View from the **bridge**

A bridge is just one way of avoiding collisions in advanced network configurations. Routers and switches are equally effective alternatives, and they're all traversed here by Bob Walder.

I recently received an email from reader, F Nelson, requesting some clarification on the terms "bridge", "router" and "hub". Given that recent columns have covered basics such as the connection of just two PCs, I thought that a tutorial on more advanced network configurations might make interesting reading this month.

When most small networks start their life, they are built with all workstations and servers resident on a single segment (i.e. all nodes on the network are physically capable of communicating with all other nodes). This works fine with smaller LANs but can cause problems as the size of the network grows and the increase in traffic causes performance problems.

Collisions are a fact of life when dealing with shared access topologies like Token Ring, FDDI and Ethernet. Such topologies are only capable of supporting a single active "message" (a communication between any two nodes on the network, say) at one time. To make matters worse, Ethernet transmits its packets of data using something called Carrier Sense Multiple Access with Collision Detect — or CSMA/CD for short. It boils down to the fact that all devices on the LAN are free to communicate whenever they want without precedence or order. A device wishing to send data listens on the network (Carrier Sense) and, if no other device is sending, begins to transmit.

Of course, it is possible that another device may also transmit simultaneously (Multiple Access), so the devices check for a "collision" of packets (Collision Detect). If a collision occurs, then all devices which were involved will pause for a random length of time (in an attempt to stop packets from the same devices colliding again) before re-transmitting their packets. As you would imagine, the more users you add to an Ethernet segment, the more collisions there are. And, the more collisions there are, the lower the effective bandwidth.

If you have logical workgroups on your LAN (Accounts and Marketing departments, for instance) you will usually find that most of the traffic could be restricted to the workgroup from which it originates. This is particularly true where each department has its own local server, since all relevant data

will reside within the workgroup. However, because Ethernet uses a broadcast technique to move its data packets around, every single node on the LAN (not just the ones in the appropriate workgroup) must listen for, and process, the packet in order to determine whether or not the data is intended for them.

Bridges

In such situations, the use of bridges can help. Bridges operate at layer 2 (the Data Link layer) of the OSI seven-layer reference model (Figs 1 & 2, pp313/315). This means they are protocol independent, allowing packets to be exchanged across a network even though the devices using the network do not share the same upper layer protocols (such as IPX, IP, AppleTalk, DECnet etc). Usually however, you are

OSI Seven layer stack

Information sent

Application Layer
Presentation Layer
Session Layer
Transport Layer
Network Layer
Data Link Layer
Physical Layer

Network media

Information received

Application Layer
Presentation Layer
Session Layer
Transport Layer
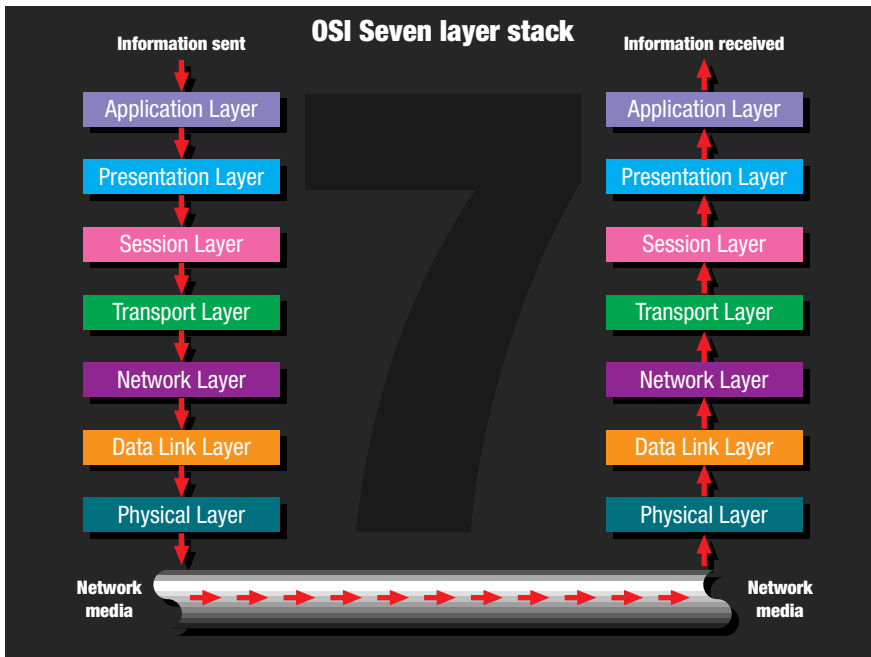Network Layer
Data Link Layer
Physical Layer

Network media

Fig 1 The OSI stack — what goes on underneath your application

restricted to the same physical medium throughout a bridged network: that is, you can only bridge an Ethernet segment to another Ethernet segment.

By installing a bridge and splitting the LAN into two segments, performance can be improved dramatically since we can now support two active messages at any one time; one on each segment. Furthermore, it is possible to isolate all intra-segment traffic so that messages between nodes in the Accounts workgroup do not cross the bridge and thus no longer impact on the bandwidth of the "Marketing" segment. However, the bridge is a completely transparent device as far as the user is concerned, and so inter-segment traffic (i.e. messages between Accounts and Marketing) travel across the bridge unimpeded.

Bridges do have their problems, however. If the initial segmentation is not performed carefully, you could find that there is still a lot of inter-segment traffic. If this traffic is regular, the users involved may well find that performance is even worse than before the bridges were installed. This is due to the fact that every time a packet crosses a bridge, a delay is introduced due to the fact that the bridge must store the entire packet before deciding which segment it should be forwarded to. It is additionally possible that the general-purpose processors used in many bridges are actually incapable of moving a continuous stream of packets, which can incur further delays. The time taken to move

a packet through a bridge is known as the bridge's "latency".

Even when inter-segment traffic has been reduced to a minimum by careful analysis and segmentation, bridges must still forward all packets which are destined for every LAN workstation. Excessive traffic of this type can still flood all segments, causing an unpleasant phenomenon known as a "broadcast storm" which can bring the network to its knees. What is required is the equivalent of a "firewall" to prevent such broadcast storms. That, plus the need to handle multiple protocols across diverse topologies, leads many users to consider installing routers instead of bridges.

Routers
Routers operate at layer 3 (the Network layer) of the OSI model (Fig 1). They are protocol dependent and have traditionally been used in applications where connections between networks and segments with different topologies (i.e. mixed Ethernet and Token Ring LANs) have been required.

Routers are able to transfer traffic down several different paths (local or wide area connections) and are typically able to dynamically choose the most efficient link. They are also capable of preventing the broadcast storms which can be prevalent in bridged networks.

Bridges are designed to make several attached LAN segments appear to upper-layer protocols as one segment. Since

Questions & Answers: SMBs, drive letters, users on the loose, and NAL

Q In the Microsoft world, what are SMBs?

Y Sanger

A The Microsoft family of networking products interoperate with one another at different levels, depending on their capabilities. Adherence to the Server Message Block (SMB) command protocol makes this possible. SMBs were designed initially for the MS-Net and PC-Net products in the early eighties and the ability of SMBs to negotiate different dialects is a key feature in their continued use.

Each successive generation of LAN products introduced different and more sophisticated functions requiring new SMBs, and each set of SMBs was given a dialect name. New dialects are supersets of previous dialects (though this is not mandatory).

When two machines want to establish a session, the first SMB transferred from the client to the server contains a list of dialects which the client understands. The server selects the richest dialect (the highest order) from the list it understands and informs the client as to which dialect will be used. This allows an MS-Net workstation to connect to a Windows NT server or, as I mentioned last month, allows a Windows for Workgroups PC to participate in a Windows 95 peer-to-peer network.

Q Is it possible to have the same drive letter mapped to different people or groups automatically under NetWare? I have a number of NetWare groups set up on my server which relate broadly to the organisation structure: ACCOUNTS, SALES, DESIGN, and so on. What I want to do is standardise on a specific set of drive letters to try and keep things as simple as possible for my not-too-technical users.

For instance, just as a standalone user would get used to the fact that the A drive is the floppy and the C drive is where all the programs and data are situated, I would like them to be able to always associate drive G with application programs, drive M with application data files, and drive P as their "personal" storage space on the server.

The problem, of course, is that each set of applications for each department is located in a different directory, as is the data. And every user has their own "home" directory (created when the account was first set up) with a name derived from the user's login name under the LOGIN directory. How do I make NetWare aware of the nature of the user and automatically assign the correct drive mappings?

One other thing I would like to be able to do, if possible, is to prevent users from "roaming" around the server disk having once logged on. Even though we are quite strict on access rights, we still have users who try the old CD\ routine so that a drive which originally pointed to SYS:ACCOUNTS\ DATA, suddenly points to SYS:. The result is that next time he tries to run his application, it bombs out with a "Can't find file" type error. Can this be prevented?

A Greaves

A This is a good method of organising your users' network access and is quite easy to accomplish under NetWare — at least with the later versions which support the "IF MEMBER OF" login script command.

Since you have your users organised into groups, you can test for the group name in the system login script and set the drive mappings accordingly. This is accomplished as follows:

```
IF MEMBER OF "ACCOUNTS" THEN
    MAP ROOT G:=SYS:ACCOUNTS
    MAP ROOT M:=SYS:DATA\ACCOUNTS
END
```

Repeat this for each group you have defined, replacing the group name and directory names as appropriate.

