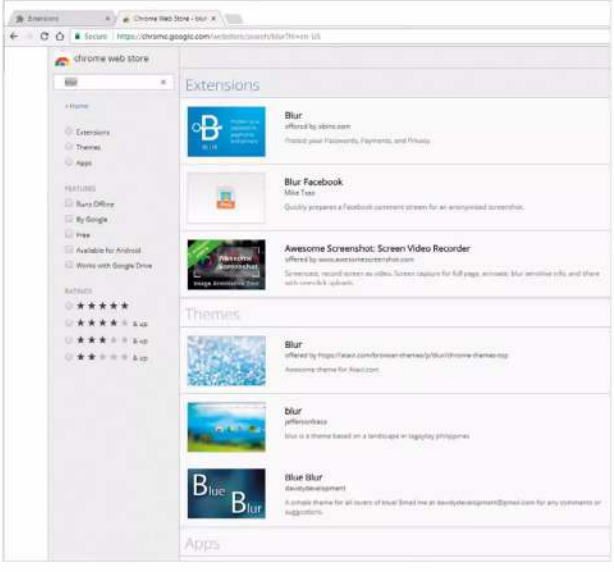


STEP 8 Under the Downloads section, it's an idea to tick the box Ask where to save each file before downloading. Again this can be a bit of a pain for the user; however it stops malicious background downloads from infecting your system, giving you more control and the ability to stop the process.

STEP 9 To the left of the Chrome Settings page you can see links for Extensions, Settings and About; click the Extensions link. With the Extensions page open, scroll down to the bottom and click the Get More Extensions link.



STEP 10 With the Chrome Web Store launched, via the Extensions link, search for Adblock Plus. Within the results, click on the Add to Chrome button on first option for Adblock Plus. This will install an advertising blocker within Chrome, securing you from any threats from Internet advertising. Do the same for Blur (an anti-tracking add-on) and HTTPS Everywhere.



How to Secure Your Home Network

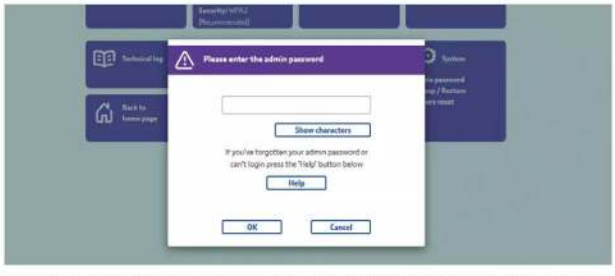
We've mentioned previously that an attack doesn't always come from the other side of the globe but can indeed be a little too close to home at times. Home network hacking is possible with the simplest of tools available on the Internet, often even just tapping into a cable.

Network Protection

Without being too paranoid, it's remarkably easy to get into a neighbour's home network. If you live in a block of flats or you use powerline adapters, you may need to consider these ten steps for better network protection.

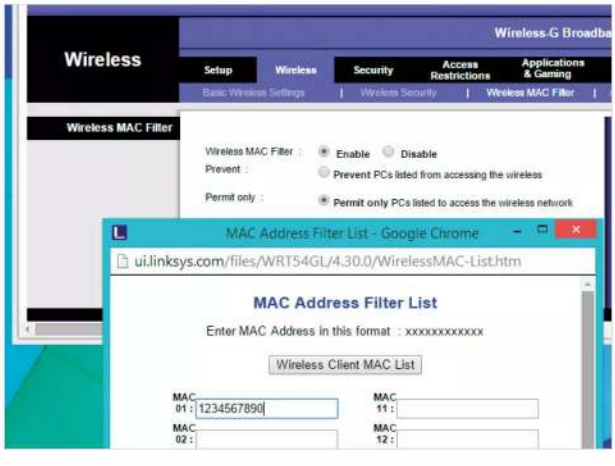
ROUTER PASSWORD

The most common entry point to gain access to your network is via the router. The router from your ISP may well be offering the latest forms of encryption but it doesn't take a genius to trawl the less reputable sections of the Internet to obtain a list of passwords. Therefore, change the default username and password to access it.



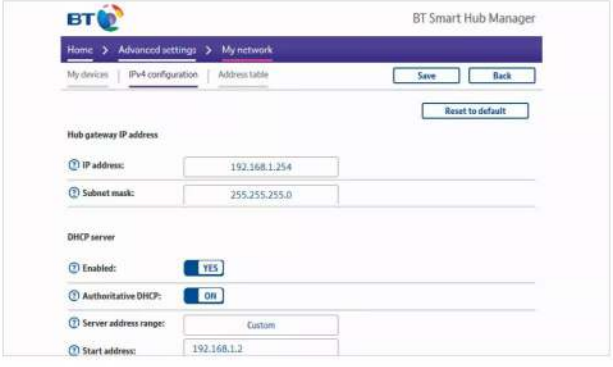
MAC ADDRESSING

Most routers these days come with a form of authentication called MAC (Media Access Code) address filtering. Every networkable device, computers, tablets, games consoles, come with a unique MAC address. The filtering allows you to enter the MAC addresses of your devices, so only they can be used on your router. Consult your router documentation for more details.



DISABLE DHCP

It can be a pain but try disabling DHCP on your router and opting for static IP addresses. Every device that connects to a DHCP router will receive an IP address. By eliminating that you get to specify the address range available. It's not fool proof but it's worth considering.



POWER OFF

According to Trustwave's 2013 Global Security Report, many home network hacks are conducted when the household is away or asleep. This leaves the hacker with ample opportunity to steal bandwidth and view files you may have on a NAS drive. The short, simple solution is to power off the router at night and if you go out for the day.

POWERLINE ENCRYPTION

Powerline adapters are an excellent resource for connecting wired network devices, without trailing lengths of cable around the home. However, depending on the adapter, it is possible to use another adapter to gain access to yours. Newer homes are common where you're able to pick up another network, so use the encryption button if the adapter has one.

ETHERNET CABLES

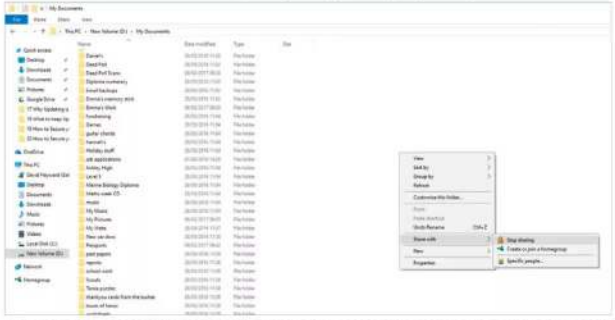
Cabling a home with Ethernet isn't a difficult project, this offers faster connection speeds than that of wireless; but if you're living in shared accomodation or a flat block, make sure that any unseen cable lengths can't be access by a neighbour. It's easy enough to splice into an Ethernet cable and steal bandwidth.

NETWORK MAPPING

Consider using a network mapping program, such as Open-AudIT, to gain a better understanding of what devices are attached to your network. Become familiar with the addresses, manufacturer, model IDs and so on of every connected object. That way, should anything new appear, you'll know it's not something you allowed.

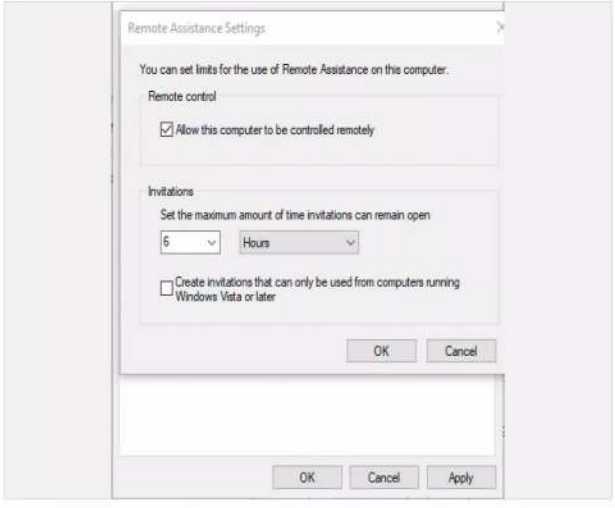
SHARE LESS

Sharing resources and files from one computer to another is perfectly fine but consider sharing less if you live in close proximity to others. Once a hacker has gained access to your network, getting to any shared folders you have will be a doddle. In extreme cases don't share anything but generally tighten password control.



REMOTE ACCESS

Remote administration on both the router and computer certainly help you out when you're not at the keyboard. Perhaps you connect to your home network from work? Whatever the reasons, it does leave a potential gap in your home network security. Consider closing it completely or double-checking the authentication is top notch.



VISIBLE PORTS

If you run a small office make sure that all your wall ports are located in areas where they are secure. Behind desks and generally away from where the public or any visitors may be able sneakily plug a laptop in.

What are Wireless Security Standards?

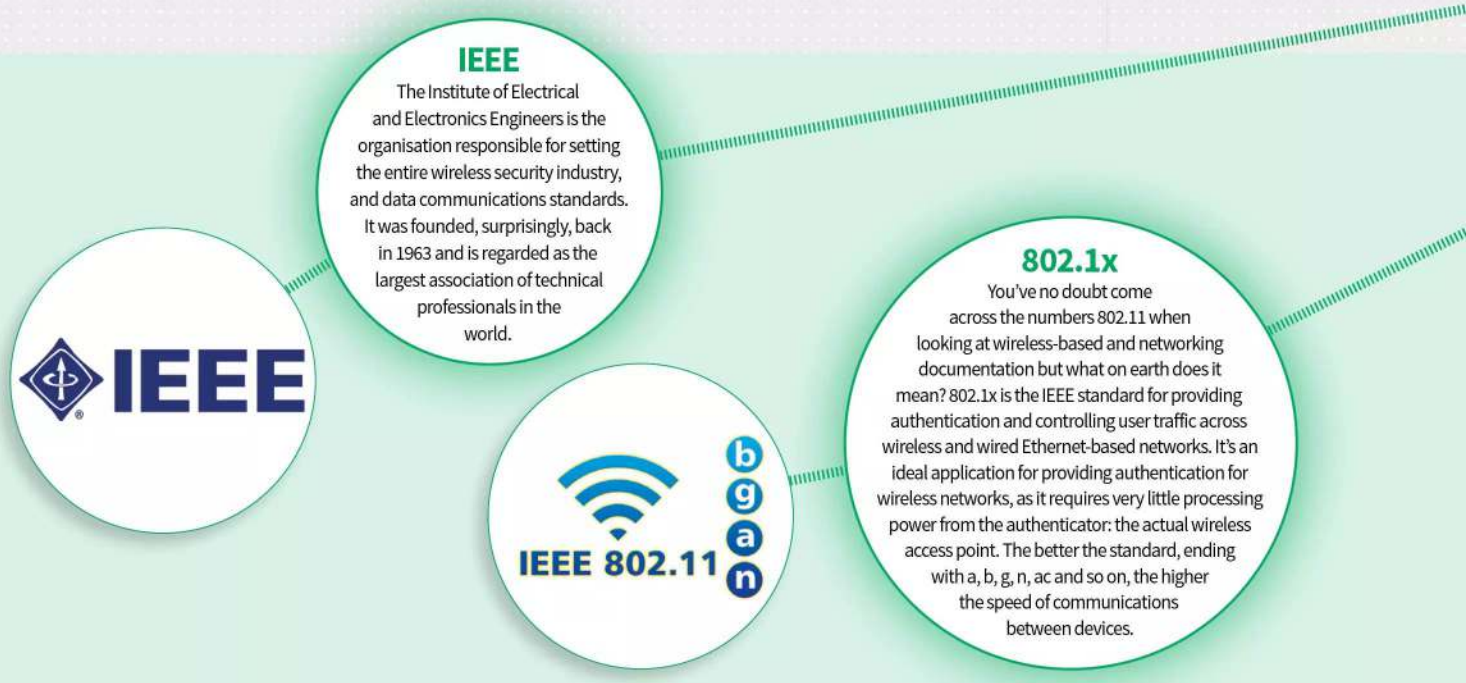
Wireless security has adhered to a number of standards since 1999, each improving over the last due to the ability for a then-modern computer to hack the security levels behind them. Tighter controls are needed as computers and the way they connect have become increasingly more complex.

WEP, WPA, WPA2, IEEE…

Amid the confusing acronyms lies a logical progression of wireless encryption and security protocols. Whilst at first they seem bewildering, it's quite interesting to learn of their history.

The technology behind delivering a wireless network has evolved over the last couple of decades and so has the ways and means in which to secure it all. It's not just simply down to choosing a password that no one is likely to guess, you need to make sure that data and connection to a wireless network is encrypted to the highest possible standard.

These standards are always moving forward and like most elements of the technology industry they come with a bewildering cocktail of acronyms and meanings. Encryption and all things security can be a confusing topic, even for experts. Here are the current, and most important, terms you should be familiar with when talking about wireless security standards, wireless networking and the hardware that lies between your wireless communications.



WPA2

WPA2 is the upgraded standard security technology of WPA. It's designed to offer the user an impressive 256-bit encryption key, which is virtually uncrackable unless you're a secret research lab with a few billion dollars to spare on quantum computing and dedicated hardware decrypting processors. There are also different sub-standards within WPA2, with AES (Advanced Encryption Standard) and TKIP (Temporal Key Integrity Protocol), both of which are encryption methods, along with the lesser used CCMP (Counter Mode with Cipher Block Chaining Message Authentication Code Protocol).

WEP

This is the original wireless encryption security standard, Wired Equivalent Privacy. Whilst the protocol worked for the late nineties wireless networks, it was soon overshadowed by the ever increasing power of the average computer. WEP uses a 40-bit standard encryption key, which is a key consisting of either 10 or 26 hexadecimal digits. That sounds like a lot of possible keys to crack but a modern, powerful computer would be able to break 40-bit encryption in around 30 seconds; compare this to months for a computer in the late '90s.

Access Point

Talking about access points, this is the hardware that acts as a receiver or transmitter for the wireless signal and network. It can physically be a number of different components, such as a router, switch or powerline adapter but essentially it's the hardware that converts a wired Ethernet network to a 2.4GHz or 5GHz wireless signal and vice versa; it's also referred as the WAP, Wireless Access Point.

WPA

Replacing the WEP standard, WPA (Wi-Fi Protected Access) provided a much needed improvement for the ever advancing march of security. It became the standard in 2003 and offered the user either 64-bit or the more adept 128-bit key levels of encryption. A 64-bit key attack would take several lifetimes when it was first introduced; these days it's estimated that it would take several months, maybe less if the attacker used several computers working as a cluster. Naturally 128-bit key lengths are mind-numbingly more complex and even by today's standards, the theoretical process of a brute force attack would take more time than the universe has estimated left to exist. Which is a very, very long time.

How to Secure Your Wireless Network

It may seem a little far-fetched but it's not unfeasible for a hacker to sit outside your house with a tablet or laptop and gain access to your home network via the router's Wi-Fi signal. Understandably it's quite rare but it's worth considering beefing up your protection.

Wi-Fi, Lock and Key

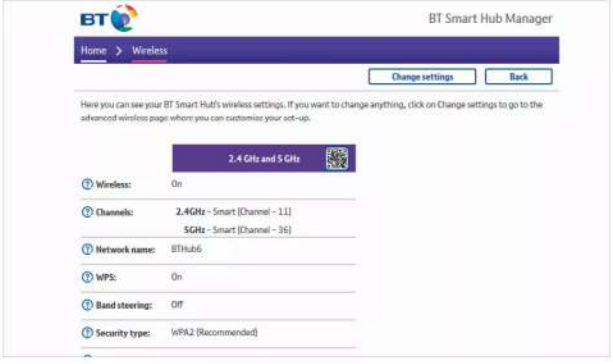
A lot of the standard tips on protecting your Wi-Fi merge with those of protecting your wired network. It's common sense mostly and keeping an eye on what's going on in your own network.

ADMIN PASSWORD

All routers come with a generic username and password. Depending on the model and manufacturer of the router, it's surprisingly easy to get hold of the username and password. For example, view www.routerpasswords.com and choose your router. With that being the case, change the administrator username and its password.

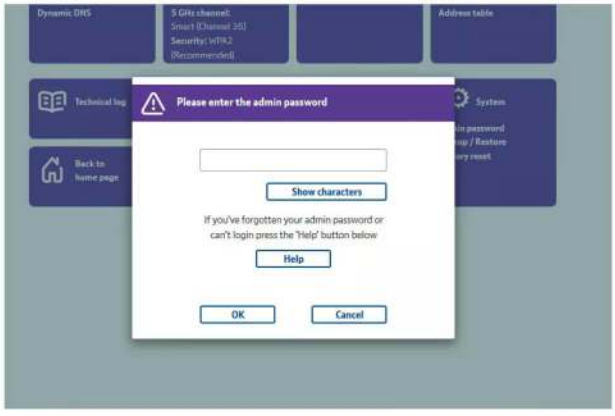
CHANGE SSID

The Service Set Identifier (SSID) is the name of the router that's broadcast so you're able to locate and connect to it. Most routers will display the name and ISP, or the make and model, making it easier for a hacker to find the information they need to gain access. It's recommend therefore to frequently change the SSID.



ISP PASSWORD

ISP supplied routers tend to have their own set of usernames and passwords. Although these are more secure than that of the default set, they are still obtainable from the more dubious quarter of the Internet. A potential hacker will easily be able to get hold of sets of passwords, so where possible change the ISP default username and password.

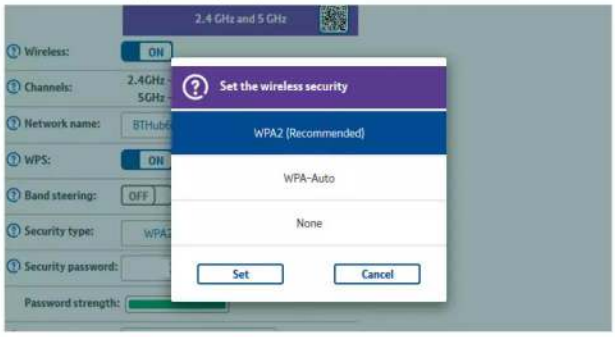


HIDE SSID

It's also possible to select an option to hide your SSID from being broadcast. Whilst this doesn't stop it being hacked, it does make it a little more difficult for someone who's casually looking around for networks to access. You'll need to consult your router documentation to find how to hide your SSID for make and model.

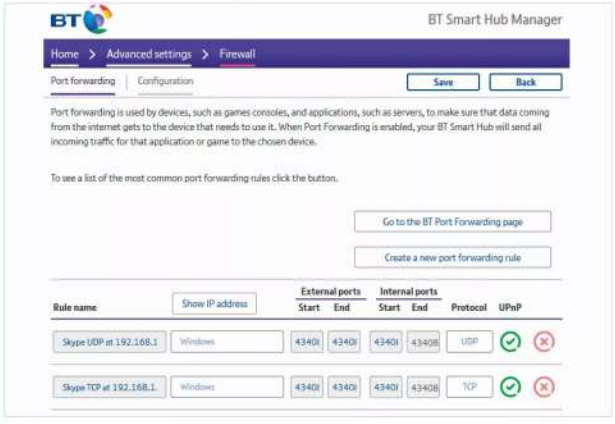
USE WPA2

Most modern routers will already come with the latest security standard enabled, WPA2; but there are instances of some routers defaulting to a lesser security type for the sake of device compatibility. It's essential that you ensure your router is using the latest and best form of encryption for your protection.



ROUTER FIREWALL

The firewall that comes with Windows is good but the firewall from third-party AV software is even better; and for extra protection, make sure that the router's firewall is enabled and doesn't have any potential leaks.



DISABLE GUEST

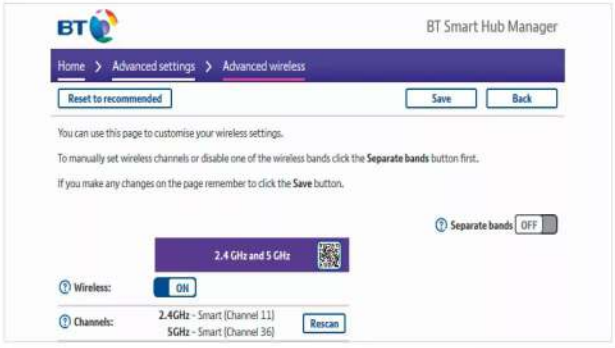
Some routers come equipped with the ability to allow a guest network. This enables users to connect to the router without requiring an encrypted password. Obviously this is a potential huge gap in your home network security. If you have no need of a guest network, then look to the documentation on how to disable it.

ROUTER RELOCATION

Most users will have their router located in the living room, near the master phone socket. This means that not only will the router broadcast through the house, it's also broadcasting over much of the street in front. Consider placing the router in a more central location of your house. This offers great coverage, whilst limiting its signal reach beyond.

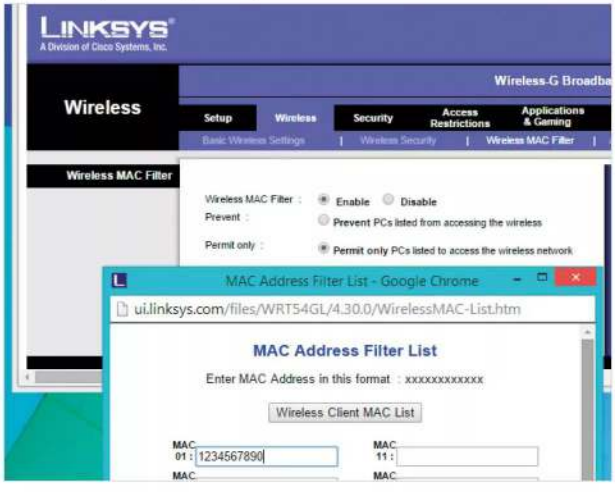
DISABLE WPS

The WPS button on a router and a device will allow easy pairing of the two without the need to enter the encryption password. This is certainly convenient but someone who may gain physical access to your router will be able to pair their own device. Look to turning off WPS in the router's settings.



MAC FILTERING

Filtering MAC addresses was discussed previously but it's worth repeating with regards to wireless network security. By filtering those devices that are allowed to connect to your router, and keeping an eye on what's connecting, you're able to control your security to a far higher degree than usual.



What is Encryption?

We've mentioned encryption and its impact on your privacy and security, but what exactly is it? The definition of encryption is 'the process of converting information or data into a code, to prevent unauthorised access'.

Kryptos Communications

To better understand encryption it's worth taking a moment to learn about its origins, how it's been developed over the years and how it applies to our modern communications.

The word encryption comes from the ancient Greek word Kryptos, which means hidden or secret. Interestingly, the use of hiding messages from others can be traced back to early Egyptian scribes who inserted non-standard hieroglyphs within other communications in order to hide the message from casual viewers. According to historians the Spartans used strips of leather with messages engraved. When the strips were read they were meaningless but when wrapped around a staff of a certain diameter the characters would be decipherable.

Of course, the modern forms of encryption are far more advanced but the overall core concept has remained the same: to be able to send a message to others without anyone else being able to decipher it. However, modern encryption now requires more than simply sending coded messages. Not only is confidentiality required, encryption must perform a level of authentication, so the origin of the communication can be verified; integrity of the communications, where both the sender and those who receive the communication can be ensured that the message hasn't been altered in between; and some form of nonrepudiation, where the sender cannot deny having sent the communication in the first place.

During the early digital age the only users of encryption were the government and military, and as such between them they created a set of algorithms and standards to protect the communication on the battlefield and from one government agency to the next. These algorithms grew in complexity as technology advanced and it wasn't long before the military-based forms of encryption were being used in commercial modes of communications. Within a few short years, bank transfers, cash withdrawals and data sent to and from modems began utilising these new protocols to protect sensitive information.

Today we're regularly seeing and using devices that boast 'military grade 256-bit AES' forms of encryption, a standard that is regarded as nearly impossible to break without spending billions on specialist hardware and software. In plain English, the modern form of encryption takes data and passes it through an algorithm together with a key. This creates a garbled file of characters that can only be clearly read if the correct key is applied to decrypt the data. Algorithms today are divided into two categories: symmetric and asymmetric.

Symmetric key ciphers use the same key to both encrypt and decrypt data. The most popular symmetric cipher is AES (Advanced Encryption Standard), developed by the military and government to protect communications and data. This is a fast form of decryption that requires the sender to exchange the key used to encrypt the data with the recipient before they're able to read it.

Asymmetric key ciphers are also known as public-key cryptography and utilise two mathematically linked keys, public and private. The public key can be shared with everyone and is usually generated by software or provided by a designated authority. The private key is something that's usually only known by the individual user. Interestingly both types of keys can be applied, where one user has a public key and another a private key, which can be combined to form a shared encryption level.

These keys are many characters in length, proving it nigh impossible for someone to Brute Force hack them. The Brute Force method involves using a program on a computer to try every possible combination of a key until the correct one is found. In the case of the 256-bit encryption, it would take 2^{256} different combinations to break the key. If you were able to force one trillion keys per second, it would still take you somewhere in the region of 10^{57} years in order to crack 256-bit encryption. However, a powerful computer can probably manage around two billion calculations per second, so in theory it would take 9.2^{50} years for your standard desktop to crack it. Take in mind that the universe has theoretically only been in existence for 1.4^{10} years.

Numbers as big as that are generally far too mind-boggling to comprehend. Suffice to say that if you're able to use 256-bit encryption for your communications or to protect your data, then you're going to be protected for at least seven times the current age of the universe.

> *Encryption is the act of protecting your data from prying eyes*

"Forms of encryption can be traced as far back as ancient Egypt, using non-standard hieroglyphs."

"Making data impossible to read is just one step, you also need the key to decrypt that data."

"The universe is 14 billion years old, but it would take seven times that time to crack 256-bit encryption."

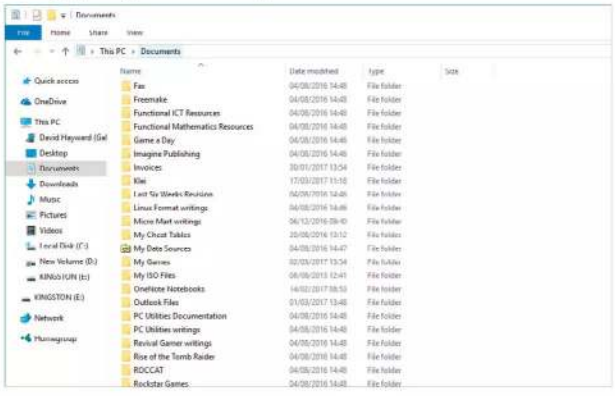
Encrypting Your Windows Laptop

Windows Pro comes with Microsoft's BitLocker program to encrypt the file system; however, Windows Home versions do not have this feature. Thankfully there are many encryption programs available for download, we're using DiskCryptor in this tutorial.

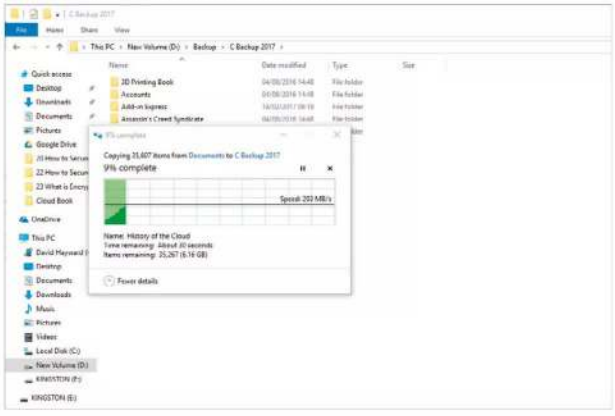
Windows, Under Lock and Key

We're going to encrypt a 2GB USB flash in this example, purely for ease of use and to demonstrate how you can encrypt your entire laptop hard drive(s).

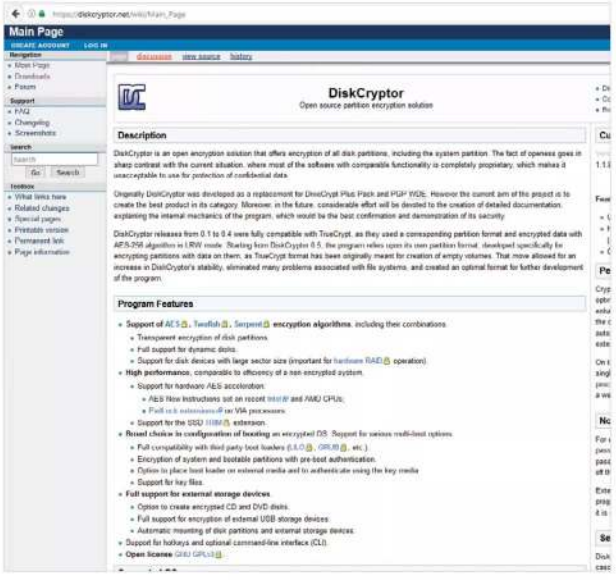
STEP 1 Encryption doesn't affect the core data, other than making it impossible to read without the decryption key but it's always worth making sure you have a backup of all your data prior to any system related changes. If you store your work or data in the Documents folder, then start by opening it in Windows Explorer.



STEP 2 Press Ctrl+A to highlight all the files, then press Ctrl+C to copy them to the clipboard. Next, choose a suitable backup location such as an external or network drive and when ready, press Ctrl+V to paste the copied data into the new location. Then, should something go wrong, you have a recent backup of your most used data.

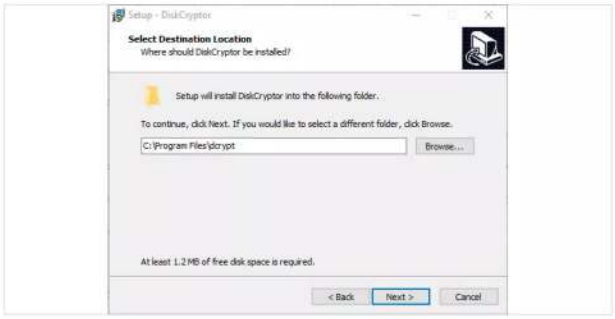


STEP 3 It's always best to ensure safe data before commencing with anything like this. It's also always worth doing (as we are) a test of the software first, on a disk that you don't mind messing up should you get the process wrong. Let's start by navigating to the DiskCryptor homepage, at www.diskcryptor.net/wiki/Main_Page.

