**Building a network for a small office need not be complex and to prove it we've gathered together seven starter kits to see how easy they are to install and use**

# Easy

**M**any small businesses are now realising that networking their PCs will make better use of their IT resources and can play a key role in keeping them ahead of the competition. Although many will have a number of employees using PCs, they will have no means of sharing information and resources. In this environment the only sharing likely to occur is via the 'sneakernet' – copying a file onto a floppy disk, walking over to a colleague's desk and handing the disk to them.

This is time consuming, unproductive and tedious at best. Sharing resources such as files and printers across a network can increase productivity and bring big savings. The SOHO (Small Office Home Office) market has been growing rapidly over the past few years and is a sector that can benefit hugely from networks. However, many people view networks as complex beasts that need technical staff to install and maintain them. Fortunately, many IT manufacturers have recognised this problem and now offer networking kits that are designed to be simple to install and use.

In this month's group test we take a look at seven of these kits that offer a wide range of options. The most basic provides enough hardware to get two PCs connected over a simple Ethernet network. We'll be looking at products that allow PCs to be networked using USB ports, offer Internet connection sharing and higher-end systems that provide a small server for centralising all your data. All are designed to be simple to install and configure and come with clear instructions to guide you gently through the entire process. Some offer support for both Ethernet and Fast Ethernet and come with a hub or a switch, so we'll be explaining how they work and which is the best choice for your business.

# *networks*

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• *Products tested and reviewed by Dave Mitchell*

# *3Com* **AirConnect Starter Pack**

**SMALL COMPANIES LOOKING** for an out-of-the-box wireless LAN (WLAN) solution may find 3Com's AirConnect Wireless LAN Starter Pack offers all they need. When the latest IEEE 802.11b High Rate specification was ratified in late 1999, 3Com was quick off the mark with support for the new standard. Four speeds are available – 1, 2, 5.5 and 11Mbits/sec and are designed to allow wireless products to use a feature called dynamic rate shifting so they can adjust their operating speed to counteract poor conditions such as interference. This will affect the operating range, which depends on the connection speed. For outdoor use this is 33m, but in the office 11Mbits/sec only stretches to 26.6m while 5.5Mbits/sec increases this to 40m.

The Starter Kit comprises three wireless PC Cards plus a base station, so you have everything you need to provide laptop users with full network access. PCs can also be included in the WLAN by using a special PCI card that provides a slot for inserting a wireless PC Card, although these were not available at the time of writing.

All wireless PC Cards operate in two modes. Ad-hoc mode supports a peer-to-peer connection between users, so that, for example, a group of three laptop users running in this mode can see each other, but do not have access to the company network. Infrastructure mode provides full access to the network, but requires the base station. 3Com's base station is a compact unit with a chunky plastic aerial that flips up at the back.

At the rear is a 10BaseT port for connection to a network hub or switch, plus a serial port for a direct link to a PC for configuration using terminal emulation software, such as Windows HyperTerminal. Build quality is not particularly good, though, as there are two small wires at the back that connect to the aerial assembly loop in front of each port and need to be moved aside to gain access. The aerial on the AirConnect card isn't fixed firmly to the PC Card body, either, so care must be taken to avoid damaging it.

Installing the PC Cards is simple enough, as our Win98 test laptop identified them correctly on insertion. There are plenty of troubleshooting utilities and tools provided as a Launcher application loads in the background. Selecting this brings up a small window that shows the connection status and general card settings. The AirConnect card supports two different power modes prolonging laptop battery life. They can detect whether the laptop is running on mains or battery supply and will automatically select the most appropriate mode.

You'll need to set up a serial port link to the base station for initial configuration, but 3Com provides a suitable cable and there's plenty of help in the online manual. Once you've assigned it an IP address you can move over to management using a standard web browser. Here, you'll find access to all the base station's settings and you can monitor who is currently logged on. A special PowerBaseT adaptor is included that allows the base station to be positioned some distance from a power outlet as it uses a standard eight-wire network cable to provide it with power and a network link.

Installation may be easy enough, but general performance falls well short of the quoted top speed. We copied a variety of files from our laptop to a PC on the main network and saw top speeds of only 3.4Mbits/sec. There are a number of reasons for this. First, the Ethernet port on the base station is only the 10BaseT variety so 11Mbits/sec speeds are simply not possible. All WLAN products use the Ethernet CSMA/CA protocol that starts to fade above 80 per cent of available bandwidth, as it will be continually monitoring packet collisions and waiting to send data. The general Windows network protocol overheads take their toll as well. The bottom line is that users are unlikely to see speeds above 5Mbits/sec for real-world wireless operations.

Even so, the AirConnect is more than three times faster than older 2Mbits/sec wireless products, as these delivered speeds in the region of 1Mbit/sec for general use. As a complete package the AirConnect also looks good value as it provides enough hardware to get three users up and running and provides full network access as well.

## SPECIFICATIONS

**INTERNET CONNECTION SHARING**
No

**NETWORK CARDS**
Number supplied: 3
Interface: Type II PC Card

**NETWORK HUB**
Model: AirConnect Wireless Base Station
No. of ports: N/A

**NETWORK CABLES**
No. supplied: N/A
Type: N/A

## DETAILS

**PRICE** £1,315 (£1,119 ex VAT)
**CONTACT** 3Com 0800 225 252
**www.3com.com**
**PROS** Easy installation with everything included for full wireless network access
**CONS** Build quality below par and disappointing performance
**OVERALL** An all-in-one wireless networking kit that's easy to install and use and offers good value, although performance for general use is well below the quoted top speed

| | |
|---|---|
| BUILD QUALITY | ★★ |
| FEATURES | ★★★★ |
| VALUE FOR MONEY | ★★★ |
| OVERALL RATING | ★★★ |

# *Compaq* NeoServer 150 Internet

**COMPAQ'S NEOSERVER** 150 Internet Plus provides a low-cost, simplified server solution for companies with limited IT knowledge. Along with basic file sharing it offers shared Internet access, email facilities, the option to create your own intranet site and yet aims to be configured inside of 15 minutes after the user has answered a few simple questions. It runs a scaled-down version of SCO Unix with a 100-user licence. Compaq claims this is easier to use than Microsoft's NT Server or Novell NetWare, as these network operating systems can be overly complex for the target market.

However, you don't need to be a Unix expert to use the NeoServer, as all administration is carried out using a standard web browser from a networked workstation. At the rear are the usual mouse, keyboard and monitor interfaces, but these have been covered up with a blanking plate so you only use the power socket, network connection and, in the case of the Internet Plus model on review, the modem port.