There is one significant drawback to this method: it is not possible to have a user who is a member of more than one group, since that user would require two different mappings for the same drive letter. The only way around this would be to allocate two different accounts for the same user (wasteful and messy) or use batch files to load applications and perform the necessary mappings within those (not always practical with Windows applications).

Since you have already elected the one-mapping-per-group approach, I will assume that you do not have this problem and the above solution will therefore work just fine.

The mapping to the user's home directory is also easy to accomplish, since NetWare places the login name in what is known as a "user identifier variable" (see pages 28-29 of your *Quick Access Guide* for a full list of these variables).

The following command will do the trick, which should also reside in your system login script:

```
IF LOGIN_NAME !="SUPERVISOR" THEN
    MAP ROOT P:=SYS:LOGIN\%
LOGIN_NAME
```

So if you were to log in as BOB, the above command would be the equivalent of typing:

```
        MAP P:=SYS:LOGIN\BOB
```

Note that if you do not have the LONG or OS2 name space loaded, you can only have directory names which are eight characters long, so you must restrict your user login names to eight characters or less if you want to use this method. This is the reason we first check that we are not logging in as SUPERVISOR (!= means "not equal to") in the above example — it is longer than eight characters and it is unlikely that the SUPERVISOR requires a personal directory anyway. If, however, you load the LONG or OS2 name space, this provides you with long file name support and the above restriction is removed.

With regard to the second part of your problem, users "roaming" around the server disk, that is solved by the MAP ROOT command as specified in the above examples. This "fools" DOS into thinking that the drive mapping actually exists at the root of the NetWare volume, so even if a user tries to CD\ he will remain in SYS:ACCOUNTS\DATA.

Having explained all this, it is worth pointing out that for users of Novell's NDS, there is a product available known as NetWare Application Launcher (NAL) which provides a far more elegant means of achieving the same end, with all management and administration of the users and applications performed via a simple graphical utility.

broadcast messages are designed to go to all workstations on the same segment, bridges cannot, and should not, prevent their proliferation throughout the LAN. Routers do not suffer this restriction and have thus become increasingly popular in recent years for large multi-protocol internetworks with complex configurations.

Routers can be relatively expensive, however, require more in the way of configuration and management than bridges, and some can be limited in the number of protocols they support. For this reason, neither one device nor the other could be considered "best", and most older networks will have a mixture of bridges and routers, with bridges providing the segmentation within a single site and routers handling the wide area connections.

Switches

While both bridges and routers can help in relieving traffic-flow problems, neither of them actually increase the bandwidth available between file server and desktop. For Ethernet users, that bandwidth is limited to 10Mb/sec, although the contention method of packet transmission used by Ethernet effectively reduces that to around six or 7Mb/sec to be shared between all users on a segment.

One way around this is to use a device called a switch, a connection-orientated device which effectively removes the problems associated with broadcasting packets. On the surface, the switch

Is the destination for this packet located to the left of this bridge? If so, pass it on

To destination   From source

BRIDGE

Legend   Other data in packet
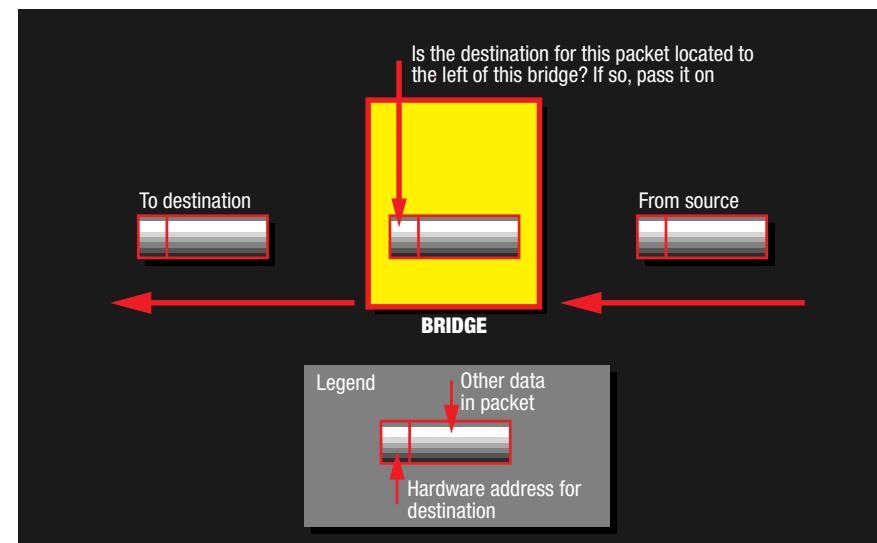
Hardware address for destination

Fig 2 Bridges allow segmentation of your network

appears to be little more than a multi-port bridge — although marketing hype will often hotly dispute this. Like a bridge, the switch learns where every node is on the network. When two nodes wish to communicate, a dedicated circuit is established between the two in a similar fashion to a telephone switch. Because each packet travels on its own dedicated circuit and because multiple circuits can be established within the switch, it is possible for multiple conversations to occur simultaneously (up to the maximum aggregate bandwidth limit of the switch); this is the main area where switches differ from bridges.

Some switches offer on-the-fly switching, which means they have only to read the first few bytes of the packet header in order to establish the connection before sending the packet. Others use a "store and forward" mechanism with large buffers and high-bandwidth backplanes. Inevitably such devices do have some latency overhead but this is minimal, and the net result of either approach is a dedicated 10Mb/sec pipe between any two nodes on the network.
■ *To come: ATM and TCP/IP*.

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French connection

Ooh-ah, Bob Walder has been to France: he reports back on Microsoft's new NT 5.0 being trumpeted at the TechEd gathering. Back at base, he deals with cabling small networks.

I have once again endured the "temptations" of Nice (the hardships I endure to bring you the latest networking news!) in order to find the latest gossip from Microsoft's TechEd conference. Two things immediately hit me. The first was the sheer scale of this sell-out event. With over 3,760 delegates, it is clear that the developer community is squarely behind the Windows platform. Not that we didn't know that already, of course; it's just that when you get the opportunity to compare the difference between this and the recent Novell event in close proximity, you begin to appreciate that Novell has an uphill struggle.

The second thing to strike me was that although my initial impression had been that there were few new products at TechEd, there was in fact plenty of new stuff around (much of which was yet to be released) but I was already familiar with most of it. Once again, this just goes to illustrate the difference between Novell and Microsoft's marketing methods. I mentioned last month that I saw a few technologies at BrainShare about which I had heard nothing previously, the result of a somewhat lacklustre marketing approach on the part of Novell. In stark contrast, Microsoft's marketing machine is always in overdrive, so by the time you get a first glimpse of a new product at TechEd, you already feel as if you have been using it for years.

A case in point was Windows NT 5.0 (formerly "Cairo"). We have heard so much about it, that it came as something of a surprise to learn of further new features: networking and routing enhancements, improved manageability, increased fault tolerance and performance, new power management and plug-and-play are all on the cards. But the most interesting additions are in the area of distributed services, with a new distributed file system, distributed public/private key security and, of course, Microsoft's answer to Novell's NDS — Active Directory (Figs 1 & 2). There is even a new centralised administration utility based on snap-in modules, called the Microsoft Management Console (Fig3), which bears a close resemblance to Novell's Nwadmin. Strange to think, given the widespread acceptance of NT Server, that Microsoft is still technically playing catch-up with Novell in many areas. But with each release, Microsoft gets closer, and even shows signs of sneaking ahead in some areas.

This will reduce most of the arguments for and against either operating system to a purely sectarian level. Each will have its strengths and weaknesses, but ultimately, they will both provide file and print services, a strong security model, distributed file systems, internet connectivity, clustering,
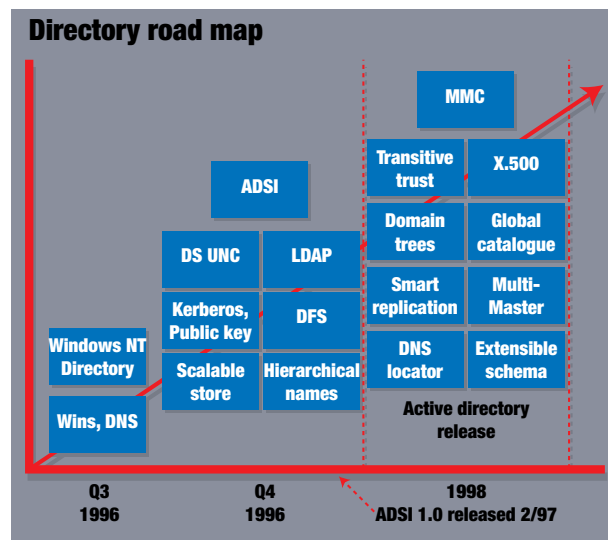
Directory road map

Fig 1 Microsoft Active Directory road map. (From Microsoft PowerPoint slide)

Fig 2 Microsoft Active Directory architecture (shows concept of domain trees on left and hierarchical Organisation Units within a domain on the right)

Architecture: General
- Physical: partitioned, replicated
- Logical: nested hierarchy
  ▶ Domain hierarchy: domain trees
    ▶ Container hierarchy within a domain

and a single point of administration via directory services.