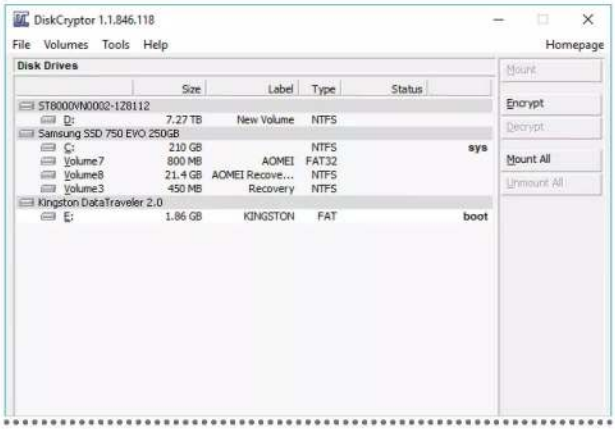


STEP 4 Using the menu to the top left, click on the Downloads link. Look for the latest version in the Download section and click the link for the Installer. This will open a confirmation box, click the Save File button to download the DiskCryptor executable file.

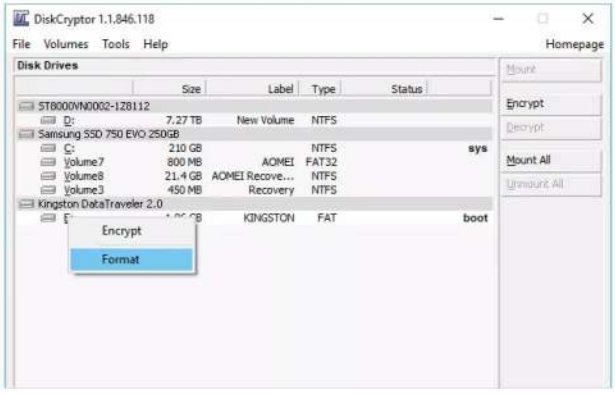
STEP 5 The dcrypt_setup.exe file should now be in your Downloads folder. Double-click it and select Yes to accept the Windows confirmation. With the DiskCryptor setup window open, click the Next button and accept the license agreement on the following page. For the remainder of the options choose the defaults, clicking Next. When done, click the Install button and reboot the computer.



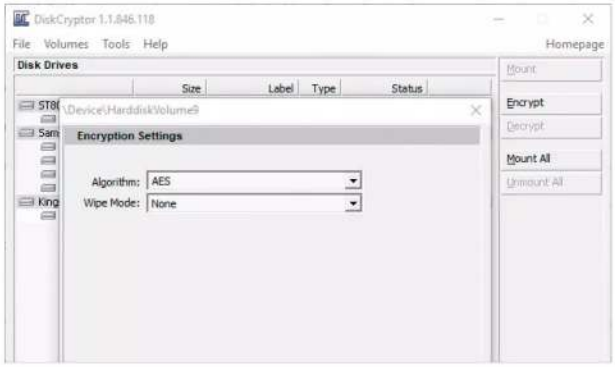
STEP 6 After a reboot, click the Windows Start button and locate the newly installed DiskCryptor program. You will need to click Yes to authorise its administrative access. With DiskCryptor open you can see the list of currently installed hard drives in your system. You can click each in turn and view its information at the bottom of the DiskCryptor window.



STEP 7 Start by selecting the disk you want to encrypt. In our example, as mentioned before, we're going to test this out on a USB stick. We recommend you do too, until you're comfortable with the process. With the correct drive selected, either click the Encrypt button to the right or right-click and choose Encrypt from the menu.

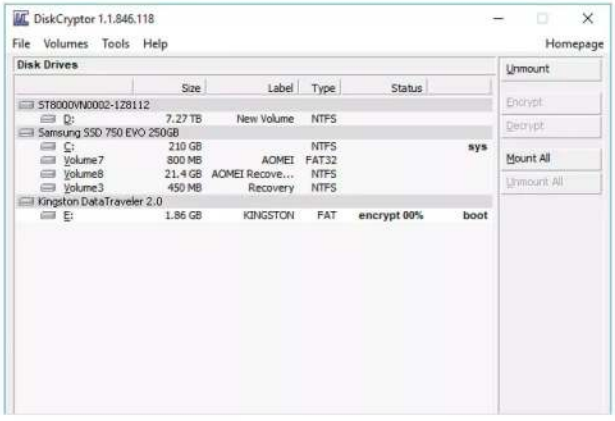


STEP 8 You're now offered a selection of available algorithms to choose from. Click the drop-down box to view them all but we recommend staying with the default AES algorithm for the time being. Leave the Wipe Mode box as None and when you're ready, click the Next button.



STEP 9 In the next section, choose a unique password for accessing the encrypted disk; you're notified how strong the password is. When you're ready, enter it again in the Confirm box. Click the OK box to start the encryption process.

STEP 10 Depending on the size of the drive, and how much data there is on it, the encryption process could take some time. When it's complete you're notified and the selected drive will the fully encrypted, with you being to access and decrypt it using the password you set up in the previous step.



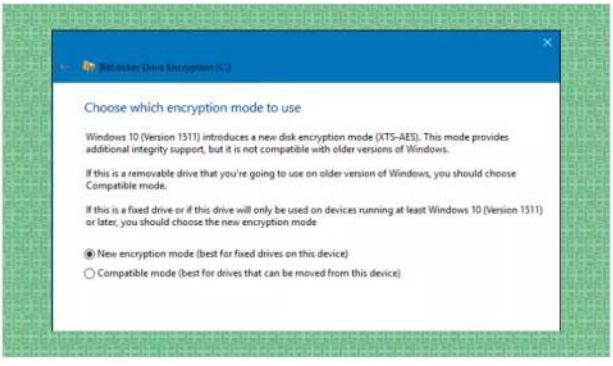
Top Ten Encryption Tools for Windows

There's no shortage of programs that can encrypt files, folders and entire drives for Windows. Whilst some are very good indeed, others tend to fall by the wayside by not offering as good a solution.

Encryption Galore

Here are ten different encryption tools for you to consider that work well with Windows, and some previous versions too. Some are free, others cost but they're all good in their own right.

BITLOCKER Available only for users of Windows Pro, Windows.1 Pro and Enterprise and Windows 7 Enterprise and Ultimate versions. If you're running the Home versions, you'll need to upgrade via the Microsoft site, or from the Windows Store. In short, BitLocker offers full disk encryption with 128-bit or 256-bit AES standards.



7-ZIP Primarily a compression program, 7-Zip can also encrypt your data with the AES 256-bit standard. It's simple to use, completely free and comes in either 32-bit or 64-bit versions depending on which type your core Windows system is.

VERACRYPT This is a free disk encryption program that's based on the popular TrueCrypt. It offers enhanced security, lots of levels of encryption and support for UEFI drives. It's available for Windows version 7 onwards as well as Mac OS X, Linux and even the Raspberry Pi.

AXCRYPT Another excellent free program, AxCrypt offers 256-bit encryption, easy to use interface, cloud storage integration, password management, secured folders and is available in a multitude of different languages. There's support for Windows Vista onward as well as support for files sizes over 4GB.

FOLDER LOCK

An excellent and comprehensive folder locking program, with support for 256-bit encryption and Windows versions from Vista onward. It costs in the region of £40 but you'll need to check for the most recent pricing. For your money, you get secure backups, USB protection, password wallets, a secure file shredder and much more.

GPG4WIN

This entry is a little more advanced but once you master its intricacies it's an extraordinarily powerful program, and free. It's designed for file and email encryption, offering incredible levels of security for Windows 7 upwards and Microsoft Outlook 2003 and newer.

CRYPTOEXPERT 8

Costing around £60, CryptoExpert 8 offer support for Windows versions from 7 onward, unlimited file size encryption, 256-bit AES encryption, unlimited secure file vaults and on the fly encryption as you move and copy files around your system.

DEKART PRIVATE DISK

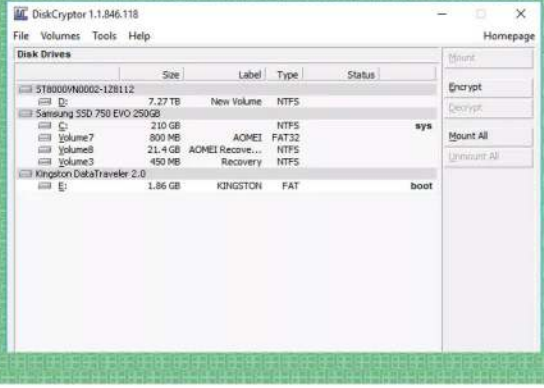
This is a simple and easy to use program that supports AES 256-bit encryption, compatibility with Windows Mobile, free unlimited support and updates; and it also includes its own firewall to help prevent hackers from gaining access to your system.

CERTAINSAFE

This is an interesting product, as it provides cloud-based encryption for any files or folders you upload into your online storage. It offers AES 256-bit encryption and an easy to use setup and integration into your cloud provider. It's Pay as you Go, so you only pay for what you use.

DISKCRYPTOR

We used DiskCryptor in the previous tutorial as it's a fairly straightforward program that can achieve high levels of encryption with ease. There's a lot more you can do with it and you can get further support from within the product's homepage.



What is a VPN?

Your system may be secure to any online threats but it doesn't always mean your privacy is assured. This is where a VPN comes in, as it offers the user a heightened level of anonymity when online and even another level of security and protection.

Virtual Private Network

Using a VPN can help hide your online presence. Whilst this may seem like an ideal way to get to illegal content, it's actually designed to help fight for your basic right to Internet and digital privacy.

Essentially, a VPN (Virtual Private Network) is a server or group of servers in a remote location that you can connect to through a client. The VPN servers then hide your Internet-bound IP address with their own, so if you connected to a VPN that's located in Australia then your IP address would be as if you were actually sat at a desktop down under.

The benefits of this are many but mainly a VPN will allow you to access region restricted websites, protect you from tracking and shield your browsing activities from those who want to find out where you are personally based. Obviously there comes a negative side, in the form of being able to access content that your country has deemed illegal for some reason but on the positive, VPNs have allowed people in countries with extraordinarily tight restrictions to get access to the outside world; often enabling them to report on what's going on in their own country to the world.

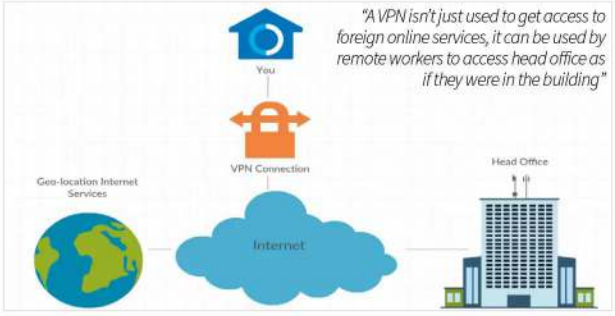
However, for most users having a VPN means they're able to gain access to TV channels in the U.S., Canada, Europe and other parts of the world. It's not always about being able to moderately 'cheat the system' by forcing the Internet to think you're somewhere else other than where you actually are though. Remote workers and employees who live in other countries can connect to company VPNs and be able to use the company's network resources as if they were physically sat in the building.

The connection from your computer to the VPN server, via the client, is usually secure to the tune of 256-bit encryption levels, depending on the VPN company who is hosting the service. All your Internet traffic will filter through the VPN server's systems, offering multiple layers of protection from viruses, malware and privacy. Beyond the other possible scenarios, using a VPN whilst you're abroad, working in a hotel for example, will enable you to access your home country's services and work resources. One more element that's worth mentioning is that using Wi-Fi hotspots is one of the biggest security risk for travellers; using a VPN can effectively improve your security whilst using a café's free Wi-Fi.

Most operating systems come with the ability to connect to a VPN through their network settings. If you have the network and connection details of the VPN in question, then you're able to connect to it using the built-in Windows, Linux or macOS options. However, the more common, and in some respects, easier method, is to use the client which most VPNs now offer as standard. The client is often simply a connection window that will ask you your login details, then provide a method of allowing you to connect to any of provider's geo-location servers, listed by country. Once the choice is made, you simply click the connect box and within a few seconds your IP address will be located within the chosen country.

There are plenty of VPN providers to choose from and we'll look at ten of the most popular in a while. Some offer a free connection service that's handy for quick browsing but isn't very fast. To gain access to faster servers, with better security and protection features you need to pay a monthly or annual subscription fee. Thankfully it's not a lot, for the most part: you'll be expected to pay in the region of £5 to £15 per month. This grants you better coverage and the ability to use up to five or more different devices, including tablets and phones.

Over the coming pages we dig a little deeper into VPNs, as you can imagine, using one will significantly improve your protection when online. In terms of Windows security, the use of a VPN is quickly becoming vital, so by the end of this chapter you'll be knowledgeable and helpfully utilising one to your own advantage.



> *Using a VPN will protect your access online and filter all your Internet traffic through its secure service.*

"You're able to access web pages and Internet services from all over the world, even if you can't from your own country."

"A VPN greatly improves security for devices and when you're using free Wi-Fi at cafés and other such locations."

How Can a VPN Improve Windows Security?

We've emphasised the enhanced privacy that a VPN offers when you're connected to its services, and the heightened levels of anonymity, but what security benefits does a VPN bring to a Windows computer with an antivirus program already installed?

Security Beyond Anonymity

It's a good question: how can a VPN improve Windows security? Whilst the privacy side is well catered for, there are some good security enhancements and features a VPN brings to the table.

BROWSING ACTIVITY

This doesn't happen often but an ISP can become compromised and details of user activities leaked or stolen. Using a VPN can hide your browsing activity from trackers and even your ISP, enabling you to browse with freedom of fear of having your details leaked or accessed by others.

ANTIMALWARE

Many VPN providers utilise a level of antimalware into their security layers. This enhances your security by filtering any downloads through the VPN first. Should there be a virus present, then it can be removed or stopped at the VPN before it even reaches you.

THREAT PROTECTION

To expand the previous feature, VPNs will filter web pages that are dangerous or contain threats. Even with a good antivirus client installed, you can still access a dangerous site. Using a VPN will stop the site from even being loaded.

HIGHEST ENCRYPTION

The connection between you and the VPN server is encrypted to the highest possible standards. This makes it near impossible for some external element to gain access to the data you're transmitting. Online banking and shopping are extremely secure with a VPN.

WI-FI PROTECTION

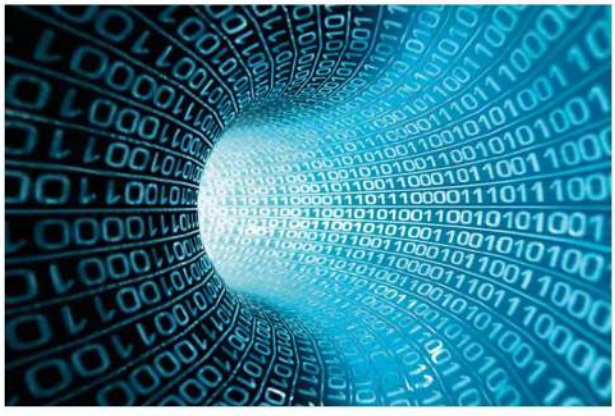
Public and free Wi-Fi hotspots are notorious when it comes to mobile security. Anyone with a little knowledge and some free tools via the Internet can intercept public Wi-Fi network and hijack your connection, revealing all your data. A VPN will encrypt the data and protect you.

AD BLOCKING

Most VPNs will also add an extra layer of security whereby they actively block any advertising from websites. Internet ads are a necessary evil in some ways, as they provide much needed funds for your favourite freely available websites. However, some contain malicious content and need to be blocked.

SECURE TUNNEL

If you're working abroad, or you're a remote worker, then a VPN connection to the company's servers will ensure that all the sensitive business data will remain secure. It's difficult for a company to ensure 100 per cent security with mobile and off-site workers but a VPN will provide a secure tunnel straight to the company itself.



USE HTTPS

Using HTTPS instead of HTTP uses the secure side of the Internet protocol. Sadly, it's not always implemented in browsers or by users. Many VPNs will force all websites to use the secure connection that a HTTPS site offers, enhancing your browsing security.

MULTI-PLATFORM

The availability of iOS and Android VPN clients means that your call data and data stored on your device is also secure. Mobile VPN apps will use the same levels of protection and security, so your data can't be stolen when you're not even aware of it.

ZERO LOGS

In some countries data retention laws are quite archaic, with governments and other bodies being able to access your data log for as long as you've been able to access the Internet. A good VPN won't detail any logs of your browsing and in most cases won't even hand over any personal information relating to you to other agencies.

Top Ten VPNs

When it comes to ensuring your data doesn't fall into the wrong hands, there are plenty of VPN options out there. The service runs on your computer, smartphone or router and encrypts all your internet traffic and forwards it through a secure server.

VPN Services

Listed below are a number of popular VPN services. The services on offer are subscription-based and they all ensure that your privacy is maintained. For a relatively small monthly outlay, you can be anonymous and even unlock access to sites previously blocked by your ISP.

CYBERGHOST CyberGhost is our favourite VPN. It offers 256-bit AES military grade encryption, no logging, access to 27 countries and hundreds of servers, protected browsing, ad blocking, access to fast servers, unlimited traffic and bandwidth and an anti-fingerprint system for up to five devices.

NORDVPN NordVPN offers two levels of encryption, access to fast servers, no logging, a kill switch in case the VPN connection drops and you're still surfing and support for multiple devices and operating systems. It's well priced and is highly regarded among the press and media.

HMA Despite its colourful name, Hide My Ass VPN is considered to be one of the best services available. Along with the usual secure 256-bit encryption connection you get blistering speeds, access to over 300 locations, anonymous email use, a free web proxy access and free extensions for your browser.

PUREVPN With support for multiple devices, 256-bit AES encryption and access to 180 locations worldwide with 750 plus servers, PureVPN is a great choice for the home user. The cost varies depending on the package but Just as with all these VPNs, it's worth checking for the latest pricing.

VPN UNLIMITED

VPN Unlimited offers a full firewall service with anti-malware, ad blocking and anti-tracking. There's 256-bit AES encryption, over a thousand servers in 70-plus locations, support for up to five devices, fast servers and app support for iOS, Android and Widows Phone. Pricing varies so it's wise to check.

PRIVATE INTERNET ACCESS

Private Internet Access VPN offers a wealth of features with its impressive service. 256-bit levels of encryption, no traffic logging, ad blocking, support for five devices and access to over three thousand servers across twenty five countries. It's surprisingly cheap too, depending on the package you opt for.

IPVANISH

IPVanish is another highly regarded and awarded VPN service. Depending on the package, you get access to fast servers, unlimited bandwidth, no logging, 256-bit AES encryption and support for up to five different devices.

VYPRVPN

VyprVPN is an exceptionally good service that offer access to fast servers, multiple device support, unlimited bandwidth and connection, 256-bit AES encryption and access to over seventy global locations and hundreds of servers.

TUNNELBEAR VPN

TunnelBear VPN offers an initial 500MB per month free service, increasing in price for unlimited bandwidth. For this you get access to fast servers across twenty plus countries, 256-bit AES encryption and support for Windows, iOS, Android, macOS and browser add-ons.

FACELESS.ME

Faceless Me is an interestingly named VPN service. Amongst its features expect to see elevated levels of encryption, unrestricted access, an easy to use interface and unlimited traffic. You get 2GB per month for free but you can pay a monthly subscription to have unlimited access and traffic.

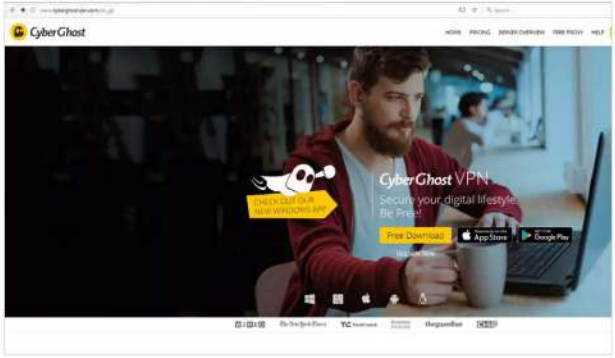
Using a VPN for Added Security and Privacy

We've covered how a VPN works, how it can improve your security and given you a top ten chart of recommended providers but we've not looked at how you would set one up and what it's like when up and running.

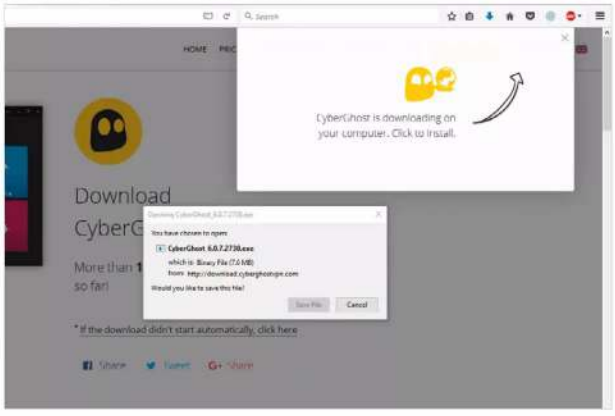
CyberGhost

We're going to use CyberGhost as the example VPN for this tutorial. You'll need to purchase one of the available packages to begin with. You can choose from a rolling monthly subscription of £9.99/mo or up to a three year plan billed £68 every three years.

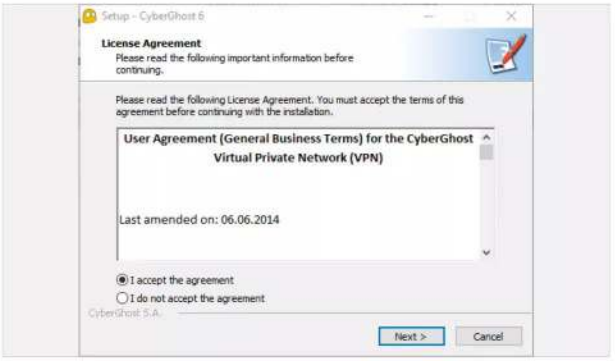
STEP 1 We won't use the free option in this instance, as the paid for services offer a better set of features with which to display the VPN in action. Start by navigating to www.cyberghostvpn.com and clicking on the Pricing link in the upper portion of the main CyberGhost site for your regional and latest pricing.



STEP 2 Assuming you've purchased one of the options, click the yellow Free Download button located in the top right of the main page. This will, after a few seconds, automatically initialise the download of the latest CyberGhost client software. Click Save File to download it to your Downloads folder.

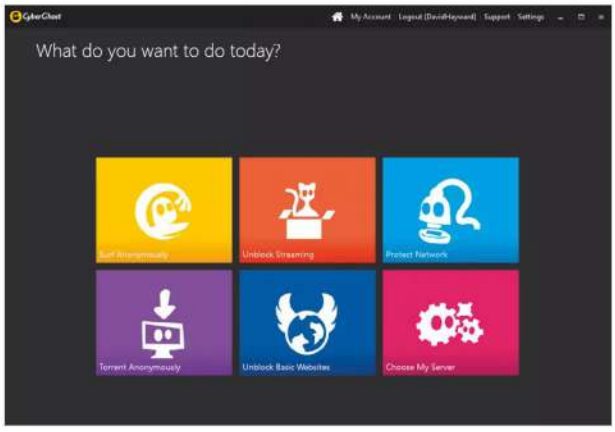


STEP 3 Go to the Downloads folder and double click the CyberGhost executable followed by a click on Yes for the Windows authentication process. Accept the agreement and follow the on-screen instructions to set up CyberGhost on your PC; the default options are fine to use, unless you specifically require a different location for installation.

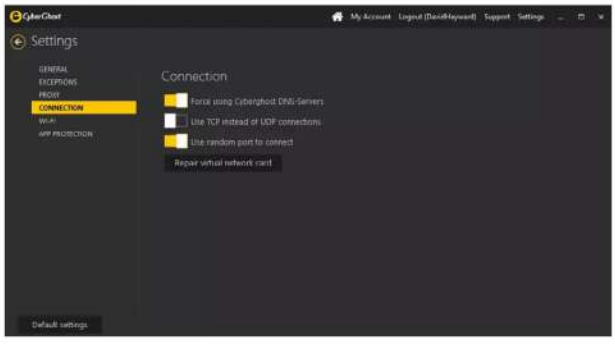


STEP 4 Once the installation is complete you're presented with the main CyberGhost client window. However, before you make a connection, click on the Login link located at the top of the client window.

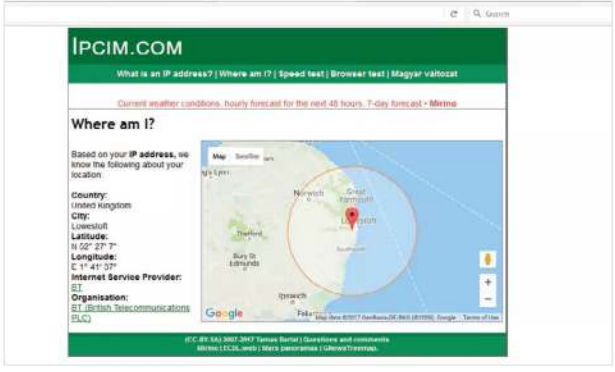
STEP 5 Enter your CyberGhost login and password that you set up when you purchased the package and click the OK button. Once the login is confirmed you're taken back to the main client window where the available options for the account package you purchased will be displayed.



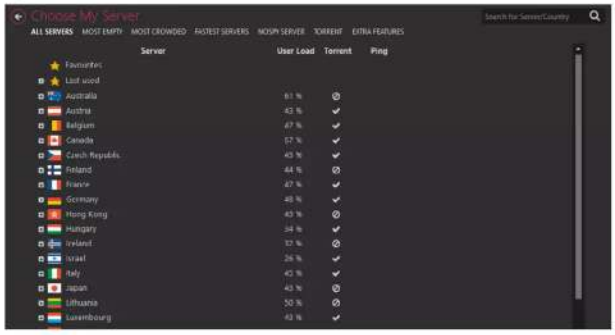
STEP 6 Before you use the service, it's best to check a couple of things. First click on the Settings link along the top of the client window. In here you can see multiple options for the control, connection and how CyberGhost will work with your PC. Generally speaking, the defaults are fine unless you have a specific reason to change them.



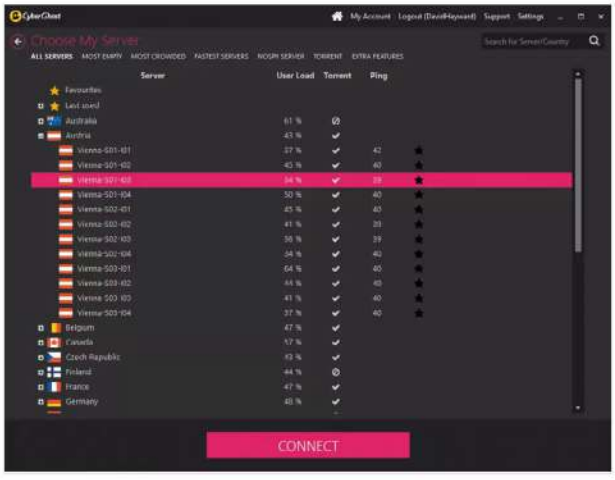
STEP 7 One more thing before connecting to the CyberGhost VPN: open a browser and enter www.ipcim.com/en/?p=where. This will display detailed information based on your IP address, such as the ISP you're using, the country, city, even latitude and longitude, complete with a map and possible radius you fall into. This is the kind of information we want to secure from prying eyes.



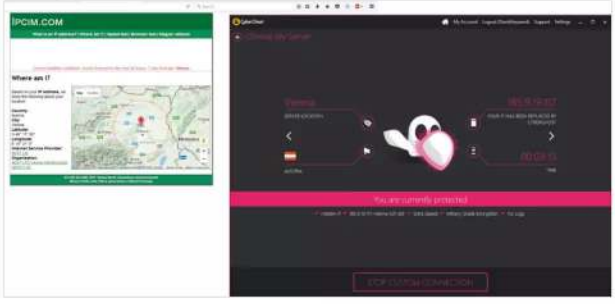
STEP 8 Click back to the CyberGhost client and return to the main window. Click the Home icon along the top of the client window and then the Choose My Server button in the bottom right. This allows you to choose your own server from the available countries that CyberGhost works with.



STEP 9 Look through the list and pick a server; we're going to use one of the Vienna servers in this instance. The Ping value is how fast the server is, the lower the ping the faster the connection. Either click to highlight the server followed by clicking the Connect button or double-click to launch the server connection.



STEP 10 The CyberGhost client will take a few seconds to connect. When it's ready you'll see a 'You are currently protected' message in the client. Close your browser and relaunch it, then return to the www.ipcim.com/en/?p=where page. You can see that the Internet now thinks you're located where the chosen CyberGhost server is, protecting and securing your privacy and personal details.



ONLINE PROTECTION & DISASTER RECOVERY

While you can successfully protect yourself and your own computer offline, as soon as you make a connection to the outside world, you're under the influence of many external factors. We'll look at how data is transmitted from your computer to the Internet, and how a canny hacker can intercept that data for their own means.

Over the coming pages you'll discover how best to protect yourself, and what strategies you can use to become more secure when online, and when you're out and about with your Windows laptop and other devices.

How Does Information Move Around the Internet?

Before we get into online protection and disaster recovery, it's worth taking a moment to look at how information moves around the Internet, in particular your information. Just how is data sent from your PC across the Internet, to potentially fall into the hands of someone else?

Information Superhighway

The Internet is a huge, complex network of computers and is widely credited as humanity's greatest achievement. It's estimated that the Internet houses something in the region of 10^{24} bytes of information, which is quite a lot.

That estimated 10^{24} bytes equates to an exabyte of potential information held by every single connected device that makes up the Internet, some of which is your information. It's an impossible number to visualise, since we're only using gigabytes or terabytes of storage in most of our devices. More to the point though, how on earth does all that connect together, and how does it work?