The NeoServer is clothed in a compact mini-tower chassis with two 5.25in bays at the front for removable hard disk carriers. One comes pre-installed with a 17GB Seagate EIDE drive which can be used either as extra storage or to back up the contents of the internal 13GB drive. Backup is always an important consideration, but we're not convinced this is the best method, as the removable drive can only be taken out with the server powered down, so it's likely to be left in place rather than be stored in a secure location.

The hardware specification is fairly good for the price and consists of an Intel Celeron 500MHz processor accompanied by 64MB of memory spread across a pair of DIMM sockets. The latter can be upgraded by sliding the motherboard carrier out from the rear, but we found it difficult to get the assembly back inside the chassis. We weren't impressed with the location of the power button either, as this sits in a small recess on the top panel and is all too easily activated by a misplaced hand, although, if pressed, it does initiate a controlled shutdown. Four PCI slots are provided with two occupied by a Compaq dual-speed network adaptor and a 56K V.90 modem card. The network connection is completed by an eight-port Compaq HB111 hub, although this is only of the 10BaseT variety and will need replacing if you want to move up to Fast Ethernet.

You also get a pair of cables – one for connecting the NeoServer to the hub and the other for the administration workstation. You'll have to source network cards and cabling for the rest of your users, as the NeoServer package doesn't include any.

We found the NeoServer easy to set up and use. The documentation is particularly good, as it covers almost every angle with clear overviews of networking principles and detailed instructions for setting up the first PC for network connection. Software configuration is dealt with by a utility supplied on CD-ROM – just load the disc and follow the instructions. Your web-browser home page is automatically set to the NeoServer, so you'll see the main Control Centre administration screen as soon as you load it. Enter a username and password, choose a letter for the shared drive, select the country and language, enter your ISP details and away you go.

The same CD-ROM is used to configure the network and browser settings on each workstation and IP addresses are dished out by the NeoServer's DHCP (dynamic host configuration protocol) services. New user accounts are easily added and each gets a personal folder on the server's hard disk that can be mapped to a local drive.

Internet connections are started as soon as the NeoServer spots an IP address that is not bound for the local network. Once a link to your chosen ISP has been made, all users with sufficient rights can share the connection and unwanted visitors are deterred by the NeoServer's built-in firewall. Server backup is a two-button affair and can be scheduled or run on demand. To restore files you view the contents of the backup drive from the Control Centre and select those you want returned to active duty. The Recycle Bin can also be controlled from here and emptied after a specified number of days have passed.

The NeoServer 150 package is a good choice for small companies that want a network server along with shared Internet access and email but don't want the hassle and additional costs of setting up a network operating system. As a complete solution it is well priced and is very easy to install and use.

## SPECIFICATIONS

**INTERNET CONNECTION SHARING**
Yes

**NETWORK CARDS**
Number supplied: None
Interface: N/A

**NETWORK HUB**
Model: Compaq HB111
No. of ports: 8

**NETWORK CABLES**
No. supplied: 2
Type: Category 5

## DETAILS

**PRICE** £1,127 (£959 ex VAT)
**CONTACT** Compaq 0845 270 4000
**www.compaq.com**
**PROS** Remarkably easy to set up and use; good documentation
**CONS** Can't attach a printer to the server; supplied hub is only 10BaseT
**OVERALL** A good solution offering shared storage; Internet access and email facilities

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|---|---|
| BUILD QUALITY | ★★★ |
| FEATURES | ★★★ |
| VALUE FOR MONEY | ★★★★ |
| OVERALL RATING | ★★★★ |

# *D-Link* Network Kit DFE-905
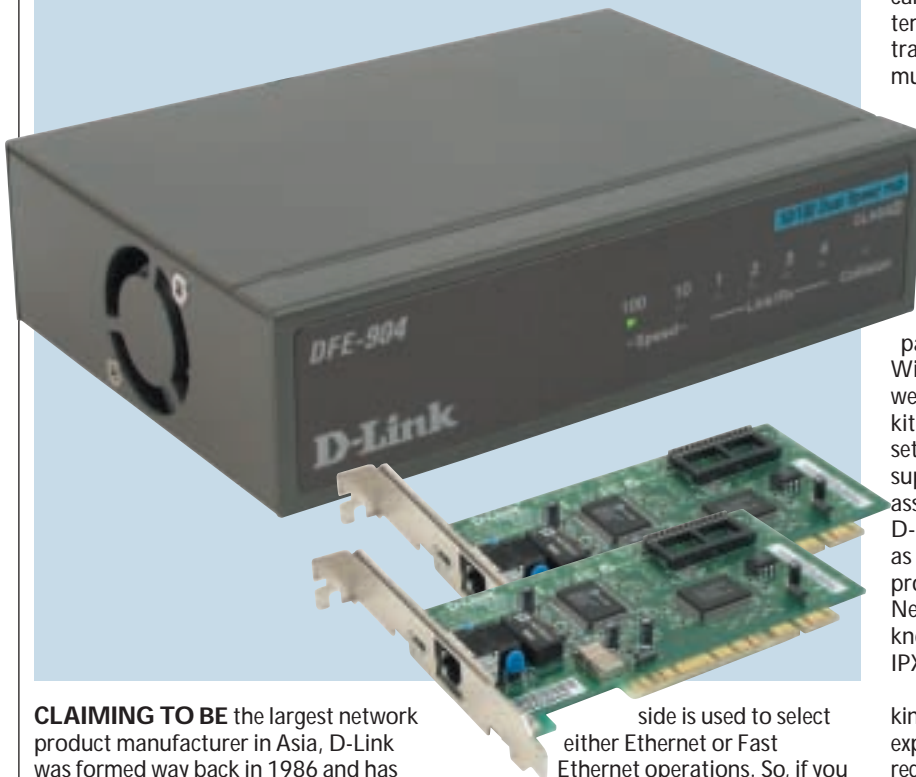
**CLAIMING TO BE** the largest network product manufacturer in Asia, D-Link was formed way back in 1986 and has its finger in just about every networking pie there is. It recognised the value of the SOHO networking market before many other manufacturers and has always had a comprehensive range of budget-priced products to suit. The DFE-905 is its network-in-a-box offering and supports both Ethernet and Fast Ethernet operation. The kit supplies all you need to get a pair of PCs networked and talking to each other and comes with two dual-speed PCI network cards, a four-port hub, two 6m lengths of Category 5 cabling and plenty of manual-related help.

The DFE-904 dual-speed hub has to be one of the smallest we've seen, as it measures a miniscule 11 x 3 x 7.5cm (w x h x d). Referred to as a 'hubby' by D-Link, it's cloaked in a solid steel case and the company has even managed to fit a cooling fan in one side. The front panel provides plenty of status info with a link status and activity LED for each port along with collision detection and speed selection indicators.