What you choose will ultimately come down to personal preference and application support and availability. If you take the relative scale of the two developer conferences as an indication of future application support, this could mean grim times ahead for Novell.

Cabling: the long and the short of it
"*Using a PC at home, I'm interested in adding a neighbour's PC to our LAN (using thin Ethernet) for (ahem!) "recreational" purposes. I've asked a number of people whether it is possible to drag a length of RG58 cable outside through the garden, and have received a mix of answers. But how far can the cable reach before the signal becomes too weak?*"
Ben Hindmarch

Should I really be encouraging the playing of Doom over the network? All over the country, I can see network administrators cowering and gibbering in a corner at the thought of their users going into work next week, full of ideas for implementing this wonderful network "stress-testing" tool.

However, Ben's query does raise one or two serious issues which I think are worth addressing here. The first is that of slinging a piece of thin Ethernet cable between two buildings. I am pretty sure that any cabling expert to whom you speak about this will hold up their hands in horror and suggest all manner of more expensive ways of doing it.

In the dim and distant past I used to be the IT manager of a large manufacturing company with a sprawling site consisting of two or three separate buildings. I had to

provide network facilities to one of these buildings which was about 30ft away from the main office structure, with a road in-between. I had neither the time nor the budget to install a fibre optic cable under the road, so implemented a quick-and-dirty solution by stringing a piece of rope across the chasm at a first floor level and attaching a piece of thin Ethernet coax cable to it with several pieces of string. This allowed me to span the gap without putting too much strain on the Ethernet cable, and this "temporary" fix lasted over two years before we finally got around to putting in the fibre — and it never gave us a day's trouble.

In other words, Ben, I think you should get away with your improvised network as long as you take some basic precautions in protecting the cable.

The second issue is that of cable length, and I think it is worth spending a couple of minutes on the limitations inherent in the most popular cabling schemes. Thin Ethernet cabling uses RG-58/U, 50-ohm coaxial cable in a bus configuration, and the

length of a segment (i.e. the distance between any two PCs) cannot exceed 185m (607ft): I would have thought this would be enough for Ben's application. In a larger network, up to five trunk segments can be connected through four repeaters (a repeater boosts the signal and counts as a node on the network) and the entire network trunk cannot exceed 925m (3,035ft).

Twisted-Pair Ethernet cabling, also known as 10Base-T or UTP (Unshielded Twisted Pair) uses twisted-pair cables (similar to telephone wire) in a star-shaped configuration. Each node (PC) attaches to a hub (or concentrator) via a twisted-pair cable using RJ-45 connectors (similar to a telephone jack).
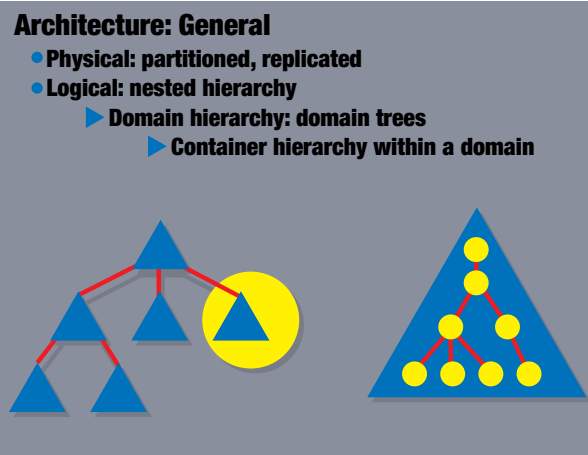
The maximum length of a UTP segment is 100m (328ft) and you can have no more than 1,024 segments in total. The maximum number of repeaters is four.

Because of the ten-fold increase in speed, these distances are reduced for 100Base-T. Fast Ethernet allows up to 100m between a network node and a hub, and allows cable lengths of 10m between two hubs. The rules specify a maximum of two hubs between any two nodes, making the maximum network span just 210m, in sharp contrast to the 10Base-T rules.

The final topology in common use today is Token-Ring. This is a token-passing network, where each node attaches to a device called a Multiple Access Unit (MAU) that sends the token from one node to the next in line. Token-Ring cabling uses IBM type-6 cable in a ring configuration. Each node must attach directly to a MAU, and each MAU can be connected to another, via a patch cable, to form a ring. If the total number of nodes on the network is less than, or equal to, eight (the number of connections on the MAU) only one MAU is required.

The maximum number of nodes in a Token Ring network is 96, and the maximum number of MAUs is 12. The maximum patch cable distance between a MAU and a node, or between two MAUs, is 150ft, while the maximum patch cable distance connecting all MAUs is 400ft.

Fig 3 Setting security policy properties in the new Microsoft Management Console

Cabling a small network
"*I have a small network of ten PCs to install, and would appreciate your advice on which form of Ethernet cabling to use: 10Base-2 or 10Base-T? Two or three of the PCs will be considerable distances from the others, so I'd like to know the maximum distances which can be spanned by cabling runs.*"
**John Isaac**

This question follows on nicely from the previous one; you should refer to this, John, to check out the cable limitations. So let's deal with the question of 10Base-2 (another name for thin Ethernet) and 10Base-T.

It often comes down to cost, which is a shame. When starting out, many sites will use thin Ethernet since it is relatively easy and inexpensive to install, particularly if all the PCs are in close proximity. The main problems with thin Ethernet are its limited expansion potential and no easy upgrade path to newer, fast Ethernet, technologies.

UTP cabling offers a far more structured approach, allowing you to reduce the amount of wire trailing around your building by situating hubs at strategic points. Management, down to the workgroup or individual node level, can be more effective with a UTP solution, since each of the hubs can contain management intelligence.

Because of the increased hardware requirement (in the form of hubs) however, 10Base-T can initially appear to be more expensive than thin Ethernet. It is often difficult to justify the higher initial outlay on a project which usually starts out as an "experiment", but If there is one thing that can be counted on, it is that your network will continue to grow and these "experiments" frequently have a habit of turning into the life-blood of the company. At this point, you will reap the benefits of a more structured approach from the outset.

There is one additional cost worth absorbing from the outset, and that is to use Category 5 cabling throughout (all four pairs). Once again, it may be difficult to justify the initial expenditure on cable which is over-specified for your initial
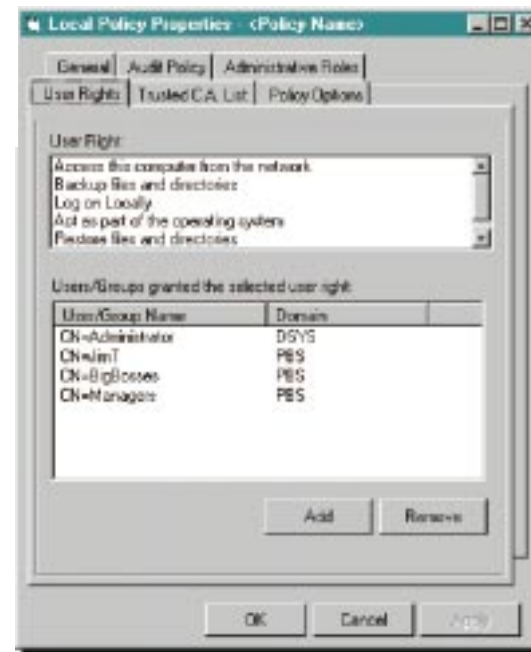
requirements, but it will provide maximum flexibility when the time comes to move to faster technologies like 100Base-T (fast Ethernet) or even ATM, and could well save you a fortune on future re-cabling costs.

Security fears
"*I have heard a couple of worrying rumours regarding security issues with some Microsoft products. Specifically, these were to do with some sort of 'denial of service' attack on Internet Information Server and a password vulnerability issue under Windows 95. I have been unable to discover further information, but since my company uses both products I am keen to learn as much as possible about the alleged problems and any known solutions. Can you help?*"
A. Smith

Microsoft has indeed identified an Internet Information Server issue that can result in a successful "Denial of Service" (DoS) attack.

It is important to recognise that this particular issue does not affect NT Server itself, neither does it provide the means to access sensitive corporate data in any way; the result of the attack is simply that IIS becomes unavailable for a period of time, and this can be remedied by restarting the web server. For more information, read the bulletin on the IIS web site at www. microsoft.com/iis/iisnews/hotnews/issue. htm. Microsoft has responded with a permanent fix that prohibits this specific type of attack, and also records the IP address of the attacker in a log file. The

Tip of the Month: Preserving the Registry

Every now and then I would like to share one or two pearls of wisdom with you; little points that do not merit a feature in their own right but which have been garnered, often at the expense of a few grey hairs and sleepless nights, both of which I would like to spare you.

This month's tip is fairly straightforward, and applies to any of the new Windows operating systems which are registry-based (Windows 95, NT Workstation and NT Server).

Whenever you are installing new products which require several updates to the Registry, make sure you reboot the machine between each update. For instance, if, when loading a new piece of software, you need to install a new protocol in order to support it, you should go ahead with the protocol, then reboot the machine before finally installing the software. This does make the whole process somewhat lengthy on occasion (especially when several reboots are necessary) but can save you considerable heartache at a later date, since it ensures that the Registry is updated and stored correctly each time it is changed.

