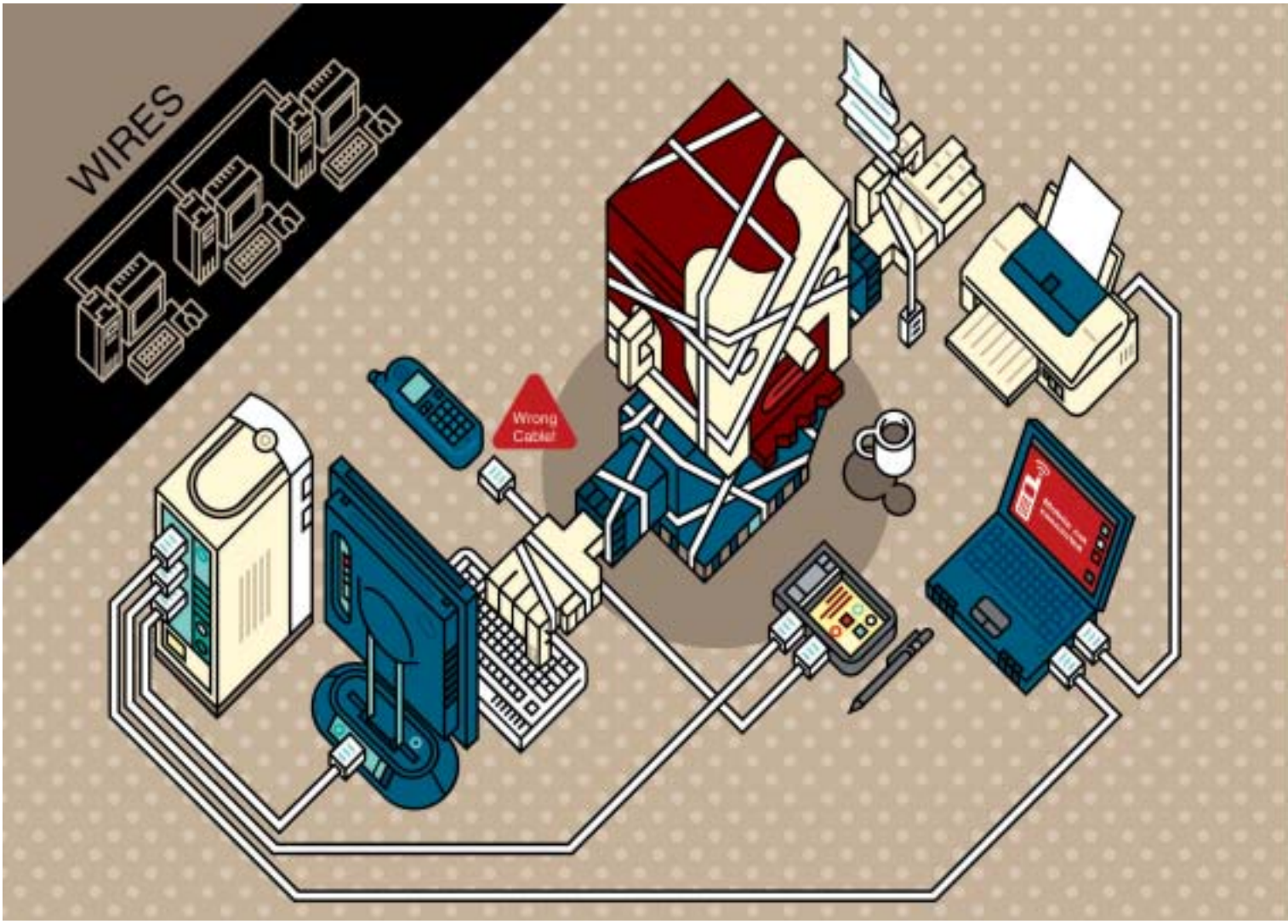


Wireless primer

Still not exactly sure of the advantages that wireless technology offers? Gordon Laing outlines how the Bluetooth and Wi-Fi standards can help you make that connection

Wireless is currently one of the most exciting and talked-about technologies. It could seriously improve the way you work and play both at home and in the office, not to mention when you're out and about. And while its name spells the end of inconvenient cabling, the technology is about a lot more than not tripping over wires and not worrying about having the wrong plugs.

