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Illustration by Paul Shorrock

Net Gains

Our extensive review of how to get net connected at home and in business: what you need, where it's from, and how much it costs.

Communications is the key to the future. No business can survive without the right comms tools, and no home user should be without the best, most affordable internet access, whatever technology that might use. And that's the crux of the problem: what's the best way to get access to the internet?

Modem access is slow and cumbersome, especially in an office. ISDN can be expensive for the individual user, and even when you have several people using the line, the cost can be prohibitive. A leased line gives you the fastest access and a permanent connection; but when does it make sense to spend the extra money on it?

To help you get the bandwidth you need without your bank balance suffering, we have a comprehensive guide to all your internet access needs. We have reviews of modems, ISDN terminal adapters and routers, as well as an explanation of how to get the best communications solutions for your own needs — and at the right price.

Ratings

★★★★★ **Highly recommended**
★★★★ **Great buy**
★★★ **Good buy**
★★ **Shop around**
★ **Not recommended**

Contents

• ***Contributors*** *Clive Akass, Roger Gann, Dave Mitchell, Ajith Ram, Nigel Whitfield and Ian Wrigley*

Accessing the internet: the home user

For the home user, until ADSL and cable modems become widely available, the internet connection choice is very limited: a dialup connection using either the PSTN or ISDN. Any other sort of net connection is way too dear. Dialup offers a choice of two bandwidths: 56Kbps for V.90 modems, and 64Kbps for ISDN HomeHighway — possibly 128Kbps if your ISP supports it. To access the internet via the PSTN you'll need a modem; to access it via HomeHighway you'll need either an internal ISDN card or an external ISDN Terminal Adapter (TA).

You can buy internal cards now for less than £50 plus VAT. External TAs cost roughly double this, so ISDN hardware won't break the bank. The more expensive ISDN devices feature their own DSPs, which place less burden on the PC's CPU.

Performance

The actual bandwidth delivered by the PSTN and ISDN doesn't differ significantly on paper, but does in practice. A V.90 modem can deliver 56Kbps in theory but in reality you're lucky to get better than 50Kbps, 45-50Kbps being more typical. By contrast, an ISDN line will always deliver the full 64Kbps, i.e. roughly 20 percent more bandwidth.

This may not sound like a big gain, but when you factor-in the very rapid setup and 'tear down' times of ISDN calls, and benefits such as immunity from line noise and abrupt disconnections, ISDN becomes very attractive. Basic Rate ISDN comes with two 64Kbps channels which can be aggregated or bonded into a single 128Kbps channel, thus doubling your bandwidth. The problem here is that many ISPs won't offer Multilink-PPP ISDN channel aggregation on a standard 'tenner a month' dialup account. Some, such as CiX, do. CiX charges £14.99 per month for such an account — a bargain.

▲ OLITEC'S SMART-MEMORY MODEM ACTS AS A FAX AND ANSWERPHONE

It's important to remember that merely having a fast link doesn't guarantee fast data transfers. If internet traffic is slow, then it doesn't matter if you have the fattest pipe on earth; the data still won't come down it any faster.

Costs

For internet users it makes sense, mainly from a family 'harmony' point of view, to have a second line installed. A second BT line normally costs £99 (inc VAT) but is currently on 'special', at £49.50 until 30th June 1999. I have Cable & Wireless cable TV connection, and installation of a second phone line was free, with the quarterly line rental running at £12. I also get £3 of free calls. This contrasts with BT's standard residential-line quarterly rental of £26.77, so it's one alternative.

If you spend a lot of time hooked up to the internet, you should consider ISDN. HomeHighway is BT's most recent innovation, bringing ISDN into the home <www.homehighway. bt. com/>. ISDN is relatively expensive and sadly HomeHighway is only a bit cheaper than standard ISDN 2e. Converting your existing phone line to Home Highway costs £116.33 though it, too, is on special at £57.58 before 30th June. Not everyone can have Home Highway installed, however.

◀ BT'S HOME HIGHWAY IS ONLY SLIGHTLY CHEAPER THAN ISDN2E

Like all its ISDN pricing, BT's tariff structure is labyrinthine: quarterly line rental is a whopping £120 but this includes £45 of free calls. Nevertheless, it's still roughly three times as dear as an ordinary phone line. HomeHighway calls cost the same as normal calls: 3.95p per minute during the day, 1.49p in the evenings and 1p per minute at weekends. For comparison, the Cable & Wireless charges are 3.75p, 1.17p and 0.8p per minute. Sensible use of Friends and Family-type discount schemes can help reduce your online costs.

ROGER GANN

Cable modems

Just recently, cable modems became a reality for those lucky users living within the NTL cable franchise in the Home Counties. In May NTL launched HiSpeed Internet, the first cable service in the UK <www.ntl.com/ cablemodems>. Users will be able to have a permanent 512Kbps internet connection for £40 (inc VAT) per month, which is both cheaper than HomeHighway as there are no call charges, and up to four times faster. Subscribers must take the NTL phone subscription as well (£8.87) and will also need to buy a 3Com/USR cable modem and network interface card for £170. Cable modem bandwidth is 'shared' among users and the number logged on affects available bandwidth. NTL makes no minimum bandwidth guarantees but claims that, with proxy cacheing, users can reasonably expect connections no slower than 256Kbps.

3Com 56K Professional Message

The 3Com Professional Message uses the X2 standard developed by US Robotics and is the fastest modem reviewed here. Its firmware is flash upgradeable to the V.90 standard while remaining backwards compatible. As its name suggests, this modem is intended to be a complete communications solution for individuals and small businesses. It can receive and store voice messages and faxes, and there are buttons to play, fast forward and delete the voice messages. The LEDs at the front help with troubleshooting, appraising you of internet connection status and whether there are any messages waiting. Its 2Mb of memory, upgradeable to 4Mb, can store either 20 minutes of voice messages or 50 fax sheets, or a combination of both, and you can retrieve the voice messages remotely using a pin number. However, the 3Com lacks the Pace's ability to call you at a remote location. Setting up is easy. The modem is recognised by the Windows 98 hardware installation routine and the software installs with little fuss. The excellent manual contains plenty of pictures and screenshots.