An important consideration with the DFE-904 is that it does not support both 10 and 100Mbits/sec operations simultaneously and a tiny switch at the side is used to select either Ethernet or Fast Ethernet operations. So, if you have even one device that only supports the lower speed, all connected devices must drop to this speed as well.

At the rear you'll find five RJ-45 sockets. However, two of these sockets are used for port four. This is because one socket acts as a standard connector for attaching a PC to the network and the other as an uplink port for cascading other hubs. Connecting to one of these sockets disables the other, so you cannot use both at the same time. D-Link gets a pat on the back for its hub manual as it provides plenty of instructions on how best to use it. Various different networking scenarios in which the hub can be used are covered in some depth and Ethernet limitations on cable lengths and the maximum number of segments allowed are explained clearly.

The DFE-530TX cards are dual-speed adaptors that support both 10BaseT and 100BaseTX operations. These are terms that refer to the different types of network standards as specified by the IEEE (Institute of Electrical and Electronics Engineers) governing body. 10BaseT is a 10Mbits/sec baseband network that uses twisted-pair cables. Baseband simply refers to a network that transmits data digitally, but each wire can only carry one signal at a time. The other term, broadband, describes analog transmissions over a wire that can carry multiple signals at the same time, such as cable TV. 100BaseTX is a 100Mbits/sec baseband network that uses twisted-pair wires but the signals from the sender's transmit wire cross over to the recipient's receive wire – a function carried out within a hub or switch.

We found the cards were simple enough to install and a small pamphlet provides a few tips on Windows networking. However, as we've found with a number of starter kits, when it comes to installing and setting up network protocols, the supplied documentation tends to assume a certain level of knowledge. D-Link is particularly vague on this topic as the pamphlet asks you to select the protocols you want to use from the Network panel in Windows. Would you know whether you needed NetBEUI, IPX/SPX compatibility or TCP/IP?

The network adaptors are typically the kind of quality hardware we've come to expect from D-Link over the years and we regularly recommend them along with the likes of Intel and 3Com cards. Our experience has shown that cheap unbranded network cards can be a big problem as they frequently cause installation problems and resource conflicts and rarely come with any worthwhile support. The D-Link cards have three indicators on their backplate showing link speed and activity that can be useful for troubleshooting. They also support auto-negotiation so, if the D-Link hub has been set to run at 100Mbits/sec, the cards will sense this on connection and will automatically configure themselves to run at the higher speeds.

Overall, the D-Link Network Kit offers a good entry point into the world of networking with the added bonus of support for both Ethernet and Fast Ethernet. It's a pity the hub doesn't support both speeds simultaneously, but you can always upgrade it later on if you feel this is a worthwhile investment.

## SPECIFICATIONS

**INTERNET CONNECTION SHARING**
No

**NETWORK CARDS**
Number supplied: 2
Interface: PCI

**NETWORK HUB**
Model: DFE-904
Number of ports: 4

**NETWORK CABLES**
Number supplied: 2
Type: Category 5

## DETAILS

**PRICE** £106 (£90 ex VAT)
**CONTACT** D-Link 020 8235 5555
**www.dlink.co.uk**
**PROS** Support for 10/100BaseTX and reasonable documentation
**CONS** Hub doesn't support both network speeds simultaneously
**OVERALL** A good value solution for networking two PCs over Ethernet or Fast Ethernet

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|---|---|
| **BUILD QUALITY** | ★★★★ |
| **FEATURES** | ★★★ |
| **VALUE FOR MONEY** | ★★★ |
| **OVERALL RATING** | ★★★ |

# *D-Link* **Phoneline USB Adapter**

**NO DOUBT MANY** small businesses are looking to the benefits of networking their PCs but may not be too keen on the idea of having network cabling snaking around the office or home or having to dismantle their systems to install network cards. It was inevitable that vendors would look to the USB port as a means of networking PCs and D-Link's 10MB Phoneline USB Adapter DHN-120 aims to do just that. Although not a starter kit in the strictest sense, the D-Link USB solution does offer a number of useful features for those looking for the simplest of networking solutions. Along with a Plug and Play installation that doesn't require the PC's lid to be removed, it uses existing phone lines to transmit data, so no further cabling work is necessary.

The USB adaptor supports the latest HomePNA2.0 (Home Phoneline Networking Association) specification that was completed at the end of 1999. This offers some big performance-related improvements over the original HomePNA1.0 specification as it increases performance tenfold to 10Mbits/sec, bringing it in line with standard Ethernet speeds and making it far more suitable for office networking. The specification is designed to allow PCs to be connected over a maximum

distance of 300m. Expansion options are almost limitless as up to 50 devices can be connected over the phone lines although, beyond this, performance is likely to suffer. It offers all the same features as a standard network so you can share files, printers and Internet connections. Furthermore, the lines can still be used for normal phone calls and older HomePNA1.0 devices will work with the latest products as well.

D-Link's USB adaptor is a tiny palm-sized slab of clear plastic with three LED indicators at the front showing power and link status, along with network activity. At the rear is a standard USB port plus two RJ-11 sockets for phone line and handset connection. The adaptor draws power from the USB port, so there are no bulky transformers to worry about.

For testing we installed one adaptor on a PC running Windows 2000 Professional and another on a Win98 SE system. Hardware installation in both cases was simple enough, as you just plug the adaptor in, wait for the system to identify it and load the drivers from the supplied CD-ROM. Phone line connection will be a problem, though, as the supplied cable is terminated at both ends with the smaller RJ-11 sockets. D-Link doesn't provide RJ-11 to BT convertor plugs so, before the USB

adaptors can be used, you'll have to source these yourself.

Software installation shouldn't cause too many headaches, as the supporting documentation is extremely good. Along with a browser-based guide on the CD-ROM, you also get a decent manual that covers virtually every installation angle and procedures for both Windows 98 and 2000 are included. It guides you gently through the process of setting up your workgroup making no assumptions along the way. The section on the TCP/IP protocol settings is excellent as it shows clearly how to provide each PC with a permanent (static) IP address and supports this with plenty of screenshots. File and printer sharing comes next, but the manual chickens out on showing how to share an Internet connection.

Once your PCs are connected to the phone line, the activity LED on each device should flash to show it is receiving or transmitting data and we achieved a connection between our test PCs on our first attempt. So far so good, but performance proved to be a big let-down. Copying 121MB of Win98SE cab files from one PC to the other took nearly 11 minutes 30 seconds for a transfer rate of 1.4Mbits/sec. This improved marginally to 1.5Mbits/sec when we copied a single 73MB .avi file but dropped to 1.3Mbits/sec for 86MB of documents and spreadsheets.