To be able to transmit all that information, the data that travels around the Internet is in packets. Each of these packets contains a header and a footer. The information stored in the header and footer contains the details regarding the data being sent. For example, if you send an email to someone, as soon as you click the send button the data will be wrapped up in headers and footers, split into numerous packets and sent on its merry way.

Whilst that sounds logical, much in the same way a telephone call takes place, the reality is quite different. Those packets can take any route possible to get to the destination, as defined by the header and footer. Those routes don't necessarily all have to be the same either. Some packets may travel from one server to the next via one data pathway, while others will take another. The server at the other end will use the information provided by the headers and footers to collate the message, reform the data and present it to the email recipient the way in which you intended it to.

Remarkably, if the server at the other end detects missing packets it can request the missing information from its available connections. Any missing data can then be sent via an alternative route, updating the information as it goes so other packets will know that the previous route isn't getting through. The headers and footers then tell the server that the data packets are all present and what they should look like; the email will arrive accordingly.

All this happens in milliseconds. This sounds incredibly complex and on paper it makes the Internet appear to be a slow, lumbering beast dealing with incomplete packets of data. In a way that's how it works but instead of being a lumbering beast, the Internet or more accurately, the servers and computers attached to it, are fathoming data packets by the millions every second.

Just as we've seen, each computer on the Internet is connected using an IP address. These are registered across the Internet, so the headers and footers in each packet contain the IP address of the sender and where the data is heading to. That way, it's not just a random collection of data travelling across the ether in the hope of landing in the right place. The DNS, Domain Name System, converts the IP addresses to readable names, such as Google.com and the like, and back again. That way when you enter the email address someone@somewhere.com the DNS servers will convert the information and the packets sent to the relevant destination.

The protocols used throughout the Internet define what the data being communicated actually is. For example IMAP, Internet Message Access Protocol, is a mail protocol for accessing email on a remote server, such as accessing Gmail. These protocols help further the transmission of data to its intended location, making it more accurate and telling the computer on the other end what it is and how to piece together the jigsaw puzzle of packets that will be received.

Essentially this is how information is sent and received around the Internet. Obviously, there's a lot more going on in the background than we've mentioned here. The complexity that you can go into when dealing with data transfers is quite staggering and a little bewildering at times. Suffice to say, all those packets of data contain information about something or someone and somewhere out there are packets of data that contain information about you, where you are, what you're doing, and other personal details such as bank accounts, passwords, names and addresses.

> *The Internet is regarded as the greatest human achievement, and it's not difficult to see why*

"Data is split into packets, with headers and footers telling servers what to do with it and where its going. "

"Along with protocols, packet information can take any possible route to its destination and it happens in a matter of milliseconds."

```
Tracing route to www.bdmpublications.com [2a03:b0c0:1:a1::18a:f001]
over a maximum of 30 hops:

  1    <1 ms    <1 ms    <1 ms  broadband.bt.com [2a00:23c4:7591:7200:ae84:c9ff:feb6:f097]
  2     *        *        *     Request timed out.
  3     *        *       11 ms  2a00:2302::1100:100:36
  4    16 ms     8 ms     8 ms  2a00:2302::1100:100:37
  5    10 ms     9 ms     9 ms  2a00:2380:300c:b000::e
  6     8 ms     8 ms     8 ms  2a00:2000:2066::4a
  7     9 ms     9 ms     9 ms  ae-6.r04.londen05.uk.bb.gin.ntt.net [2001:728:0:5000::6b5]
  8     8 ms     8 ms     8 ms  ae-0.r24.londen12.uk.bb.gin.ntt.net [2001:728:0:2000::5d]
  9     9 ms     9 ms     9 ms  ae-1.r25.londen12.uk.bb.gin.ntt.net [2001:728:0:2000::153]
 10    11 ms    12 ms    11 ms  ae-2.r02.londen01.uk.bb.gin.ntt.net [2001:418:0:2000::104]
 11    10 ms    11 ms    10 ms  2001:728:0:5000::af6
 12     *        *        *     Request timed out.
 13    11 ms    10 ms    10 ms  2a03:b0c0:1:a1::18a:f001

Trace complete.
```

"DNS servers translate IP addresses to readable locations, the packets then know where exactly to head to deliver the data."

How Can Internet Data be Intercepted?

We've seen how data travels around the Internet in packets and with the help of various protocols that determine its source, destination and what manner of data packet it is. While that's all well and good, it's worth knowing how a hacker goes about intercepting that information.

The data packets that make up a message, or a string containing a username and password, are sent to and from yours and other computers without most of us ever really knowing what's going on in the background. It's this lack of knowledge that's the hacker's greatest tool. Well, that and some clever software that's freely downloadable from the Internet. Let's look at how data can be intercepted by a hacker. Let's use the scenario that you're on a business trip, or just out and about, and you're using a café's free, public Wi-Fi.

There are numerous, and quite ingenious, ways in which data can be intercepted by a hacker.

> ***Man in the Middle***

Normally you need to be using an unsecure network, such as a public Wi-Fi but there are other ways and means.

MITM

The first and most notable form of attack is called MITM or Man In The Middle. This attack utilises a set of free tools that can essentially grab data packets from the locally used network. This means that the data packets leaving your computer must travel through the free Wi-Fi's network before going off into the Internet to its destination. The MITM attacker can sniff out this data, intercept the stuff that looks interesting, which can be done by reading the headers and footers and determining what the message/information contains, and decode it to view in plain text on their computer.

Think of this form of attack as a postman opening a bank statement letter, writing down all your bank details, then sealing the envelope before posting it through your door. The data packets are easily intercepted on the free Wi-Fi and unless you're using a HTTPS site, they take very little effort to decode and read.

Shoulder Surfing

Whilst not a technical way of intercepting data, hackers will still use the old tried and tested method of stealing information simply by sitting close to you and peering over your shoulder whilst you enter login details or write an email.

It doesn't take much skill, as we're usually so busy concentrating on other things that we often fail to notice someone looking over our shoulder. However, it's a real and credible threat, so be wary.

Fake Wi-Fi

This is another element to a MITM attack, also known as an Evil Twin. Essentially a hacker can sit at the same café as you and everyone else and use a set of tools that can pretend to be the actual Wi-Fi router belonging to the café. This enables them to do several things: first, they're able to beam out the fake Wi-Fi signal to every device within range, which in turn (if the users have their devices set to attach to any freely available Wi-Fi) will instantly connect to the fake signal. Secondly, once they have a device connected, they're able to use their laptop and the tools therein to intercept all the traffic that's being sent to their fake Wi-Fi signal. Thirdly, the attacker can connect themselves to the actual café Wi-Fi and act as a filter to the real connection to the Internet. The victim isn't even aware that their connection is compromised.

Naturally, this means that every single scrap of data is being filtered through the hacker's system. It's just up to them to collect it all, decode it and use the information within for their own gains.

Fake Sites

We've mentioned fake websites previously. This way of data interception is often working hand-in-hand with the scenario we're using as an example. Combining the aforementioned Evil Twin and packet sniffing methods, a hacker, who has taken the time to set up the scam, can create several fake website front ends that mimic banking sites, Outlook access, login pages and so on. They then host those sites on their interception laptop, together with the Evil Twin fake Wi-Fi and should a user connect and request the page of their bank they instead get the fake site that the hacker set up.

The victim will then unwittingly enter their details, which will be stored by the hacker before forwarding the victim to the actual bank website. The victim will then be required to re-enter their banking details into the actual bank website. For their part, they simply think they're mistyped a password and gain access to their account as normal. Sadly, the hacker now has plain text information regarding all their login details and can begin to transfer money from their account.

10 Tips to Protect Yourself Against Interception

While it may seem like fearmongering, detailing the ways in which data can be intercepted, it's sadly a real world fact. Public Wi-Fi, hotspots and free access points are the bane of the security industry. Thankfully, there are ways in which you can protect yourself.

Public Safety

Despite the different and varied ways a hacker can gain access to your inbound and outbound data, there are means in which you can defend yourself. Here are ten tips to help you protect your data from being intercepted.

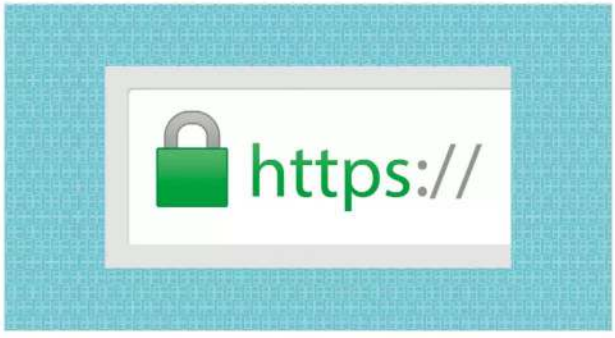
TIP 1 Not all public Wi-Fi access points are havens for nefarious hackers but that doesn't mean you should let your guard down. Every security software and firewall in the world can't help you if you're not savvy when it comes to information security. If you're going to use public Wi-Fi, don't use it for banking or other highly personal detail transactions.

TIP 2 It may not always be possible to spot an Evil Twin fake Wi-Fi access point. It's often best to double-check with members of staff, if it's a café, airport, restaurant or similar, that the Wi-Fi you're connecting to is actually theirs and not one that's being spoofed. Avoid Wi-Fi names like 'Free Wi-Fi Here' or similar.

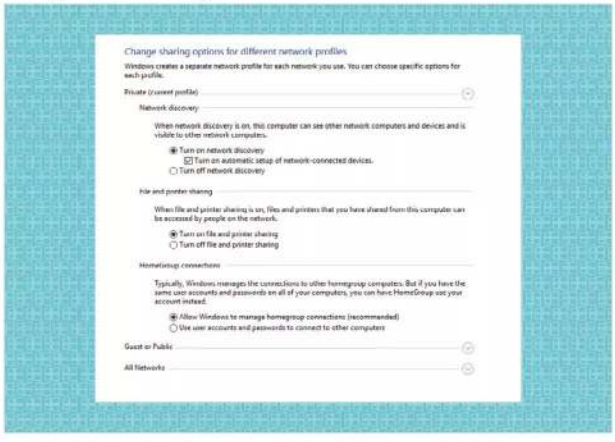
TIP 3 Always double-check a website for spelling errors, older logos or anything else that may raise an alarm. If your banking website looks even remotely different from when you last used it, try and avoid logging into it until you get to a more secure Internet location.

TIP 4 Ensure you use the latest antivirus and antimalware definitions for your security client. If you're going to use public Wi-Fi, make sure you're up to date prior to leaving, especially airport Wi-Fi points, and that the client is in good working order.

TIP 5 Always use HTTPS to access any website. This means that the information and data packets will be sent and received in an encrypted form and will make it exceedingly difficult for a hacker to decipher them. If possible, use an add-on such as HTTPS Everywhere for your browser of choice.



TIP 6 Turn off file sharing when you're using a public Wi-Fi access point. Whilst it's great to share your content on your home or work network, once you start using another network, your computer could start sharing that data with anyone who's also connected to the same network.



TIP 7 If you're not planning on using any public Wi-Fi points, then make sure that the Wi-Fi is turned off on your laptop, phone, tablet and other devices you have on you. There are instances when a device can automatically attach to any available network, unless otherwise told not to.

TIP 8 Using a VPN when accessing a public Wi-Fi point is a fantastic way of protecting your data packets. They can still be intercepted but the VPN client encrypts all outgoing and incoming data with the highest possible levels, making it virtually impossible for a hacker to decode.

TIP 9 To avoid shoulder surfers, make sure that the area behind you is clear and enter passwords etc. via your keyboard in the same way you'd protect your card details in an ATM. Cover your keyboard as much as possible and make a point of looking around to make sure no one is watching you over your shoulder.

TIP 10 If possible, always use a two-factor form of authentication. For example, some banks will utilise both a login from their website as well as a text sent with a unique code to a registered phone number. This way you ensure that the banking site is legitimate and a hacker can't go any further without the SMS pin sent by the bank.

How to Secure Your Devices

Mobile device hacking is on the rise. Most people now carry a phone or tablet around with them all the time, containing their emails, browser data, photos and enough personal information for someone to be interested.

Ten Tips for Safer Mobiles

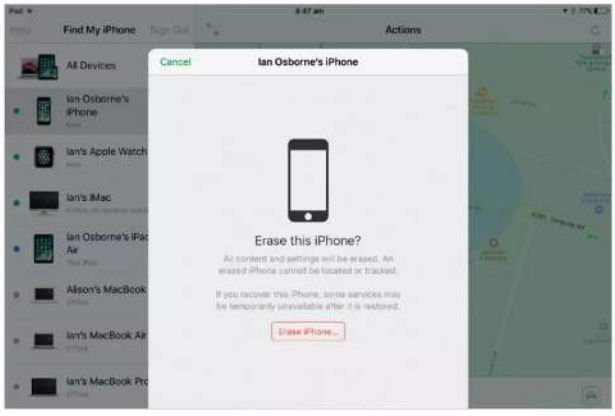
Your personal information is worth quite a bit to the right group of people. It's not just Windows security you need to keep in mind, you need to consider your mobile security too.

SECURITY LOCK

Locking your device is one of the most basic of security tips for mobile devices. Either use a number code, pattern lock or finger print to lock your device when not in use. Should someone steal it, it becomes a little more difficult for them to gain access. That won't stop a professional digital criminal, but it will deter the rest.

REMOTE WIPE

If possible set up some form of remote wipe. Should your phone or tablet be stolen or lost, you'll be able to use another Internet connected computer to send a delete signal to the lost device. You may never see the phone again but at least the personal data within is now out of the hands of others.

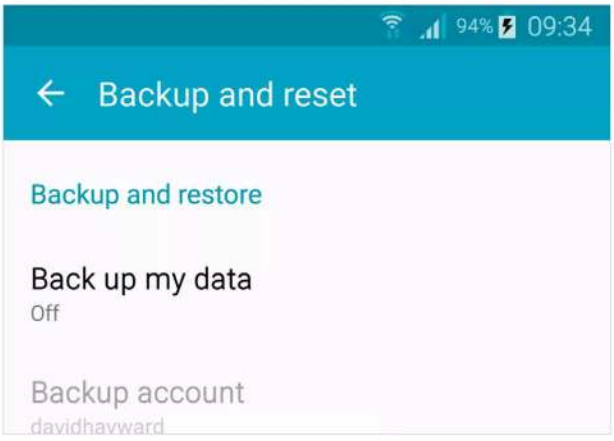


MOBILE ENCRYPTION

It's possible to set up data encryption on mobile devices these days. For example, you can encrypt the entire device or just the part that contains emails and personal or banking data. Either way, encryption will protect the contents of your device.

BACKUP DATA

Make sure that the data you have on your device is regularly backed up. You may have umpteen security elements in place but if the device is lost and you haven't made a backup, then your data is lost too.



BLOCK INSTALLATIONS

Try to avoid installing third-party apps. iOS devices are covered in this regard thanks to Apple's walled garden approach to its app store. However, Android users are particularly vulnerable. Don't install anything from an unknown source and research plenty before installing anything.

NO ROOTING

Avoid jailbreaking or rooting your device. Whilst it's regarded as a positive process, to remove the built-in software from the manufacturer and give you control over the device, it often also opens your device to backdoors that were previously sealed. Unless you know how to properly secure a device, leave rooting alone.

UPDATE SYSTEM

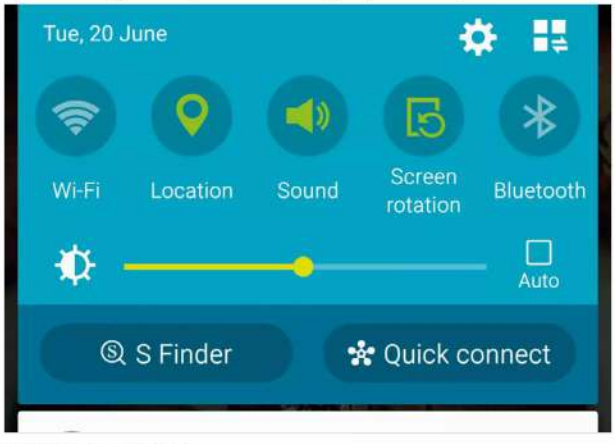
Keep your system as up to date as possible. It can be a pain having to frequently accept update and upgrade messages from your device, and waiting for the OS or the app to update itself, but more often than not an update will provide much needed security patches.

FALSE TEXTS

Be aware of social engineering phone scams, Vishing and Smishing in particular. Criminals love sending false banking texts, links to fake websites and all manner of other scams designed to gain access to your personal information.

POWER OFF WI-FI

Remember to turn off your Wi-Fi when you leave the home or office network. If you desperately require Internet access and don't want the data charges, then consider using a VPN if you're connecting to public Wi-Fi points.



MOBILE AV

Download and install a good mobile antivirus and malware tool set. Bitdefender, McAfee and all the other major security companies offer a mobile version of their products and with it you'll be better prepared for any potential cyber attack.

How to Secure Yourself on Facebook

Facebook has become one of the best sources for cyber criminals to gain personal information on the Internet. Without realising it, a user is giving out reams of data and in most circumstances they're making it public.

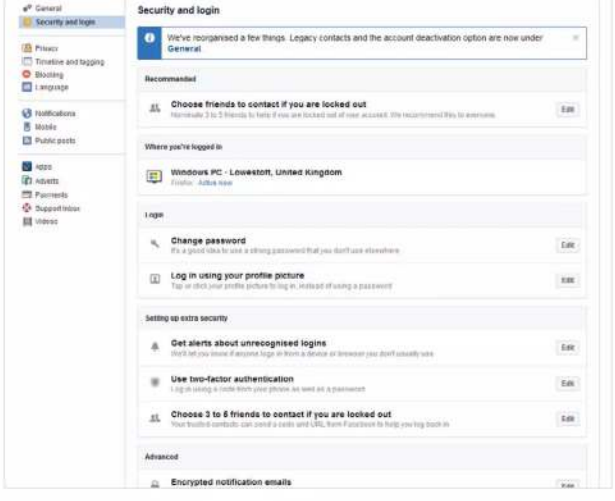
Tips for Better Facebook Profiles

The dangers of social media aren't just for young people, many adults have been duped into befriending someone they don't know and exposing their personal information.

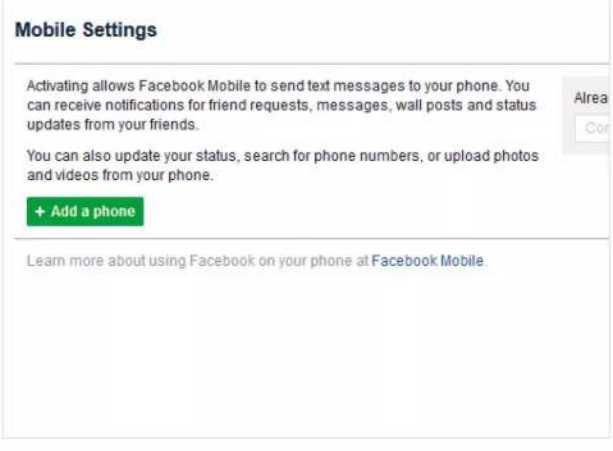
Facebook's policy forbids the use of fake names but it does allow nick names to be used. Where possible, use your nickname instead of your real name. This will effectively hide your real name details from those who would wish to exploit it.

Go to Settings > Privacy, and make sure that the Who can see my stuff section is set for just friends, as opposed to friends of friends or public. This will effectively hide your Timeline contents from others and only your confirmed friends will be able to see any updates.

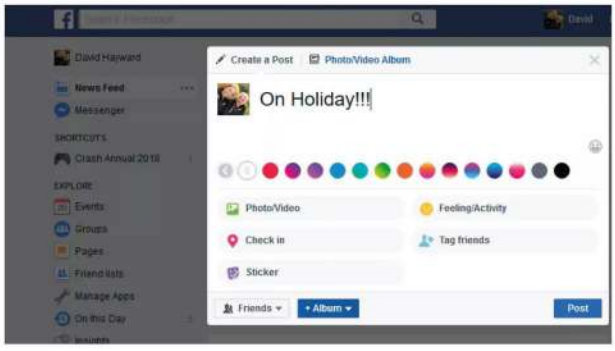
Set up two-factor authentication, alerts about unrecognised logins and make sure that emails from Facebook are encrypted. These can all be found in the Settings > Security and Login section.



Never post any contact information on your profile. We often automatically start filling in the phone number field on a site but take a moment to consider what the ramifications could be should your number be made aware outside your circle of friends. That also includes house address too.



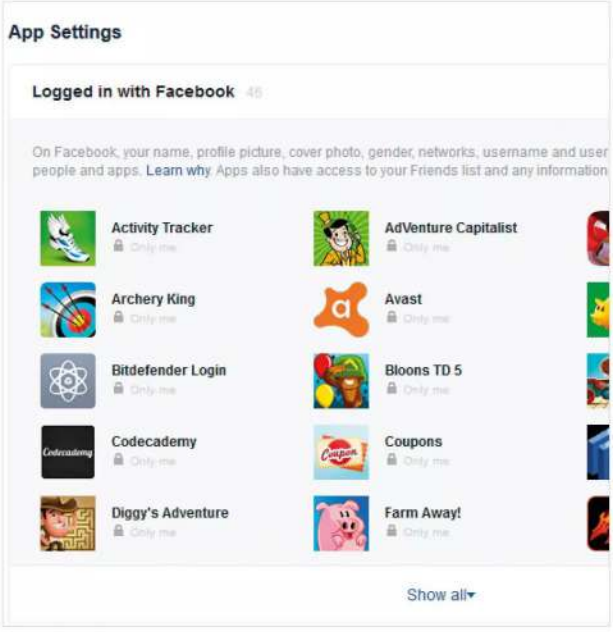
Tempting as it may be, try to avoid posting your location. Whether you're at home alone, or you're on holiday, should that information be made available then a criminal will know that your house is empty or worse, that you're alone in it.



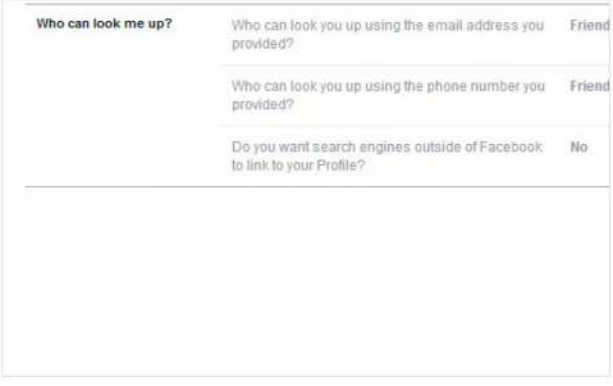
Try and avoid sharing random thoughts of the day, inspirational quotes, fake news or other such items that appear on your Timeline from others. Often these instances are created to farm for shares and likes and as such can often be traced back to individuals who are simply looking for active Facebook accounts.

Try not to accept every friend request you get. Take a moment to check the person out and if necessary message them to find out who they are and how they know you. If their comment is something like 'we met at the bar last month' then it's best to ignore the request, as they could be fishing for information.

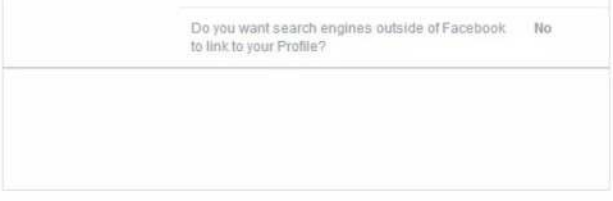
Not all apps you install on your phone or tablet are good. Take a moment to read what an app will try to access when it's installed. Often a rogue app will attempt to access your Facebook account to farm for your and your friend's information.



Whilst in the Settings > Privacy section, consider editing the default options for the Who can look me up fields. These will prevent the public, or even friends of friends, from being able to find you on Facebook, which in turn adds a higher level of security to your account.



Finally, ensure that the Do you want search engines outside of Facebook to link to your profile option is set to No. This will hide you from someone who has entered your name into Google in the hope that they might be able to find your Facebook account.



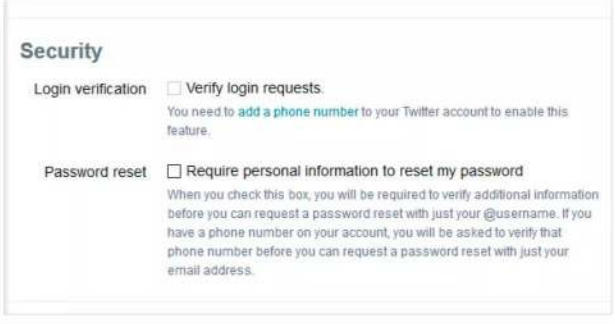
How to Secure Yourself on Twitter

Twitter's success has boomed in recent years. Where once it was simply one of the more popular social media platforms, thanks to presidential candidates and scores of celebrities, it's fast become the modern media phenomenon.

Securing the Twitterverse

Sadly, due to its popularity, Twitter is a hotbed of scammers, spammers, hackers and social engineers scouting out the next potential victim for monetary gain, or simply behaving abusively. Here are ten tips to help secure your Twitter account.

If you click on your profile picture and choose Settings and Privacy from the menu, you're able to set up a form of two-factor authentication called Verify Login Requests. This will enable Twitter to use your phone number to send texts for any login requests. So even if your password is compromised, the hacker can't get in without the text code.



Just like most other social media platforms, phishing scams are rife on Twitter. Be wary of anyone sending you Tweets claiming to be someone you know, offering a too-good-to-be-true job or even informing you that your account is compromised. It's likely a phishing scam, so delete and report the instance to Twitter.

We've previously mentioned the fact that using weak passwords is, unsurprisingly, not recommended. However, you'd be amazed at how many people still use the likes of 'password1234' or something similar. Set a good, strong password that will take some cracking.

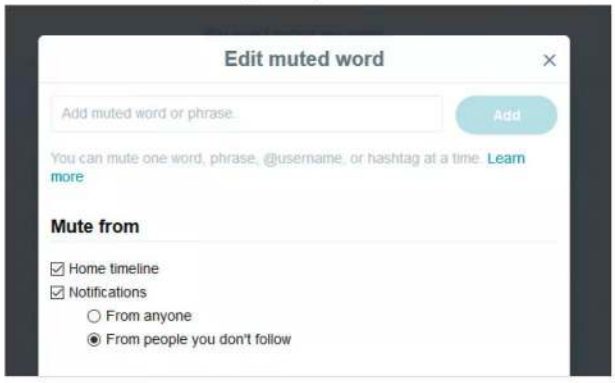
There are many accounts on Twitter that simply aren't real. These bots, as they're known, can be programmed to post daily amusing, inspiring and socially acceptable Tweets. On the flip side, other bots are designed to Tweet suspicious links to virus-infested websites. In short, unless you trust the account, don't follow any links. address too.

Within your account settings, you'll see a menu to the left with a Privacy and Safety option. Click this to enable Twitter privacy, Discoverability, Direct Message notifications, the ability to hide sensitive Tweets and the removal of blocked accounts. It's worth going through the list to further secure your account.

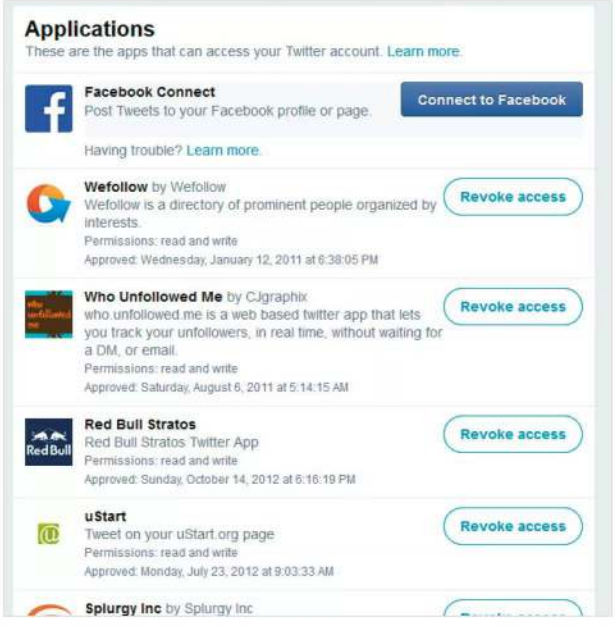
Direct messaging in Twitter is both advantageous and dangerous at the same time. Whilst great for communicating directly with another user, it's also used by others to lure in victims or send links to malicious websites. It's best to ignore most messages unless you know who they're from.

If you use your Twitter account to login into any third-party apps or games, then you may need to consider setting up a secondary Twitter account. Whilst convenient, some apps can be hijacked to collect account details, leaking them to hackers.

Word Muting is an excellent feature within Twitter's account settings. With it you're able to mute any words you don't want to see in your notifications or timeline. There are often Tweets you'd like to avoid even seeing in your timeline, so muting them is an ideal solution to help keep your account clean and free from negative aspects.



It's always worth browsing through the Apps section in the Twitter options. This is where you can allow or revoke access for any apps you've used via the Twitter account; and you can also see what rights each app has to your Twitter account.



Like Facebook, be careful of what you post. It's nice letting others know you're off on holiday to the Bahamas for several weeks but there could be a rogue account that's now informed of an empty house; and if you were foolish enough to mention your address in previous Tweets, they know exactly where to go.

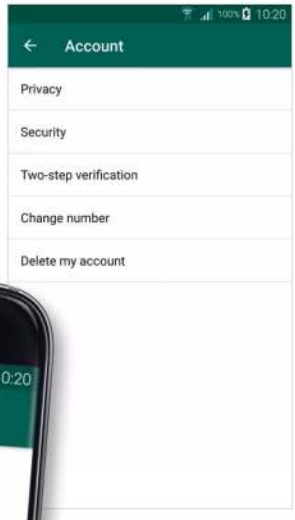
How to Secure Yourself on WhatsApp

With over a billion users worldwide, WhatsApp is proving to be a force to be reckoned with in the social media marketplace. This messaging app was released over eight years ago and developed by the Facebook team; since then it's become the most popular messaging app.