I once managed to completely wreck an NT Server by installing several products one after the other, without rebooting between each. Eventually, the Registry became so corrupt that the machine was unusable. Results are not always this extreme, but problems are likely unless you follow this advice. I have never been able to ascertain whether the problem lies with poorly written application software or with the operating systems themselves. I suspect the latter, but either way, you have been warned.

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hot-fix can be downloaded from the Microsoft FTP site at ftp://ftp.microsoft.com/bussys/winnt/winnt-public/fixes/usa/nt40/hotfixes-postSP3/iis-fix.

The second issue you mentioned regarding Windows 95 is also fairly minor, involving the vulnerability of network passwords on computers running Windows 95 to a malicious program. If a computer running Win95 is left unattended while a user is logged on to a network, it may be possible to obtain that user's network password by a programmatic examination of the computer's memory. Typically, accomplishing this would require physical access to the computer, although the network password could

potentially be acquired if a malicious program designed to search for passwords, via the same examination of memory, were to be downloaded and run by a currently logged-on user.

I am not aware of any instances where this vulnerability has been used to gain access to customers' networks. However, Microsoft recommends the following precautions to prevent the current user's network password from being accessed by unauthorised means:
■ Log off the network when leaving the computer for long periods of time.
■ Run a password-protected screensaver when leaving for a short duration.
■ Do not run mistrusted programs on the

network, the web, or received via email.
■ Install the security update for Windows 95 as follows:
Step 1. Download the appropriate update file (from the list, below) to an empty folder;
(a) If you are running Win95 Retail Release (version 4.00.950) or OEM Service Release 1 (OSR1, version 4.00.950 A), download SECUPD.EXE. Double-click the System icon in the Win95 Control Panel if you are unsure of exactly which version you are running.
(b) If you are running Win95 OEM Service Release 2 or 2.1 (version 4.00.950 B), download SECUPD2.EXE.
(c) If you're running the Microsoft Client for NetWare Networks with the Microsoft Service for NetWare Directory Services (MSNDS) installed, *also* download NWREDUP4.EXE. You can see if you're running this service by double-clicking the Network icon in Control Panel. If "Service for NetWare Directory Service" is listed, this fix is applicable.
Step 2. In My Computer or Windows Explorer, double-click the update file(s) you downloaded in Step 1.
Step 3. Follow the instructions on the screen and reboot your machine.

PCW   Contact

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Mind games

Bob Walder returns from BrainShare. Nothing sci-fi or sinister, but snippets from Novell's recent technical conference. And advice from Microsoft turns out to be worryingly wrong.

I am always amazed by how invisible Novell's marketing is. Just look at what happened to GroupWise, for instance. Novell had a robust, scalable, widely installed enterprise messaging system available while Microsoft Exchange Server was still a twinkle in Bill Gates' eye. And yet what did Novell do to capitalise on its lead? Nothing.

Bringing things a little more up to date, how many of you have heard of Wolf Mountain? No, not the big lump of rock in the US, but the codename for Novell's answer to Microsoft's Wolfpack clustering initiative. Yes, Novell has clustering, and I have seen it working, too. But have we heard anything about it? Nope.

Every year I find myself lulled into believing that Microsoft is about to achieve world domination and that Novell is about to roll over and die. But my eyes were well and truly opened once again this year at Novell's technical conference, which is called, somewhat appropriately, BrainShare.

Followers of fashion

It is a fact of life that NT is seen as the up-and-coming platform, and is certainly very "fashionable" right now. In contrast, NetWare is regarded almost as a "legacy" system, and is thus frequently lumped into the same class as IBM mainframes, COBOL and the Model T Ford (or any Ford, for that matter), particularly by the "younger" computing generation which has grown up with Windows.

But the astute networking person will buy a product based on "fitness for purpose", and in this area NetWare still has an awful lot going for it. For a start, it is by far the easiest operating system to manage, thanks largely to Novell Directory Services

(NDS). The thing is, NT Server manages to fool people into thinking that it is easy to manage by adopting the exact same graphical interface as the user's desktop operating system: "If I can master Windows 95 then NT must be a cinch, right?"

Only when the network is installed does the hapless administrator begin to realise how difficult NT can be. Adding new users, adding printers and particularly assigning user rights to files and directories are all very much more straightforward under NDS. And don't even get me started about adding new network cards or disk controllers. Changing a hardware component under NT can render your system unusable if something goes wrong, whereas under NetWare you are always in control.

Don't get me wrong, I am certainly not "anti-NT". My company runs both NT and NetWare servers, each employed according to its fitness for a specific purpose — our biggest NT box (a superb Olivetti dual-processor server) hosts Exchange Server, for instance.

On the Border

The biggest problem is that Novell simply will not shout as loud as Microsoft. When you think of an internet/intranet platform, for instance, you will probably consider NT first. I certainly did. So it came as a pleasant surprise to see Novell's Border Manager demonstrated at BrainShare this year.

Border services are those which act at the junction between our corporate networks and the internet, and Novell has been working hard in this area. The resulting product set includes a packet filter firewall which can handle both IPX and TCP/IP traffic, the fastest proxy cache server currently available, circuit gateways,

Virtual Private Networking (VPN), integrated DHCP/DNS and remote access capabilities. Once again, manageability is the key, with Novell's solution offering the unique ability to easily manage net access to the individual user level through NDS, all from a single point of administration across the enterprise.

Vamping it up

NetWare itself (or IntranetWare, as it is now called) is also due for a major revamp in the near future. Currently codenamed Moab, this will bring a number of significant new benefits including native TCP/IP, an enhanced Multi-Processing Kernel (MPK), integrated DHCP and DNS servers managed via NDS, built-in Java support and a massively scaleable file system called Novell Storage Services (NSS).

For the first time, therefore, Novell customers will be able to run either or both native IPX and native TCP/IP across their networks, and will be able to employ a fully integrated DHCP and DNS solution which is currently the only one available to be managed completely via NDS. DNS domains are represented by containers within the NDS tree, and the DHCP server is BOOTP compatible (unlike the Microsoft one).

On the hook

There is also, finally, an inkling that Novell is prepared to play Microsoft (and others) at its own marketing game. Novell Replication Service (NRS) is a dedicated file system tool for replicating, distributing and synchronising information across a network of geographically dispersed servers, improving fault tolerance and making key files available for quicker access locally. A significant new product, then, which leverages the existing benefits of NDS —

and yet Novell plans to offer it free (the actual shipping version, not just a beta) for the first nine months or so, only charging for the product once version 1.1 is released. This "give it away to get 'em hooked, then charge 'em for it" approach to product marketing has been employed by every man and his dog for the last year or so, and it is not before time that Novell seems to be catching on.

Microsoft might appear to be the Spice Girl of the networking world at the moment, but there is many a good tune played on an old fiddle, so don't write Novell out of the story just yet!

Service Pack 1: How and why

Q. *"In a recent issue you mention the need for Service Pack 1 if installing Office 97 with the original Windows 95 or upgrade version of Windows 95. You didn't mention why. Can you explain — briefly?"*
Dave Griffiths

A. There are few things more irritating than being told to install something without being given a reason why, aren't there? Well, Dave, here is the gospel according to Microsoft, so you can judge for yourself. The Windows 95 Service Pack 1 is a collection of add-ons and updates for the released version of Windows 95. Previously released add-ons for Windows 95 included in this Service Pack are:
• Microsoft 32-bit DLC Protocol for Win95 Microsoft Exchange Update

• Microsoft Internet Explorer 2.0 (hopefully you will have a later version of this by now!)
• Microsoft Service for NetWare Directory Services (MSNDS)
• Microsoft Windows 95 Infrared Driver (IrDA) version 1.0
• Microsoft Windows 95 SLIP and Scripting Support for Dial-Up Networking
• Microsoft Word Viewer for Windows 95

Tools for use with Windows 95 Scripted Installation and Network Management included in this Service Pack are:
• Microsoft Batch Installation Utility for Windows 95
• Microsoft INF Generator Utility for Win95
• Microsoft INF Installation Tool for Win95
• Microsoft Support Assistant for Win95
• Microsoft Systems Management Server PDF File
• Microsoft Windows NT Server Management Tools for Windows 95

But possibly the most important bits are the bug fixes and patches:
1. OLE32 Update. The Windows 95 OLE 32 update addresses file-management behaviour in Microsoft Word, Microsoft Excel, and Microsoft PowerPoint for Windows 95.
2. Microsoft Windows 95 Shell Update. This update to the Windows 95 Shell32.dll file fixes a problem in which files copied onto themselves can be truncated to a zero-byte file size (oops!). This update to Shell32.dll also makes it possible to browse Novell Directory Service printers from the Add Printer wizard.