Although performance is nowhere near the quoted figures, it should be enough for small offices indulging in simple file and printer sharing with minimal traffic between PCs. If you're expecting traffic volumes to be higher, then the only alternative is to install Ethernet or Fast Ethernet. At £125, the DHN-120 is also comparatively expensive, as you could set up a basic Ethernet network for less money. Overall, the factors in favour of D-Link's USB networking solution are the simplified installation, no extra cabling needs and the ability to expand the network easily over existing phone lines.

## SPECIFICATIONS

**INTERNET CONNECTION SHARING**
No

**NETWORK CARDS**
Number supplied: 1
Interface: USB

**NETWORK HUB**
Model: N/A
Number of ports: N/A

**NETWORK CABLES**
Number supplied: 2
Type: USB cable/phone cable

## DETAILS

**PRICE** £147 (£125 ex VAT)
**CONTACT** D-Link 020 8235 5555
**www.dlink.co.uk**
**PROS** Easy to use; plenty of expansion and good documentation
**CONS** Poor performance and costly
**OVERALL** The easiest way to set up a network using your internal phone lines, but low on speed and expensive

| | |
|---|---|
| BUILD QUALITY | ★★★ |
| FEATURES | ★★ |
| VALUE FOR MONEY | ★ |
| OVERALL RATING | ★★ |

# *Farallon* Internet Sharing Starter Kit

**FARALLON MOVED INTO** the small network arena mid-1999 with the release of its Internet Sharing Starter Kit (ISSK) which is aimed at home users and small offices looking to create a simple network, but with the added bonus of sharing a single Internet connection. However, the ISSK is only of any use if you're just planning to network a couple of PCs. The kit comprises two of Farallon's EtherWave PCI network cards, two short lengths of Category 5 network cable, a five-port hub and a two-user copy of Vicomsoft's SurfDoubler TCP/IP routing software. The software is only designed to allow an Internet connection on a PC to be shared with one other networked PC and cannot be upgraded. If you want the connection to be shared among more PCs, Farallon does offer an option to trade in the SurfDoubler software and redeem its value against Vicomsoft's SoftRouter Plus software.

Although we found installing the ISSK very easy, some users may have problems, as Farallon only provides separate booklets for each piece of hardware. The network cards are poorly covered and the model referred to in the manual is not the same as that supplied with the kit. There's nothing to help with network configuration either, so you're on your own when it comes to installing

and setting up TCP/IP. The EtherWave cards themselves are unexciting as they are only the basic 10BaseT variety. A single RJ-45 port provides the network connection and is supported by link status and activity LEDs which could prove useful for troubleshooting. However, if you think you may move to Fast Ethernet in the future, these cards will have to be replaced for dual-speed versions. The Starlet/5 hub is a basic plastic box with five 10BaseT ports at the rear and a switch alongside port one allows it to function as a normal network port or as an uplink for cascading another hub. At the front is a row of LEDs showing link status and activity for each port and one showing detected collisions. A small guide is provided, although there's little to do here other than switch the hub on and connect each user to it.

SurfDoubler acts as a router as it identifies IP traffic that is not for a system on the local network and automatically opens a connection with your chosen ISP. Further outbound Internet traffic is routed to the ISP while incoming traffic is sent through to the local network and on to the client that requested it. The software allows the connection to be shared as it uses a feature called NAT (Network Address

Translation) where all local IP addresses are mapped to the Internet address provided by the ISP. This has an added security bonus, as all PCs on the local network are hidden behind the router ensuring that their addresses are never allowed onto the Internet.

Installing the SurfDoubler software on our Win98 test system proved to be reasonably simple. Once the software is loaded, it fires up a wizard-based utility that leads you through each step. If you already have a Windows Dial-Up Networking profile configured it will offer to use these settings or help create a new profile. It supports DHCP (Dynamic Host Configuration Protocol) so it can dish out local IP addresses to both PCs and the wizard shows where in the Networking Properties you need to go to select this. One area where we would have liked to have seen more help was with client configuration. For the second PC to be able to access the system running the SurfDoubler software it needs the IP address of the host's network card entered as a gateway, but there was very little information provided about how this is carried out.

With SurfDoubler running you can load any Internet application, such as a web browser on either PC, and a connection will be automatically established. From the main PC you can view Internet activity as a line graph and close or open a connection manually. Obviously, you won't want the link left open when it's idle, so you can set SurfDoubler to close it after a specific period of inactivity as well as limit the time the connection can remain open.

Farallon's network starter kit offers a simple solution for connecting a couple of PCs and sharing an Internet connection among them. However, upgrade potential is extremely limited and the router software only supports two PCs. At £99 ex VAT the kit is comparatively expensive as well, especially as you'll have to source a modem yourself.

## SPECIFICATIONS

**INTERNET CONNECTION SHARING**
Yes

**NETWORK CARDS**
Number supplied: 2
Interface: PCI

**NETWORK HUB**
Model: Farallon Starlet/5
Number of ports: 5

**NETWORK CABLES**
Number supplied: 2
Type: Category 5

## DETAILS

**PRICE** £116 (£99 ex VAT)
**CONTACT** Farallon 01494 562 734
**www.farallon.com**
**PROS** Simple setup; software router offers good control over Internet access
**CONS** 10Mbits/sec Ethernet hub and cards; average documentation
**OVERALL** A simple solution for a small network with shared Internet access, although only two PCs are supported by the software and the price is comparatively high

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|---|---|
| BUILD QUALITY | ★★★ |
| FEATURES | ★★ |
| VALUE FOR MONEY | ★★ |
| OVERALL RATING | ★★ |

# Putting Ethernet in the frame

Ethernet is a most remarkable thing. Since it was first mooted in 1973 by Robert Metcalfe, Ethernet has grown to become the dominant networking technology, now boasting an estimated 100 million interfaces installed worldwide.

Ethernet allows networked devices, such as PCs and printers, to communicate with each other over a shared medium or cable and is known as a connectionless service. When one PC sends a message to another device on the network, all other devices including the sender can hear it. However, only one transmission at a time is allowed on the network, so if two devices start talking at the same time it will cause a collision.

Clearly, a protocol, or set of rules, is required to stop this happening and a method called CSMA/CD (carrier sense multiple access/collision detection) was designed to do just that. It requires each device to listen first before transmitting and if no-one else is talking it can send its data. Unfortunately, this method actually causes collisions, as many devices may try and transmit at the same time when they think the line is free.

To stop collisions becoming permanent, a method clumsily called truncated binary exponential backoff is used. Each device that senses a collision randomly generates a small integer and uses it to calculate the number of milliseconds (thousandths of a second) it should wait before retrying and will do this 16 times before giving up.

However, if a device gets access to the network and starts transmitting, then what's to stop it hogging the line? To stop this happening, Ethernet packets (or frames – they're the same thing) cannot be larger than 1,518bytes. Essentially, the rules for Ethernet are: listen first, if no-one else is talking then start talking but don't talk for too long.