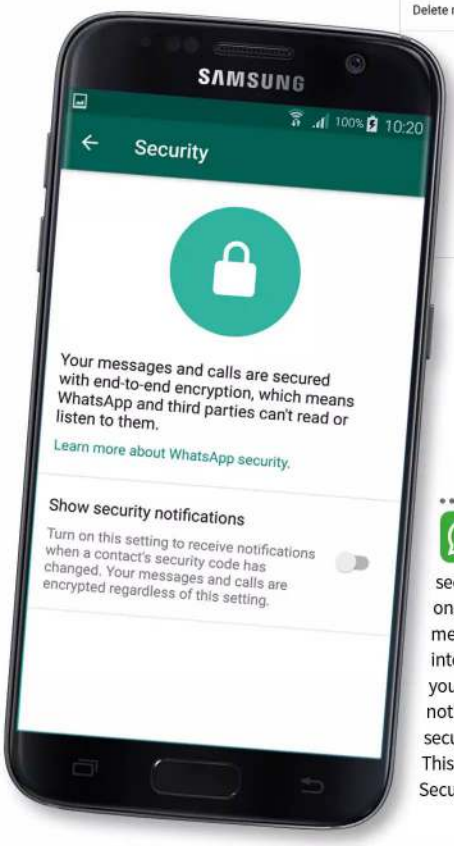
WhatsApp Security Tips

With this popularity comes a darker side to messaging. Accounts of terrorists using WhatsApp, along with hackers, scammers and all manner of nefarious individuals and groups are ever in the popular media.

Protecting your WhatsApp account can be done mainly through the Settings > Account > Privacy option. In here you're able to secure your personal details, profile, status, messaging and who can see your account.



For added security you can opt for two-step authentication, which will require a PIN when registering your phone number with WhatsApp. This is an absolute must for those who use the app regularly.

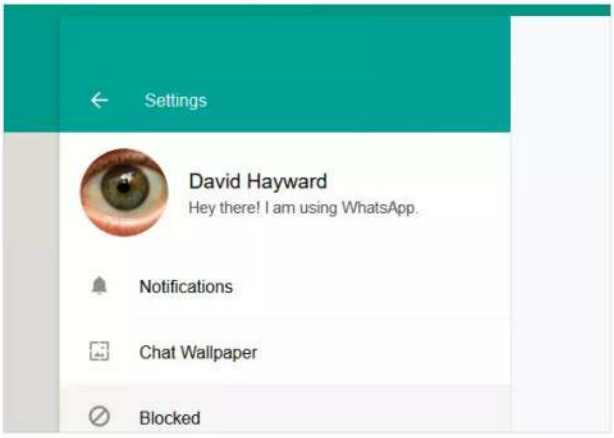


Thankfully, WhatsApp already encrypts and secures messages sent from one device to another. This means that your data can't be intercepted and read. However, you can opt to view security notifications if a contact's security setting has been altered. This is in the Settings > Account > Security menu.

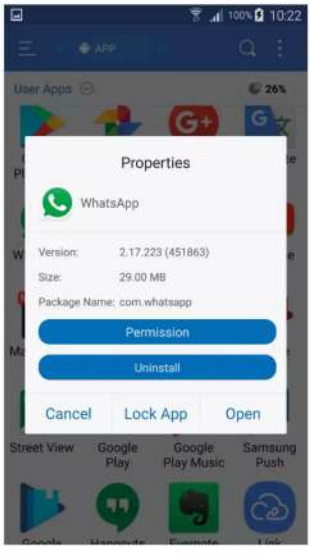
Beyond WhatsApp itself, make sure that your phone or tablet is securely locked with an access PIN, pattern, facial or finger print recognition system. This way, should you lose your phone, it will be locked against anyone who tries to access it and WhatsApp.

Generally you're not able to add users to your chat list if you don't already have them in your contacts list. However, clever phishing scams can have a victim add a contact, who can then message them using WhatsApp; as with all social media platforms, be wary of phishing attacks.

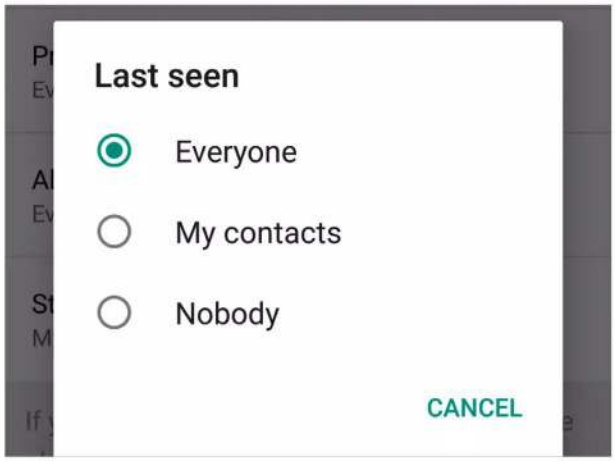
You can block users via the WhatsApp Web feature. Log into WhatsApp Web, and click on the three horizontal dots by your profile picture. Then click Settings and from there the Blocked option. You can select contacts to block from WhatsApp.



You can block all images from appearing on your photostream within WhatsApp. iOS users can look to their Settings then Privacy > Photos and deselect WhatsApp from the list of allowed apps. Android users will need to create a file called .nomedia within the WhatsApp images folder to stop the app from listing pictures.

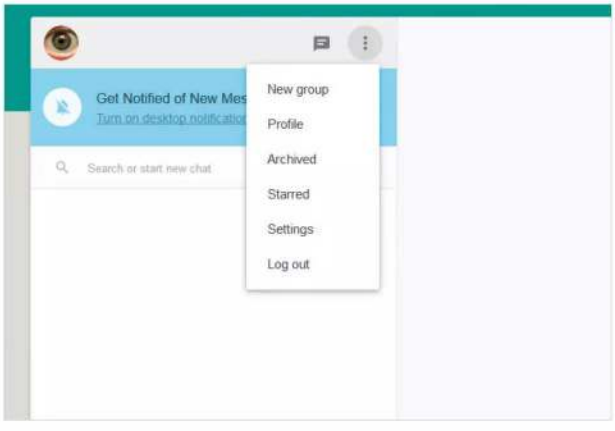


If you don't want WhatsApp contacts to see where you've been, you need to disable the Last Seen option within the Privacy settings. This will prevent other users from 'seeing' your movements. Should a malicious contact be added, they will never know where you are or have been.



Be wary of scams where you're contacted through other social media accounts informing you that your WhatsApp account has been compromised. These often request you to add a so-called legitimate contact, who in reality isn't, or visit a webpage that's riddled with malware.

If you use WhatsApp Web it's always best to ensure that you've logged out of it correctly before leaving your computer. The last thing you need is for someone to come over to your computer and view any conversations between contacts.



What to Avoid when Creating a Password

Creating a strong password sounds easy on paper but when you're presented with the password box it's easy to become stumped. Should you get past that part, there are also security rules to follow to further protect that password.

PA55W0RD1234

To help you create the perfect password, and secure it further, here are ten tips for happier password management. There's always password pitfalls but stick to these general tips and you should be okay.

OBVIOUS DATES

Never use your date of birth, partner's date of birth, children's date of birth, pet's names, family names or even the town where you grew up in. This is all information that can easily be collected from social media sites or even a clever Internet search.

VISIBLE PASSWORD

Never write your password down on a Post-It note or somewhere near your computer. It's not too difficult for someone to visit your computer whilst you're on a coffee break and read the note.

SAME PASSWORDS

Never use the same password for multiple sites. It's tempting and easy to have a single password for everything but should that password ever become compromised you will lose access to every site you visit, including any banking sites.

COMMON PASSWORDS

Try and avoid using common words in your password. Most password attacks are brute force, using dictionary words to gain access. Avoid using sequences of numbers, such as 1234. Instead, try inserting numbers, capital letters and symbols into words, such as C0m"o% instead of the word common, for example. However, avoid common words altogether if possible.

CHANGE REGULARLY

Regularly change your password. Most companies and good sites will require you to enter a new password that hasn't been used previously in the last few months every thirty days or so. If not, then you should actively keep changing your password yourself.

UNTRUSTED DEVICES

Never enter your password on a device or computer you don't trust. Entering your account details on a public computer, such as a kiosk or library, is dangerous as you don't know what protection these machines have nor whether they've already been compromised.

PUBLIC WI-FI

Try to avoid logging into certain sites when you're using public Wi-Fi. We've already covered how data on a public, free Wi-Fi access point can be intercepted. Your passwords, therefore, can be intercepted and viewed in plain text by a hacker.

LENGTHY PASSWORDS

Don't use short passwords. The longer they are, generally, the harder and more complex it will be should anyone try to crack it. A longer password that also utilises upper and lower case, numbers and symbols can't easily be viewed by any shoulder surfers.

SECURITY QUESTIONS

In addition to creating a password, some sites also offer a rescue security question. Sadly most of these questions are a little too easy to get the answers for. Questions such as Mother's Maiden name, first pet, town where you grew up, etc. can again be obtained by the clever hacker.

STRONG PASSWORDS

A strong password isn't going to be easy to remember at first. For example, something like 8%&KY4&$XzwMhfrk will take a hacker around a hundred thousand years to crack but it hardly flows off the tongue. Find a happy medium and make your password as strong as possible.

Password Generators and Tools

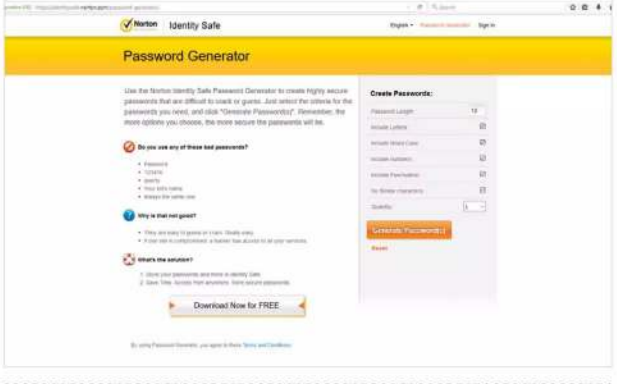
We've looked at some tips on what not to include when coming up with a strong password. However, it's not always as straight forward as that. Whilst some can come up with an elaborate and incredibly strong password, others struggle. Thankfully, there's help on offer.

Top Ten Password Generators

We live in an age where you don't have to sit with a dictionary and cryptic decoder to come up with an excellent password. There are many generators freely available to help you out. Here's our top ten.

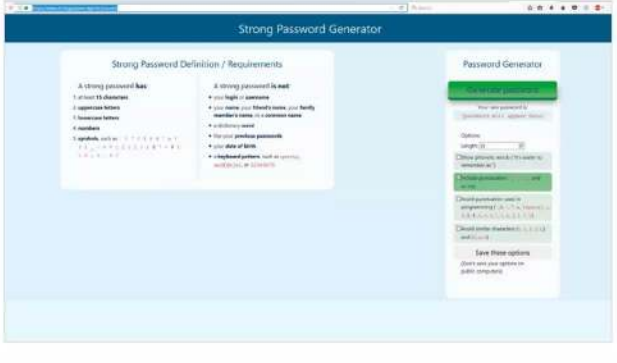
NORTON IDENTITY SAFE PASSWORD GENERATOR

Norton by Symantec, offers a handy free password online generator. You can set the password length, include letters, mixed case, numbers, punctuation and no identical characters. You can find it at: **https://identitysafe.norton.com/password-generator/**.



STRONG PASSWORD GENERATOR

Another great online resource that will create an incredibly strong password based on the options you choose. You can choose the length, punctuation and avoid similar characters but also display phonetic words to make it easier to remember. Try it out at: **https://strongpasswordgenerator.com/**.

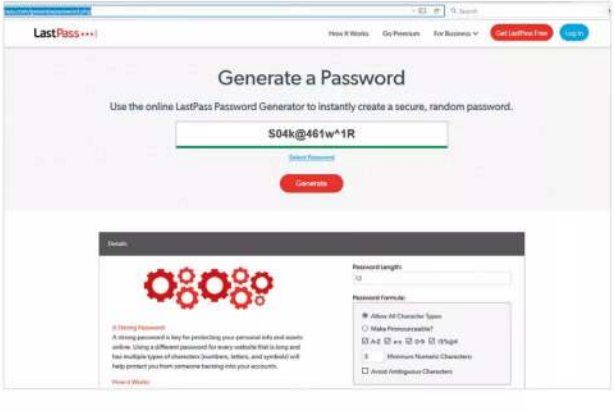


WIGHT HAT PASSWORD GENERATOR

This online password generator has been around for quite some time and has proved to be one of the best available for those after a unique and unbreakable password. There are ample options, and none of the passwords generated are stored remotely. Visit: **http://strongpasswordgenerator.org/** for more information.

LASTPASS

LastPass is a popular password management program, which we'll look at in the next section; it also offers a free password generator. Found at **https://lastpass.com/generatepassword.php**, this excellent tool will help you create a strong and virtually unbreakable password in seconds.



MSD SERVICES

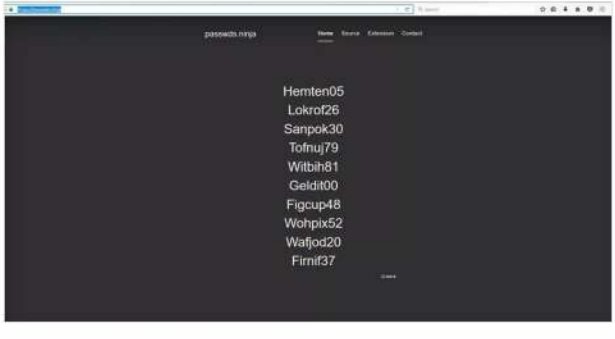
An interesting site this, one that will allow you to create multiple unique passwords, based on length, upper and lower case, number and symbols as well as whether the end result will be pronounceable or completely random. It's at **https://msdservices.com/apg/index.php** for those after several passwords.

SAFEPASSWD

Another great site to have in your password arsenal. SafePasswd has been around since 2006 and is regarded as one of the best online password generators. The options are many and with them you can create something truly impossible to crack. You can find it at: **https://www.safepasswd.com/**.

PASSEDS.NINJA

This is a quick and easy online password generator. You won't get any options or added extras, you simply click a button and ten unique passwords will be displayed for you to choose from. It's worth looking into for a quick solution to password creation; **https://passwds.ninja/**.



XKPASSWRD

This site is powered by the XKPasswd.pm Perl module, which offers a range of settings to help create a unique and very strong password. There are plenty of options to choose from and you can save and load your preferred configuration for later. It's at: **https://xkpasswd.net/s/** if you want to check it out.

LITTLELITE PASSWORD GENERATOR

Another simple but easy to use and good online password generator. LittleLite offers some options, including password length, number, upper and lower case, symbols and spaces. It's found at **http://www.littlelite.net/pwdgen/** and certainly worth considering bookmarking.

DINOPASS

For kids at school or when online, DinoPass is an excellent resource that will help them come up with a memorable, yet strong password. You can choose between a simple or strong password type, depending on where it's going to be used and there's meanings of each to help out, too. You can find it at: **http://www.dinopass.com/**.

Top Ten Password Managers

Creating uncrackable passwords is one thing, remembering them for each of the services that require one is something else entirely. The reason why most people opt for a single password for all their accounts is simply due to not being able to remember them all. This is where password managers help.

Manage Those Passwords

Password managers differ in what they offer, how they work and what optional extras they provide. Therefore it can be tricky to find one that fits the bill. Some are free, others cost a monthly or annual fee; here are ten to consider.

LASTPASS

LastPass, which also offer a free password generator, is regarded as one of the finest managers available. There's a free version that offers unlimited password storage, cross-platform access, two-factor authentication and elevated levels of encryption. There's also a Premium version that offers a lot more, including 1GB of encrypted file storage and higher levels of encryption.

STICKY PASSWORD

Sticky Password is available both as free or Premium versions, costing just £24 and offers two-factor authentication, autofill for websites, advanced biometrics; it's also available on all major platforms. The Premium version goes further with cloud backup and syncing and with every license purchased a Manatee is saved. Certainly worth considering.

ZOHO VAULT

Zoho Vault is another excellent password management application. With a free version on offer, moving up to Enterprise levels for just €7 per month, Zoho allows unlimited passwords, access from all platforms, password tracking, offline access, auto-login for websites and much more.

DASHLANE

With free, Premium and Business options available, Dashlane covers a huge user base. Its features are many and it offers the user a high degree of encryption and security alongside all the usual auto-filling, two-factor authentication and the ability to export data.

KEEPER

Keeper is a powerful and feature rich password manager that has Individual, Family and Business plans available for £20.99, £44.99, and £22 per year respectively. With unlimited password storage, unlimited device syncing, finger print login and secure cloud backup, amongst others, it's certainly one to consider.

KEEPASS

KeePass is a freely available, open source password manager that's regularly updated and comes with a long list of interesting features. You can import and export password data, it's fully portable so there's no installation required and it adheres to 256-bit AES encryption.

1PASSWORD

1Password offer an individual and Family plan for as little as £2.30 and £4 per year. With it you can access password across all your devices and operating systems; there's offline access, automatic synching, 1GB of secure storage available and a 365 day password history recovery.

PASSWORD BOSS

Password Boss offers both free and Premium plans, with the Premium plan costing around £24 per year. There are ample features to enjoy, including cross platform support, full military encryption, cloud synching and more.

TRUE KEY

True Key is an excellent password manager with a free and Premium plan available; the Premium plan costing around £29.99 a year. It's unique in that it utilises facial recognition as well as finger print, and integration with Windows Hello. There are plenty of other options available too, so it's worth looking into.

LOGMEONCE

LogMeOnce is an award-winning password manager that incorporates many interesting features. It's ultimate selling point, however, is a passwordless operation, whereby you are able to log in to any website or service just by using facial recognition. Prices do vary across the Premium, Professional and Ultimate editions but the personal version is free.

Shopping Online and Security

Windows is continually improving and as such the new updates have brought a more customisable degree of control over the operating system's privacy configuration; something that Microsoft has always been criticised for in the past.

The length of breadth of online shopping is far too vast to cover every conceivable angle here. So rather than

"10 Online Shopping Security Tips"

focus on particular elements, here are ten online shopping security tips to apply across the board.

RUSH BUYING **Don't be fooled into rush buying something that's at a ridiculously low price. If a site is selling an iPhone for £20, then it's more than likely to be a ruse to lure you in and steal your money.**

FAKE SITES Ensure that you're buying from a real website. Fake sites are remarkably easy to create by the clever hacker and are designed to steal your transactions. Be wary of sites other than the big names. While smaller online shops are fine, just look into the type of security it's using and do some research before purchasing.

BOGUS EMAIL Strange email addresses are something to look out for with suspect online shops. If the support email or contact information for the site is something like: ebayhelp@gmail.com instead of support@ebay.com, then there's most definitely something wrong.

USE HTTPS

Remember to load up the online shop using HTTPS instead of HTTP. This will ensure that the transactions and data sent between you and it are encrypted to the highest possible levels. If possible, use a browser add-on such as HTTPS Everywhere.

STRONG PASSWORDS

Use a strong and unique password for all your shopping sites. Occasionally, although not often, websites can be hacked and the database of users is leaked. If your password is strong enough, it will stand up to any decryption methods.

AVOID PUBLIC Wi-Fi

Tempting as it may be, don't use a public Wi-Fi access point to conduct any online shopping. For one, you could be attached to an Evil Twin Wi-Fi point, where the hacker is filtering all information through their system and two, all your data can be intercepted and potentially read.

SHOPPING APPS

If possible, always use an online shop's dedicated app rather than the standard website. Websites can be compromised, however apps from iTunes and the Windows Store, for example, can't be altered by a third-party.

3RD PARTY SECURITY

Invest in one of the many third-party antivirus and malware suites, such as Bitdefender. These programs also offer extra security when shopping online and can help prevent any hacking or data interception from happening whilst the transactions are in progress. They can also check the site you're buying from, too.

PAYPAL

If possible use PayPal or a Credit Card as opposed to a Debit Card. Credit cards have an extra layer of protection and legal standing than that of a debit card; PayPal features many protection elements within its accounts too.

BANK TRANSACTIONS

Always keep an eye on your bank account and the transactions that go on after you've conducted online shopping. This will help you get an idea of what's going on and should something suddenly crop up that looks suspicious, then you're able to inform your bank before too much damage is done.

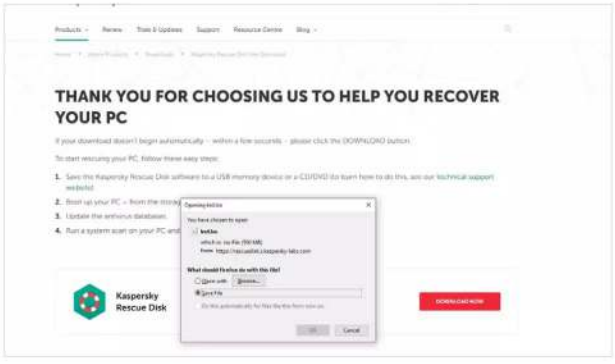
How to Remove a Virus or Malware from a Windows PC

So far we've looked at ways to prevent getting scammed or indeed getting malware on your system, but what if you're unlucky enough to already have some form of digital infection? Thankfully, there's a way to remove malware and viruses from your computer.

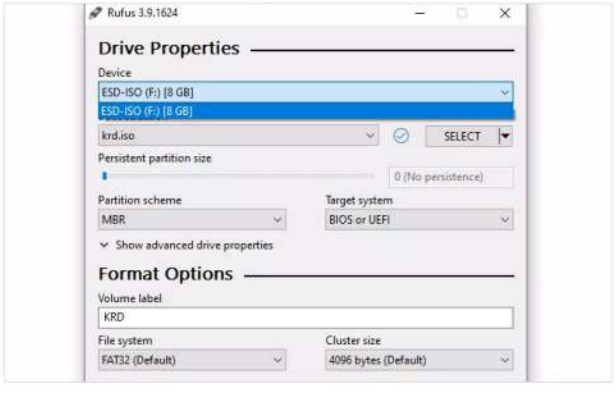
Malware Busters

For this tutorial we'll use a pre-configured rescue disk from Kaspersky. We'll need to transfer, or burn, the disk contents to a CD or a USB stick and boot into the safe environment through one of those mediums.

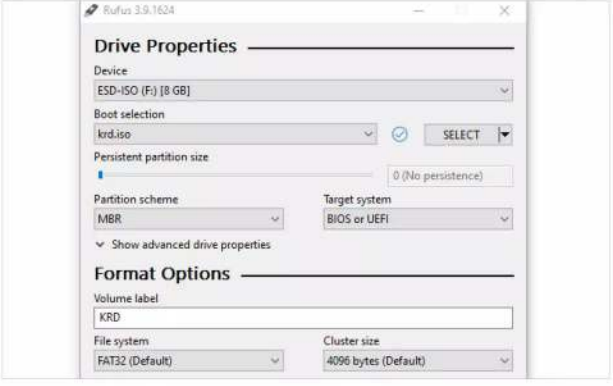
STEP 1 Make sure you have a blank CD or a USB stick that's at least 1GB in size. The Kaspersky Rescue Disk is downloaded as an ISO (which is an image file containing all the disk information), and can be downloaded from **https://www.kaspersky.com.au/downloads/thank-you/free-rescue-disk.**



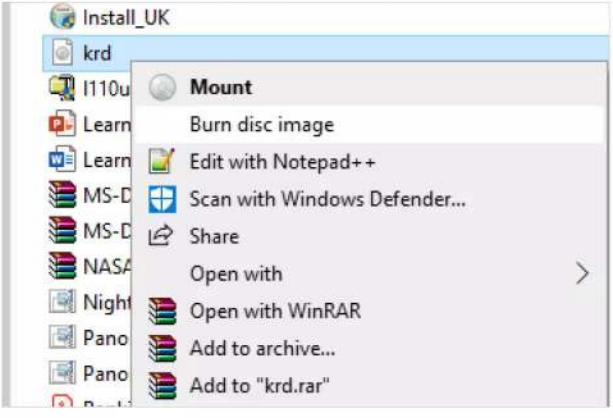
STEP 2 To transfer the ISO to USB download Rufus; which is an executable that doesn't require any installation, and can be downloaded from: https://rufus.ie/. Insert your USB stick and double-click Rufus. Check that the Device label is pointing to your inserted USB stick, if not then you may need to close Rufus, remove the USB, then re-insert the USB and re-start Rufus. The remaining options can be left as their defaults.



STEP 3 Click the Select option, and using Windows Explorer, locate the downloaded Kaspersky Rescue ISO – it'll be called krd.iso. Click the Start button to select the image and continue with the process. This will copy the contents of the ISO to the USB while also making the USB a bootable device.



STEP 4 If you're using a CD, start by inserting the CD into the drive. Locate the downloaded Kaspersky Rescue ISO, right-click it and choose Burn Disc Image from the context menu. Tick the Verify disc after burning option, and click the Burn button to start the process. Once the ISO is burnt to the disc, you can power off your computer.



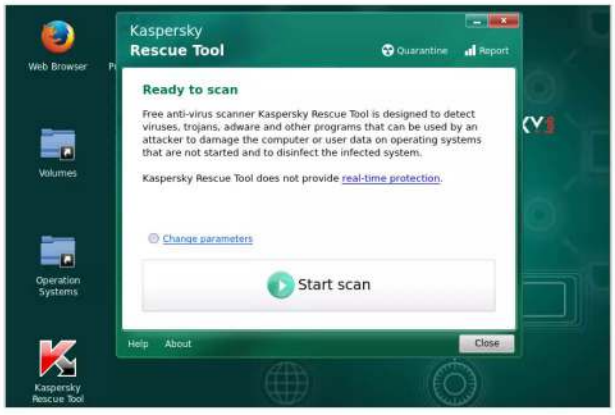
STEP 5 You'll now need to allow your PC to boot up into the Kaspersky Rescue CD environment. Power up your PC and open the Boot Option Menu. This could be accessed by pressing F12 (depending on the make and manufacturer of your PC motherboard). With the boot options available, select either the CD or USB stick and press Enter.

STEP 6 The PC will now boot into the Kaspersky Rescue Disc environment. This is a custom Linux operating system with all the necessary security tools pre-installed. First, you'll need to choose which language to load the environment in. Use the arrow keys, and press Enter for your language choice. After that, choose the Graphic Mode.

STEP 7 Begin by accepting the license agreement. After that, the rescue disc will check its status and open a window asking for you to start scanning the system. However, it's best to check you've got access to the Internet in order for it to update first. Close down the Rescue Tool window, and click on the Network box in the bottom-right. Connect to Wi-Fi, or Wired as required.

STEP 8 Once connected, relaunch the Kaspersky Rescue Tool from the desktop icon, agree to the license once more. Before you begin, click on the Change Parameters link in the Kaspersky Rescue Tool window. This will enable you to choose which drives the tool can scan for infections and malware. Tick all the drives in your system.

STEP 9 When you're ready to continue, click on the Start Scan button in the Kaspersky Rescue Tool window. This will begin the process of scanning all the drives selected in the previous step. Be aware, that, depending on the size of your drives and the amount of data on them, this could take quite some time.



STEP 10 While the scan is working, you'll see the object that the tool is currently processing. You'll also get a brief run-down of any threats currently found, time taken, and number of files scanned. Once complete, you can view a report by clicking on Details. Hopefully, you're malware free, and you can remove the USB/disc and reboot the system.

ADVANCED SECURITY TIPS

If you want to improve your Windows security further, then this section will look at more advanced ways and means in which you can achieve that goal. We cover firewalls, sandboxing and virtual environments, and how to tell which programs are communicating beyond your home network.

Our easy to follow tutorials will help you create a reliable backup of Windows and all your data, so should something unfortunate happen, you'll be able to restore your files with confidence.

Windows Privacy Settings

Windows's new updates and special edition updates have brought a more customisable degree of control over the operating system's privacy configuration; something that Microsoft has always been criticised for in the past.

Windows is said to be the last true Windows desktop release, with the Redmond company now opting for a rolling release cycle, that will add or remove features over time through regular updates.

> **Going Private**

There are many advantages to this particular setup. A Windows user will always be up to date with regards to security, options and support. Any new hardware that's released will be added to the vast driver database that Windows already uses and it will operate at its maximum potential. Microsoft can gradually roll out features that would require a brand new operating system, thus maximising the capabilities of the OS. Of course, the company can charge for certain additional features that would ordinarily be a part of the OS, such as a media centre for example.

However, profit margins aside, it's the rolling security and updates that the user will benefit greatly from. As Microsoft evolves Windows, user and developer feedback can help improve the way the OS protects its user base. A prime example is the new privacy settings available post-Fall Creators Update, which was gradually rolled out to Windows PCs around late October 2017. The privacy settings and options that are now on offer are a radical improvement over the previous, rather bleak, features that came with the original Windows setup. Now, the user has greater control over what the OS can and cannot do to affect an individual's privacy.

Providing you've applied the Fall Creators Update, you can view the current privacy options by clicking the Windows Start button and typing privacy into the search box. Click on the Privacy Settings option, with a padlock icon, and the core privacy options window will open. There are, at the time of writing, nineteen different options available to browse through. Each option, when clicked, will display a subset of available options that can then be enabled or disabled and turned on or off, depending on your preference.

For example the first option, General, offers the user a choice of opting for advertising via apps, allowing websites to provide locally relevant content based on the user's language list and allowing Windows to track how an app is launched to improve search results. Whilst that in itself doesn't sound too much like your privacy is being infiltrated, there are those who don't want the installed apps and the OS having too much knowledge of where they are and what to advertise. Like most privacy options, it's a personal preference as to what you're happy sharing with the system and its connected technologies. Whilst opting to turn every privacy setting on will inevitably open your use of Windows up to whoever or whatever is readily receiving the information, likewise turning everything off will effectively hide you (to some degree); but at the cost of possible loss of available features. There's a fine balance needed to get the best from your privacy and still enjoying Windows's many features.