PCW DETAILS

★★★★★

Price £199 (£169 ex VAT)
Contact 3Com UK
0800 225 252
www.3com.co.uk

Diamond Supra Express 56e Memory

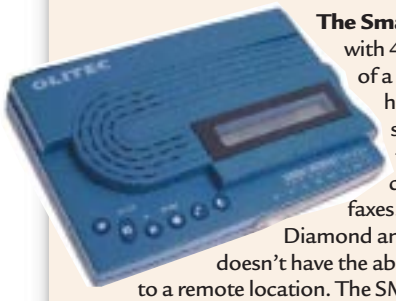
Diamond's Supra Express 56e has 2Mb of memory which can store 15 voice messages, each of 30 seconds length, or 40 fax pages. This data will be retained even if the power supply is interrupted. The memory can be upgraded to 6Mb. Like the other modems here, the Supra Express can send and receive faxes with speeds up to 14.4Kbps. And like the Pace and the 3Com, it has a message forwarding facility: using the software provided, you can program the modem to forward the voice and fax messages to another location. The Supra Express supports both K56Flex and V.90 protocols, and the firmware is flash upgradeable. Like many external modems, this too has a set of useful LEDs. The bundled software continuously monitors the modem status and offers troubleshooting tips, and we had no trouble installing the modem drivers and configuring the software. This modem did not compress text as well as others, though. But as you can upgrade the memory, and as it is by far the cheapest modem of its kind, it's perfect for the home user.

PCW DETAILS

★★★★

Price £99 (£84 ex VAT)
Contact Diamond Multimedia
UK 0118 944 4444
www.diamondmm.co.uk

Olitec SmartMemory Pro



The SmartMemory Pro comes with 4Mb of memory in the form of a SmartMedia card which has to be inserted before switching on. Olitec claims that this is the only modem capable of storing colour faxes. However, unlike the Diamond and Pace modems, it doesn't have the ability to forward messages to a remote location. The SM Pro has a well-lit LCD and remote control, and its full duplex speakerphone allows hands-free conversation. Its firmware supports the K56Flex standard and is flash upgradeable to V.90. This modem was difficult to install and configure, however. It wasn't immediately recognised after the drivers were installed from the CD-ROM, and in fact, drivers for the model we saw weren't even listed on the CD, so we had to manually install the numerous .inf files on the CD to find the exact match — an time consuming and frustrating process. But once you're up and running, troubleshooting isn't a problem. The detailed manual, along with the LCD and indicator lights, provide ample help. We did have trouble downloading files, as the modem kept dropping the connection. But when it could keep the connection, it achieved high speeds that enhanced overall performance.

PCW DETAILS

★★★

Price £141 (£120 ex VAT)
Contact Direct Source
0118 981 9960
www.euro-tech.co.uk

Pace 56 Solo

The Pace 56 Solo functions as a modem, fax and digital answering machine. It can store approximately eight minutes of voice messages or 30 pages of faxes in its 2Mb of memory, which can be upgraded to 6Mb. The K56Flex firmware is flash upgradeable to the V.90 standard. With the built-in microphone you can use the Solo to conduct a hands-free conversation, and the modem can store four telephone numbers and a confidential four-pin access number in non-volatile memory. The modem status is highlighted by a set of LEDs which help in troubleshooting. Fax messages can be previewed on a PC before printing — the modem has a fax button which prints directly to the default printer. The Solo also has a nifty feature called Follow Me, which allows you to program the modem to call you at a remote location if you have messages waiting. This is one of the easiest modems to set up. True to its plug-and-play roots, it is detected by the hardware installation wizard and the drivers and software install without a hitch. There were no problems during testing, either. The Solo posted good speeds while downloading text, but was slow downloading large images.

PCW DETAILS

★★★★★

Price £199 (£169 ex VAT)
Contact Pace Communication
UK 0990 561001
www.pacecom.co.uk

Accessing the internet: small networks

▲ WINGATE, A FLEXIBLE, MULTI-PROTOCOL PROXY SERVER

Connecting a single user to the internet is a simple enough problem to solve: one user, one PC, one modem, one phone-line, one ISP account. The problems arise when one more than one person needs access. OK, you could give every user their own modem, phone line and ISP account, but this is expensive and cumbersome.

The ideal solution would be a permanent, leased-line connection to your ISP, but this isn't cost-effective where small numbers of users are involved unless you make extensive use of ISDN. Eight hours of ISDN up-time costs about £16 (ex VAT) per day or roughly £1000 per quarter.

Sharing a single connection between several users makes a lot of sense. Having a single connection makes internet access so much more controllable and efficient: you can eliminate the complexity and expense of maintaining multiple phone lines, modems and user accounts for each individual connection under conventional schemes. You only need a single phone line (analogue or digital) to service the connection, so there are line-rental savings to be had. You only need one ISP account, too, which as well as being cheaper, also makes it easier to manage. And the user experience is better: if you go down the ISDN router or proxy server route, users no longer have to explicitly initiate an internet connection; all they have to do is fire up an internet application and the connection will be made for them. And if you want to limit or control access to the internet, then very often these solutions allow you to limit connection times: some even let you limit access to sites with 'questionable' material.

So, we're again left with Hobson's choice — a dialup connection, but this time shared, using either the PSTN or ISDN2e. BT offers a business version of HomeHighway, called BusinessHighway, but plain vanilla ISDN2e maybe a better bet. It's very similar to BT Highway but only offers a digital connection: if you want to plug in an analogue phone you'll need an external device such as a router with analogue phone sockets.