So far so good, but how do stations know when a collision has occurred? Remember that when a device transmits a message everyone including the sender can hear it. If the sender transmits and hears nothing but static it knows the message never got through as the line wasn't free. If it hears the message it sent then it knows it must have been received.

So how do devices know when a message they've heard on the network is for their attention? Every network interface card (NIC) has an address placed in its memory chip at the factory and this is usually found on a small sticky label on the card. This MAC (media access control) address is made up of six bytes of data and is unique. The first three bytes represent the address assigned to each card manufacturer and they can then choose the last three bytes.

Ethernet data frames follow a specific format and start with an 8-byte preamble field, which is nothing more than an electronic clearing of the throat to say that it is about to say something. Next comes the destination address followed by the source address, a couple of bytes to say what the message type is and then the data itself. A 4-byte frame check sequence completes the frame and is also used to verify that the data in the frame hasn't been corrupted during transmission.

This all sounds rather complicated, but the good thing about Ethernet is all the listening, collision detection and retransmissions are carried out automatically by the NIC and are completely transparent. The only time you're likely to become involved is if excessive collisions are causing network performance problems.

On very busy networks, as more data is transmitted, the likelihood of a collision occurring increases and eventually the network can reach a stage known as thrashing – there are so many colliding transmissions that no data is actually getting through to its destination. This state usually occurs at around 80 per cent utilisation of available bandwidth.
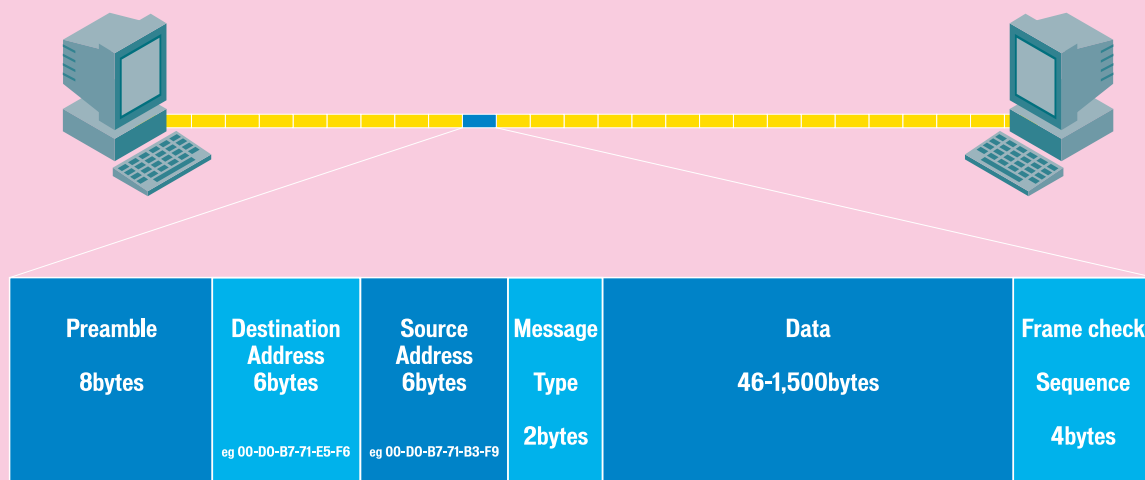
This problem can be alleviated depending on the type of hub you choose to install. A basic Ethernet hub is designed to receive transmissions, refresh them and send them to all its ports. Every device connected to the hub is on the same physical network and this is called a collision domain – every device can hear all the others and they are all affected equally by collisions.
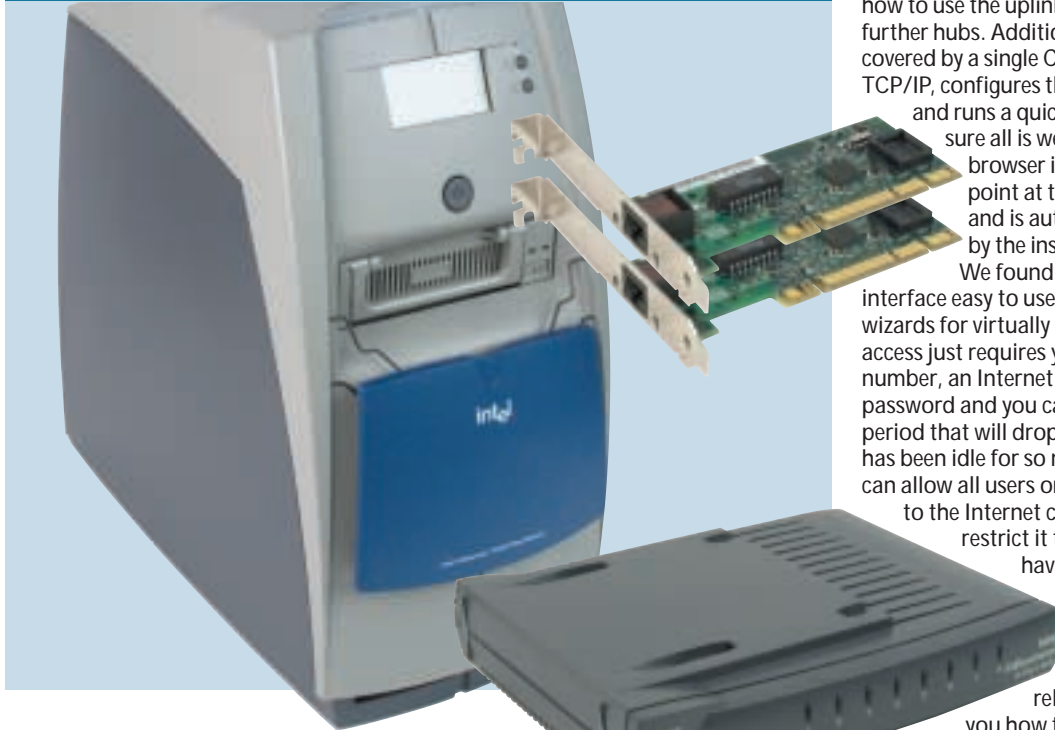
A switch, or switching hub, can reduce these problems by breaking the network into smaller collision domains. Physically, these look no different to a hub but contain powerful processors and memory that allow them to read and store the MAC addresses contained in each frame's header.

When a transmission occurs between two devices, the addresses are stored in a forwarding table held in memory, enabling the switch to 'remember' which physical port each device is connected to. Consequently, when further frames are received they are switched only to the port to which the destination device is connected, so in this way network traffic is reduced dramatically as transmissions are no longer being propagated across the entire network.