There are some interesting additions to the Fall Creators Update privacy settings, which are certainly worth looking over, if you want a best of both worlds approach to privacy and features.

Location – The Location option will allow Windows and its apps to use your current location to specialise any content. It's innocent enough but for added privacy it's worth considering turning it off.

Camera – This is an excellent addition that will define which installed apps have access to the computer's webcam. You can turn off app access to the camera globally or browse through the apps to decide which has access, or not.

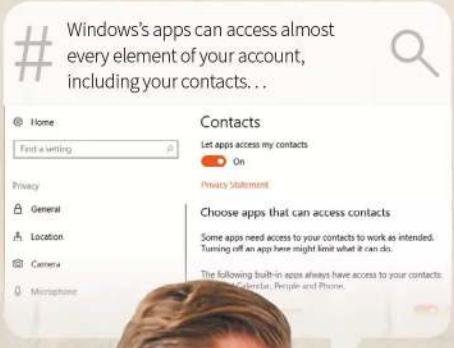
Microphone – The same applies for the computer's microphone; which apps can access it or not, and whether you want to globally turn it off.

Contacts – The Contacts section details which apps can have access to your current Windows account contacts. Disabling this globally may have a severe impact on how some apps, such as Skype and email work.

Radios – This option will define which apps can control hardware such as the computer's Bluetooth device, Wi-Fi or any other kind of wireless receiver. Obviously, some apps will require access to share information or allow access to shared areas.

Background Apps – Windows's background task handling is far better than in previous versions of the operating system. Memory is released as apps drop into the background, as is processor allocation. However, you can further define which apps will be allowed to run in the background with this option.

Taking time to go through each of the available options is something every Windows user should do. This way you become familiar with how the OS shares your account data and what exactly has access to your Windows computer and its hardware.



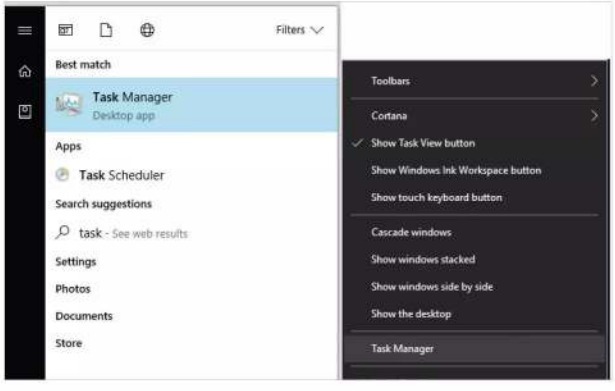
How to Check which Apps are Sending Information

Most Windows apps and programs have some element of code that will attempt to communicate with an external source. That communication could be to check for the latest version, or patches and updates, or it could be malicious software sending personal data.

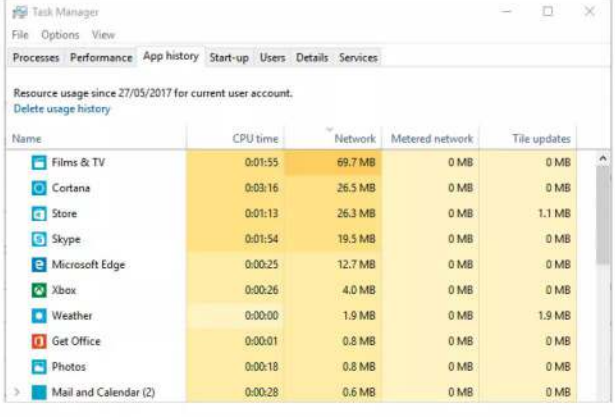
Look Who's Talking

There are a number of ways in which you're able to view which programs and apps are sending data to Internet and external sources. Some methods are better than others, so it's worth trying them all to see which works best for you.

STEP 1 The first port of call to help monitor what apps are accessing the Internet is Task Manager. Click the Windows Start button and type task, then click the Task Manager result in the search box. You can also right-click the taskbar and select Task Manager from the available option in the menu.



STEP 2 With Task Manager displayed, click the More Details arrow (if it's available). This will expand the Task Manager options. From here, click the App History tab and then the Network column so that there's a downward pointing arrow above it. This indicates network use in a descending order of amount of data sent.

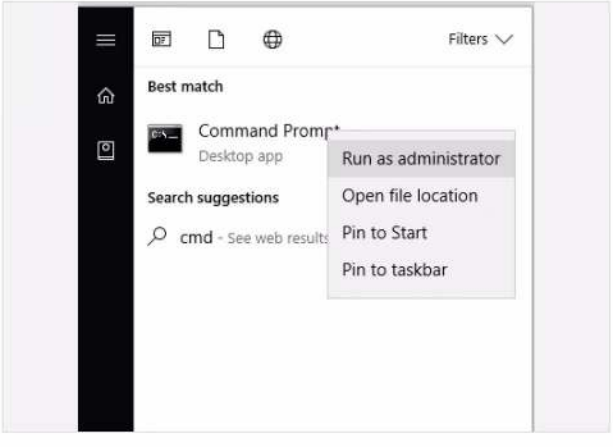


Name	CPU time	Network	Metered network	Tile updates
Films & TV	0:01:55	69.7 MB	0 MB	0 MB
Cortana	0:03:16	26.5 MB	0 MB	0 MB
Store	0:01:13	26.3 MB	0 MB	1.1 MB
Skype	0:01:54	19.5 MB	0 MB	0 MB
Microsoft Edge	0:00:25	12.7 MB	0 MB	0 MB
Xbox	0:00:26	4.0 MB	0 MB	0 MB
Weather	0:00:00	1.9 MB	0 MB	1.9 MB
Get Office	0:00:01	0.8 MB	0 MB	0 MB
Photos	0:00:18	0.8 MB	0 MB	0 MB
Mail and Calendar (2)	0:00:28	0.6 MB	0 MB	0 MB

STEP 3 This is a reasonably accurate way of viewing which installed programs have been accessing the outside world. The amount of data being sent to and from your PC can be quite illuminating, and surprising, as you may never even realise you have a particular app installed never mind that it's communicating with an external source.

Films & TV	0:01:55	69.7 MB	0 MB	0 MB
Cortana	0:03:16	26.5 MB	0 MB	0 MB
Store	0:01:13	26.3 MB	0 MB	1.1 MB
Skype	0:01:54	19.5 MB	0 MB	0 MB
Microsoft Edge	0:00:25	12.7 MB	0 MB	0 MB
Xbox	0:00:26	4.0 MB	0 MB	0 MB
Weather	0:00:00	1.9 MB	0 MB	1.9 MB
Get Office	0:00:01	0.8 MB	0 MB	0 MB
Photos	0:00:18	0.8 MB	0 MB	0 MB
Mail and Calendar (2)	0:00:28	0.6 MB	0 MB	0 MB
Sport	0:00:01	0.5 MB	0 MB	0.5 MB
OneNote	0:00:01	0.1 MB	0 MB	0 MB
Twitter	0:00:01	0.1 MB	0 MB	0 MB

STEP 4 Another excellent method is by using the Netstat command. Click on the Windows Start button and enter **cmd**, then right-click the Command Prompt option and choose Run as Administrator from the menu. When the message to authenticate the action pops up, click on Yes.



STEP 5

With the command prompt open enter the following: **netstat -e -s -p tcp -b**. The information populates the command prompt box quickly, so you need to scroll back up to the top to see it in its entirety.

```
Administrator: Command Prompt

Microsoft Windows [Version 10.0.15063]
(c) 2017 Microsoft Corporation. All rights reserved.

C:\WINDOWS\system32>netstat -e -s -p tcp -b
Interface Statistics

                           Received            Sent

Bytes                     596867720        65196200
Unicast packets              515780          349675
Non-unicast packets           16485            6265
Discards                          0               0
Errors                            0               0
Unknown protocols                 0

TCP Statistics for IPv4

  Active Opens                            = 5067
  Passive Opens                           = 405
  Failed Connection Attempts              = 121
  Reset Connections                       = 763
  Current Connections                     = 16
  Segments Received                       = 712631
  Segments Sent                           = 572026
  Segments Retransmitted                  = 7899
```

STEP 6

What you're looking at here is a list of programs, from the column to the far left, with the IP address of its source and the destination address in the middle column; with a third column detailing if the connection is established or not. It can be confusing to view at first but after a moment or two it should begin to make sense.

```
Active Connections

  Proto  Local Address          Foreign Address        State
  TCP    127.0.0.1:55247        Windows:65001          ESTABLISHED
 [nvcontainer.exe]
  TCP    127.0.0.1:55366        Windows:55387          ESTABLISHED
 [NVIDIA Web Helper.exe]
  TCP    127.0.0.1:55387        Windows:55366          ESTABLISHED
 [NVIDIA Share.exe]
  TCP    127.0.0.1:55407        Windows:55408          ESTABLISHED
 [thunderbird.exe]
  TCP    127.0.0.1:55408        Windows:55407          ESTABLISHED
 [thunderbird.exe]
  TCP    127.0.0.1:55414        Windows:55415          ESTABLISHED
 [firefox.exe]
  TCP    127.0.0.1:55415        Windows:55414          ESTABLISHED
 [firefox.exe]
  TCP    127.0.0.1:55416        Windows:55417          ESTABLISHED
 [firefox.exe]
  TCP    127.0.0.1:55417        Windows:55416          ESTABLISHED
 [firefox.exe]
  TCP    127.0.0.1:65001        Windows:55247          ESTABLISHED
 [nvcontainer.exe]
  TCP    192.168.1.180:55255    db5sch101101426:https  ESTABLISHED
```

STEP 7

If you want to create a friendlier way of viewing Netstat active connection data, you can pipe the contents to a text file. For example, in the command prompt enter **cd** to take you to the root of the C: drive. Then create a new folder to store the text file with **md activity**, and enter it with **cd activity**.

```
Administrator: Command Prompt

C:\Windows\System32>cd\

C:\>md activity

C:\>cd activity

C:\activity>
```

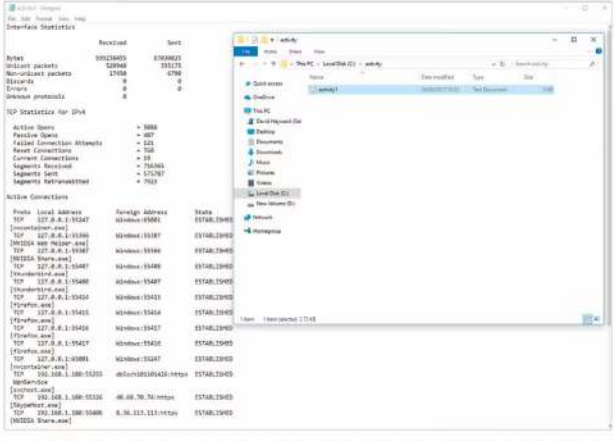
STEP 8

In the activity folder, enter the following: **netstat -e -s -p tcp -b > activity1.txt**. This is the same command as before but this time the output is being sent to a text file, named activity1.txt, rather than outputting to the command prompt window.

```
Administrator: Command Prompt

C:\Windows\System32>cd\

C:\>md activity

C:\>cd activity

C:\activity>netstat -e -s -p tcp -b > activity1.txt

C:\activity>
```

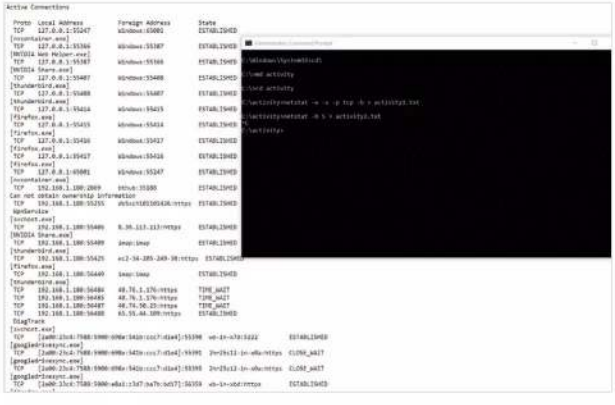
STEP 9

Using Windows Explorer, locate the C:\activity folder you created and within the activity1.txt file. Double-click the **activity1.txt** file and it opens in Notepad where you're able to view it without the often difficult to read command prompt window.



STEP 10

If you want to simplify the information and the process, enter: **netstat -b 5 > activity2.txt** into the command prompt within the activity folder on the C: drive. This will record the information and only write the data once you've pressed **Ctrl+C**, which stops the process. Use this for around two minutes to get a record of what's going on.



What is a Firewall?

The data packets that come and go between your PC and the outside world can be defined by a set of rules. These rules state whether a packet has access to the system in the first place, then whether or not it can gain access to its destination program. Collectively, these rules make up a Firewall.

Great Walls of Fire

The term firewall comes from fire prevention, where a physical wall is constructed in order to halt the spread of a fire. In digital terms, the physical wall stops malware and other threats from spreading into the system.

Some form of digital protection against unwanted entry into a system has existed for many years but the more recent software side of a firewall, one that we're reasonably familiar with, has only been around since the '80s.

Prior to the modern firewall, system administrators blocked unwanted access through various stages of hardware layers. Long lists of allowed computer addresses were painstakingly entered into mainframes and routers, where programmable chips filtered the white list and simply stopped all access to addresses that weren't on the list; think of a nightclub bouncer, if your name's not on the list you're not getting in.

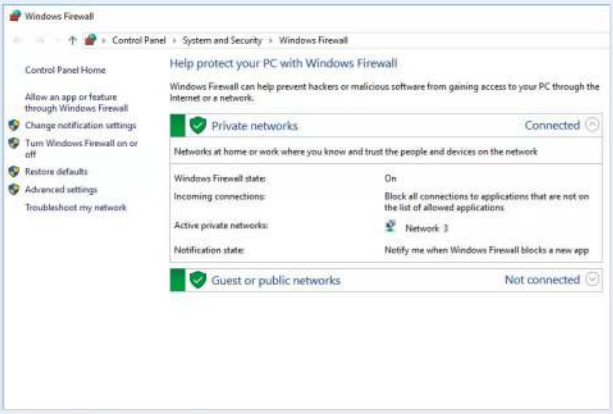
In its simplest guise, a firewall will look to a defined set of rules then apply those rules to any data packets that pass through it. For example, if you've created a rule whereby all Telnet traffic is blocked, any packet that's trying to reach port 23, the port that Telnet applications listen on for data, will be blocked. While suitably effective this low-level packet filtering does have its Achilles heel, in that it treats each packet as an independent piece of data: not knowing whether it's a part of an already established stream of data. This can be targeted by hackers who want access to a system with a firewall in place. The clever hacker is able to spoof a packet and thus tricking the firewall into letting it pass. It takes some time, and it's a bit hit and miss, but most hackers have plenty of patience when it comes to getting into a network. Therefore a much needed higher degree of firewall monitoring is called for.

Stateful Inspection firewalls were introduced in the mid '90s and enabled a firewall to log all the connection that passed through it determining what was the start of a new packet stream, part of an existing packet stream or something random. This allows a firewall to allow or drop any access based on a data packet's history. In terms of effectiveness, this makes the firewall more efficient and faster at dealing with connection requests as it doesn't need to continually analyse each packet as an individual but rather as a whole stream. For added layers of protection, if a packet doesn't match any of the connection histories, then it can be evaluated and filtered through the various rules to determine its legitimacy.

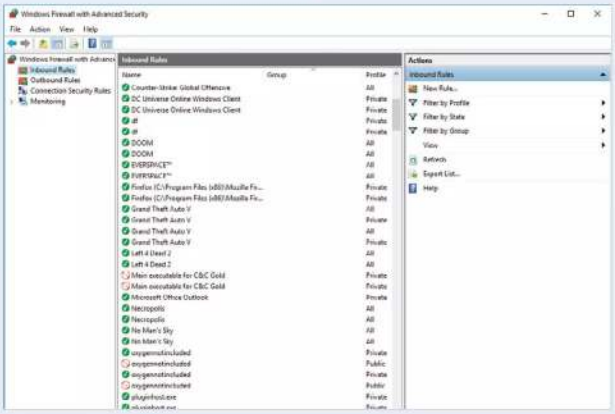
A further layer of protection was included into the basic firewall early in the 2000s. Application-layer analysis enabled firewalls to inspect packets that were targeting individual applications within the operating system. Each program or application installed in the system will use a set of protocols to communicate with the outside world. When an application is installed, on a Windows system for example, the installation mechanism will automatically add an instance of it to the Windows firewall. This means that it is able to send and receive information successfully through the Windows firewall without any of it being blocked. By blocking an application's access to the outside world, the user could miss out on regular updates, fixes, patches and so on. One of the key benefits to an application-layer firewall is that it's excellent at blocking specific content, such as known malware and viruses or dangerous websites. It's also capable of determining when a particular protocol is being misused by a rogue application.

Where the firewall proceeds from this point is unclear. However many experts agree that although we'll always need a firewall, the modern systems, networks and devices have so many potential access points that it's fast becoming less efficient to run the standard firewall model. In effect, the modern firewall, regardless of how complex and efficient it has become over the years, is quick becoming a bottle-neck for the operating system. What some experts are theorising is that at some point in the future, the need for a single, overall firewall will be outdated and that the next-generation operating systems will require each program and application that can be installed to act as its own firewall. Whether this will come about is pure fantasy at the moment but at the speed digital technologies grow and evolve there's a good chance of finding out soon enough.

> *Hardware firewalls are an early example of network security*



"The built-in Windows firewall is certainly good enough for most users' needs. It's fast, effective and can be easily configured."



"When each program, application, game and so on is installed, it is entered into the Windows firewall so it can communicate with the outside world."

"There are countless freely available third-party firewall clients. Some are very good, others not so much."

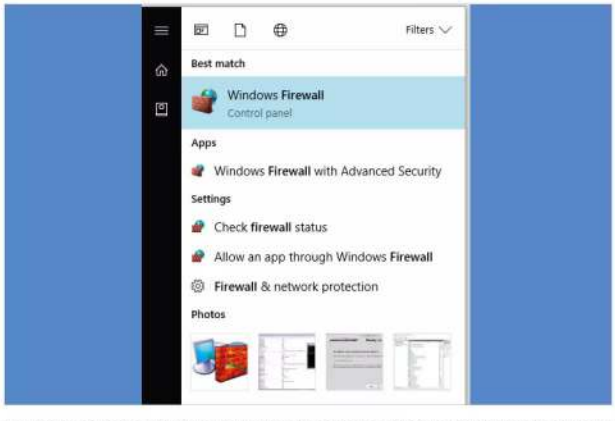
Improving the Windows Firewall

The built-in Windows firewall is a surprisingly good security application. Whilst it may not be as efficient as something offered by one of the third-party security suites, it's certainly more than adequate for the average user.

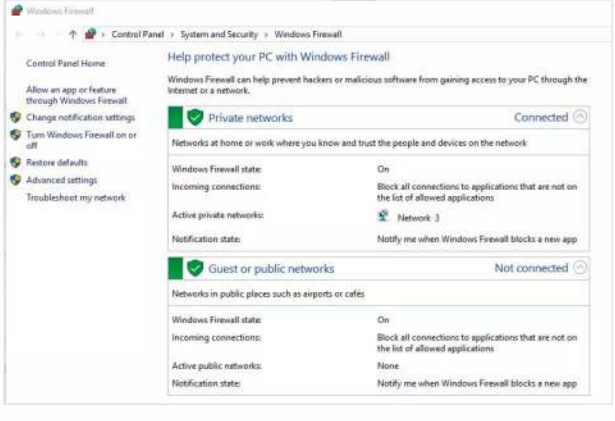
Getting to Know Your Firewall

Generally, there's little need to ever configure the Windows firewall. However, getting to know how it works and improving it is part of being more security-conscious. Here's some tips on how to manage it better.

STEP 1 You can open the main Windows firewall console window by clicking on the Windows Start button and entering firewall into the search box. Click the returned link, Windows Firewall Control Panel, to launch it.

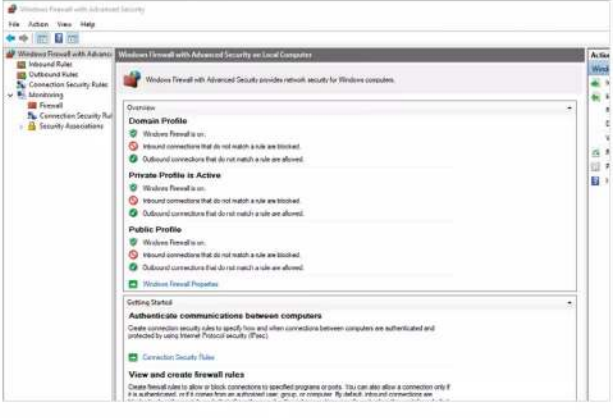


STEP 2 The Windows firewall console window starts by detailing the basic status of the firewall. It should be On by default, unless you've installed a third-party security suite which contains its own firewall. There are two kinds of network listed, Private and Public. Private is for home or work, whereas Public is for cafés and the like.

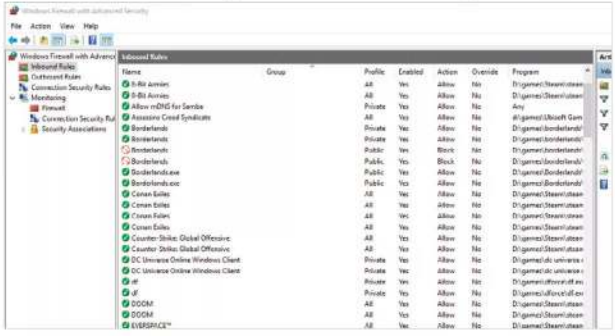


STEP 3 Down the left-hand side are some links that will help you configure and improve the firewall, as well as turning it on or off (which isn't recommended under any circumstance other than the installation of an improved third-party firewall). To begin with, start by clicking on the Advanced Settings link.

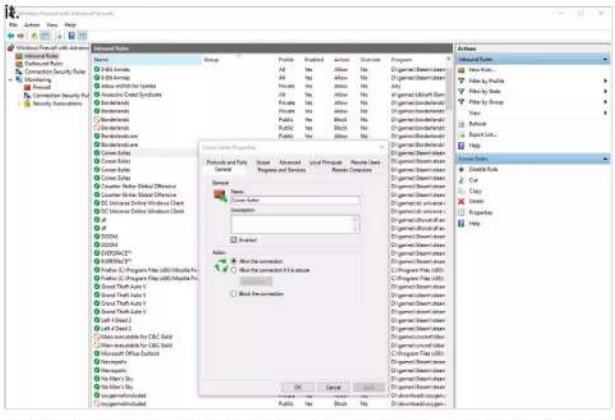
STEP 4 The Advanced Settings link launches a new console window. This new console defines the inbound and outbound rules for the entire system and its installed programs and applications. You can set authentication rules between computers, view and create new firewall rules, view the current firewall policies and even monitor what's being blocked in realtime.



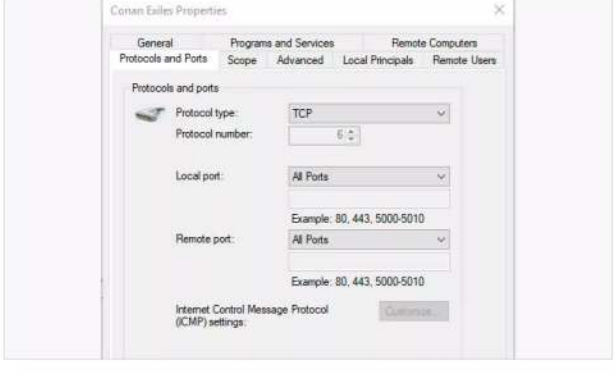
STEP 5 Click on Inbound Rules to the right-hand side of the main console window. This will list the current rules that allow traffic into your computer and to the applications that require it. For example, in this screenshot there are rules for various games that allow multiplayer interaction and the ability to 'talk' to the game server as well as install updates.



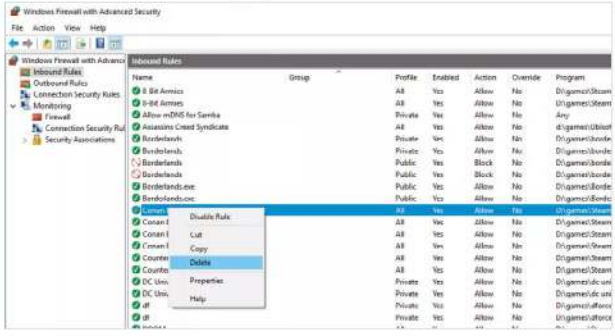
STEP 6 These rules are automatically entered into the firewall when you install the program, game or app. When you install a program you're required to accept and authenticate the process, clicking on Yes to start the installation. This level of administrative access also allows entry of the program into the firewall. Pick one of the entries and double-click



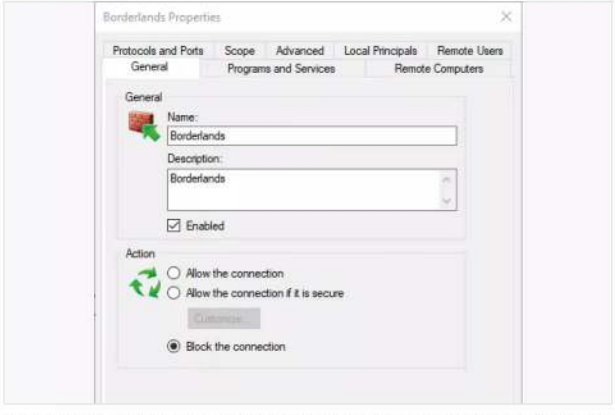
STEP 7 The properties of each firewall entry allow a greater degree of control for that particular program. You can change the name of the entry, allow or block the connection, define the physical location of the program on your computer, allow access to the program from remote computers, set the protocol and port number it uses and even which network controller to use.



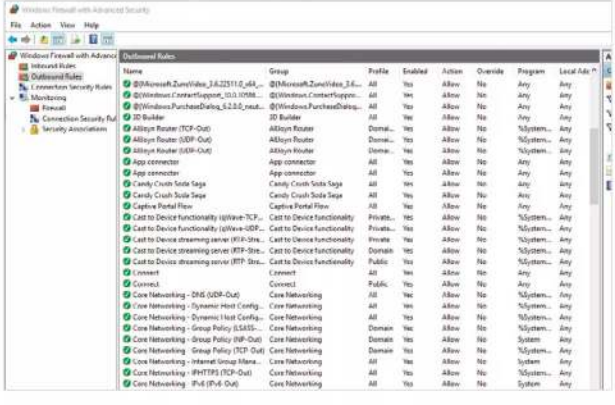
STEP 8 Sometimes, uninstalling a program doesn't automatically remove it from the Windows firewall. The exact reasons why are varied but to help improve the efficiency of the Windows firewall, whenever you remove a program from your system, it's worth checking the firewall to see if its entry has been deleted. To delete an entry, right-click then select Delete from the menu.



STEP 9 You may not want to delete a rule as it could be used later or if you reinstall the program and it fails to recreate the firewall entry. The recommended process then is to block the rule from communicating with the outside world. To do this, double-click the rule and from the General tab click the Block the connection button.

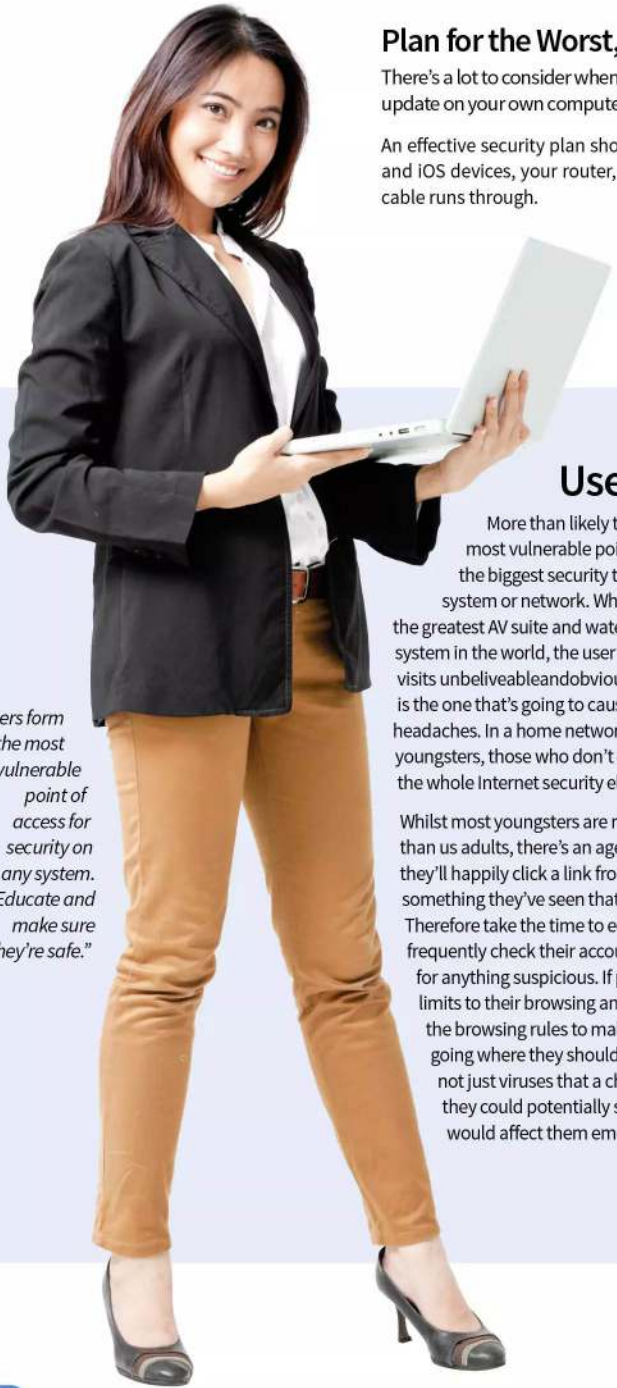


STEP 10 Similarly, the Outbound Rules link will detail the various programs that are allowed to communicate from your computer to an external destination. It's good practise to familiarise yourself with the rules of the firewall, as a rogue program will need to set a rule to communicate. You can then block that rule and stop the threat from reporting back.