Wireless technology has, of course, been with us for a long time, bringing us information and entertainment via radio and television. But over the following pages we'll specifically be looking at the latest standards that enable our notebooks, PDAs, PCs and mobile phones to communicate without a wire in sight.

These recent advances mean you can synchronise your PDA or use a mobile phone car kit or headset without ever connecting a plug. Indeed, you don't necessarily have to take the phone or PDA out of your bag. You can network every computer in your home or office without laying cables, and wander round with your portable while remaining online.

In this feature we're focusing on the most important wireless standards, Bluetooth and Wi-Fi, both of which are being built into more and more devices. We'll find out how they work, what they can do and how you can integrate them into older devices.

ILLUSTRATIONS: LEE HASLER

We've also spoken to people who are already using various wireless technologies and discussed the security concerns. After all, with all that data flying around, how do you stop people listening in? So read on to discover a brave new world in which wires will never tie you down.

Wireless basics

You might well think that wireless communications between computers is a new thing. In fact, it has been around for some time. Infrared technology has long been used, particularly for linking mobile phones with notebooks and PDAs. The big problem with infrared though is that it is a line-of-sight technology, which means the devices need to be facing each other and within close proximity.

Conversely, Bluetooth and Wi-Fi employ radio waves. This means the devices don't need to be facing each other in order to communicate. Their data can also happily travel through obstacles, meaning devices remain connected even in different rooms.

Although Bluetooth and Wi-Fi both use radio waves, they are, unhelpfully, incompatible standards designed for different tasks. Bluetooth is a short-range cable-replacement technology for linking devices near to each other, such as mobile phones, headsets, PDAs, notebooks and car kits. This is known as a personal area network or a PAN for short. The focus is on temporary links that are quick and easy to set up.

The Wi-Fi standard, on the other hand, is a wireless version of proper computer networks and is a cable-free version of ethernet. Just like ethernet it can be used to network an entire office of systems or simply link two PCs, say, for playing games. The focus here is on high-performance networking, only without the wires. This is why it's often known as wireless LAN or WLAN (wireless local area network).

You'll find Bluetooth and Wi-Fi in different types of devices. Bluetooth now comes as standard in most higher-end phones, notebooks and PDAs, certain peripherals such as keyboards, mice and printers and even some digital cameras. Wi-Fi is normally only found in notebooks or PCs. Some models, such as Sony's SRX range of notebooks, have both.

If your device doesn't have Bluetooth or Wi-Fi it can be easily fitted by inserting a card or a USB adapter. These can cost as little as £50 and prices are steadily falling. In addition, Bluetooth and Wi-Fi are also international standards, so they will work anywhere in the world.

Bluetooth in detail

This short-range radio technology is named after the Viking King Harald Blåtand (translated as Bluetooth), who achieved peace in Denmark and unified Scandinavia in the 10th century. The 21st century Bluetooth follows very much in this spirit of unity, simplifying and standardising wireless connections.

Bluetooth operates on a frequency of 2.4GHz and has an effective range of 10

How safe and secure is wireless?

The radio waves that allow Bluetooth and wireless LANs to penetrate indoor walls are equally able to make it out on to the street to anyone who cares to listen. Fortunately, both technologies have built-in security to keep your data private.

Bluetooth devices won't communicate with each other unless both have had the same passkey entered. Besides, once an eavesdropper has spotted you and got within range, you'll probably have moved on and taken your personal area network with you.

Of more concern are wireless LANs. These are designed to be left on all day and could potentially provide access to anyone directly outside the building. The answer is to activate WEP (wired equivalent privacy), which means all users wanting to connect must enter a special passkey. WEP is provided as standard on all wireless LAN products but must be activated by the person setting up the access point.

In the long term, WEP will be replaced by a robust security amendment currently known as 802.11i. For now, the Wi-Fi alliance has taken a subset of 802.11i and come up with WPA (Wi-Fi protected access), which offers better security than WEP and will hopefully be offered as a firmware update on most existing Wi-Fi products. WPA will also be compatible with 802.11i when it arrives later in 2003.

Wi-Fi (802.11b) and Bluetooth share the same 2.4GHz frequency, as do cordless phones, video transmitters and even your microwave oven. While interference is possible, the worst that can happen is a reduction in performance. There's also no evidence that any of these technologies constitute a health risk.

metres although, in practice, this can be significantly reduced by walls. Since Bluetooth is designed to connect devices that are usually located on or immediately around their owner, this isn't an issue. Its top data speed is 1Mbps (megabits per second), although normally you'll only get a maximum of 721Kbps (kilobits per second) in one direction.