However, ISDN 2e does have a feature called Multiple Subscriber Number (MSN) which allows up to ten separate 'analogue' phone numbers to be assigned to the analogue ports on your ISDN device. There's a £20 setup fee for MSN and the first two numbers are free. So, with a single ISDN line and the right kit, you would have two analogue lines for virtually the same cost as two ordinary business lines. While ISDN2e running costs are modest — call charges are the same as voice calls — the monthly rental is high, typically £133.75 (ex VAT) compared to a normal business line of £37.34, but you do get a £57.50 call allowance. The bottom line is that the rental on a single ISDN2e line works out almost the same as two ordinary business phone lines, which means a single ISDN line could service a small office at no extra cost, particularly if you make good use of MSN.

Note that sharing an internet connection across a small network doesn't rule out an analogue modem connection, which is still the most cost-effective solution for non-intensive use. There are a couple of possibilities here.

Modem sharing

One is to use modem-sharing software to share a single modem (or ISDN TA) between several users. This is cheap, lets you use existing kit, and will free up phone lines. However, users will still have to manually initiate an internet connection and although the hardware is shared, the actual connection isn't: once a connection is made, other users on the network can't access the internet.

Although Windows 9x allows users to share a fax modem, sharing a data modem is not a standard feature and you have to go outside for third-party solutions. Perhaps the best known is Artisoft i.Share 3.0 <www.artisoft.com> which adds internet sharing to your LAN and costs $129 for up to three users. When you load a web browser or other internet software, i.Share checks to see if a connection already exists. If not, it logs on to your ISP. Another candidate is SAPS from SpartaCom <www.spartacom.com/sapsfrm.htm>.

▲ EICON'S DIVA T/A, REVIEWED ON PAGE 196

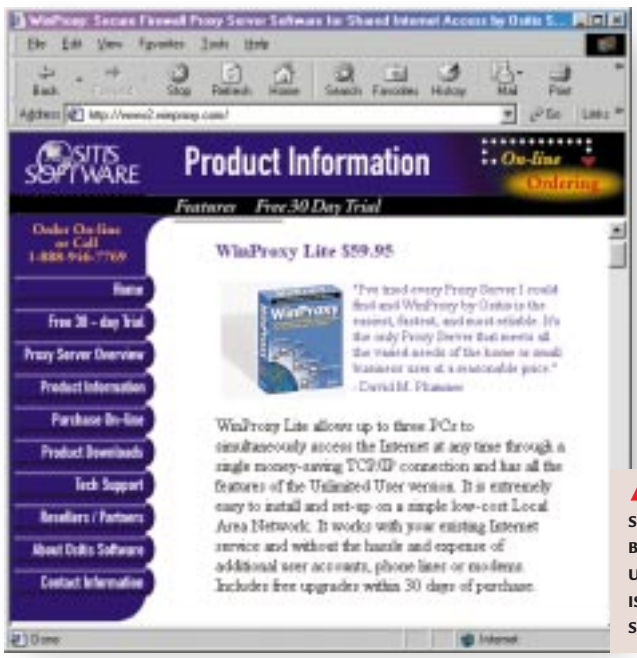
Proxy server software

Another inexpensive solution is to put some proxy server software between the LAN users and the modem. Now, whenever a user wants to connect, they simply fire up an internet app and the proxy server (a non-dedicated PC) will look to see if the data requested is already cached on the server. If it is, it's served up without making a call; if it isn't, the proxy server makes the connection without any further user intervention. Once up, other users on the network can use the same connection at the same time.

The idea behind the cacheing element of proxy servers is to capture the most heavily transferred data at the connection and minimise the traffic that needs to pass over that link. It can not only accelerate the supplying of web data, but can also cut connection charges. And when online, other users on the LAN can share the one link.

Perhaps the best known is Deerfield WinGate 3.0 <www.wingate.com>, a flexible, multi-protocol proxy server for Windows 95, NT Workstation and NT Server. It provides a cacheing proxy service for HTTP clients, as well as FTP, IRC, NNTP, POP3, SMTP, RealAudio and telnet protocols. It supports dialup modem, ISDN and direct LAN internet connections. WinGate is available in three flavours: the three-user Home version costs $40, the six-user Standard costs $70, and the Pro version costs $300.

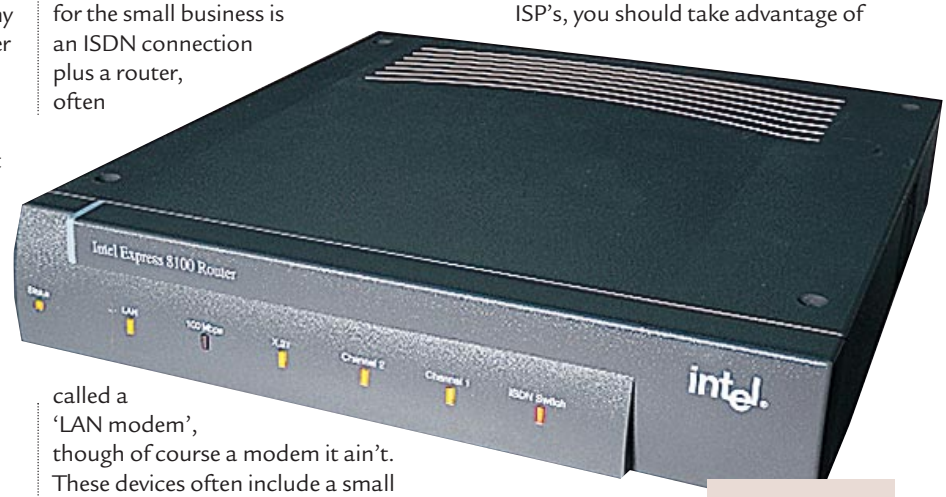
Another candidate is Ositis Software WinProxy 1.1 <www.winproxy.com> which offers a similar, if less complete, range of features. The three-user WinProxy Lite version costs $60. Also, by the time this issue of *PCW* hits the newsstands, Windows 98 Second Edition will be available. This has a new feature, Internet Connection Sharing, which is just a fancy name for a proxy server, so this could be a good one-stop solution.