## Basic Ethernet frame composition

| Preamble | Destination Address | Source Address | Message Type | Data | Frame check |
|---|---|---|---|---|---|
| 8bytes | 6bytes | 6bytes | 2bytes | 46-1,500bytes | Sequence 4bytes |
| | eg 00-D0-B7-71-E5-F6 | eg 00-D0-B7-71-B3-F9 | | | |

# Intel **InBusiness Small Office**

**INTEL'S ASSAULT ON** the small-business networking market began with the acquisition of Dayna Communications at the end of 1997 and resulted in the release of the InBusiness range. Primarily consisting of compact Ethernet hubs and switches, the emphasis is very much on low cost and ease of use.

The latest member of this family is the InBusiness Small Office Network that aims to provide everything a small business is likely to need, including file and printer sharing plus shared Internet access. It centres around Intel's Small Business Network Appliance – a compact server that runs the new Windows for Express Networks, which has been designed by Microsoft specifically for controlling server appliances. Based on Windows NT4, it supports up to 25 users and comes pre-installed and ready for use.

Physically, the server appliance is well designed and built. The front panel flips up to protect the power button and above is a comprehensive backlit LCD panel that keeps you up to date with server operations. No monitor is required – in fact, no graphics capabilities are provided at all, as the server appliance is designed to be configured and managed using a

standard web browser from a logged-in workstation. It does have a parallel port, though, that can be connected to a local printer and shared among users.

At its heart is an Intel motherboard with a 440BX chipset, an Intel Celeron 466MHz processor and 64MB of memory on a single DIMM module. Storage is provided by a 13GB Quantum lct10 EIDE hard disk and a backup function is also available with an optional 13GB Quantum hard disk mounted in a removable carrier at the front that can be used to mirror the contents of the main drive. Four PCI slots are provided with one taken up by a 56K V.90 modem, but upgrading the system is not really an option as the casing is not easy to remove. Along with the server, Intel also provides a couple of dual-speed network cards and an eight-port InBusiness 10BaseT hub.

Installing the server appliance is simply a case of connecting the power, network and modem cables and switching it on. The LCD panel provides a running commentary of the proceedings and, after a few minutes, it's ready. Network card installation is helped along by a small pamphlet and the hub gets its own booklet, which

outlines a few network scenarios and how to use the uplink port for cascading further hubs. Additional options are covered by a single CD-ROM that installs TCP/IP, configures the protocol settings and runs a quick check to make sure all is well. The resident web browser is configured to point at the server appliance and is automatically loaded by the installation routine. We found the browser interface easy to use as it provides wizards for virtually every task. Internet access just requires your ISP's phone number, an Internet username and password and you can select a timeout period that will drop the connection if it has been idle for so many minutes. You can allow all users on the network access to the Internet connection or restrict it to only those that have an account on the server. For email, the appliance can't act as a server, but the release notes show you how to set up a range of different email client products such as Outlook Express, Eudora and AOL.

Windows for Express Networks defaults to a fully open system, so you'll need tighter security. This only takes a few minutes and thereafter only those users with valid accounts can use the server's facilities. As each user is created they're also given a personal folder on the server. The advanced management features are extremely good as you can view the server's operating temperatures and voltages and ask to be advised if faults are detected. The server can also be accessed over a serial port or modem-to-modem link and an emergency console can be used to view and modify BIOS settings and installed hardware. There's even a facility for remotely managing the server over the Internet.

We were impressed with the number of features offered by the InBusiness solution. Everything a small business could need from a network is here and users with limited technical knowledge will find it simple to set up and run.

## SPECIFICATIONS

**INTERNET CONNECTION SHARING**
Yes

**NETWORK CARDS**
Number supplied: 2
Interface: PCI

**NETWORK HUB**
Model: InBusiness 8-Port
Number of ports: 8

**NETWORK CABLES**
Number supplied: 1
Type: Category 5

## DETATILS

**PRICE** £1,469 (£1,250 ex VAT)
**CONTACT** Intel
01793 431155
**www.intel.com**
**PROS** Easy setup and excellent management
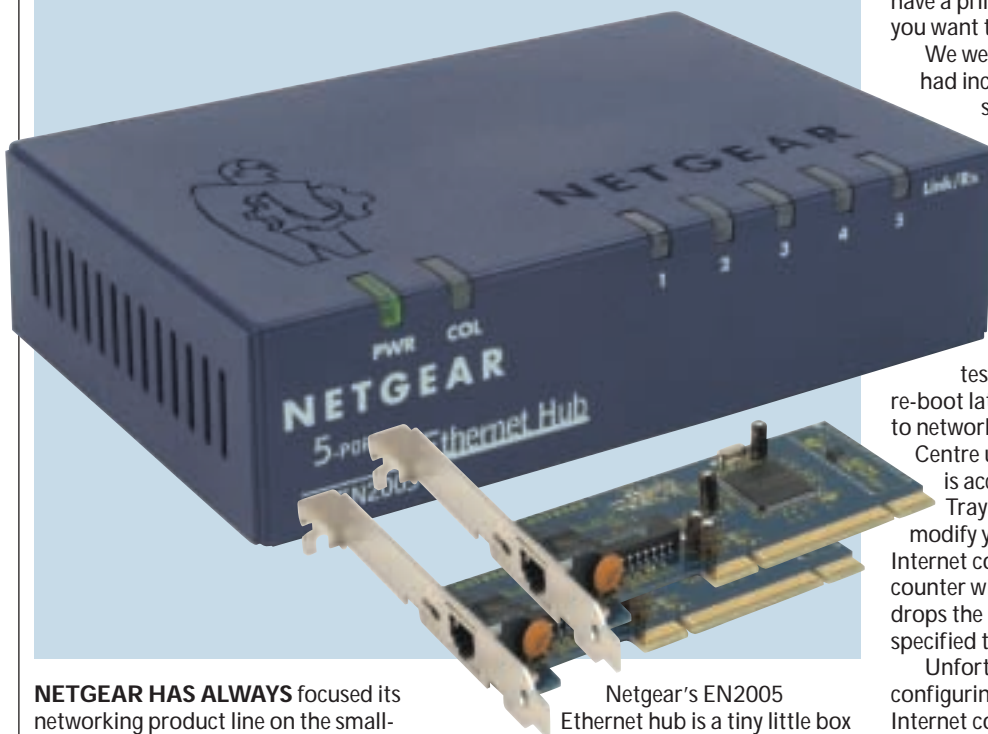**CONS** Upgrade options limited
**OVERALL** A client/server solution that's well designed and simple to use and manage

| | |
|---|---|
| **BUILD QUALITY** | ★★★★ |
| **FEATURES** | ★★★★★ |
| **VALUE FOR MONEY** | ★★★★ |
| **OVERALL RATING** | ★★★★ |

# *Netgear* Network Starter Kit SB105

You can decide whether to share your hard disk and CD-ROM drive and, if you have a printer already installed, it asks if you want to share this resource as well.