To put these speeds in perspective, the most common type of infrared operates at just 115Kbps, although standard USB 1.1 boasts 11,000Kbps. Therefore, while Bluetooth is perfect for modest data transfers, it is a little slow for transferring larger files, especially between notebooks.

It's interesting to see several printers now equipped with Bluetooth, but their wireless connection should only really be used with portable PCs. Desktops should still ideally use a USB connection, especially when you're printing large files.

In the first instance, Bluetooth devices connect with each other using a process known as pairing. In order to pair two devices, one is temporarily set as 'discoverable' and the other performs a 'device discovery' to find it. Depending on the device and what you want to do, you may have to repeat this process the opposite way round, thereby allowing both devices to discover each other.

The pairing process is painless and need only be performed once for each new coupling. After this, they're added to a 'paired devices' list and can start communicating straight away. Just think of a PIN code and enter it into each device. Devices without keyboards, such as headsets, will have a fixed PIN you'll need to enter in the other device.

Raising your profile

Bluetooth can be used in many different ways. You can already buy Bluetooth phone headsets that don't tie you to your desk and it can also enable networking and file transfer. Each application is defined by a specific Bluetooth profile. Devices are programmed with the profiles relevant to their use, so a mobile phone may include the headset profile for voice communications while a printer may not.

In order to perform specific tasks, both devices need to have the profiles in common. For example, if your Bluetooth phone doesn't have the headset profile then it won't talk to a Bluetooth headset. Infuriatingly, you can't simply download a new profile to update most Bluetooth devices, so you must check for compatibility before buying – simply having Bluetooth alone is not enough.

While Bluetooth can be used to wirelessly network PCs or notebooks, its limited speed and range will prove frustrating. Where the technology excels is in creating ad-hoc couplings with modest data requirements, such as connecting a mobile to a car kit or telephone headset.

Since even 3G (third generation) mobile data rates are far below Bluetooth's maximum, it is also an ideal way of connecting phones with PDAs or notebooks. Indeed, if you've ever tried to line up the infrared ports on a phone and notebook while they're resting in your lap or on a train table, you'll love Bluetooth.

With this in mind, we recommend road warriors and mobile data users equip their phones and portable PCs with Bluetooth. While a handful of older phones can be upgraded with new battery packs, you're really looking at buying a new phone with Bluetooth built in, such as Sony Ericsson's T68i or Nokia's 7650.

Fortunately it's much easier to equip older notebooks and PDAs which don't have Bluetooth already built in. External USB Bluetooth adapters typically cost between £30 and £70, while internal CompactFlash, PC Card, Memory Stick and Secure Digital cards can be obtained for £60 to £150. Finally, don't forget a Bluetooth adapter on your desktop PC will allow handy wireless synchronisation with suitably equipped PDAs and phones. For more information on the short-range standard, go to www.bluetooth.com.

Wi-Fi in detail

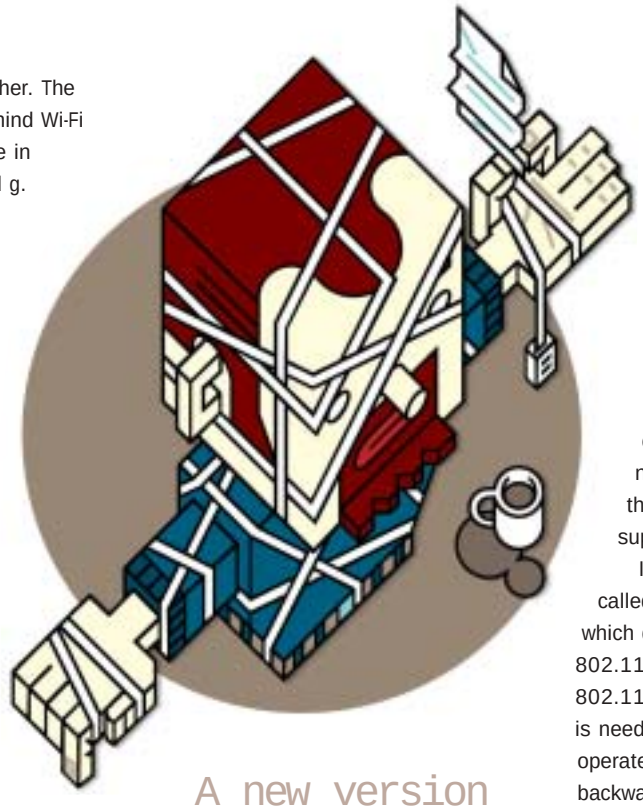
A clarification is in order before we look at the second main wireless standard, Wi-Fi. Wi-Fi is actually the name of a certification process for wireless LAN products