3. Windows 95 Common Dialog Update for Windows 3.1 Legacy Printer Drivers. In Windows 95, when 32-bit applications print using Windows 3.1 monolithic drivers or the Windows 3.1 Pscript.drv / Unidrv.dll driver, the applications sometimes fail. This update addresses that problem.
4. Vserver Update: File and Printer Sharing for Microsoft Networks. An update for a known problem with File and Printer Sharing for Microsoft Networks and a certain UNIX shareware network client (Samba's SMBCLIENT). The update corrects a problem with share-level security.
5. NWServer Update: File and Printer Sharing for NetWare Networks. This addresses an issue with File and Printer sharing for NetWare Networks which might affect data security for corporate users.
6. Vredir Update. The Vredir Update fixes a problem that affects only Windows 95 users who use UNIX Samba servers.
7. Windows 95 Password List Update. The Windows 95 Password List Update protects your password file against potential security violations.
8. Microsoft Plus! Update (System Agent Update). The Microsoft Plus! Update provides an updated version of Sage.dll to fix a minor problem with System Agent: When version 1.0 System Agent is running, programs that perform floating-point calculations might be slightly off in precision.
9. Printer Port (Lpt.vxd) Update. The Service Pack 1 will install a version of the parallel port driver (Lpt.vxd) that was available previously

on the Win 95 CD in the \Drivers\Printer\LPT folder. This driver corrects problems seen on some ECP (Extended Capabilities Port) equipped machines.

All things considered, I would advise any Windows 95 user to install Service Pack 1, whether or not they intend to run Office 97.

Service Pack 1: Which one?

Q. *"You recently mentioned the need for Service Pack 1 when running Windows 95 and Office 97 together. Can you please tell me which version of SP1 I should use, and from where it can be downloaded?"*
Mr A Mallik

A. Well, Mr Mallik, there is only one version of SP1 available (unless you count the different language versions) and that can be downloaded from the Microsoft WWW site. Try www.microsoft.com/windows/software/servpak1/sphome.htm. After installing the update, go into your Control Panel and double-click the "System" icon. On the "General" tab, the version number will be reported as 4.00.950a.

Will WFWG and Win95 work?

Q. *"In the May 97 Networks section of PCW, the last paragraph read, '...is it possible to connect WFWG to a machine with Win95?'. Mark Baynes replied that it is possible and that he does it all the time. Looking for confirmation, I phoned Microsoft who denied this was possible. Can it be done? And if so, what do you have to do in order to run a mini-network?"*
E Clark

A. I must confess to being a little perturbed by Microsoft's response. You would think that the technical support line of a company would know its products inside out, and that makes me slightly nervous, since I am about to contradict their words of wisdom.

You see, the bottom line is that Windows 95 uses the same workgroup model and underlying protocols as Windows for Workgroups. Because of this, computers running File and Printer Sharing for Microsoft Networks can be seen by computers running Windows for Workgroups. The only real caveat (which shouldn't cause any problems in most situations) is that Windows 95 computers will be favoured in Browse Master elections because of the higher version number of the browser software.

A user running Client for Microsoft Networks can therefore access the shared resources on a computer running Windows for Workgroups, providing both computers are using a common protocol. Conversely, a user running Windows for Workgroups can connect to the shared resources on a computer running File and Printer Sharing for Microsoft Networks, providing both computers are using a common protocol and the user has been granted access to the resources on the computer running Windows 95 (don't forget this last point).

The protocol issue is worth stressing, since it tends to be forgotten, especially when attempting to resurrect older machines and incorporate them in a new network. It can also cause problems, since many newer Windows 95 networks will be

running TCP/IP, a protocol which carries quite a heavy resource overhead and which can often be difficult to implement on older machines with limited memory. In such cases, you can always resort to NetBEUI (the default protocol of pure Microsoft networks) or the commonly used "IPX/SPX Compatible Transport With NetBIOS".

The Windows 95 machine is configured for networking in the manner I described last month. When configuring the Windows 3.11 machine, it is vital to ensure that you have the user name and workgroup name set correctly. To do this, fire up the Windows Setup utility from the Main program group, then select Options and Change Network Settings. Here you will be presented with three buttons.

"Drivers" allows you to install the appropriate support software for your network card. "Sharing" allows you to specify whether you wish to make your disk and printer resources available to others. If you do not, check any boxes in the "Sharing" section, then even if the rest of your network is configured correctly, you will not be able to access resources on the Windows 3.x machine. The final button is "Networks", and here you should click on "Install Microsoft Windows Network" (to keep things simple initially, check the "No additional network" box too — you can always add additional network support later once everything else is working).

When you confirm everything you will be presented with the Network Names box, where you can enter the user name, workgroup name (make sure this is identical on all machines, Win95 or Win 3.x, which need to communicate with each other) and unique computer name. That's all there is to it. If anything does not go according to plan, try the approach we used last month: remove all networking first, reboot the machine, then start from scratch.
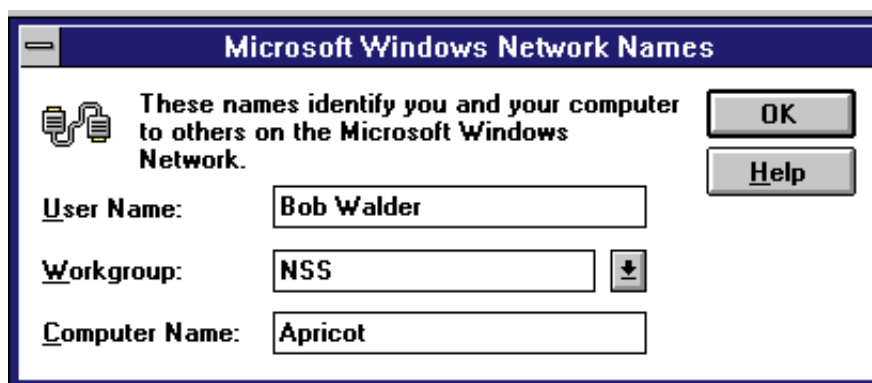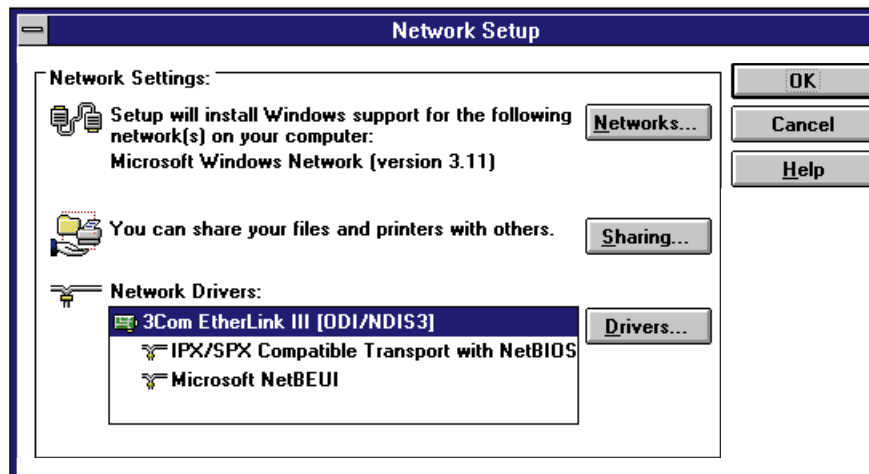
Try it: I am sure you will find it works. As
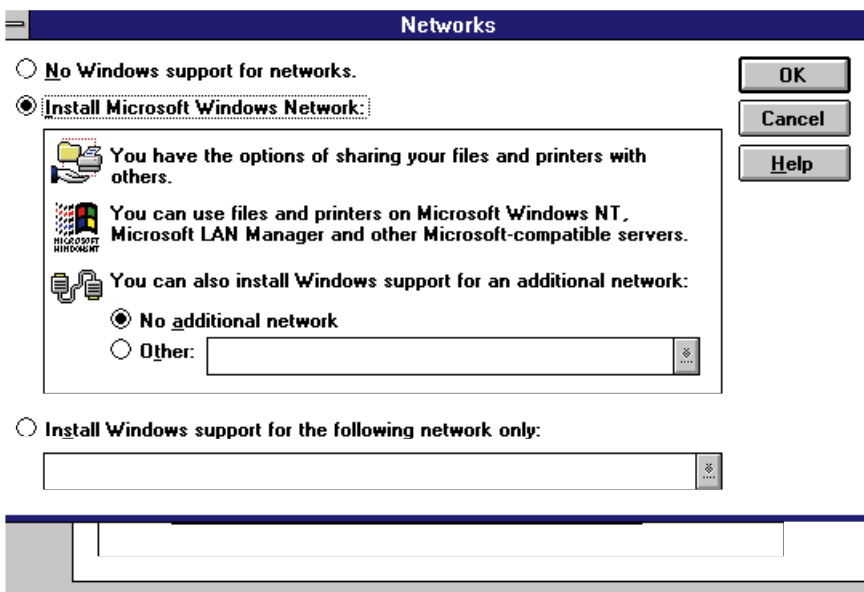
Adding Microsoft Network support in Network Set-Up utility

Adding Network Adapter

Top Network Set-Up screen after installing network support and adapter

Above The final step — assigning the user, computer and workgroup names

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Book Review

Title Internet Firewalls and Network Security
Author Siyan & Hare
Publisher New Riders
Price £37.49 (inc CD)

Although this book starts off with a brief history of the internet and a tutorial on IP addressing, it is far from a beginner's book. It rapidly moves into a discussion of UNIX configuration files, which will be completely superfluous to those readers whose primary interest is NT. By chapter three we are back on generic ground, with a very useful section on how to go about defining your own corporate security policy — something everybody should do. The second part of the book looks in detail at firewall architectures and theory of operation, and provides plenty of advanced reference material. Then it goes and spoils itself again by getting product specific, spending whole chapters on particular firewall implementations and toolkits. I never feel this is a good idea, since it means the book is out of date even before it is published. Although there is a whole chapter on FireWall-1, for instance, there is no mention of the NT version, even though it is a well-established product on the NT platform. Weak points of this book, therefore, are the total UNIX orientation (ignore this criticism if you are a UNIX boffin) and extensive product-specific chapters. However, if you can ignore those bits you are left with a reasonable (if now slightly expensive) reference work on security policies and firewall architecture.