▲ **Putting proxy server software between the LAN users and the modem is an inexpensive solution**

Routing

Quite simply, the best internet solution for the small business is an ISDN connection plus a router, often called a 'LAN modem', though of course a modem it ain't. These devices often include a small ethernet hub as well, so they make for an attractive one-stop small office connectivity solution.



▲ **Intel's Express 8100 router, reviewed on page 199**

With a LAN modem installed, all users on the LAN have the same fast, transparent access to the internet. There's no need to initiate a connection, as you'd normally do with Dial-Up Networking; you simply load a browser or send an email. The router will then connect to the ISP, in a mere two or three seconds — a time so short that you'd be forgiven for thinking you've got a permanent link.

All LAN modems support a feature called Native Address Translation (NAT) which lets you use a cheap, 'tenner a month' (or freebie) dialup account, rather than a £50pm 'business' account. They also typically offer bandwidth management, only using the second 64Kbps channel when really necessary, and dropping it when an incoming analogue call to an MSN number is detected.

Controlling call costs can be a problem with demand dial routers. The more sophisticated routers offer tariff management to help you control call charges, but the very minimum you should do is ask for fully itemised bills for your ISDN line. As the ISDN line will be dialling just one phone number, your ISP's, you should take advantage of any discount schemes like BT's Business Choices and Key Contact. Many ISDN calls don't last longer than the 4.2p minimum call charge duration: for a payment of £10 per quarter, you can reduce the minimum call charge to 2.5p, but you'd have to make something like 600 4.2p calls for this to be worthwhile.

There's a good range of SOHO routers from which to choose [*see p199*], all very good choices. Ramp Networks <www.rampnet.com> also sells a range of analogue routers, notably the WebRamp 200I which contains a conventional V.90 modem instead of an ISDN TA.

Ramp also sells a router that allows you to multiplex ordinary dialup modems to get extra bandwidth from ordinary PSTN phone lines. The WebRamp 300e allows you to hook up to three modems to this simple LAN hub. Of course, you'll need several modems, phones lines and ISP accounts to take advantage of this, so you'll have to keep an eye on costs. The proprietary COLT multiplexing scheme exerts an overhead, so the second modem increases bandwidth by roughly two-thirds, while a third only adds about another half. Windows 98 supports the use of MPPP using multiple modems, too.

ROGER GANN

AVM Fritz!Card USB

AVM is one of the first companies to deliver a USB ISDN TA. The Fritz!Card USB has plenty of indicators across the front panel, including D- and B-channel status. At the rear there's only ISDN and USB sockets: power is taken directly from the host PC's USB port. Installation takes a little longer than some, but Windows 98 users will still find it a cinch. Just plug in the TA and it is automatically recognised, requiring only the supplied drivers to be loaded. There's a little extra work to do, as you then have to install the CAPI drivers which loads nine virtual modems. For Windows 95 you must be running OSR 2.1 with the USB supplement installed. AVM includes an unbeatable software bundle, as its Fritz!32 is a complete communications centre. It offers similar features to RVS-COM such as fax and voicemail, but also supports the IDtrans protocol that adds better security and more features for file transfer operations than the Eurofile protocol. Performance tests show there's nothing to be lost or gained with a USB TA: it delivered download speeds almost identical to the Billion BIPAC. The Fritz!Card USB looks good value, although at the time of writing AVM was still developing UK drivers. They should be available by the time you read this.

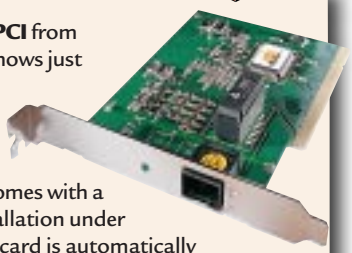
PCW DETAILS

★★★★

Price *£138 (£118 ex VAT)*
Contact *SAS Distribution*
01293 852800
www.avm.de

Billion BIPAC PCI

EDITOR'S CHOICE PERSONAL COMPUTER WORLD



At a mere £35, the BIPAC PCI from Tiawanese company Billion shows just how low ISDN TA prices have dropped in recent months. Here you have a highly affordable solution for single users that's easy to use and comes with a decent software bundle. Installation under Windows 98 is simple as the card is automatically identified, requiring only the supplied drivers to be loaded. It's also one of few internal TAs that provides a sync light on the backplate showing D-channel status. The BIPAC appears as a network adapter using NDISWAN miniport drivers that work fine for internet access but can also be used for remote access. The BIPAC supports MultiLink-PPP so you can bundle two B-channels together for fast 128Kbit/sec internet access. The bundled RVS-COM software installs a further eight virtual modems that provide COM port emulation, so older modem-based apps can still be used. These also allow the BIPAC to provide fax functions and access other online services such as bulletin boards and CompuServe over ISDN. Whatever your comms needs, RVS-COM has the answer: it provides remote access, fax server and voicemail services, and terminal emulation, and brings them all together in a single interface for easy access. A comprehensive package at an unbeatable price.

PCW DETAILS

★★★★★

Price *£35 (£29 ex VAT)*
Contact *Eurotech*
01189 810 011
www.billion.com.tw

BT Speedway

BT's Speedway TA is an external unit that connects to your PC's serial port and uses an external power supply. Build quality is solid enough and it has plenty of status lights that can be useful for troubleshooting connection problems. Windows 98 doesn't auto-detect the Speedway, but the automatic routine on the supplied CD-ROM makes light work of installation and the documentation provides plenty of help in setting up internet access. You also get NDISWAN CAPI drivers to provide remote access services, but note that Windows NT 4 drivers are not available. The Speedway supports ML-PPP links but expect to see a 10-20 percent performance hit if you use both B-channels: the serial port controller, even on the latest PCs, is not up to handling 128Kbit/sec speeds. The only way around this is to fit a high-speed serial controller card. Also, many ISPs don't currently support dual-channel connections, so you should check this out before buying. Many of BT's ISDN TAs are rebadged AVM products so it comes as no surprise to see Fritz!32 software under the Speedway banner, an excellent selection of communications tools. Four main apps provide Group 3 fax services, file transfer between PCs, BBS access and phone answering machine functions.