guaranteed to work with each other. The wireless ethernet technology behind Wi-Fi is called 802.11 and is available in several versions, called a, b and g.

The original and most widespread version of wireless ethernet is called 802.11b. Like Bluetooth, it operates on the 2.4GHz frequency, but is much more powerful and can deliver maximum speeds of 11Mbps at distances up to 100m. Again, in practice, 802.11b may only achieve shorter ranges, but should still cover the best part of an average home or office.

In theory any 802.11b device should be able to talk to another, but it doesn't always work. This is where the WFA (Wireless Fidelity Alliance) comes in. The WFA developed a testing and certification program and the Wi-Fi badge. Two products carrying official Wi-Fi certification should happily communicate, so it's advisable to go only for 802.11b products with this badge.

While 802.11b is fast enough for most situations, applications such as high-quality wireless video require higher data rates. This, coupled with concerns about interference with other 2.4GHz technologies, led to the development of 802.11a. This version is gradually being released. It operates on the 5GHz frequency and boasts maximum speeds of 54Mbps at distances up to 30m. As with 802.11b, the data rate is reduced at longer distances.



A new version called 802.11g is now emerging which delivers the 54Mbps speed of 802.11a at the 2.4GHz frequency of 802.11b

Since 802.11b and 802.11a operate on different frequencies, they are incompatible with each other but many new wireless LAN products offer dual-band facilities that allow them to operate on both 802.11b and 802.11a networks. To achieve 54Mbps, though, both devices need to support 802.11a.

Interestingly, a new version called 802.11g is now emerging which delivers the 54Mbps speed of 802.11a at the 2.4GHz frequency of 802.11b. Unsurprisingly, 802.11g support is needed on both devices for them to operate at the full speed, but it is also backwards-compatible with existing 802.11b networks, albeit at their top speed of 11Mbps. The vast majority of wired ethernet networks operate at either 10 or 100Mbps.

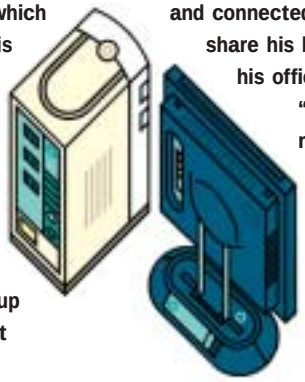
The Wi-Fi alliance intends to certify 802.11a and 802.11g products, and will use an extended capabilities badge with tickboxes to indicate support for different speeds and frequencies. In the meantime, it's safe to assume a plain Wi-Fi tag means there's 802.11b technology inside. Coincidentally, Apple's AirPort technology also employs 802.11b and so should work with

Wireless at work

Bob Alexander is a freelance IT consultant working from home. He has a PC in his home study which is used for work purposes. He prefers to keep this for his own use, so bought his son Dan a PC for his bedroom. Bob's wife Katie sometimes brings a notebook home from her office, too, so all three require separate internet access.

"Fast internet access was essential for running my business," explained Bob, "so after entering my postcode into the BT Openworld website and finding I was in their area, I signed up for ADSL." Bob went for the self-install option but decided to buy his own ADSL modem.

"I'd read that going for a router with a built-in modem would give me more flexibility, so I bought a D-Link DSL-504".



With a phone point in his office, Bob installed the router there and connected his PC directly using ethernet. Bob wanted to share his broadband with his son, but running a cable from his office router to Dan's bedroom was proving difficult.

"In the end I fitted a wireless access point to my router in the office and got one of those USB Wi-Fi adapters for Dan. Now he can share my broadband and even use my office printer. And I didn't even have to do any DIY."

"The best part, though, was realising I could just insert a Wi-Fi PC Card into Katie's notebook, allowing her to get online anywhere in the house – it's brilliant for browsing from the sofa in the living room, but I don't think we'd take it as far as the bedroom!"