■ *My thanks to Computer Manuals (0121 706 6000) for keeping me supplied with review samples.*

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for Microsoft's advice? Perhaps we are seeing the beginning of the end of effective Windows 3.x support. To be fair, the company does have a huge product portfolio and cannot be expected to support every version of every product indefinitely.

PCW Contact

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The cable guy

Bob Walder is your new man on Networks. He begins by explaining how to make the best connections, and takes you through cabling and the ins and out of correct configuration.

Many correspondents to this column seem concerned with the basics of networking, so this seems like a good place to start. In the future, I will be concentrating on the most popular products used in most networking applications. But I won't be concentrating exclusively on the basics: I will cover the spectrum of networking, including management, groupware, Branch Office/Small Office connectivity issues *et al*.

A couple of letters reflecting readers' concerns come from Scott Walker and Chris Thomson, both similar in content. Chris writes: "*I was interested to read John Rowlatt's letter, in the June issue column, relating to the linking of two PCs together, using only Windows 95. I have tried this between my Dell Optiplex GXMT5133 (built-in 3Com Etherlink III 3C509b-TPO network card) and my Compaq Prolinea 5100, with an NDC NE2000 card (configured as a Novell/Anthem NE2000 compatible), but with no success. The 3Com help files even give instructions on how to set up a 'peer-to-peer network by creating the same Client for Microsoft Networks' on each PC with 'IPX/SPX-compatible Protocol' and using the 'File and printer sharing for Microsoft Networks' network service.*

"*Am I missing something obvious? I have used a standard Category 5 cable between the two PCs and both individually show the relevant Workgroup in Network Neighbourhood but they don't seem to talk to each other. Diagnostics on both cards pass OK and they are configured OK in Win95 (no conflicts). My eventual aim is to purchase a mini-hub, as my business is likely to expand to another PC soon and we will all want to share the one HP DesignJet 250C plotter (we all use AutoCAD, hence*

the A0 plotter) and be able to access files (drawings) between PCs. Should my current setup work? Or do I need to consider a mini-hub to link the two PCs?"

OK, two things here. The first is to deal with why your current setup will not work, and the second is to take a general look at configuring peer-to-peer networking under Windows 95 so you can check that you have done everything right.

If you need to connect two or more PCs without using a 10Base-T hub, the only way to do it is to use Thin Ethernet. Standard Thin Ethernet (also called 10Base-2) coaxial cable is readily available and easy to use. Whenever you buy a network card with a BNC (Thin Ethernet) connector, you should also get a small T-shaped device called a T-connector. This is plugged into the card's BNC connector and the Thin Ethernet cable can then be connected between the two PCs. You can connect as many PCs together in a chain as you like (although there are distance restrictions) and you will always be left with two spare connectors; one at each end of the chain. Each should be fitted with a "Terminator", a plastic or metal-tipped "cap" which is also supplied with some of the better quality Ethernet cards. Do not try to connect a single piece of coax cable directly to the BNC connector on the network cards — it will not work. You must use the T-connectors and terminators.

Once, this Thin Ethernet stuff would have been your best option until 10Base-T arrived. Now we no longer connect PCs in a chain but with a "star" configuration, with a hub at the centre. Each port of the hub is connected to a PC, or to another hub, and all communications go via the hub. This provides more flexibility in cabling our networks, and uses lighter and cheaper

cable which resembles telephone wire (*don't try to use telephone wire!*).

Standard 10Base-T cable is designed to connect a PC to a hub, not a PC to a PC. The signalling simply will not work, which is your problem in a nutshell. If you want to use 10Base-T, you should be investing in a hub: small four-port devices can be had for around £50 these days. But Thin Ethernet cable is even cheaper, provided your card has connectors for both 10Base-T and Thin Ethernet. If your card supports only 10Base-T connectors, there is one other possible option, provided you only want to connect two PCs.

When you need to connect two hubs which do not have "cascade" ports, or when you need to connect a file server directly to a router, say, you use something called a "crossover cable". Externally this looks exactly like a standard UTP cable, except the pairs of wires within the outer sheath are arranged slightly differently.

Using a crossover cable plugged directly into the UTP ports of your network cards may provide the breakthrough you are looking for (though I cannot guarantee it will work). Unfortunately, crossover cables are not as readily available as standard ones, so if you are treated to a blank stare when you ask for one, get out of the shop quickly and try a more specialised retailer, or order one from the Inmac catalogue.

Scalpels out!

Next, call up your Control Panel and double-click the Network icon to bring up the network configuration window (Fig 1). We're going to try some drastic surgery now, to make sure we are starting from a solid base. So, scalpels at the ready, and have your Win95 CD-ROM or floppy disks to hand.
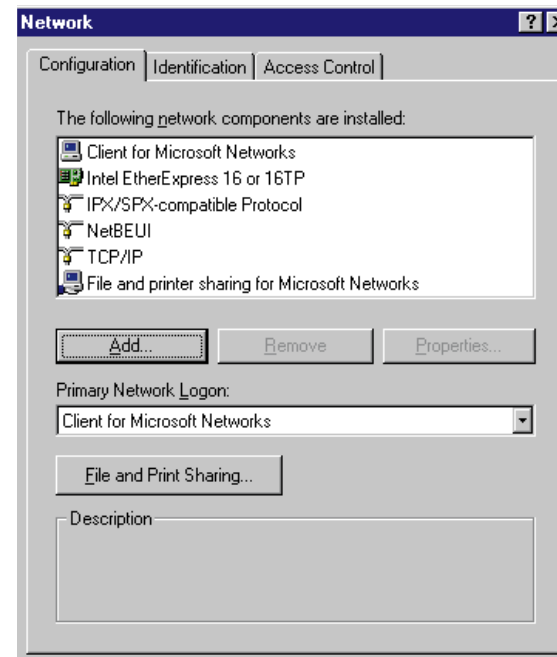
Fig 1 Network configuration window

1. Once your machine has restarted, click on the Network icon in the Control Panel again, and on the Configuration tab, click the Add button.
2. In the Select Network Component Type dialog box, double-click the type of component to install, as shown in the list in Fig 2. We are going to add our adapter.
3. Up will come a two-pane window with a list of manufacturers and a list of the network card drivers. Select your manufacturer (Intel, in this case), then select the

First, select the line which has the network card icon (Intel Ether-Express in Fig 1) and click on the Properties button. Make a note of the adapter manufacturer and type, together with the current resource settings, as you will need these later. Now, back to the Configuration screen. Make sure the network adapter is still highlighted and click on the Remove button — "hey, where did all the networking stuff go?"

Don't panic: we are now going to add everything back, step by step. But first you should click on the OK button and restart your machine, just to make sure that everything has really gone.

appropriate network card (EtherExpress 16 or 16TP), and click OK.
4. If, however, you have a driver disk which was supplied with your network card, you are better off using those drivers. Click on the "Have Disk" button, and browse the floppy disk looking in the root or Win95 (or however it is named) directory for a file with the extension .INF. Highlight this file, click OK, and you will get a list of the network card drivers which are on the disk. Select the appropriate one. You have now caught up with the rest of us.
5. When you return to the Configuration screen, you should see the Ethernet card,

the Client for Microsoft Networks and IPX/SPX Compatible Protocol components, and the Primary Network Logon should be the Client for Microsoft Networks.

If any are missing, or if you later delete them by accident, they can be added manually. Click on the Add button, select Client, Microsoft, and you can install the Client for Microsoft Networks. Clicking Add/Protocol/Microsoft will let you add the IPX/SPX Compatible Protocol.
6. Back on the Configuration screen, select Client for Microsoft Networks and click Properties. Ensure that the box "Logon to Windows NT Domain" is *not* checked, and check the "Quick Logon" box. Click OK.
7. Select your ethernet adapter and click Properties. In the "Driver Type" tab, ensure you are using the Enhanced Mode NDIS Driver. The Bindings tab should show a check box next to the IPX/SPX Compatible Protocol. You can ignore the Advanced tab for now but the settings on the Resources tab should be changed if necessary to match those set on your ethernet card. This is the trickiest bit, since every network card is different. Some require you to set jumpers or DIP switches on the card, some let you make the changes in software, others are fully plug-and-play.

You must determine what hardware settings are used (e.g. interrupt and I/O address range) and ensure that the settings on this screen match whatever you have set on the card. Then click OK.

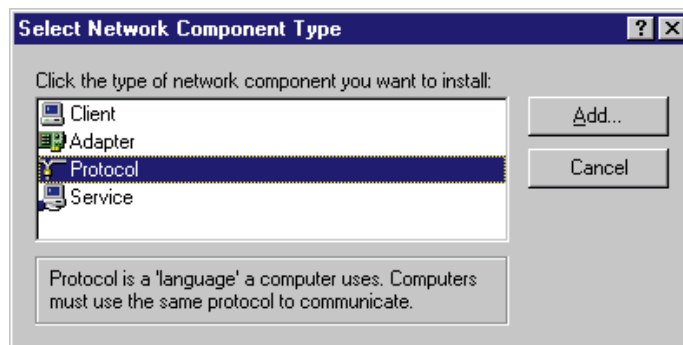If you need to troubleshoot your network

Fig 2 Network component window

the network, so it might be helpful to put something descriptive in here, like "Bob's Computer in Accounts".