PCW DETAILS

★★★

Price *£100 (£85 ex VAT)*
Contact *Eurotech*
01189 810 011
www.bt.com

Eicon Diva T/A

The Diva is an extremely well endowed external TA that, with its serial and ISDN ports plus a couple of RJ-11 analogue sockets for connecting PSTN phones and fax machines, is well suited to the small office. Internet connections can be set to use either a single B-channel or both channels together, and BACP can monitor traffic levels and use only the second channel when necessary. Delays help to avoid picking up or dropping the second channel too often, but don't forget that multi-channel links cost extra as you're effectively making two calls to the same number. Even AO/DI is supported, so providing your ISP supports it, you can keep a low-cost permanent connection open using the D-channel. The Diva's Manager utility simplifies installation by searching for TAs, and even checks the firmware level and offers to upgrade it. The Diva uses different connection profiles stored on the host PC that are downloaded as required, and wizard-based assistance is available throughout. Test results showed there was nothing to separate the Diva from BT's Speedway, but you'll see a performance drop for multi-channel links due to standard serial port limitations. The Diva is comparatively expensive but it has a lot to offer in terms of features. The only drawback is a lack of any decent bundled software.

PCW DETAILS

★★★

Price *£282 (£240 ex. VAT)*
Contact *Eicon HQ Europe*
0181 967 8000
www.eicon.com

Hardware for hosting a web site

If you want to host your own web pages, you might think that a permanent connection is the only solution. But a dialup ISDN connection can work in both directions. With your ISP bringing the line up when there's traffic for your site, you'll pay only when there are people looking at your server. If the bulk of your traffic is email, things that don't have to be done in real time, then a dialup router will probably do the trick. But when your staff start to realise the web is out there, and want to use it, things become less clear cut. The first stage is probably to install a server of some sort on your network — Windows NT, Linux, or a Unix system. It can provide email, so you won't need to pester your ISP each time you need another address added, and web cacheing to speed up access. With a system that isn't running NT, you could even make do with a 486-class PC.

▶ **The Cobalt Qube serves well as a mail server and web cache**

Without a web cache, as more users start to look at the web at the same time, you'll notice congestion — they are, after all, effectively sharing one modem or ISDN line. You can double the capacity by using both channels on your ISDN line, but that costs twice as much. And here's where the maths gets tricky. You can, in theory, have an ISDN line connected all the time during business hours for around £500 per month, provided your ISP offers you a local call. Use both channels, and you're down to only half the business day. And for that £500, you could have a permanent link.

But it's not quite that simple. Add to the telephone charges the cost of an ISDN network connection from your ISP — typically around £100 per month — and the costs mount up. And lots of short calls will actually cost more, because of BT's minimum charge per call. Some of this can be managed: a router like the Shiva Integrator series has complicated 'tariff management' which allows you to control calls accurately, to minimise the phone bill — and even signal an alert via SNMP when a budget has been exceeded. Even so, when things start to get busy or unpredictable, dialup can be a cost nightmare — and routers with such features are likely to cost several hundred pounds at least.

You'll often find net providers telling you that a small leased line — like a 64K link, or 128K — isn't sufficient for hosting a web server. It may not always provide the fastest response, but you can certainly shift several gigabytes of data each month. And while hosting a site at your ISP may give better performance, if you want things like live links to a particular type of database, it might be easier to have everything under your control.

Once again, you don't have to break the bank for hardware to host a server, unless you run Windows. A Unix or Linux system will serve web pages happily on a low-end Pentium, provided you have plenty of memory and good hard disks. Even a brand new machine, with SCSI hard drives and tape backup, need cost no more than £2,000.

You can, of course, run a server like this on a dialup ISDN link. But remember that with people potentially accessing the site all day, you could soon pass the eight hours a day break-even point where a leased line is cheaper.

Remember too that if you want speed, a leased line is the answer, since ISDN simply won't go above 128K. Leased lines can run much faster, though you'll pay dearly for them. A 2Mb line, for example, will cost over £6,000 in BT rental alone, before you've added the charges from an internet provider.

You'll also need a leased line router, which is likely to cost around £1,000 depending on speed and facilities. And since the router is the most crucial link between your network and the rest of the world, it's not worth skimping on.

One of the benefits of ISDN, of course, is flexibility, with additional bandwidth available when you need it. That isn't necessarily lost, however, when you move up to a leased line; some providers will allow you to 'aggregate' a leased line with ISDN, so you could have, for example, a 64K line which is doubled to 128K with ISDN when the traffic exceeds a preset level, giving you perhaps the best of all worlds.

So, what's the best solution? It all depends, but if you're dipping your toe in the water, an ISDN router with a system to act as mail server and web cache — like the Cobalt Qube — will do fine. But once your usage starts to go above five or six hours online a day, or there's heavier use of web browsing instead of email, it's time to think about changing the router for a leased line. ISDN aggregation will help even out the peaks on a slow line, and if you want to publish lots of live information from a system on your network, you might need to look at faster links than 128K.

A good router and a decent server for your email and web pages are the key. Choose both wisely and they'll grow with you, saving on costly replacements.