If you've got two PCs on opposite sides of your home, you could network them using wireless LAN adapters rather than trailing an ethernet cable

other 802.11b devices. From this point on, we'll refer to all the 802.11 technologies as wireless LAN.

Wireless networks

As its name suggests, wireless LAN is a technology designed for networking computers or PDAs. Essentially it's exactly the same as using normal wired ethernet, except without the cables. You can use it to directly connect two machines or to connect one or more to various shared network resources.

In either case the devices in question, whether notebooks, desktops or PDAs, need to be equipped with wireless LAN facilities, typically using external USB adapters or internal cards. Like Bluetooth, you're looking at spending around £50 on a USB 802.11b adapter and packs of two for wireless gaming are even being sold for less than £100. Internal PC or CompactFlash 802.11b cards typically cost between £50 and £150.

For wireless communications with a network you'll need to connect a wireless access point to the network hub using an ethernet cable. Wireless access points are small boxes with antennae that should be positioned high in the corner of a room for the best coverage. Once configured, any device in a range will be able to connect to the network as if it were physically linked with a cable. The device will be able to share the same resources, from files and printers to an internet connection.

Basic single-band 802.11b Wi-Fi wireless access points are available from around £120 and should support several users with sufficient coverage for a home or small office. For greater coverage or to connect more users you can use more powerful access points or simply connect two or more to the hub.

Extended possibilities

While wireless LAN was originally developed to keep corporate notebook users connected as they wandered their office, it's also invaluable for situations where cabling would prove inconvenient or impossible. If your office has run out of fixed network points the addition of a single wireless access point will provide many more potential connections.

If you've got two PCs on opposite sides of your home you could network them using wireless LAN adapters rather than trailing an ethernet cable. Better still, if you're using a broadband router or gateway, you could connect a wireless access point and browse the web anywhere in your home; the coverage may even extend into the garden. There are also adapters available for games consoles which let them connect to your broadband internet service wirelessly.

Finally, wireless LAN technologies are being launched in many public areas such as airport lounges, train stations and even coffee shops while London's Royal Kensington Hotel has just installed a wireless hotspot for its customers. The idea is to provide high-speed web access to customers with Wi-Fi-equipped portables. Some charge a subscription, while others offer it free as an incentive to visit.

BT's Openzone program intends to set up 400 public Wi-Fi 'hotspots' by June 2003; see www.bt.com/openzone. As an international standard, you can also take your Wi-Fi portable abroad and use public hotspots there. Indeed, as Wi-Fi hotspots appear in more public places, you've got to ask who needs 3G phones? Find out more about Wi-Fi at www.weca.net. ■

Glossary

- 802.11 **Technical name for the wireless ethernet standard, also known as wireless LAN or WLAN.**
- 802.11a **Wireless network standard operating at 5GHz with speeds up to 54Mbps. Only required by power users or those wanting high-quality wireless video. Incompatible with 802.11b unless dual-mode adapters are employed. Products will be recognisable by having both Wi-Fi certification boxes ticked.**
- 802.11b **Wireless network standard operating at 2.4GHz at speeds up to 11Mbps. The most common WLAN standard and the first to receive Wi-Fi certification. Under the forthcoming Wi-Fi certification scheme, 802.11b devices will have a single tick.**
- 802.11g **Forthcoming wireless network standard operating at 2.4GHz with speeds up to 54Mbps. It is faster than 802.11b but backwards compatible.**
- Bluetooth **Wireless standard designed for temporary, short-range connections between devices such as mobile phones, headsets, car kits, PDAs and notebooks.**
- PAN (personal area network) **Refers to the close proximity of devices communicating with Bluetooth. Bluetooth can network up to eight devices simultaneously.**
- Profile **Used in Bluetooth to define certain applications, such as file transfer or headset communications. Two Bluetooth devices need certain profiles in common to work together.**
- Wi-Fi **Wireless fidelity testing and certification process set up for 802.11 wireless LAN products. Devices with the Wi-Fi badge should work together.**
- WEP (wired equivalent privacy) **Security built in to all 802.11 wireless LAN standards.**
- WLAN (wireless local area network) **Broad term for all 802.11 standards. Effectively a wireless version of the ethernet networking standard.**