Creating a Security Plan

A security plan will help you form a better strategy when it comes to tackling your Windows and home network security. A good plan will help keep on top of backups, updates and possible areas of weakness that malware or hackers can exploit.



Plan for the Worst, Hope for the Best

There's a lot to consider when coming up with a good security plan. It's not just a case of occasionally checking for an OS update on your own computer, you have to take into account other computers and the entire network.

An effective security plan should encompass the whole of your network, which includes Windows computers, Android and iOS devices, your router, any powerline adapters, Wi-Fi coverage, access passwords and even where the Ethernet cable runs through.

It may sound a little extreme but like most checklist-type scenarios it can be as in-depth as you like. However, it's worth at least considering some aspects of the home network and overall security before starting a plan.

Users

"Users form the most vulnerable point of access for security on any system. Educate and make sure they're safe."

More than likely the 'user' is the most vulnerable point of access and the biggest security threat to any system or network. Whilst you can have the greatest AV suite and water-tight security system in the world, the user who carelessly visits unbeliveableandobviouslyfakedeals.com is the one that's going to cause you the most headaches. In a home network that's often youngsters, those who don't quite understand the whole Internet security element.

Whilst most youngsters are more tech-savvy than us adults, there's an age range where they'll happily click a link from a friend or something they've seen that looks cool. Therefore take the time to educate and frequently check their accounts or computers for anything suspicious. If possible enforce limits to their browsing and regularly update the browsing rules to make sure they're not going where they shouldn't. Remember, it's not just viruses that a child can download, they could potentially see something that would affect them emotionally.

Updates

Obviously a must-have section of a good security plan is to regularly check for system and program updates. Thankfully, Windows and most security suites will run an automatic check whenever the system is powered up and connected to the Internet. However, there's always some point where an update failed to initialise for some reason or another. Therefore, it's often best to manually check.

Consider too checking for updates for the most frequently used programs. Microsoft Office, GIMP, your browser and even games will inevitably have an update available which can enhance, protect and improve the security of the program. After that, make sure that the other installed programs on the system are up-to-date too, as it's best to make sure there's few weaknesses as possible.

Programs

It can be difficult to keep track of what programs are installed on a system but it's not impossible. If you're serious about the security of your home network and its systems, then taking stock of what programs are installed on each system is worth doing.

Running through a checklist of installed programs you may notice one that shouldn't be there. A quick lookup of the program may reveal that it's a popular backdoor for hackers to get into a system and the attached network. That being the case, it needs to be removed and any firewall entries checked and disabled.

Routers

The family router is the first point of access for anything malicious on the network, since it's the gateway to the outside world. Make sure that the router software is up-to-date and that it's using the best possible wireless security standards and encryption.

It's also beneficial to make sure that the router's admin password and access passwords are hidden from sight. It doesn't take much for someone to look through the front window and make a note of a router password that's carelessly on show for all to see. Consider too, that not all visitors to your home are going to be chivalrous towards viewing your network password.

It's also worth tracking the range of the wireless signal from the router. By installing and using a good Wi-Fi scanner on a mobile device you can tell where the Wi-Fi signal from your router lies beyond your home. Whilst it's good to have a powerful signal, it won't take much for someone to sit nearby with a laptop (or a neighbour) and hack into your network. A Wi-Fi analyser will help you determine the best placement for security and more efficient use of the signal.

Passwords

It's not common for a home user to frequently change their password to the same degree as would an office worker but it's certainly something worth implementing. Using a combination of a good password manager and generator, you can set a 30-day password limit for all users and their access to the sites they visit.

It might sound like an awful lot of hard work on the part of everyone involved but weak passwords and the same password being used across Facebook, banking and gaming is a huge security vulnerability.

Backups

We'll cover backups in a few pages time but for the meantime though making sure that each account and computer is regularly backed up can take much stress out of a security situation. If you're unlucky enough to catch a virus or other malware, or are unfortunate enough to be hacked, you'll need to act quickly to prevent any loss of personal information. This usually means wiping your computer completely.

Having a good and reliable backup solution will help you recover your valuable data in no time, should you ever need to wipe everything or all your data is compromised through malware. It's also worth thinking of investing in a fireproof safe to store your backups along with cloud options for off-site backup security.

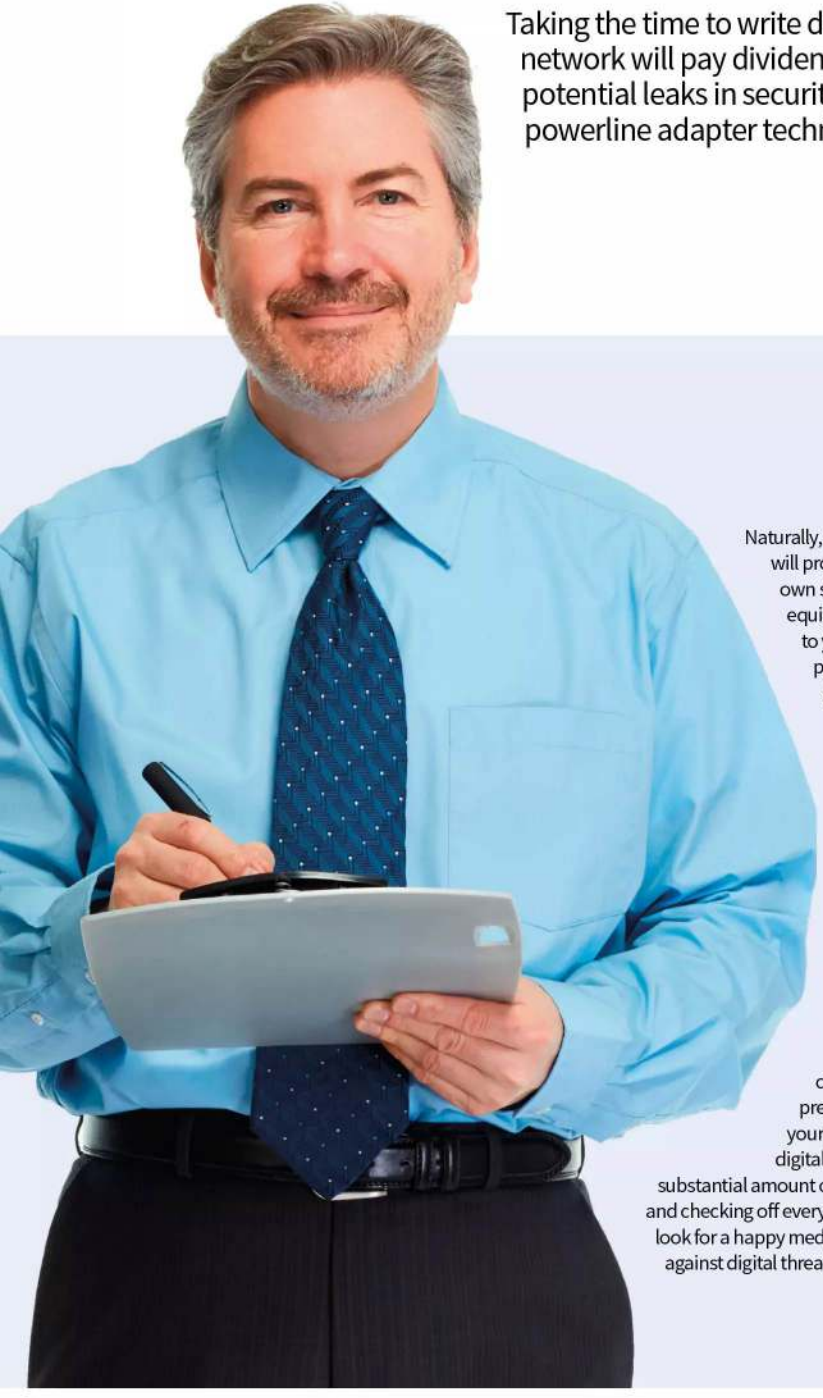
Cabling

It's not always something you need to check but ensuring that the home's Ethernet cabling is secure is an essential element to network security. For example, if you live in shared accommodation, it's possible for a neighbour to be able to be able to connect to your Ethernet cable and steal your bandwidth or gain access to your network resources.

If you can implement all or just some of these elements into your plan, you will be well on the way to making sure that your home network is as secure as possible, without becoming too paranoid over potential threats from outside sources. After all, you lock your doors when you're not at home so why shouldn't you lock your network too.

Windows Security Checklist

Taking the time to write down an effective security plan for your home network will pay dividends in the long run. With it you're able to spot potential leaks in security, secure your home network, Wi-Fi and powerline adapter technologies, and ensure digital peace of mind.



Naturally, this is just our example and will probably be different to your own setup and depending on the equipment you have available to you. For the sake of this publication we've taken a more generic approach but it's worth using it as a foundation from which you build your own, personal and unique checklist. Your checklist can be as intricate as you like, detailing specific hardware or software on one or all your computers, devices and so on, that needs to be updated regularly. Just remember though, there is a point where you can become a little too security conscious. Whilst it's great to be prepared for anything, and run your home network like a veritable digital Fort Knox, it can take up a substantial amount of your time applying patches and checking off every item on the list. Therefore, look for a happy medium, whilst remaining vigilant against digital threats.

We've come up with a template security checklist that you can use to create your own, for your

> **Plan Ahead**

home network. Remember to tick each section and remember to keep checking regularly and alter it as new devices are added.

Checklist

Router

Make sure that your router's admin password and access passwords are in a secure, unviewable place. So visitors can't see them when they come into your home.

Wi-Fi Security

Login in to your router and check that the Wi-Fi is using WPS2. Then check the currently attached devices for any anomalies. If you use any other form of router security, double check it's still functioning as updates can reset routers.

Wireless Positioning

Using a Wi-Fi analyser on your phone or tablet, measure the impact of the wireless signal from the router. If it's reaching out into the street and not so much the rear of the house, then consider moving it. Keep an eye on the signal power and weak locations.

OS Update

Check for any operating system updates on all the computers and Windows mobile devices that connect to the home network.

Security Suite Update

Run a similar update check on any antivirus clients, VPN clients or other third-party security programs and applications.

Program & App Update

Run any update checks on frequently used programs and applications. After that, run as many updates on other installed programs on all your computers.

Installed Rogue Program and App

Check each computer on the network for its list of installed programs. If there's anything in there that doesn't look right, research it and remove it if necessary. Make a note of the programs installed (as a screen shot or physical note) and compare them with each frequent check.

Password Reset

Set a regular, usually 30-day, password reset. Each individual user should be able to reset all their passwords for every site they visit and make sure that the passwords they're using are strong. Use a password manager and password generator if needed.

Firewall Integrity

Check that the firewall on each computer, and potentially any devices, is up and running and that there's no rogue programs within the inbound and outbound rules set.

Backup Important Files

Make sure that each computer and device is regularly backed up. We'll cover how to effectively back up a Windows computer later on. Back up important documents and keep the backup copy somewhere safe; consider purchasing a fireproof safe.

What is a Sandbox?

Sandboxing is an important security technique that's used by companies and individuals the world over. It's not something the average user will normally come across but you can guarantee that every piece of software you use has been sandboxed at some point in its development.

Playing in the Sand

Everyone from software developers and security experts to the hackers themselves will use a sandbox environment to help build and test their products; so what exactly is a sandbox?

Just as the name suggests, a sandbox is a place where you can do something without it affecting the surrounding area: visualise a sandbox in the middle of a garden. In digital security terms, this means a sandbox is a tightly controlled environment that's isolated from the main operating system where a person can test or analyse software and its impact on a virtual system.

The sandbox can be one of a number of implementations: web based, operating system based, program based, network based or even emulating interaction with the Internet. There are countless more examples, each depending on what exactly is being tested and what functions are required to complete the test.

For security, a sandbox is usually an extremely isolated environment that doesn't have access to anything on the company network, or any contact with a host machine. Here the security expert is able to conducts tests on untrusted pieces of code, known malware and viruses and even website content. Should those tests reveal something nasty within, the security expert is able to work their magic and develop a fix that can be further tested and finally deployed to the company's servers, where it's downloaded as updated virus definitions by the security suites and applied to a customer's computer.

Imagine that from the point of view of a hacker, then. The hacker has developed a particularly nasty piece of code that could bring down government agencies and cause widespread panic among the global digital community; they're hardly going to test it on their own computer. They need to create a sandbox environment whereby they can trigger the malware, ransomware or whatever, and let it run its course. In the meantime they can run through various procedures to try and wipe the malware, as a security expert would, to find any weaknesses. Once they've perfected the malware and wiped out any perceivable vulnerabilities, they can then happily upload it to the Internet and sit back as the world is infected with their code.

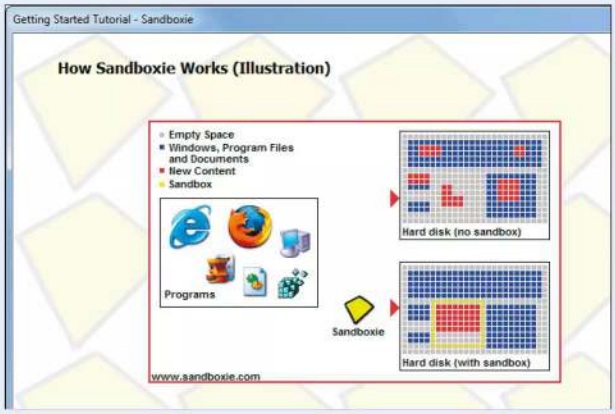
It's not always the testing of malicious code that's associated with sandboxes. For example, the words you're reading now were written using Office 365/ Word 2016. Before the product was released by Microsoft, the development team behind Word will have gone through extensive testing, making sure that all the individual components within and that make up Word 2016 all worked. To do so, they will have used a dedicated and separate environment to the one they're using to program on. This specialised environment will have mimicked a real world setup as much as possible, so that when the developer wanted to test something they could compile the code and execute it in an environment that wouldn't affect their normal day-to-day workplace.

The often severe lockdown of a sandbox system does make it difficult to emulate what the average user may be using. The standard desktop computer has many different elements, both hardware and software, that work together to make up the computer that you've customised and personalised. A developer, security expert or software tester can never hope to create something that works 100 percent with every Windows desktop system that's out there.

It's generally accepted then that when testing in a sandbox it's advisable to use as common a hardware and software setup as possible. This way, the developer will likely create a program that works on as high percentage of the computers available. Those computers that differ from the norm, and that may require a little more work for the product to install and work on, can then be dealt with through minor patching and bug testing.

So what's this got to do with you, we hear you say. Well, there are ways in which you can create your own sandbox environment to test in. Consider how many times you've downloaded software from the Internet and executed it without even examining how it may affect your computer. How many times do you visit websites and happily click on whatever message may appear without even reading it properly. With your own sandbox environment, you can download and install a piece of software and see how it runs within a test setup without it ever impacting your real machine. If you get into the habit of testing every bit of software in a sandbox first, you'll certainly be glad should the day come you discover a hidden virus in the folds of an otherwise harmless looking program.

> *Using a virtual machine as a sandbox is a great way to test programs for every version of Windows, not just the latest*



"Sandboxie is an environment designed to allow you to test programs without them being installed on your computer."

"VirtualBox is considered to be one of the leading and easiest to use virtual machines, where you can create a sandbox environment to test in."

Running Windows as a Sandbox

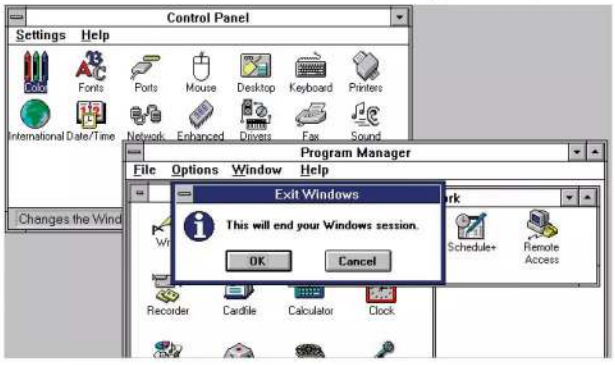
We've already talked about how a sandbox works and essentially what one is in terms of computing and security. However there are many advantages to creating your own virtual sandbox environment. It's not always purely to test suspicious code, as you'll soon discover.

Sand Between Your Toes

If you're still convinced that a sandbox environment can help you out, then read on. We've compiled a list of ten reasons why creating your own Windows sandbox is beneficial to the average user.

OLD PROGRAMS

Within the Windows virtual sandbox environment you may be able to run older programs that would normally fail, even in compatibility mode, under more modern hardware drivers. Often an older program will look for a specific driver set, if it's too modern then it can fail. Virtual environments use older type drivers by default.

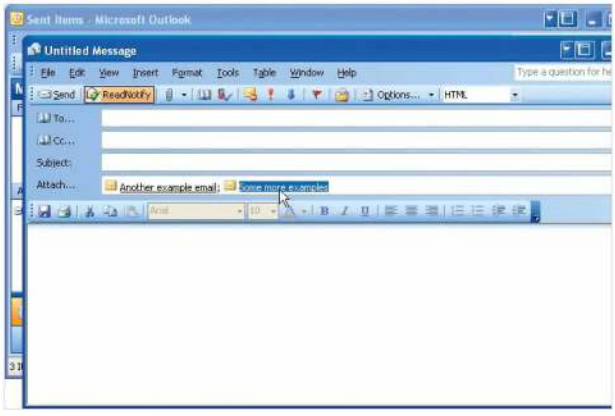


SAFE BROWSING

Within a virtual environment you can browse a site without any of its code being written to the main, host computer. This could simply be cookies and other such relatively harmless additions to sites or it could include data miners and malicious links.

HOST PROTECTION

If you think that a download link or email attachment may contain a virus, then opening it in a safe, virtual environment is the safest bet. Of course, you shouldn't open any unknown email attachments but if you need to, do so in a sandbox. The virus will infect the sandbox and not the host (real) computer.



SOFTWARE TESTING

If you're serious about your security and the safety of your home computer, then you should be downloading and installing software in a test environment first before applying it to your real computer. A virtual environment is a great place to see how software works and whether it's worth installing or not.

VIRTUAL OS

The beauty of a virtual environment, such as one created by VirtualBox, is that you're able to run Windows, macOS and Linux operating systems on top of your host operating system, whatever system that may be. You can install Windows within a virtual environment whilst using Linux or macOS, or vice versa.

VIRTUAL BACKUP

It is possible to create a virtual copy of a physical machine. This is an excellent way of making sure that the entire machine, that is a snapshot of the OS as it was when copied, is safely backed up and accessible regardless of what operating system you choose to use.

SECURE ANONYMITY

Within a virtual Windows environment you're able to create an anonymity system. By this we mean, you can install a VPN and use the Tor network and surf the Internet without fear of being traced; and what's more, none of it will affect your host operating system.

SAFE DEVELOPMENT

If you're considering developing your own software and apps, then using a virtual environment is an ideal place to test the code as you create it. Should a function you've written have an adverse effect on the OS, then you won't damage your working system.

```
Program Check_Group
  use crystallographic_symmetry, only: Space_Group_Type, set_spacegroup
  use reflections_utilities, only: Hkl_Absent
  use Symmetry_Tables, only: spgr_info, Set_Spgr_Info

  ....... ! Read reflections, apply criterion of "goodness" for checking,
          ! set indices i1,i2 for search in space group tables ...
  ....... ! omitted for simplicity
  call Set_Spgr_Info()
  m=0
  do_group: do i=i1,i2
    hms=adjustl(spgr_info(i)%HM)
    hall=spgr_info(i)%hall
    if( hms(1:1) /= "P" .and. .not. check_cent ) cycle do_group ! Skip centred groups
    call set_spacegroup(hall,Spacegroup,Force_Hall="y")
    do j=1,nhkl
       if(good(j) == 0) cycle  !Skip reflections that are not good (overlap) for checking
       absent=Hkl_Absent(hkl(:,j), Spacegroup)
       if(absent .and. intensity(j) > threshold) cycle do_group  !Group not allowed
    end do
    ! Passing here means that all reflections are allowed in the group -> Possible group!
    m=m+1
    num_group(m)=i
  end do  do_group
  write(unit=*,fmt=*) " => LIST OF POSSIBLE SPACE GROUPS, a total of ",m," groups are possible"
  write(unit=*,fmt=*) "    ---------------------------------------------------------"
  write(unit=*,fmt=*) "       Number(IT)      Hermann-Mauguin Symbol      Hall Symbol"
  write(unit=*,fmt=*) "    ---------------------------------------------------------"
  do i=1,m
    j=num_group(i)
    hms=adjustl(spgr_info(j)%HM)
    hall=spgr_info(j)%hall
    numg=spgr_info(j)%N
```

FAMILY FRIENDLY

If you have a single-family computer, a virtual environment is a great place for the kids to go without fear of them potentially breaking the system. It doesn't happen often, kids are mostly more tech-savvy than adults but little fingers do have a habit of clicking things they're not supposed to. Virtual environments can be backed up and redeployed easily.

RESTRICTED ACCOUNTS

Again, using children as an example, a virtual child's Windows account can come with all manner of restrictions and monitoring software, to stop them from wandering into the scarier parts of the Internet, such as installing Net Nanny. Again, these controls won't affect the host computer or adult accounts.

Installing VirtualBox on Your PC

Oracle's VirtualBox is one of the easiest virtual machine platforms for the beginner to experiment on. Within it you can install Windows, Linux and older operating systems, without ever having to alter your main computer's setup.

Going Virtual

Using a Virtual Machine (VM), will take resources from your computer: memory, hard drive space, processor usage and so on. So make sure you've got enough of each before commencing.

STEP 1 The first step is to get hold of the latest version of VirtualBox. Enter www.virtualbox.org, and click on 'Download VirtualBox'. This will take you to the main download page. Locate the correct host for your system: Windows or Mac – the host is the current, installed operating system – and click the link to begin the download.

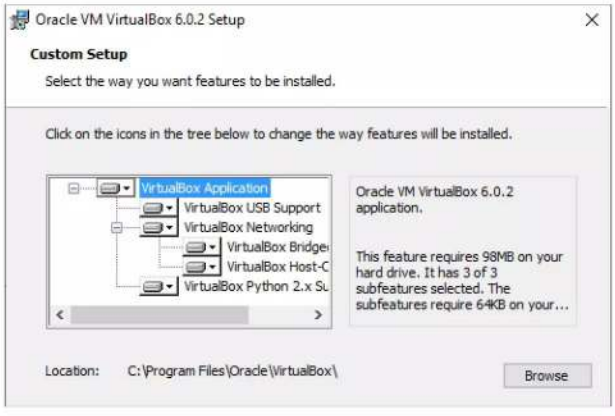
STEP 2 Next, while still on the VirtualBox download page, locate the VirtualBox Extension Pack link. The Extension Pack supports USB devices, as well as numerous other extras that can help make the VM environment a more accurate emulation of a 'real' computer.

STEP 3 With the correct packages downloaded, and before you install anything, you need to make sure that the computer you're using is able to host a VM. To do this, reboot the computer and enter the BIOS. As the computer starts up, press Del, F2, or whichever key is necessary to Enter Setup.

STEP 4 As each BIOS is laid out differently, it's very difficult to assess where to look in each personal example. However, as a general rule of thumb, you're looking for Intel Virtualisation Technology, or simply Virtualisation; usually within the Advanced section of the BIOS. When you've located it, Enable it, save the settings, exit the BIOS, and reboot the computer.

STEP 5 With the computer back up and running, locate the downloaded main VirtualBox application, and double-click to begin the installation process. Click Next to continue, when you're ready.

STEP 6 The default installation location of VirtualBox should satisfy most users, but if you have any special location requirements click on the 'Browse' button and change the install folder. Also, make sure that all the icons in the VirtualBox feature tree are selected – none of them have a red X next to them. Click Next to move on.

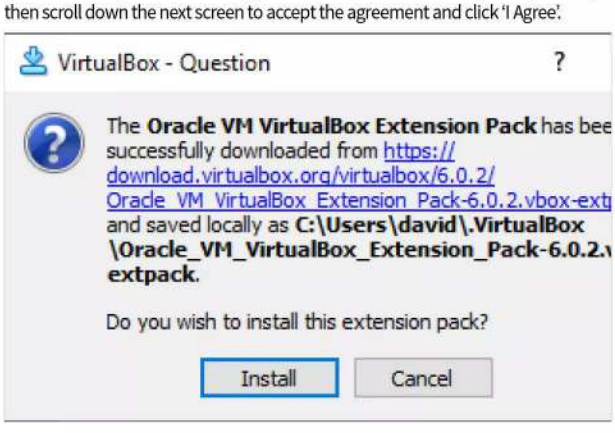


STEP 7 This section can be left alone to the defaults, should you wish. It simply makes life a little easier when dealing with VMs; especially when dealing with downloaded VMs, as you may encounter in the future. Again, clicking Next will move you on to the next stage.

STEP 8 When installing VirtualBox your network connection will be disabled for a very brief period. This is due to VirtualBox creating a linked, virtual network connection, so that any VM installed will be able to access the Internet, and your home network resources, via the computer's already established network connection. Click Yes then Install to begin the installation.

STEP 9 You'll probably be asked by Windows to accept a security notification, click Yes for this, and you may encounter a dialogue box asking you to trust the installation from Oracle; again, click yes and accept the installation of the VirtualBox application. When it's complete, click finish to start VirtualBox.

STEP 10 With VirtualBox up and running you can now install the VirtualBox Extension Pack. Locate the downloaded add-on, and double-click. There may be a short pause while VirtualBox analyses the pack, but you'll eventually receive a message to install it. Click Install to begin the process, then scroll down the next screen to accept the agreement and click 'I Agree'.



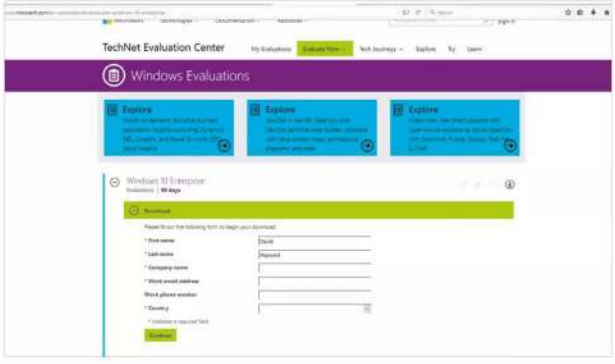
Installing Windows in VirtualBox

Installing Windows within a VM carries with it a clause: you need to make sure you have a valid license. However, if you're testing something then you can use the Windows Enterprise Evaluation image, which will last for 90 days.

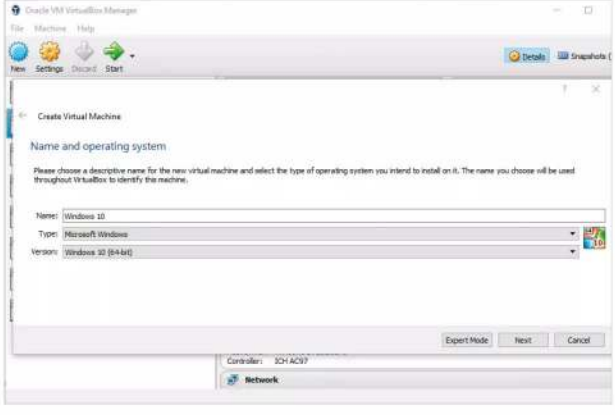
Window Installations

Naturally you might own a spare Windows license to use for the VM but for this tutorial we're going for the 90 day Windows Enterprise Evaluation model. To begin with, browse to https://microsoft.com/en-us/evalcenter/evaluate-Windows-10-enterprise.

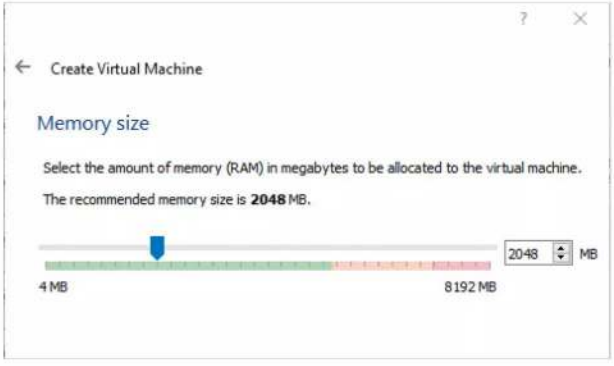
STEP 1 You need to register with Microsoft prior to being able to download the Windows image; simply click the Register button and fill in the required fields. When done, click Continue and choose the ISO Enterprise option, then your language choice and 64-bit, followed by the Continue button once more to begin the download.



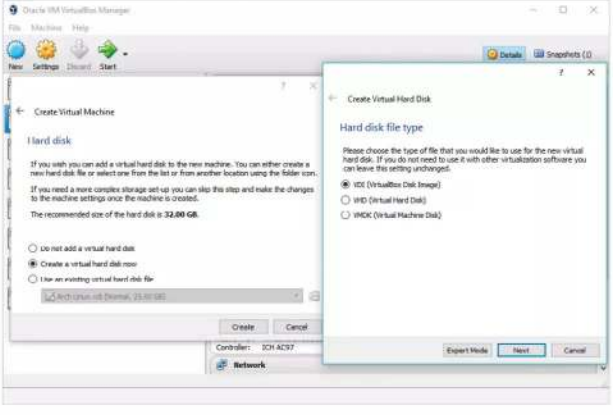
STEP 2 The ISO you're downloading is around 4GB in size, so it may take some time, depending on the speed of your connection. Open VirtualBox and click on the New icon located in the top right of the main VirtualBox window. In the Name field enter Windows, this should automatically change the Type and Version fields accordingly. Click Next when ready.