13. In Access Control tab make sure the "Share-Level Access Control" box is checked.

14. The configuration is now complete, so click OK. You will be prompted for many disks or your Win95 CD-ROM at this point, following which you will be asked to reboot your machine.

15. When backing up, you should be asked for a user name and password, and if creating your network from scratch, you can make these up (try to remember them!).

16. You should be able to browse the network using the Network Neighbourhood icon and the workgroup you created should be visible, as should all Windows 95 clients in the same workgroup as your own PC.

17. Even though you can see the other machines in your workgroup, you won't be able to do much with them until you have created some shares. Bring up the "My Computer" window and right-click on the C: drive. If your networking is functioning correctly, there will be a "Sharing" option on the menu.

18. Select "Sharing" and check the "Shared as" box. The share name will default to "C", and you can leave it as this or give it a more descriptive name.

19. Under "Access type", check the "Full" box. This is all we need to do for now as, to begin with, we are more interested in getting the network up and running than in security. Click OK and the icon for the C: drive will change, to indicate it has been shared.

20. Try to browse the drive from another PC in the same workgroup. If all is OK, repeat the process with other drives and printers throughout your workgroup.

Happy networking!

I'm off to Novell's BrainShare conference in Nice, so next month I will share the juicier bits of gossip with you.

adapter at a later date, you will need to go to Control Panel/System/Device Manager/ Network Adapters. There you can view the existing resources used by the adapter, check to see if they clash with any other device in the system, and change them if necessary. If you are not using plug-and-play devices, remember to change the settings on the adapter itself so they always match those you set within Windows 95.

8. You can have a look at the properties in the IPX/SPX Compatible Protocol screen if you like, but there are no changes to be made.

9. Presumably, you want to share disks and printers between your networked PCs, so click the File and Printer Sharing button and check the boxes which are applicable (if you are not sure, check them both). Click OK and you will see the "File and Printer Sharing for Microsoft Networks" entry appear on your Configuration screen.

10. Move on to the "Identification" tab. Win95 requires you to define a workgroup and computer name for each networked computer, independent of the type of networking software you use. First, you give your computer its name: keep it simple, use 15 characters or less, and make sure that every computer on your network has a *unique* name. This is very important.

11. The default Workgroup name is WORKGROUP. You can leave this as it is, if you are creating a network from scratch, but if you change it, you must make sure that it is *identical* on every PC on your network. For those of you who are adding a Win95 client to an existing network, this should be the same as that used on all existing PCs, or should be the existing NT Domain name if you want this PC to act as a client to an NT Server (I will cover using Win95 as a client to NetWare and NT servers in more detail in a future column).

12. The description field is for information. Do with it as you will. However, this field is displayed as a comment next to the computer name when users are browsing

A star is born

Do you know your thin ethernet from your T connector? Your star cabling layout from your 10Base2? Mark Baynes puts networking basics in the spotlight to help you get connected.

Most letters I get are concerned with basic networking problems, so this month will be of use to most people. I will be covering the basics of networking PCs in terms of network topology and cards. As ever, this will be hands-on and based on real-life situations. Some information will already have been covered in previous columns but bear with me, because it is worthwhile to cover every step. We are only concerned here with ethernet networks, not the wonderful world of Token Ring.

So what are we trying to do? And, more importantly, why? Networking is simply a matter of connecting two or more computers together so that their resources can be shared. Whether a network is the web or two PCs in your bedroom, the principles are the same. By resources, most people mean files, but the most commonly shared resource on a network is a printer.

On the bus
The first thing you are going to need is a good network card and some cabling. For most people, their first network is a peer-to-peer affair whereby two or more computers share their files with each other. The most simple way to do this is to use 10Base2 or thin ethernet cable (also known as BNC) to establish a bus topology (i.e. network structure) as seen in Fig 1.

You will need an appropriate length of cable between each PC to be networked, and it's a good idea to buy cable lengths slightly longer than you need in case you move your PCs (but not so long that it turns into spaghetti all over the floor).

Each PC will need a network card with a BNC connector and each card will also need a T-connector. The connector attaches to the BNC port, or stub, which sticks out of the back of the network card. The BNC cable does *not* attach directly to the stub (Fig 2). T-connectors are usually included with the card.

Thin ethernet cable is easily recognisable because it will have the BNC connectors at either end: sometimes these are covered with a rubber sleeve, sometimes not, and the cable is quite stiff in comparison to twisted pair or 10BaseT cable. This is because it is shielded and is therefore more robust. Thin ethernet is not sufficiently robust that it will withstand a desk or chair leg being placed on it or a person's weight being applied to it.

Now, whether or not your BNC network cable (or cables) snake all over your office, with BNC cabling you are merely organising a single line or daisy-chain of PCs and the network cards at either end of the line have to be terminated. This is done by attaching a T-connector to the network card stub, but instead of attaching *another* piece of cable to the *other* side of the connector, you attach a terminator block (Fig 2).

It may be that at some point one of the PCs at either end of the network may need to be removed for some reason: you can remove the T-connector from the PC and just leave it dangling there, and the network will still work well as long as the terminator is present: I've done this a number of times. But it is much better to shorten the network by that single cable run and move the T-connector to the PC which is now at the end of the line.

Star spotting
If you have five or more PCs, or you plan to have more in future, you might be best advised to use a different type of cabling layout from the bus topology, the star, at the centre of which is a hub (or repeater, if you prefer the old-fashioned term). I have used both topologies and prefer the star simply because it is easier to manage. The problem with the bus approach is that the network signal goes from one PC to the next, so if there is a break in the cable in the middle of the network, PCs either side of the break cannot communicate with each other. Also, you have to faff around with T-connectors and terminators — thin ethernet cable is difficult to tuck away out of sight.
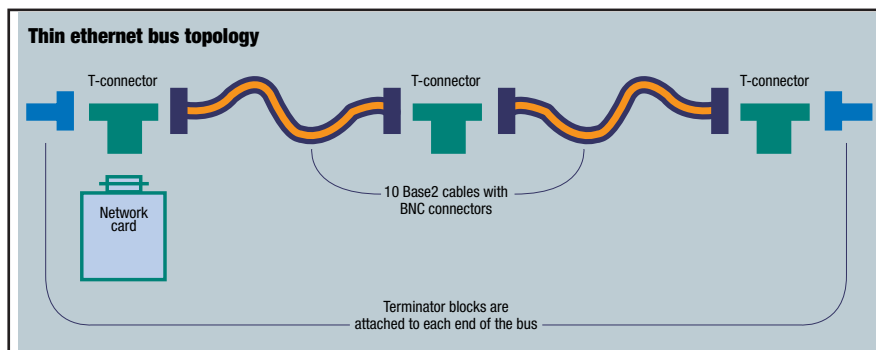
If you use the star approach (Fig 3) all

Thin ethernet bus topology

T-connector T-connector T-connector

Network card

10 Base2 cables with BNC connectors

Terminator blocks are attached to each end of the bus

Fig 1 The thin ethernet bus topology requires terminator blocks to be attached to the T-connectors of the network cards at each end of the bus

Connecting thin ethernet cable

BNC port

BNC connector

Twisted pair star topology

HUB

Twisted pair cables with RJ-45 connectors

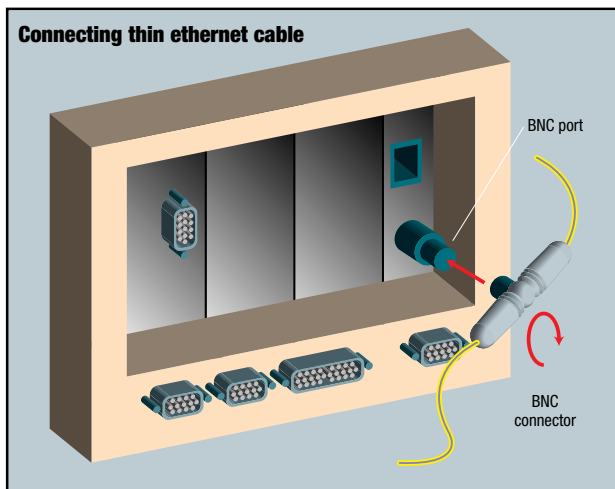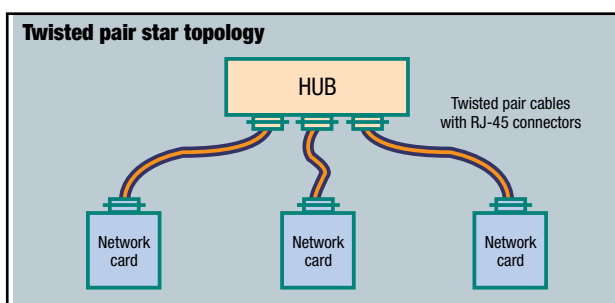Network card

Network card

Network card

Fig 2 (left) Thin ethernet cable is always attached to the network card via the T-connector, never straight to the BNC stub on the card itself *(Source: 3Com)*

Fig 3 (below left) The twisted pair star topology means the extra expense of buying a hub but is a much better network layout to manage

PCs are connected directly to the hub, so if a length of cable is damaged, only the signal to the PC on the end of that cable run is affected: the others are still in contact with each other. There is the extra cost of the hub, but it's well worth it in the long run.