Nigel Whitfield

3Com **OfficeConnect**

Combining an ISDN router and ethernet hub in a box smaller than a videocassette, 3Com's OfficeConnect is aimed squarely at the SOHO market. There are four 10BaseT network ports at the rear and one can be used to cascade other hubs. Along with an ISDN socket, it has two analogue ports allowing standard phones and fax machines to be used over ISDN. The front panel provides plenty of visual information, with LEDs for network activity plus indicators for ISDN D-channel and B-channel status. To install, just connect a workstation to one of the ethernet ports, load a web browser, and the OfficeConnect automatically displays its home page. Here you can enter details about your ISP and create dialup links to other remote offices, although the OfficeConnect cannot accept incoming calls. Outbound calls can be configured to use one ISDN B-channel, or both for a faster link. BACP (Bandwidth Allocation Control Protocol) is supported, so the second channel will only be used if demand is high enough, while DBA (Dynamic Bandwidth Allocation) lets you make a phone call even if both B-channels are being used for data transfers. The OfficeConnect is a remarkably small but well built package that is an excellent choice for the small office.

PCW DETAILS

★★★

Price *£353 (£301 ex VAT)*
Contact *3Com*
0800 225252
www.3com.com

D-Link **DI-106**

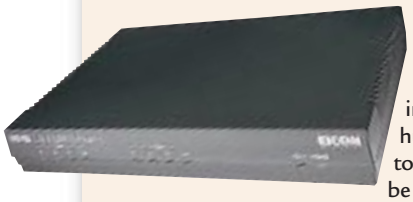
D-Link's offering for the small office is similar to the OfficeConnect in that it combines ISDN router and ethernet hub, although the DI-106 comes with six 10BaseT network ports. Two analogue ports are provided for connecting standard phone and fax machines. Build quality is a little flimsy but the smoked-plastic front panel does offer a comprehensive range of status indicators. A serial port on the side provides local access for configuration using a terminal emulation session, but D-Link's Java-based utility is more fun. It will scan the network for D-Link routers and fire up your default web browser when it has located one. Next, you create a profile with your ISP details and decide how you want the ISDN B-channels used for on-demand internet access. BACP allows the second B-channel to be used only when required, and NAT (Network Address Translation) hides your network behind a single IP address to keep out intruders. The DI-106 does accept incoming calls from remote users dialling in from a laptop or PC. User accounts are password protected, CHAP and PAP authentication can be applied, and callback verifies the caller's location. The DI-106 looks extremely good value for the small office, as it combines plenty of useful features and is simple to set up and use.

PCW DETAILS

★★★★★

Price *£323 (£275 ex VAT)*
Contact *D-Link*
0181 235 5555
www.dlink.com

Eicon **Diva LAN**



The Diva LAN Eicon has similar features to Intel's Express 8100 but adds an integrated four-port 10BaseT hub and two analogue ports to the recipe. Further hubs can be cascaded from the ethernet ports and the Diva supports up to fifty users. Profiles are used to control access and line usage and are easily created using a web browser interface that links directly with the router. Documentation is particularly thorough and most users with limited technical knowledge will have on-demand internet access sorted in minutes. A small background utility provides access to configuration details, status, and a log file. Incoming and outgoing calls are allowed and the Diva supports authentication using encrypted passwords, so security is a strong feature. AO/DI allows the D-channel to be used for low-cost permanent connections, and voice calls can be made even if both ISDN B-channels are being used for a MultiLink data connection: DBA (Dynamic Bandwidth Allocation) will steal a channel from the existing connection, allowing you to make your call. When you've finished, the Diva hands the channel back to the data call. Overall, the Diva combines most of the features of the other routers reviewed here, although the high price may deter smaller companies on a tight budget.

PCW DETAILS

★★★★

Price *£485 (£413 ex VAT)*
Contact *Eicon*
0181 967 8000
www.eicon.com

Intel **Express 8100**

Although the Express 8100 doesn't have any analogue ports, it still stands out from the crowd thanks to its superb features that make it suitable for larger offices. All the tools for determining and controlling ISDN line usage are here, but it also supports AO/DI (Always Open/Dynamic ISDN) which creates a permanent link to other routers using the X.25 protocol over the D-channel. It's ideal for links where speed isn't important, but if traffic increases it will grab B-channels as required. VPNs (Virtual Private Networks), or Internet Tunnels as Intel calls them, allow low-cost connections to other sites to be made over the internet, although as these use a proprietary protocol there must be an Intel router at both ends. There's plenty of activity and status information on the front panel, and as the Express 8100 is one of few routers that offers a dual-speed network port, it's equally at home on ethernet or fast ethernet networks. Intel's Device View software includes plenty of wizards to help with setting up internet access and links to other office networks. The Express supports incoming calls from other routers and remote users, and the tools for remote management and monitoring are superb. Real-time 3D graphs show general activity, and the data can be used to create utilisation reports.

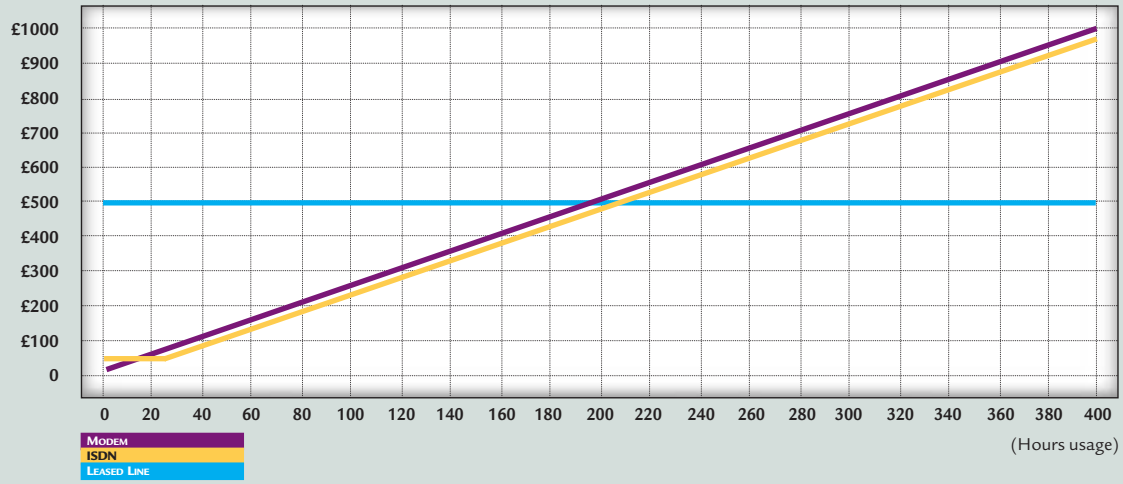
PCW DETAILS

★★★★★

Price *£405 (£345 ex VAT)*
Contact *Intel*
01793 403000
www.intel.com

PCW Labs Report

Costings



This graph is based on standard BT charges for business rate PSTN calls, BT BusinessHighway and ISDN2e, and an estimated cost for a leased line. When studying it, you should consider how many staff you have working for you and how long each of them is going to be online.