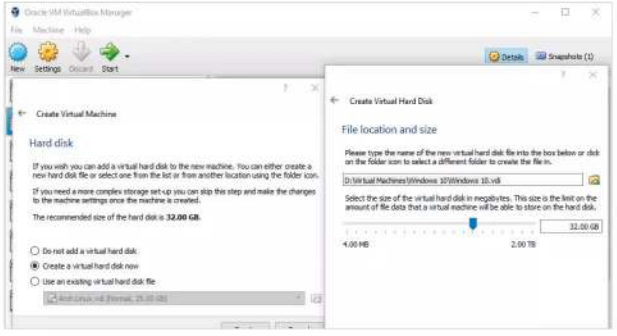
STEP 3 You need to set an amount of memory from your host computer to use as virtual RAM for the VM. Naturally, you don't want to take too much as your computer will suffer due to low memory when the VM is running. Ideally, you need to allocate around 2GB of memory to the VM. Click Next when ready.



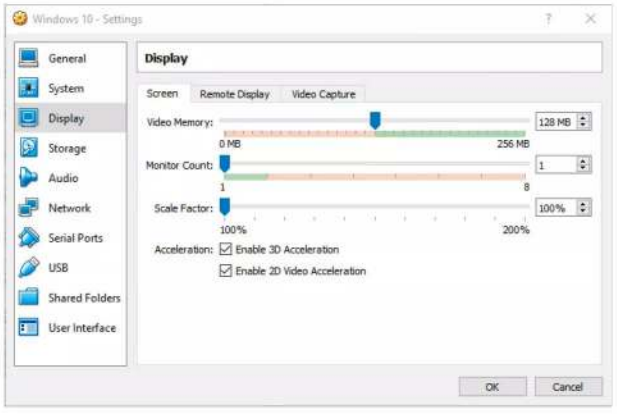
STEP 4 The next section will enable you to create a virtual hard disk, in which the Windows virtual machine can be installed. The default option: 'Create a virtual hard disk now' is recommended, then click the Create button to proceed. The pop-up box will detail the type of virtual hard disk; stick to VDI and click Next.



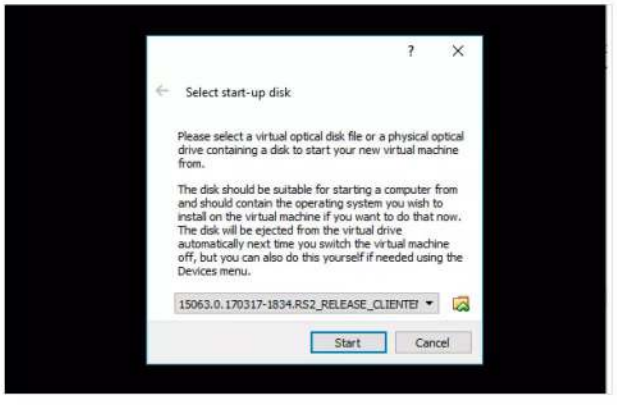
STEP 5 The default Dynamically Allocated option will suffice for this instance, so click Next. VirtualBox recommends that you allocate 32GB of physical hard drive space to creating the virtual hard disk. Make sure your hard drive has enough spare capacity and click the Create button.



STEP 6 The Windows VM is now listed in the available VMs in VirtualBox. Before you begin to install it though, click on the Settings icon whilst the Windows VM is highlighted. In the General tab, click Advanced and enable Bidirectional for Shared Clipboard and Drag 'n' Drop. In Display, enable 3D and 2D Video Acceleration. Click OK to finish.

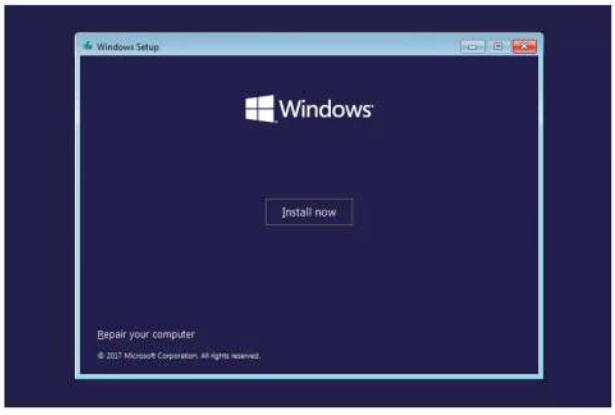


STEP 7 With the Settings console window closed, and the VM highlighted, click on the Start button. This will open a new window, asking for the location of the Windows ISO you downloaded from the Microsoft site in the first few steps. Use the folder icon to locate the ISO and click Open, then the Start button to commence the installation.

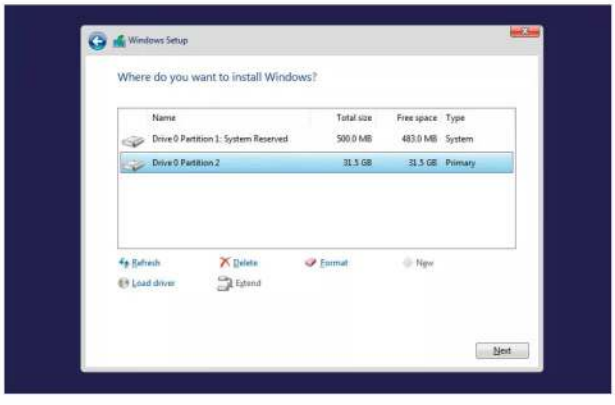


STEP 8 The Windows ISO will now load, and begin the installation process. The first options you need to set are the language, time and keyboard. Set your preferences, although the default is English US to begin with, and click on the Next button when you're ready to continue.

STEP 9 You now have an Install Now option available. Click it to begin the installation, then tick the license agreement box followed by Next. There are two possible options to install Windows, Upgrade and Custom. Since this is a blank hard drive, the Custom option is the only viable mode. Click it to continue.



STEP 10 The drive available will be the 32GB virtual hard disk you created. Click on the New button, then Apply to create a new valid drive that Windows can be installed on. You'll be asked what additional partitions will be created, click OK to accept. Choose the largest partition size and click Next to install Windows.



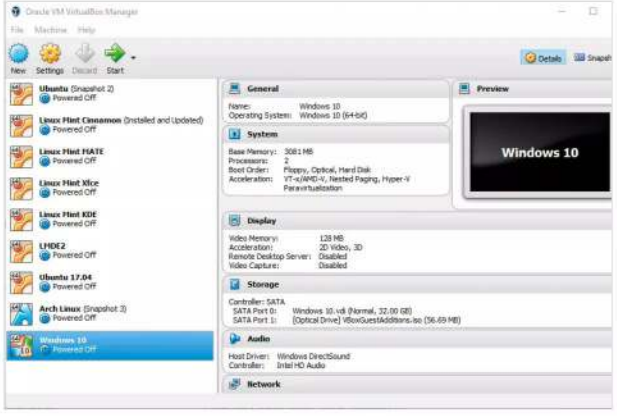
Creating VirtualBox Snapshots of Windows

One day the testing process of a Windows VM will inevitably leave the system in a broken or malware riddled state. You can wipe it and start again but a far better solution is to create snapshots, so you can easily revert to a previous build.

Take a Snapshot

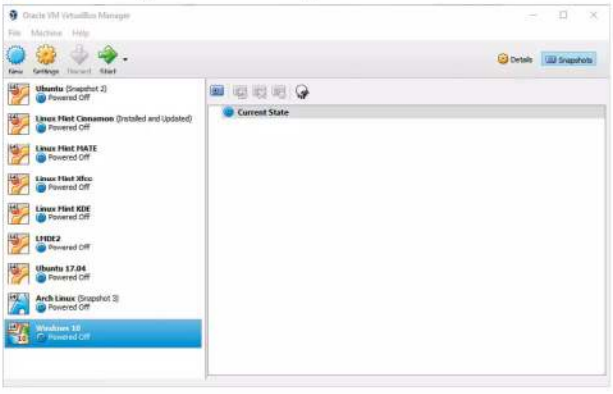
Setting up Windows, installing the drivers, updates and programs takes a fair amount of time. If you take a VirtualBox snapshot, you can return to where you left off in an instant.

STEP 1 To begin with open VirtualBox. If it's already open, shutdown the Windows VirtualBox image you created. It's not necessary but it's often easier, to ensure the VM is closed prior to creating a snapshot.

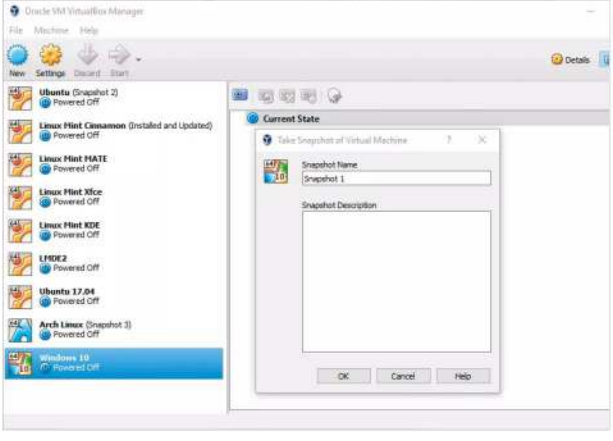


STEP 2 A Snapshot in VirtualBox is simply an image of what the virtual machine 'looked' like at the time the Snapshot was taken. You can make multiple Snapshots and revert to any whenever you wish. Snapshots taken are labelled next to the name of the VM.

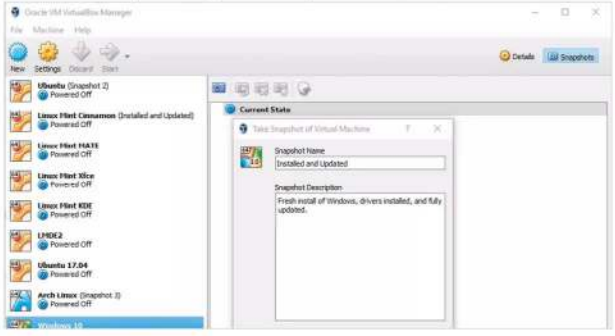
STEP 3 You can see that the state of all the virtual systems is currently Powered Off. To create a Snapshot of the Windows VM, click to highlight the system's entry in VirtualBox, then click on the Snapshots button (it's a camera icon), located to the far-right of the VirtualBox console.



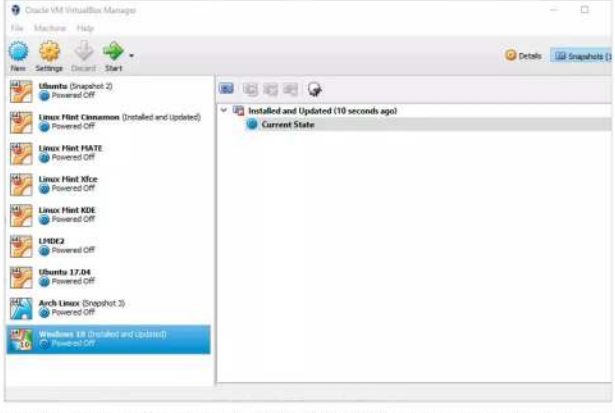
STEP 4 At present there aren't any Snapshots of Windows available. To create one, click the camera icon just above the words Current State, the icon at the opposite end of the sheep icon. This will launch the Take Snapshot of Virtual Machine console window.



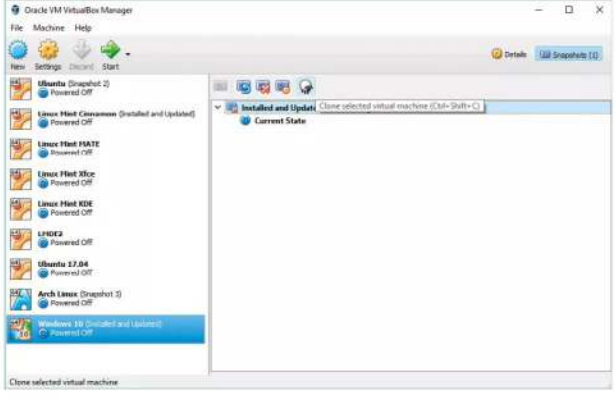
STEP 5 If you want you can name the Snapshot: Installed and Updated for example, along with a description to help identify it easier from the other Snapshots you may eventually end up making. It's not hugely important but if someone else wants to load up Windows, they know which Snapshot to go for. When you're done, click the OK button.



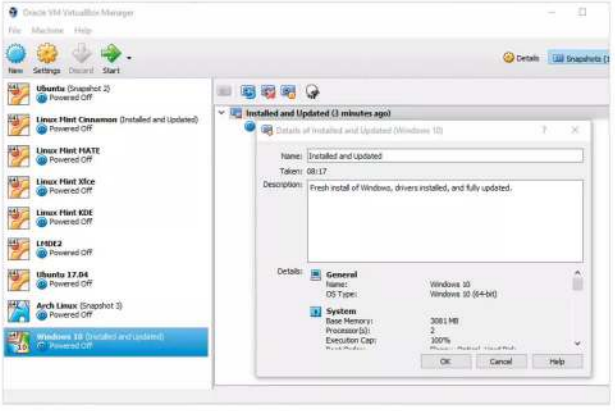
STEP 6 The process happens almost instantly and you're left with an entry in the Snapshots section detailing the named Snapshot, how long ago it was taken and a Current State entry. The Current State is literally its state when you boot it up. With it highlighted, you can take more Snapshots by using the camera icon again.



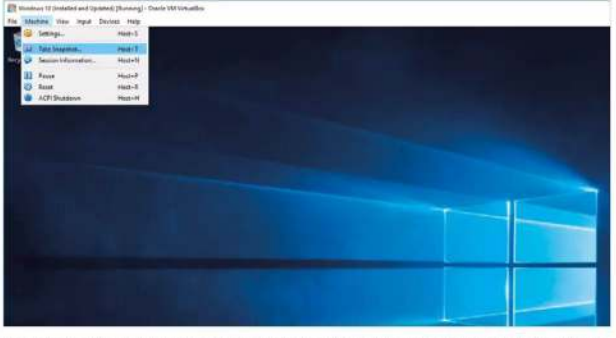
STEP 7 If you click the named Snapshot, you get more options available in the toolbar just above. Here you can Restore a selected Snapshot, if you have multiple entries. You can Delete a Snapshot and view detailed information regarding one; and with the sheep, you can Clone the current Snapshot as a new virtual machine.



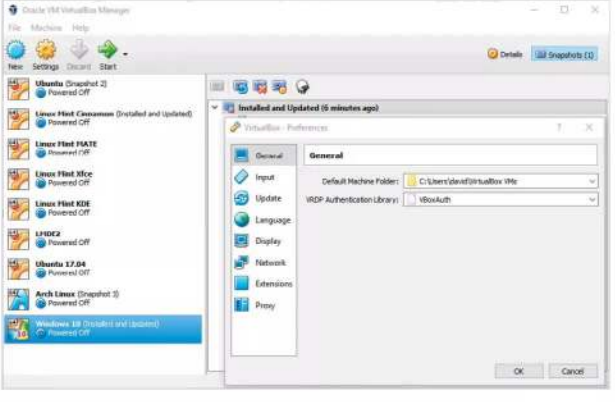
STEP 8 If you click the Details of the named virtual machine icon, the one next to the sheep, represented with an orange circle, you can view the VirtualBox settings of that particular Snapshot. This way you can assess any issues that may arise with other virtual machines; here you can see which settings worked and which didn't.



STEP 9 You shutdown the guest system, as mentioned in Step 1, but VirtualBox guest doesn't need to be shutdown in order for a Snapshot to be taken. For example, prior to installing an experimental program, click the Machine entry in the VirtualBox top menu bar and choose Take Snapshot. The process works the same way as in Steps 4 onward.



STEP 10 Each Snapshot taken can easily be reverted to, cloned, deleted and so on. However, Snapshots are stored by default in the Users/username/VirtualBox VMs folder in Windows. If you've only a limited amount of space on your C:\ drive, you may want to set the path to a bigger hard drive in the File > Preferences option in VirtualBox.



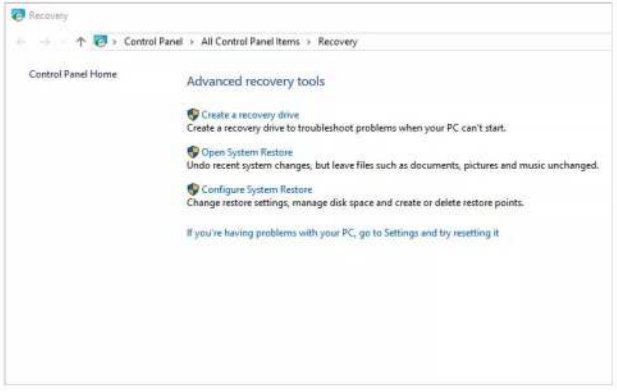
Create a Windows Recovery Drive

Since Windows 95, Microsoft has offered users the ability to create a recovery drive, which is used to help troubleshoot a Windows PC that is failing to boot, by presenting various options. If you haven't done so yet, you ideally should have created a Windows recovery drive.

Time to Recover

You need an 8GB USB drive minimum, in order to successfully create a recovery drive. It wipes the contents off the drive and you won't be able to use it for anything else, so make sure it's labelled and stored in a safe place.

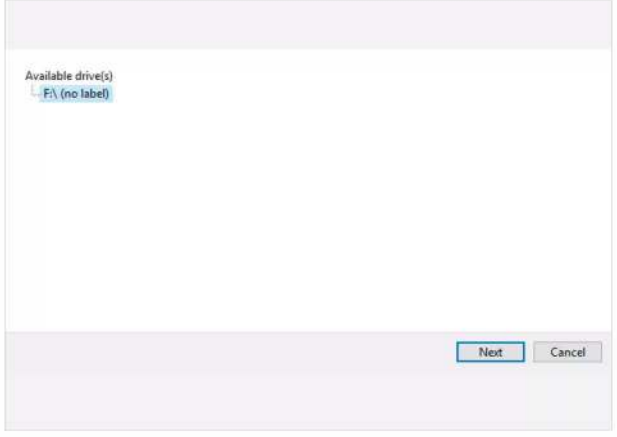
STEP 1 Insert the USB drive into your PC and close the Explorer window that opens upon insertion. Click the Windows Start button and type recovery, then click on the Recovery Control Panel. In here you can see several options available; you want the first, Create a recovery drive.



STEP 2 Click the Create a recovery drive link and accept the UAC authentication message that pops up. First, there's the option to backup any important system files to the recovery drive, alongside the usual recovery options. This is a good idea as it can replace these vital files in the event of a boot failure. Click Next to continue.

STEP 3 There's a short wait as Windows analyses the available locations where it can install and create the recovery drive. Eventually, providing you inserted the 8GB plus USB stick prior to starting the process, you're asked to select the destination from those Windows has discovered.

STEP 4 In the example we have here, there's just one possible location, the F:\ drive. If you have more than one possible destination available, make sure that you're selecting the correct USB drive for your recovery drive. When you're ready, click on the Next button.

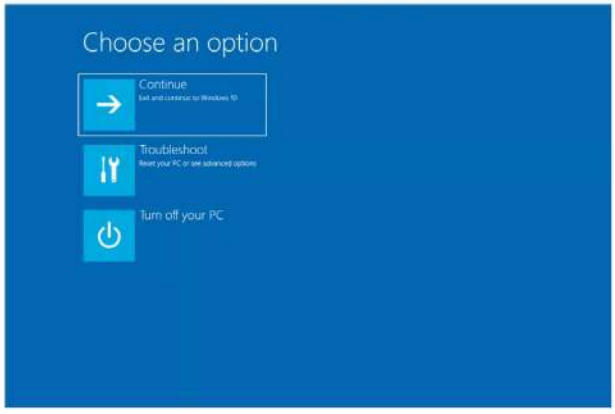


STEP 5 Before committing to creating the recovery drive, Windows will offer one final warning. Remember, everything that's currently on the USB stick you chose as the recovery drive will be erased during the process of creating the drive. If you have any files stored on it, make sure they're backed up to another location.

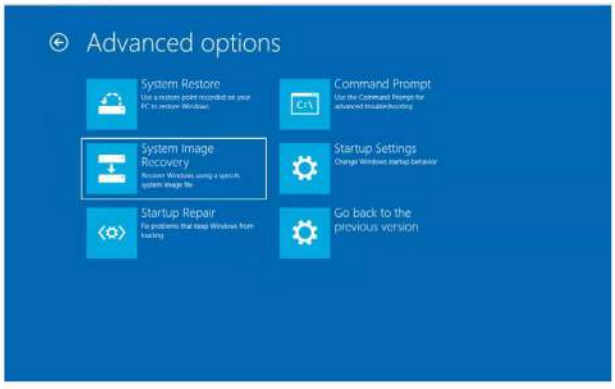
STEP 6 When you're ready click on the Create button to start the process. It may take some time, depending on the speed of the USB stick used, as Windows prepares, formats and copies the utilities and files over to the USB recovery drive.

STEP 7 When the process is complete, you receive a recovery drive is ready message. The only option available to you is to click the Finish button. This will close the recovery drive window and return you to the Recovery console.

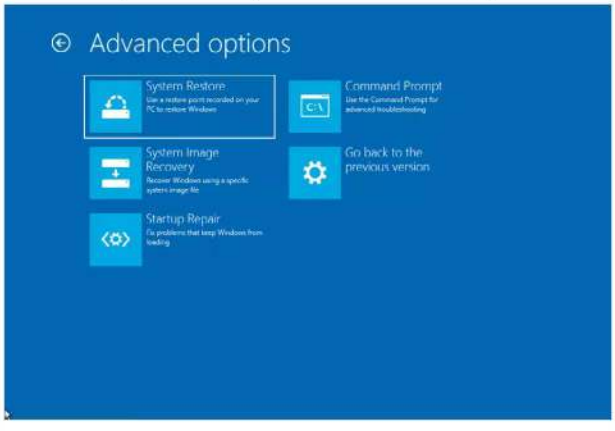
STEP 8 Store the drive in a safe place, as it can restore vital system files should anything ever go wrong with your system and leave it unable to boot. Should something go wrong, you see the Windows safe mode boot options when you try and power up your computer.



STEP 9 From the safe mode boot options, choose the Troubleshoot tile followed by Advanced Options. From there you can choose the System Restore and System Image Recovery options along with your rescue drive to help you recover Windows.



STEP 10 Alternatively, set the BIOS to boot to the newly created recovery drive and follow the onscreen instructions to launch the recovery method. Start by choosing your language, then select the Troubleshoot option and then opt for one of several recovery options.



How to Back Up Windows

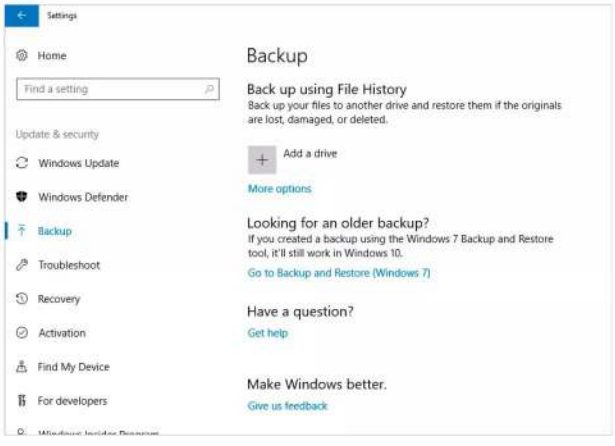
Even with the greatest possible cyber protection in the world guarding your computer, there's still a chance something could go wrong. It might not even be malware-related; a broken hard drive or other component can cause as much grief. Therefore, you need a good backup.

Backing Up

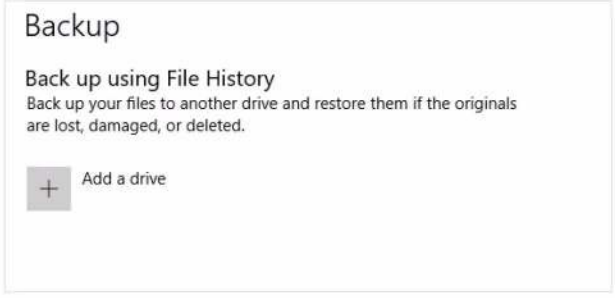
Computers are unpredictable beasts, so you need to make sure that all your files and important data are securely backed up and more importantly, you're able to restore them easily. Thankfully, it's a straightforward process.

STEP 1 Windows has, since its early days, featured some form of backup tool. Windows was launched with the File History backup tool, which is a simple to use tool to ensure stable and regular backups of important files are made. Start by clicking on the Windows Start button and selecting Settings from the menu.

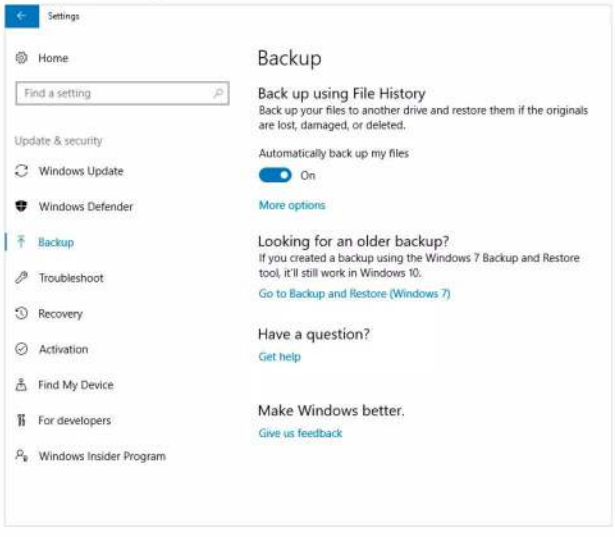
STEP 2 Once in the Settings console, click on the Update & Security icon, followed by the Backup option from the menu on the left. You can see a number of possible options before you: Add a Drive, More options, Go to Backup and Restore (Windows 7), along with help and feedback links.



STEP 3 Ideally you need to insert a reasonably sized USB stick or use a second hard drive in your computer. If you have a USB stick, insert it now, or if you own a second hard drive power off the computer and install it and boot back into Windows. Once done, click the Add a Drive icon.



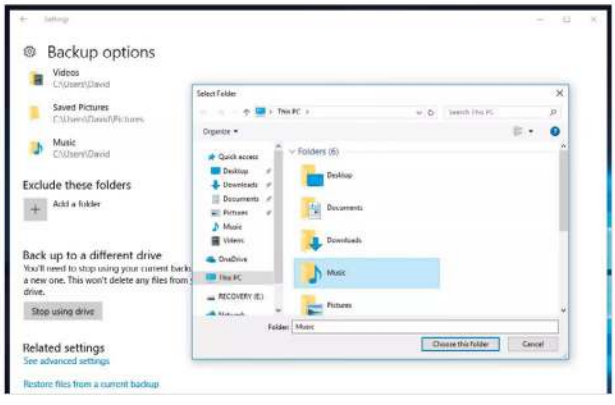
STEP 4 Windows will search for any capable drives on to which it's able to back up your files. When your drive or USB device is displayed, click the drive link. Notice that an 'Automatically back up my files' switch button has appeared where Add a drive once was.



STEP 5 From here, click on the More Options link that's under the switch button, this will open the Backup Options console. This section details the backup schedule, the location and which folders will be included in the backup; and for how long Windows will retain your backed up files.

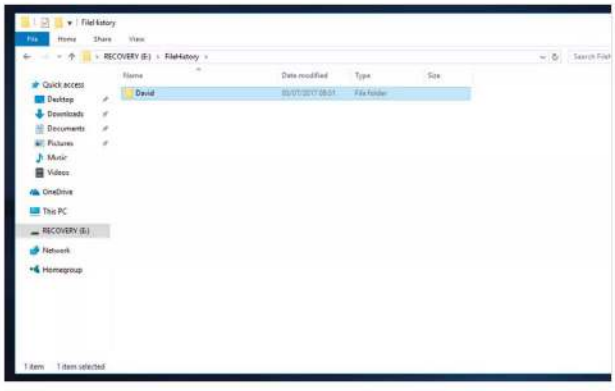
STEP 6 If you scroll down through the Backup Options console, you can see that the entirety of your user folder within Windows has been added by default. This includes the Music and Videos folders, as well as Searches, Camera Roll, Contacts, Favourites and so on.

STEP 7 At the bottom of the console window you have the options to stop using the selected drive and to Exclude any folders from the default. If you don't want to back up folders for Music, Videos etc., click Add a folder on the Exclude these folders icon, then pick the folder to exclude and click the Choose this folder button.

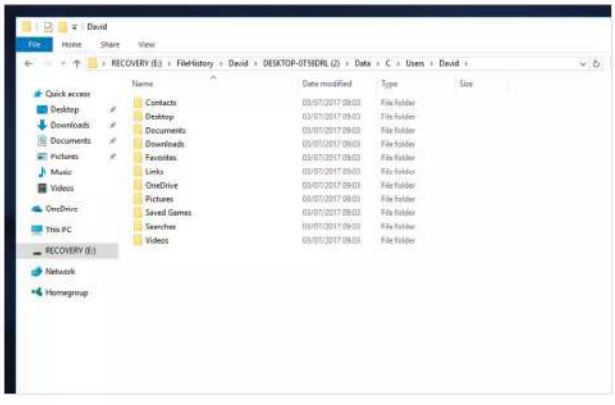


STEP 8 When you're ready to start backing up, you can click the Back up now button to the top of the Backup Option console window. Alternatively, you can wait for an hour when the default schedule kicks in. Obviously, depending on the size of the files within your backup folders this could take some time.

STEP 9 The backed up files will be stored on the chosen backup drive, within a folder called FileHistory. Inside that folder will be the specific user folder, so if you use File History backups for more than one user, their user names will be listed here too.



STEP 10 Drilling deeper into the folder layers reveals more default folders, containing important XML data that Windows uses to store the chosen options. You can find the actual files that have been backed up in the Data folder, laid out in the same folder structure as on your system, i.e. C > Users > Name > Documents etc.