We were impressed to see NetGear had included Internet connection sharing, as you can designate one PC as an Internet gateway, providing it has a suitable communications device. You can choose between ADSL or cable modems, ISDN terminal adaptors or a standard 56K modem. We chose the latter and FirstGear proceeded to test our dial-up connection. One re-boot later and our first PC was ready to network. FirstGear loads a Control Centre utility on the gateway PC that is accessible from the System Tray and from here you can modify your network settings and Internet connection. A useful idle time counter will reduce call charges as it drops the link if it hasn't been used for a specified time.

Unfortunately, when it came to configuring our other PCs to share the Internet connection, Netgear's documentation fell apart as there was no mention of how to do this. To get this to work we had to enter the host computer's local IP address as a gateway in the network TCP/IP settings on each client PC and add our ISP's DNS (domain name server) IP addresses as well. We were then able to share the connection over our local network but it's too much to expect novices to be able to do this themselves.

The Internet connection sharing capabilities could prove to be cost-effective as you'll only need to purchase a single modem and one Internet account for the whole office to use, although it was a shame that the documentation left us high and dry when it came to configuring client PCs. Problems aside though, the Netgear Network Starter Kit does offer good value for money, as you'd be hard pushed to source each component separately for less cash.

**NETGEAR HAS ALWAYS** focused its networking product line on the small-business and home-office users and offers a wide choice of budget-priced hubs, switches and network cards. Up until March this year, NetGear was part of Bay Networks, which then became Nortel Networks, so you may see some magazine advertisements still referring to these company names.

The original company began producing network starter kits back in 1997, with the early SB104 model offering a four-port 10BaseT hub, and was the first of its kind to bundle in a pair of dual-speed network cards allowing PCs to be upgraded easily to Fast Ethernet. The SB105 adheres to the same philosophy, as you get two dual-speed PCI network cards, a five-port 10BaseT hub and a simplified installation guide. A couple of 3m Category 5 network cables are also included. This cabling is the only type you should use when setting up a network as it is classed as data-grade cable. You may see older Category 3 cable available but should avoid it at all costs as it is only voice-grade quality. Should you decide to upgrade you will almost certainly experience problems as, although Category 3 cable can handle standard 10Mbits/sec throughput, it can't cope with the higher speeds of Fast Ethernet.

Netgear's EN2005 Ethernet hub is a tiny little box about the same size as a portable cassette player. A row of status LEDs on the front show link status and activity for each port while a separate pair to the left reveal power status and detected collisions. At the rear you'll find six RJ-45 sockets. Port 5 commands the last two of these – one can be used for a standard connection to a PC, or the uplink port alongside allows a second hub to be cascaded from it to increase the number of available ports. Unfortunately, the supplied documentation doesn't discuss this option so you've no way of knowing whether you need a straight-through or cross-over cable to link the hubs together. Note also that, as the hub is only of the 10BaseT variety, it will have to be replaced with either a dual-speed or 100BaseTX version if you want to upgrade to Fast Ethernet.

The documentation guides you through the process of fitting the network cards and installing them under Windows. Next, you can use the accompanying FirstGear CD-ROM to help set up your network connection. It starts by asking for a unique computer name and a common workgroup name and explains the purpose of these requirements at each step along the way.

## SPECIFICATIONS

**INTERNET CONNECTION SHARING**
Yes

**NETWORK CARDS**
Number supplied: 2
Interface: PCI

**NETWORK HUB**
Model: EN2005
Number of ports: 5

**NETWORK CABLES**
Number supplied: 2
Type: Category 5

## DETAILS

**PRICE** £67 (£57 ex VAT)
**CONTACT** Netgear
01344 397 021 **www.netgear.com**
**PROS** Good value and includes Internet connection sharing
**CONS** Hub only 10BaseT; Internet connection sharing poorly documented
**OVERALL** A good value network starter pack with Internet connection sharing for all users; pity about the documentation, though

| | |
|---|---|
| **BUILD QUALITY** | ★★★ |
| **FEATURES** | ★★★ |
| **VALUE FOR MONEY** | ★★★★ |
| **OVERALL RATING** | ★★★★ |

HIGHLY COMMENDED PERSONAL COMPUTER WORLD

## Table of features

| Manufacturer | 3Com | Compaq | D-Link | D-Link | Farallon | Intel | Netgear |
|---|---|---|---|---|---|---|---|
| Product | AirConnect Wireless LAN Starter Pack | NeoServer 150 Internet Plus | Network Kit DFE-905 | Phoneline USB Adapter DHN-120 | Internet Sharing Starter Kit | InBusiness Small Office Network | Network Starter Kit SB105 |
| Telephone | 0800 225 252 | 0845 270 4000 | 020 8235 5555 | 020 8235 5555 | 01494 562 734 | 01793 431 155 | 01344 397 021 |
| URL | www.3com.com | www.compaq.co.uk | www.dlink.co.uk | www.dlink.co.uk | www.farallon.com | www.intel.com | www.netgear.com |
| Price (ex VAT) | £1,315 (£1,119) | £1,127 (£959) | £106 (£90) | £147 (£125) | £116 (£99) | £1,469 (£1,250) | £67 (£57) |
| Server | ✗ | NeoServer 150 | ✗ | ✗ | ✗ | InBusiness Server App | ✗ |
| Operating system | ✗ | SCO Unix | ✗ | ✗ | ✗ | Windows for Express Networks | ✗ |
| Processor | ✗ | Celeron 500MHz | ✗ | ✗ | ✗ | Celeron 466MHz | ✗ |
| Modem | ✗ | ✔ | ✗ | ✗ | ✗ | ✔ | ✗ |
| Internet connection sharing | ✗ | ✔ | ✗ | ✗ | ✔ | ✔ | ✔ |
| **Network cards** | | | | | | | |
| Number supplied | 3 | None | 2 | 1 | 2 | 2 | 2 |
| Interface | Type II PC Card | N/A | PCI | USB | PCI | PCI | PCI |
| Speeds supported (Mbits/sec) | 1, 2, 5.5, 11 | 10/100 | 10/100 | 10 | 10 | 10/100 | 10/100 |
| Auto-negotiation | N/A | N/A | ✗ | N/A | ✔ | ✔ | ✔ |
| **Network hub** | | | | | | | |
| Model | AirConnect Wireless Base Station | Compaq HB111 | DFE-904 | ✗ | Farallon Starlet/5 | InBusiness 8-Port | EN2005 |
| Number of ports | N/A | 8 | 4 | ✗ | 5 | 8 | 5 |
| Speeds supported (Mbits/sec) | 10 | 10 | 10 or 100 | ✗ | 10 | 10 | 10 |
| MDI/X port | ✗ | ✔ | ✔ | ✗ | ✔ | ✔ | ✔ |
| **Network cables** | | | | | | | |
| Number supplied | None | 2 | 2 | 2 | 2 | 1 | 2 |
| Type | N/A | Category 5 | Category 5 | USB cable/phone cable | Category 5 | Category 5 | Category 5 |
| Length | N/A | 2.2 metres | 6 metres | 1.7 metres/4.5 metres | 2.2 metres | 2 metres | 3 metres |

# Buying with an eye for expansion

For most small businesses, a 10Mbits/sec standard Ethernet network will be all they ever need, as it is perfectly capable of handling the demands of simple file and print sharing. However, it would be wise to ensure that the network can be expanded easily if demand increases.