For instance, if you're a single user, you would have to be online for eight hours a day, for four weeks, to make it worth your while investing in a leased line. But if you have four staff working for you, they only need to be online for around two hours a day before a leased line becomes cost effective. However, various other factors have to be taken into account over and above these base costs.

First of these are the discounts you may be able to negotiate for yourself from the various telecomms providers. We have quoted rates based on BT's basic call rate of 0.0395p per minute for both PSTN and ISDN calls, but you might be able to negotiate a discount of up to 20 percent, as well as listing your ISP as one of your cheaper-rate numbers using call plans such as Friends and Family or PremierLine. Also, if you call up for short periods many times over, don't forget the minimum call charge of 4.2p for PSTN calls and 2.5p for ISDN calls.

We haven't taken into account the amount of time it takes to connect to your ISP, which takes longer over a modem than via ISDN.

Finally, there are the connection charges. BT is currently pushing ISDN, so depending on when you choose to connect, you may be able to get a cheap deal on the setup. You may also be able to get a reduced rate for having a second PSTN line fitted. Generally speaking however, the slower the connection, the less you will pay for connection charges.

Bandwidth **requirements**

If all this has left you feeling bewildered by the choices available, here's a quick guide to working out which service you require.

Bandwidth is a measure of the speed of connectivity your organisation has: the higher the bandwidth, the faster the data transfer will be and the more people can use the connection at the same time without things slowing down to an unmanageable level.

If you just have one or two people accessing email and browsing the odd website, a V.90 modem, which can handle a maximum of around 56Kbits per second, will be fine. But if more than one or two people need access, then a move to **ISDN** is a good idea. ISDN gives you either 64Kbit/sec if you just use one channel or 128Kbit/sec if you use both. Don't be fooled into thinking that 64Kbit/sec will give you only slightly better throughput than a V.90 modem, though. There's a world of difference, and even a single ISDN channel will happily cope with three or four users unless they're browsing very graphically heavy web sites all the time.

If you have one ISDN channel and things are getting sluggish, see if your ISP supports **bandwidth on demand**. This is a way of your ISDN connection stepping up to use both channels and giving you 128Kbit/sec, when you need it. This happens automatically, and this — or simply using both channels all the time — should support a small- to medium-sized organisation perfectly happily. You really shouldn't need more than 128Kbit/sec unless you have a lot of heavy web browsers or a massive amount of email.

If this is the case, you should probably be looking to get some kind of **dedicated leased line** installed. However, remember that a 256Kbit/sec leased line — the next step up from the 128Kbit/sec you are achieving with ISDN — is going to cost a fairly hefty sum, especially if you're based outside a major city. For many people, going to a leased line really isn't necessary; there are other solutions, such as using more than two ISDN channels, which will provide just as high bandwidth for much less money — especially if you're only using the line during business hours.

IAN WRIGLEY

Alternative Technologies

Emerging technologies promise to make cheap, fast datacoms widely available. They will revolutionise private web use and can be a good option for business use — when and where they are available.

Asymmetric Digital Subscriber Line (ADSL), which piggybacks up to 2Mbit/sec onto BT's old steam phone lines, is largely at the trial stage, though Kingston Communications <www.kingston-comms.co.uk> offers a full service in the Hull area. Even ADSL's slower (hence 'asymmetric') downstream transfer rate of about 256Kbit/sec is faster than ISDN. But it covers only the 'local loop' to the nearest exchange: on the wider web, as with any basic connection, the transfer rate is constrained by the slowest link in the chain.

End-to-end ISDN links guarantee bandwidth all the way. However, ADSL links are always on, and charged at a flat rate, so for many purposes transfer speeds aren't important.

Londoners can try ADSL from as little as £30 a month, provided they're in BT's trial areas: details are at www.isntrial.bt.com. Packages targeted at businesses include quality-of-service guarantees and cost much more. I-way <www.i-way.net.uk>, for instance, offers a £350-a-month link with up to eight fixed IP addresses (cheaper links allocate IP addresses on the fly, limiting use of the line for tasks like web hosting). The trial ends this summer and BT is expected to launch a national service before the end of the year. The rollout will take many months and will reach only to within a mile of local exchanges.

Also spasmodic will be the rollout of cable modems. These pump 512Kbit/sec down the fibre links that pipe TV to millions of homes; business coverage is rather less. You get full speed both ways, and the link may at times be faster (possibly slower) than rated: neighbours are in effect on a local network, sharing bandwidth.

Cable companies claim end-to-end links will be fast, but we'll only really know when the services are running in earnest. NTL is setting the pace with a £40-a-month service in its franchise areas; you'll need to buy a £149 cable modem. This pricing is significant, as it will set a level for rival services. Telewest <www.telewest.co.uk> is expected to roll a similar service out early next year. Cable & Wireless <www.cwcom.co.uk>, perceiving no competition in its franchise areas, is ignoring the needs of PC users for the time being. Set-top boxes for its digital TV service, which launched on 1st July, will have cable-modems but these will be used initially only for interactive services from 100 sites.