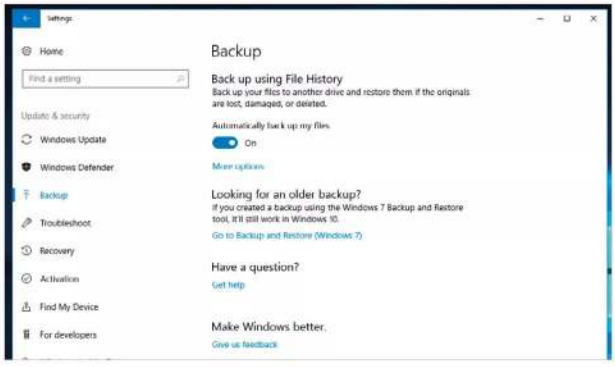
How to Create a Windows System Image

Backing up your files is perfectly fine but in the event of having to wipe your hard drive and start again, getting everything back in order can be time consuming. However, creating a system image means you can almost instantly restore the entire system without needing to rebuild Windows.

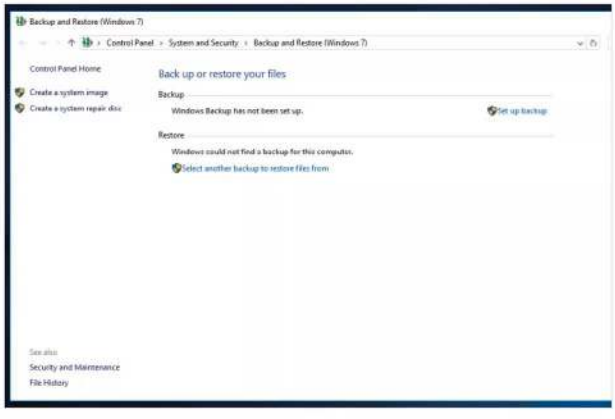
System Imaging

A system image works in much the same way as the VirtualBox Snapshots. You're essentially taking a snapshot of your entire system, which can then be restored quickly. Saving you having to reinstall Windows, all your programs and data.

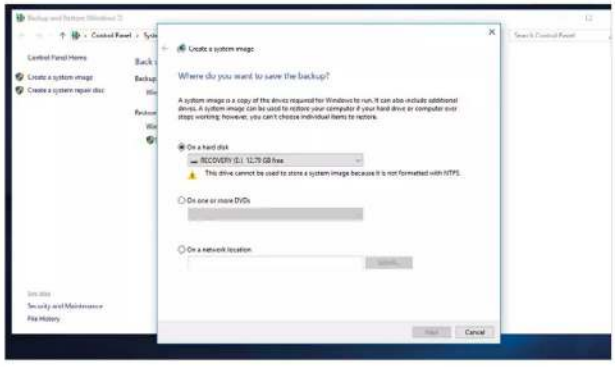
STEP 1 To begin, click on the Windows Start button and once more navigate to Settings > Update & Security > Backup. From within the Backup console window, where you were in the previous tutorial, click on the Go to Backup and Restore (Windows 7) link under the Looking for an older backup section.



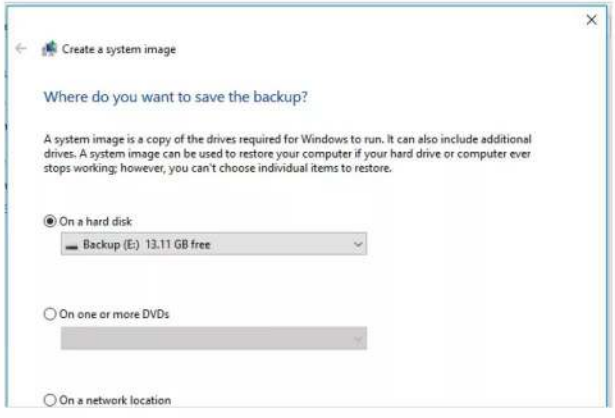
STEP 2 This will launch a new window, the Backup and Restore (Windows 7) console. Microsoft has kept this feature intact through Windows.1 and 10 purely due to compatibility support for backups done under older versions of the OS. To the left there are two links, click on the Create a system image link.



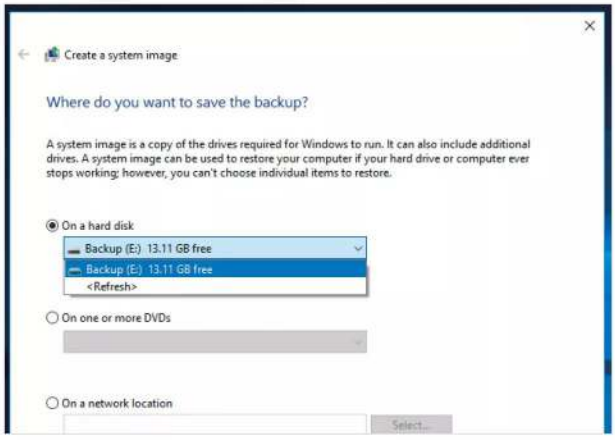
STEP 3 Windows will now scan your system for a drive that is able to house the system image files. You may need to make some changes to any drives according to what messages you get back from the scan. In this example, the drive we're using needs to be formatted as NTFS before Windows can use it.



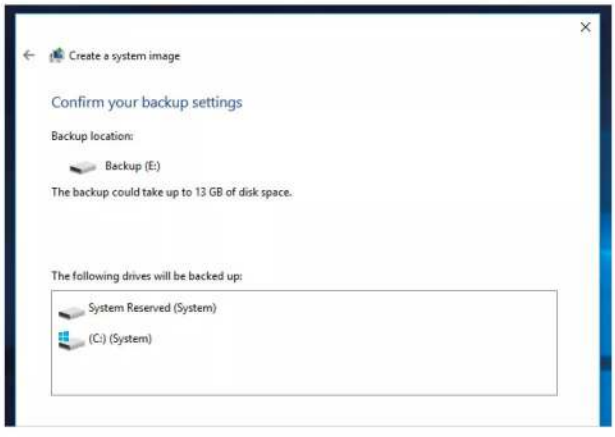
STEP 4 Providing you've met the requirements, you're offered a choice of where the system image can be written to. A drive is the quickest solution when it comes to restoring the image but you can opt for DVDs; it depends on the size of the image as to how many DVDs you need. You can even select a network location.



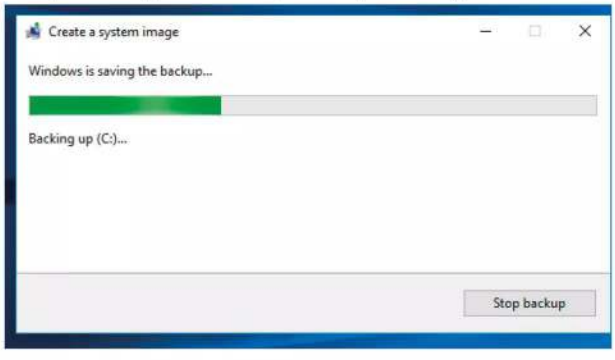
STEP 5 For this example, let's use an internal second hard drive. Make sure that the correct drive (it could be a high capacity USB stick or even portable USB hard drive) is selected, then click the Next button to continue.



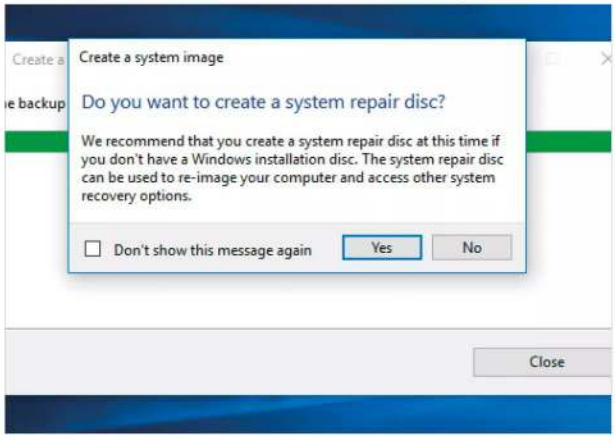
STEP 6 The next window will display the drives that are included in the system imaging process. In this example, the C:\ drive, the system drive and the System Reserved partition are to be backed up. When it comes to restoring the system you'll need both partitions for Windows to be able to boot up correctly.



STEP 7 When you're ready to continue, click the Start Backup button. This will begin the imaging process, which can take some time depending on the amount of space used on the C:\ drive and the speed of the drive you're writing to. Allocate ample time if you're writing to DVD.

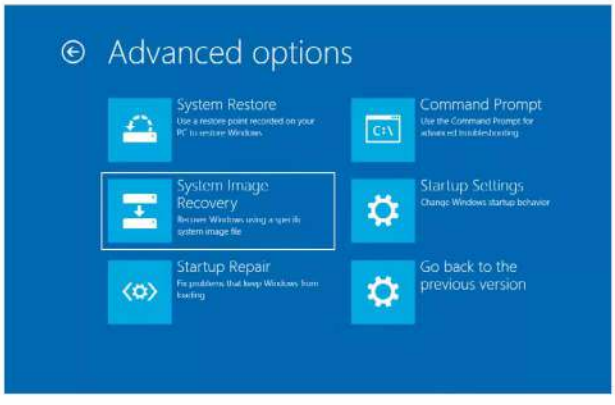


STEP 8 Once the process is complete, Windows will ask you to create a System Repair Disc. This disc will allow you to boot into the environment where you are able to launch the system image restore.



STEP 9 If you click Yes to creating the System Repair Disc you need to make sure you have a blank DVD to hand. Follow the on-screen instructions and click on the Create Disc button to burn the repair files to the disc.

STEP 10 Should you need to restore Windows from the system image, you can boot into the System Repair Disc and select the System Image Recovery option from within the Advanced Options of the Trouble Shoot menu. Follow the instructions and within minutes Windows will be back as it was when the system image was taken.



Extreme Windows Lockdown Tips

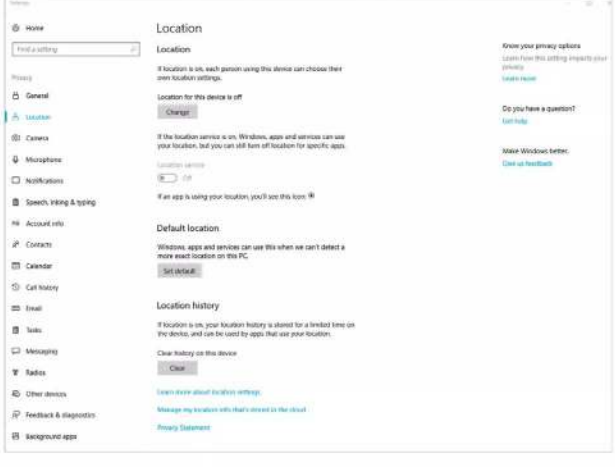
There are numerous ways and means to greatly improve Windows's security and privacy. Precisely how secure and private you want to get is purely down to you. You can opt for better than average or through these tips below, absolute extreme security.

Windows Security: The Paranoid's Guide

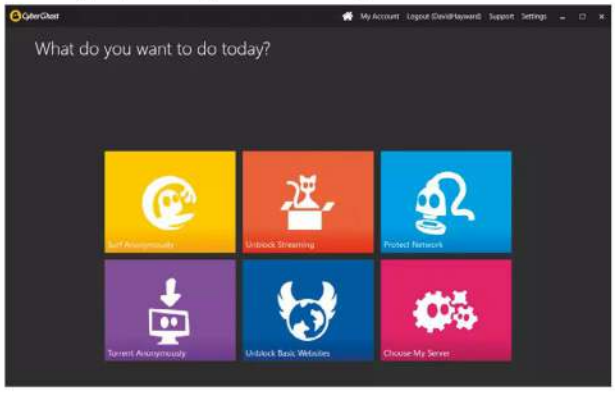
If you're fanatical about securing Windows and locking it down to the point where the NSA would be impressed, then follow these top ten extreme lockdown tips.

TIP 1 Let's begin with the easiest tip, unplug the computer from the Internet. Naturally there are disadvantages to this and you won't get updates for Windows or programs. However, you certainly won't get any Internet-borne malware infecting your machine.

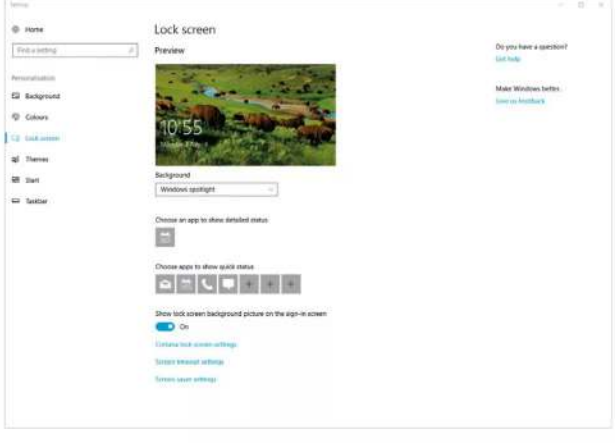
TIP 2 Click the Windows Start button and type privacy into the search box. Open the Privacy Settings link and turn off every option within the eighteen available Privacy sub-categories to the left of the console window.



TIP 3 When online use a VPN and where possible, also use the Tor browser. Both of these combined will greatly improve your anonymity and improve security by utilising the site blocking and anti-scamming properties of a good VPN such as CyberGhost.

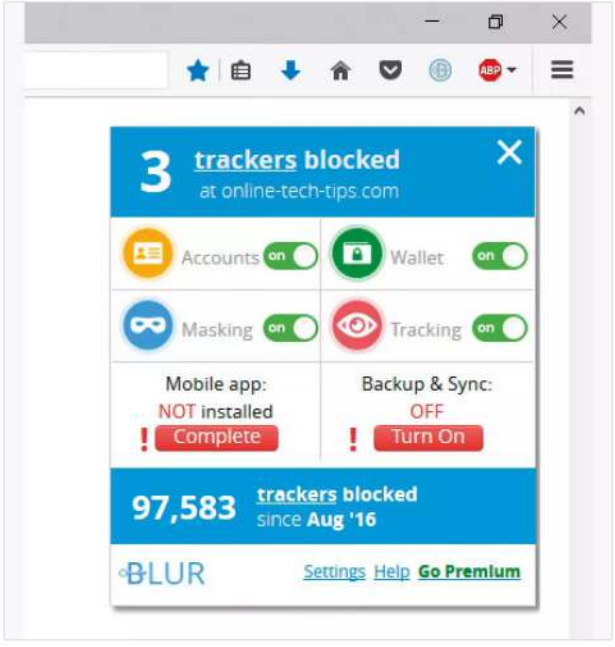


TIP 4 If you step away from your computer on regular intervals, you need to make sure that no one will be able to get on to it. From the Windows Start button type lock and click the Lock Screen Settings link. In here set a lock so that only you can get back to your desktop once you've entered a password.

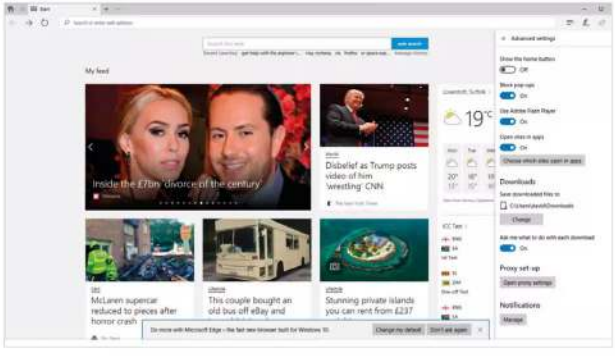


TIP 5 Depending on the age of your computer, it's possible to create a boot password from the BIOS. You need to consult your motherboard manual as to how to accomplish this but you can set a password for being able to boot into your computer (before Windows even starts) and getting into the BIOS itself.

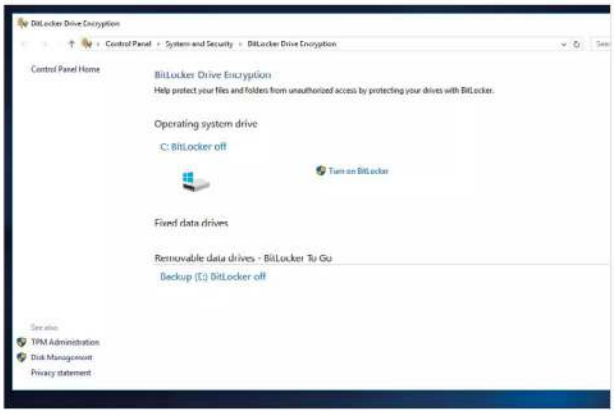
TIP 6 Consider installing several add-ons to your browser to improve its security and prevent any unwanted data miners or rogue scripts from being executed. Adblock Plus, Blur, No Script and other examples will secure your browsing session. For an extreme route, use the Tor browser.



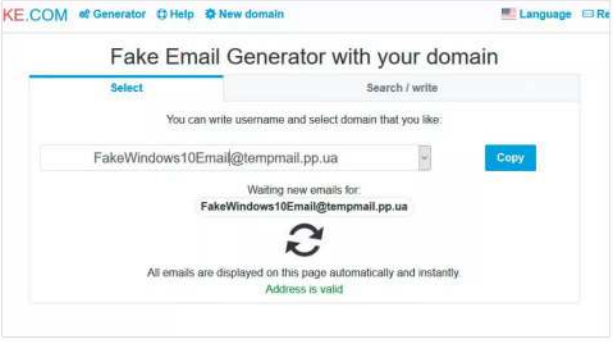
TIP 7 Flash and Java are superb entry points for malicious code to infect your computer and for snooping of various personal settings and data. Disabling both Java and Flash will prevent any such backdoors but limit your browsing experience on some sites.



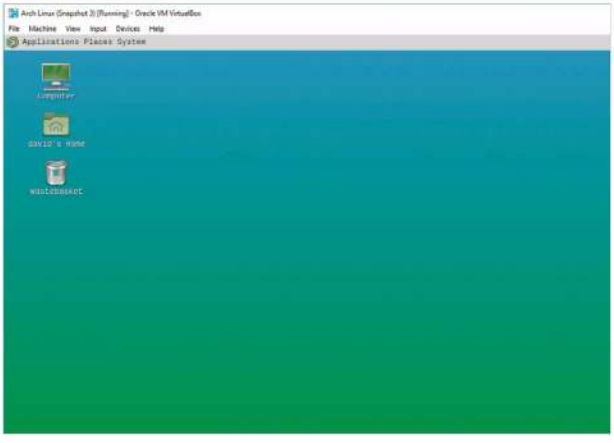
TIP 8 Encrypting your installed hard drives and any external devices you use is an excellent way of securing your data and locking down Windows. Whilst it can be inconvenient, you can be safe in the knowledge that any lost data is virtually unhackable by all but the military supercomputers.



TIP 9 Normally you'd use a valid email account to log into Windows, via an activated Microsoft account. However, consider setting up an alternative account that isn't linked to you. That way any data sent via Windows to other sources won't contain any personal data.



TIP 10 Use a Virtual Machine within Windows to conduct your day to day browsing and online work. The VM could be Windows too or even adopt a more secure environment such as one of the higher-end security versions of Linux. Either way, a VM will be far more secure than Windows on its own.

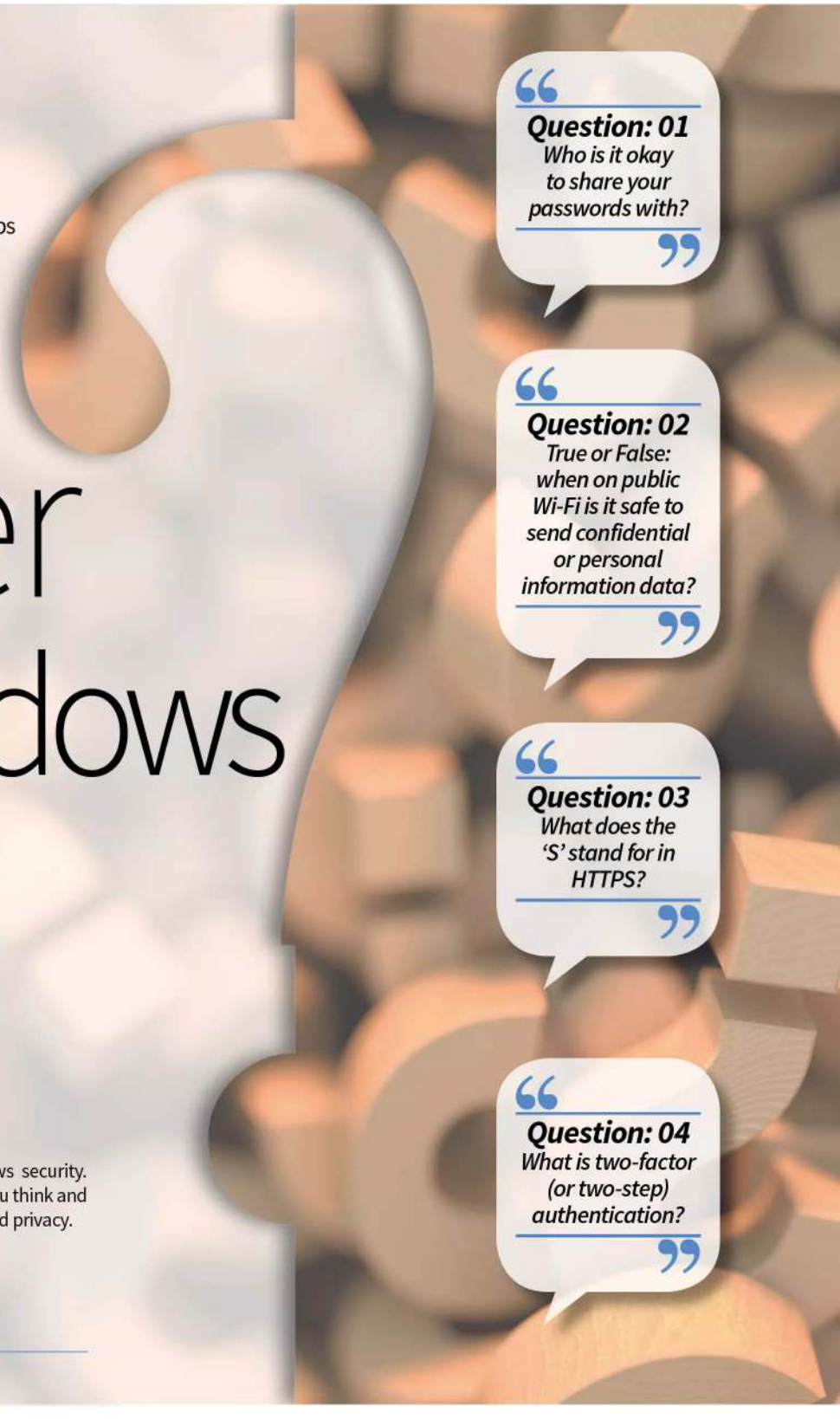


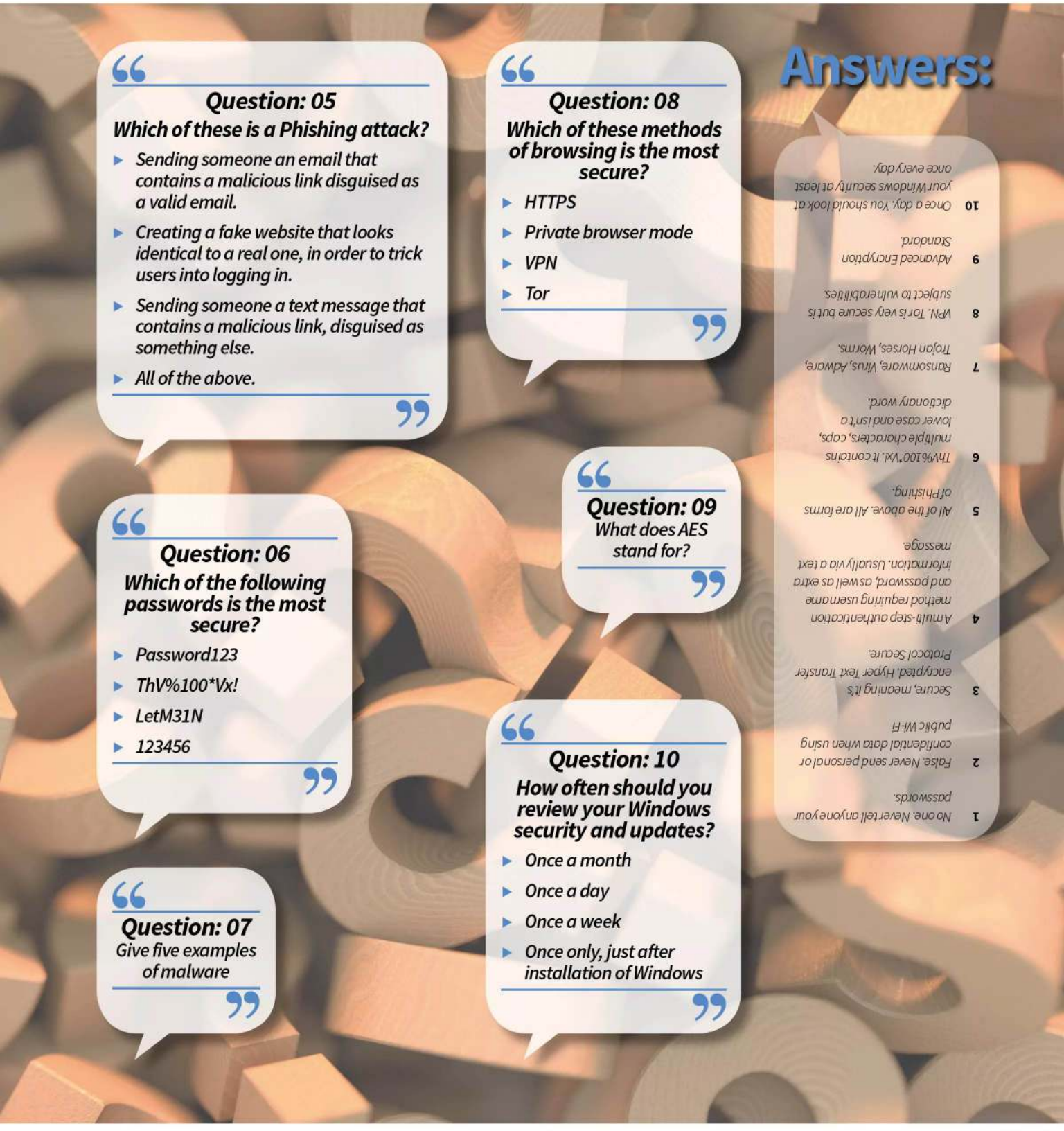
Strange as it may sound, being able to answer questions on cyber security helps expand your understanding of the subject. Plus it's a good way to test your knowledge and see how much you've taken in so far from this book.

Cyber & Windows Quiz

Answer These Questions

Ten questions on cyber security and Windows security. They're not too difficult but enough to make you think and consider the whole aspect of digital security and privacy.





Question: 05

Which of these is a Phishing attack?

- Sending someone an email that contains a malicious link disguised as a valid email.
- Creating a fake website that looks identical to a real one, in order to trick users into logging in.
- Sending someone a text message that contains a malicious link, disguised as something else.
- All of the above.

Question: 06

Which of the following passwords is the most secure?

- Password123
- ThV%100*Vx!
- LetM31N
- 123456

Question: 07

Give five examples of malware

Question: 08

Which of these methods of browsing is the most secure?

- HTTPS
- Private browser mode
- VPN
- Tor

Question: 09

What does AES stand for?

Question: 10

How often should you review your Windows security and updates?

- Once a month
- Once a day
- Once a week
- Once only, just after installation of Windows

Answers:

1. No one. Never tell anyone your passwords.
2. False. Never send personal or confidential data when using public Wi-Fi
3. Secure, meaning it's encrypted. Hyper Text Transfer Protocol Secure.
4. A multi-step authentication method requiring username and password, as well as extra information. Usually via a text message
5. All of the above. All are forms of Phishing.
6. ThV%100*Vx!. It contains multiple characters, caps, lower case and isn't a dictionary word.
7. Ransomware, Virus, Adware, Trojan Horses, Worms.
8. VPN. Tor is very secure but is subject to vulnerabilities.
9. Advanced Encryption Standard.
10. Once a day. You should look at your Windows security at least once every day.

What the Experts Say

Amongst the many quotes from security experts of the modern digital age, some stand out as either remarkably fortuitous or simply worth mentioning. We've compiled ten top quotes from the security world, that both entertain and make you think.

> *Relying on the government to protect your privacy is like asking a peeping tom to install your window blinds*

> If you spend more on coffee than on IT security, you will be hacked. What's more, you deserve to be hacked.

White House Cybersecurity Advisor, Richard Clarke.

> Computer security can simply be protecting your equipment and files from disgruntled employees, spies and anything that goes bump in the night, but there is much more. Computer security makes sure no damage is done to your data and that no one is able to read it unless you want them to.

Bruce Schneier, Protect Your Macintosh, 1994.

> The only truly secure system is one that is powered off, cast in a block of concrete and sealed in a lead-lined room with armed guards.

Gene Spafford.

> No serious commentary will say that the user has no responsibility. We all have responsibilities to lock our doors in our homes and to buckle up when we get in cars.

Spokesman, Information Technology Association of America, Business Roundtable, AP, May 19, 2004.

> The condition of any backup is unknown until a restore is attempted.

Schrodinger's Backup.

> Phishing is a major problem because there really is no patch for human stupidity.

Mike Danseglio, program manager in the Security Solutions group at Microsoft, April 4, 2006.

> If security were all that mattered, computers would never be turned on, let alone hooked into a network with literally millions of potential intruders.

Dan Farmer, System Administrators Guide to Cracking.

> The whole notion of passwords is based on an oxymoron. The idea is to have a random string that is easy to remember. Unfortunately, if it's easy to remember, it's something non-random like 'Susan'; and if it's random, like 'r7U2*Qnp,' then it's not easy to remember.

Bruce Schneier.

> Like the death of a celebrity from a drug overdose, publicised data loss incidents remind us that we should probably do something about taking better care of our data. But we usually don't, because we quickly remind ourselves that backups are boring as hell and that it's shark week on Discovery.

Nik Cubrilovic, TechCrunch.com, October 10, 2008.

> People often represent the weakest link in the security chain and are chronically responsible for the failure of security systems.

Bruce Schneier, Secrets and Lies.

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