The majority of network starter kits come with a basic Ethernet hub with four or five ports and limited expansion capabilities, but it's likely this will be the first component to be dropped when you expand. To increase the number of available ports you can connect more hubs together in a daisy chain. Also called cascading, one port on each hub is used to connect the two devices together. A special cable with the send and receive wires crossed over may be required, but most hubs have a dual-function port often identified as an MDI/X port. It can function as a normal port or, with the flick of a switch, become a cross-over port allowing a standard straight-through cable to be used to link a second hub.

There is no limit on the number of hubs that can be in a cascade but, as signal quality and timing cannot be maintained beyond a certain point, no two end stations on an Ethernet network can be separated by more than four hubs or five wiring segments.

If available bandwidth is being soaked up, the quickest option is to move up to Fast Ethernet as this offers an immediate tenfold increase in performance. Fast Ethernet is designed to look and feel like basic Ethernet, so there's very little required to upgrade. When building your network it is advisable to fit dual-speed Ethernet cards in all your PCs, so they are ready and waiting.

To make life even easier, ensure all the cards support a feature called auto-negotiation. This means they will detect the maximum speed of the hub or switch they are connected to and automatically configure themselves to operate at the highest available speed. Most will even do this on the fly, so each PC doesn't need rebooting. Cost considerations are low, as the price difference between standard and dual-speed cards is now so small it would be a false economy not to opt for the latter.

When you want to move to Fast Ethernet, all you need to do is replace the hub with a model that supports both speeds. However, it is not advisable to buy a hub that only supports Fast Ethernet, as this will mean that you won't be able to connect legacy devices.

# Editor's **Choice**

**M**any small businesses are wary of networks as they assume that a high level of technical knowledge is required to set up and maintain them, even to the point of having specialist staff. While this is true of networks for large companies, it should not be the case for the small business or home office looking to join together a modest number of users.

Consequently, the most important consideration here is the ease with which it can be installed and configured. Clear documentation plays a big part in this, as many non-technical users will want to be guided through the process of installing the hardware, wiring it together and getting the PCs talking. As the previous pages show, too many manufacturers make assumptions – particularly when it comes to setting up network protocols. Clearly, some manuals could benefit from extra pages explaining what they are and how to load and configure them. Ethernet's limitations also need to be clearly described, as breaking these rules can easily make a network become unstable. Too many hubs between PCs can cause problems that are difficult to troubleshoot and it is possible to accidentally create a wiring loop that causes network traffic to circulate endlessly, soaking up all the bandwidth.

A problem we often see with many businesses is how quickly their network runs out of steam and needs upgrading. The type and variety of data crossing today's networks has changed dramatically over the past few years so it's important that the network can be improved to keep up with demand. Although all the starter kits only provide at best a pair of network cards, the sensible choice is to opt for dual-speed adaptors. This is because when it comes to upgrading to Fast Ethernet, you won't have to touch your PCs again, they'll adapt to the new speed automatically.

Internet connection sharing is a valuable feature for any network, as it can offer big savings by allowing many users to share a single Internet account. Four of the network kits offer this as standard, although with varying degrees of success. Both Intel and Compaq provide connection sharing with simple management and control features. Netgear's solution is a lot simpler, but does allow an unlimited number of users to share a connection whereas Farallon's option is limited to only two PCs.

While an Ethernet hub is a crucial part of the networking equation, most of those supplied are only good enough to get you up and running. Four or five ports may be enough for a simple home office but once you start adding other users and devices, such as network printers, you'll need to add more ports. However, hub prices are so low it's a better bet to replace them with something larger when the time comes.

## The winners

Considering we are looking at simple networking solutions for small businesses, our **Editor's Choice** goes to Intel's InBusiness Small Office Network as it provides everything you need for your first network. It was a close call between Intel and Compaq as the products are closely related, but the InBusiness package was more complete. It's the more costly, but the installation was easy, as the CD-ROM-based utility took the hard work out of configuring each client PC. There's also little to separate the Intel and Compaq web-browser management interfaces, as they were both easy to understand and use and there was plenty of wizard-based help. Intel scored higher, though, as the kit came with a pair of dual-speed network cards to get two PCs up and running, plus a decent eight-port hub.

A printer can also be attached to the server appliance and shared among users. The management facilities were the best as you can set up good security and can also keep an eye on the server's vital signs from a networked workstation. The server can even be monitored and configured from a remote location.

Our **Highly Commended** award goes to Netgear for its SB-105 Network Starter Kit, as it offers very good value. For only £57, you get a pair of dual-speed PCI network cards, a basic five-port 10BaseT Ethernet hub and a couple of decent lengths of cable. However, the Internet connection sharing tools make it stand out from the crowd as it was a feature we hadn't expected to see at this low price. Although the documentation fell short of our expectations, the FirstGear software utility will prove to be a useful tool for small offices on a tight budget and could reduce Internet access costs substantially as everyone on the network can use the same ISP account.

*Intel's InBusiness solution was the most complete package on offer*
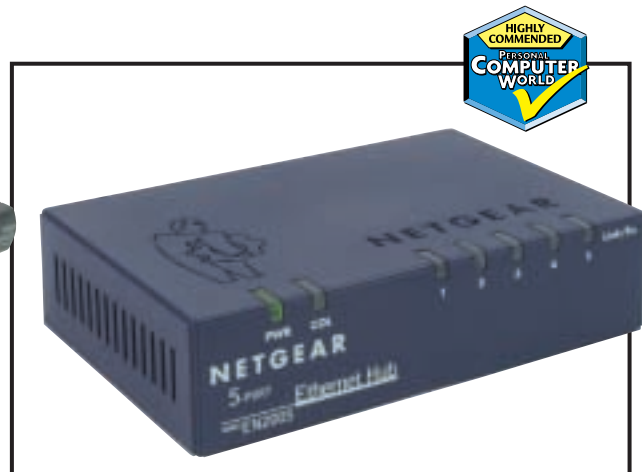
*Netgear captured everything you need to network at a budget price*