Happily, C&W does have competition, and from a direction it has most to fear: satellites. You can get a link anywhere, now. Big users are companies needing to disseminate information to many dispersed sites: a car company to its dealers, for instance. Initial outlay, for a dish aerial, PC card and installation, is of the order of £1000 per site and prices are competitive with land-based services. Delivery speeds are enormous: up to 30-40Mbit/sec.

▲ ERICSSON'S R380 PHONE-ORGANISER SUPPORTS THE WAP PROTOCOL FOR WIRELESS WEB LINKS. CELLPHONE SPEEDS WILL SOON OUTPACE ISDN

Satellite-based internet services like Easynet's £50-a-month Easysat deliver web pages at up to 400Mbit/sec <www.easynet.net>, using a 56K phone link as return channel. But links using the satellite as a channel in both directions are becoming affordable [*see News, p26*].

Tele2 <www.tele2.co.uk> offers land-based wireless links but currently only in the Reading area. A 128Kbit/sec web link costs £65 a month for up to 150Mb of traffic, plus 50p per extra megabyte. The monthly charge goes up to £195 for a 384Mbit/sec link, or £650 for the equivalent of a 128Kb leased line. There's a £465 one-off connection charge.

Cellphones are becoming a serious option. Current GSM links are adequate for email and simple web pages, but cellular links will outpace ISDN in a couple of years. BTCellnet, which has set up its own fee-free web provision <www.genie.co.uk>, reckons 30 percent of web traffic will be mobile within six years.

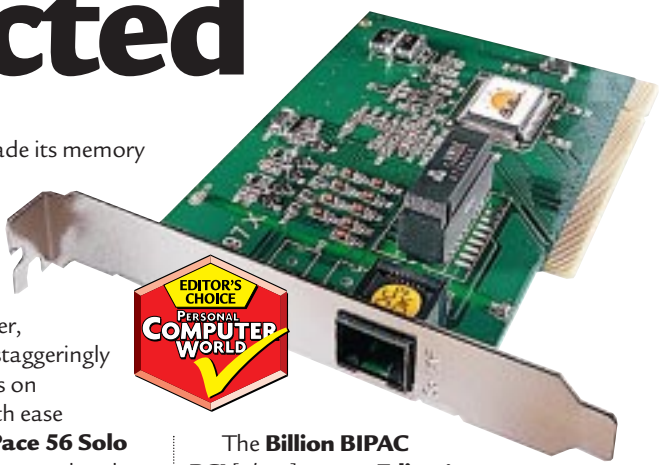
CLIVE AKASS

▲ ADSL HOST SITE AT WWW.BTINTERACTIVE.COM. DIAGRAM SHOWS DATA AND VOICE SIGNALS DIVERGING AT THE HOME. THE SAME LINE CAN BE USED SIMULTANEOUSLY FOR BOTH

Well **connected**

Choosing the best modem was a tricky task. The Diamond Supra Express 56e Memory was the cheapest by a long shot, although it was very slow. The real battle was between the Pace 56 Solo [*below*] and the 3Com Professional Message modem. They were very similar on features, although the Pace did just steal a march as you can upgrade its memory to 6Mb, not just 4Mb as with the 3Com, and it can phone you back at a remote location — no more paying expensive hotel phone bills. However, the 3Com's results were staggeringly good, posting high scores on all three tests. But for both ease of use and features, the **Pace 56 Solo** wins the **Editor's Choice** award and the **3Com Professional Message** is **Highly Commended**.

Once you've recovered from ISDN2e or Home Highway installation and rental costs, you'll find there are plenty of TAs to choose from — and all at affordable prices. There's also a wide range of interfaces on offer, with the four TAs on review covering PCI, USB and serial port connections.



The **Billion BIPAC PCI** [*above*] gets an **Editor's Choice** award because it offers such great value. The card is easy to install and configure, costs less than a cheap 56K modem and still comes with a comprehensive software bundle.

AVM's Fritz! USB is

Highly Commended as it sets the standard for the next generation of USB TAs. Installation is easy, and the comms software is nothing short of superb.

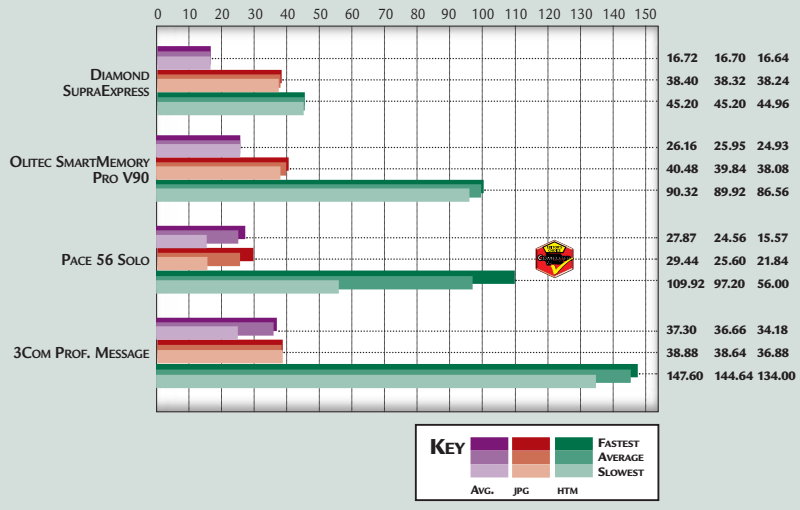
The ISDN router that will suit your office will very much depend on the role it is to play. If you only want to add shared ISDN access to your existing network, then **Intel's Express 8100** [*above*] is an excellent choice. But those who want to set up a small network, provide shared ISDN access and connect old phones and fax machines, would do well to look at our last **Editor's Choice**, the **D-Link DI-106** [*below*]. It satisfies

all these requirements, and all for a remarkably low price.

AJITH RAM AND DAVE MITCHELL

PCW Labs Report

Modem Performance Results (Units are in Kbits/sec)



ISDN T/A Performance Results (Download speeds in seconds using dual-channel link)