All hubs have simple connection indicator and network traffic lights on each port which can tell you whether there is a live PC at the other end of the cable run,

and give a crude indication of network traffic. There are many different sizes of hub available: from mini-hubs with only four ports, to hub units with 12 or 15 ports which can be connected to other hub units, thus providing a single logical hub of 60 ports or more. For most small offices a hub with 10 or 12 ports will suffice.

Hubs can be daisy-chained together using a special crossover port. I do this in the office, with one hub downstairs with all the network PCs and the print server connected to it, which is then daisy-chained using a long run of cable to another hub upstairs, which has the server attached to it.

You can get 10Base2 hubs which use the BNC approach but most people use twisted pair or 10BaseT hubs which use what is called an RJ-45 port and connector, which looks similar to the connector on the end of a phone or modem line but which is slightly different. The RJ-45 connector on the end of the cable goes into the RJ-45 port in the network card at one end (Fig 4) and the hub at the other end, and that's it.

Twisted pair cable is also thinner than thin ethernet cable so it is easily tucked under the corner of carpets and up the stairs (you should see my house…). But this flexibility is at the expense of resilience, although it is reasonably durable. Because the nature of the star approach means that you will have lots more cable lying around, it is quite often a good idea to fix some plastic ducting to the wall and run the cables through this. You can find this type of ducting in most DIY stores and it's worth the time spent installing it.

Play your cards right
If you are not sure what sort of topology to adopt, I would suggest a combination card, so-called because it has both BNC and RJ-45 ports which allow you to install the card once and change cable types as you wish.

Some cards have an AUI (Attachment Unit Interface) port but for most small networks a combo card with BNC and RJ-45 ports will do fine. I am on record as having stated my belief that it is well worth investing in a good-quality card: 3Com has

Bang on queue

Following publication of the Hands On Networks column in April's PCW, I've received several letters regarding the issue of print servers. Here's one of the best. Thanks for your input, everyone!

■ "With regard to your reply to a reader's letter about print servers which do not require a network print queue. In fact, the HP JetDirect card supports the functionality you need, in both the internal and external flavours.

"Download Windows for Workgroups drivers for the card, so that a WfWG Network PC can print directly to the printer. The driver uses MS DLC.

"You can also add HPNetwork Printers to W95 which will work in the same way. I've a group called `HP_Network_Printers` in my Network Neighbourhood and can map a local device directly to the device in the Network Printer group.

"If a printer can be made visible in a WfWg network, I think it can be viewed and used by OS/2, and even SCO Open Server 5.0 with Advanced File & Printer Services.

Jason Cathles
jcathles@compuserve.com

Connecting twisted pair cable
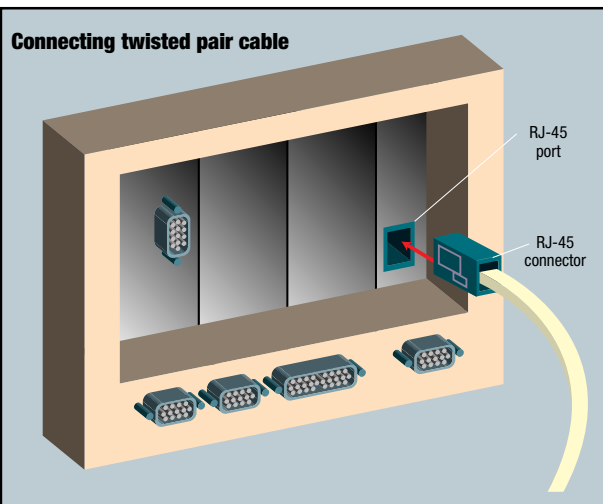
RJ-45 port

RJ-45 connector

Fig 4 Connecting twisted pair cable is simply a matter of plugging the RJ-45 jack on the end of the cable straight into the socket in the card. *(Source: 3Com)*

kindly lent me some of its rather good EtherLink cards: the EtherLink III ISA combo and the EtherLink XL PCI RJ-45 card.

Upon opening the box of any good network card you should find at least three things: the card itself, a documentation booklet, and a floppy disk containing a setup program and basic drivers for the usual network clients. The only ones with which we are immediately concerned are the Windows drivers.

My installation machine is an ageing 486DX2 50MHz ISA PC with 12Mb RAM and a 500Mb hard drive, running Windows for Workgroups. It normally has an SMC card installed in it (and has done for the last three years) which has been trouble-free, but for the purposes of this month's column I have removed it.

Physical installation of the EtherLink is simple: just open the machine, slot the card into a free ISA slot, screw down the rear plate, attach the network cable to the card

via the RJ-45 or BNC socket, ensure that the network cable you are attaching to the card is attached to the rest of the network, and that's it from the hardware side.

But this is only because the EtherLink is software configurable. If you have a card where you have to faff around with jumper switches on the card itself, you will have to set these correctly. I always leave the PC casing open anyway, until I know the new network card is working.

It is always a good idea to check which IRQ and memory address space is free for your card, irrespective of whether your PC and card combination can automatically detect these settings. If you insist on jamming a card into every available slot in your PC, you may have some juggling to do. I always try to keep things as simple as possible in the knowledge that they will get complicated anyway.

PCW Contacts

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3Com 0800 966197: www.3com.com/

Suspect packages

Mark Baynes learns his lesson — you must treat each new bit of software with suspicion, no matter which supplier it comes from. A simple installation could turn into a real ordeal.

My Ant Web network is in a far worse state than last month, for the simple reason that we decided to buy a scanner. "What on earth has a scanner got to do with a network?", I hear you ask. I have always considered networks to be not just cables, cards and hubs, but also the PCs, servers and associated gadgets that hang off them.

I bought a Hewlett-Packard ScanJet 4p and decided to install it on one of the clone PCs we use that are running Windows 95. I installed the HP SCSI card and the HP
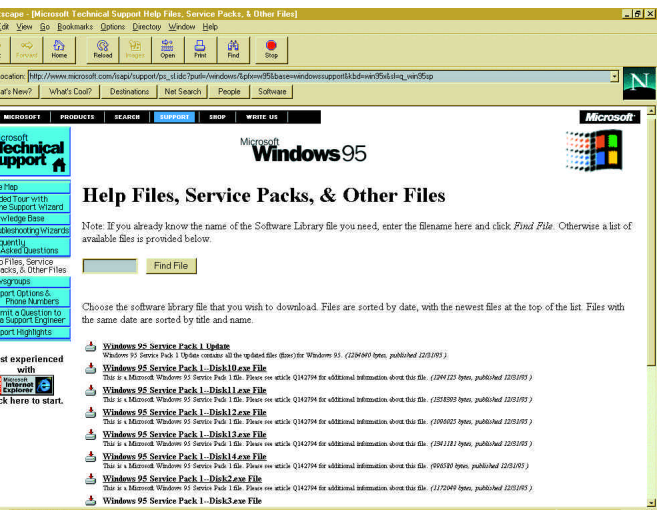
Right Make sure you install the Win95 Service Pack 1 update before putting Office 97 on your system

Below Check out the *Network News* web site for a comprehensive set of links to networking companies

Deskscan and Visioneer PaperPort software that comes bundled with it. I re-booted, and the PC froze with a memory exception error. I re-installed. The PC re-froze with the same memory error. Assuming it was the PC that was the problem, I removed the SCSI card and placed it in my own PC. The same thing happened — twice. The problem is that the PC on which I first installed the scanner now crashes whenever any software is run, so I have to reconfigure it.

I insist that all data is kept on the server, so it's only Win95 and the applications that need to be re-installed. I called HP tech support who advised me to remove a couple of lines, referring to the PaperPort software, from the system.ini file. When I did this, the scanner worked but nothing else, so I re-installed Windows 95 on my PC, re-installed the PaperPort software, edited the system.ini file, and then put my applications (Office, HTML editor, just the basics) back on to my machine. It worked OK.

The trouble is that this nonsense took me a whole day to sort out. My LAN was an irrelevancy, with half the PCs trashed. The reason I recount all this is that you should always treat *any* new software as being suspect until proved otherwise. An important technical note that came out of this is that if you have an original version of Windows 95, especially the upgrade from Windows 3.x, and are going to install Office 97 onto a Windows 95 PC, make sure that you install the MS Windows 95 Service Pack 1 before you install Office 97, which you will find at www.microsoft.com/windows95/. I wasted another day before I twigged what was going on.

Web sites

I am currently overwhelmed by emails from readers and I must apologise if a reply does not appear in print — there isn't enough space to print them all. One FAQ is the whereabouts of good sources of networking information on the web. I don't know of any single site worth visiting, but you could try the home page of *PCW*'s sister publication, *Network News*, at www.NetworkNews.vnu.co.uk and check out the "Links" hot spot which has a comprehensive list of networking

Compaq Prosignia 200 workgroup server

I have used Compaq servers for years, and although it is a byword for reliability and performance, Compaq traditionally also means expensive, so I was more than interested to review the new Prosignia 200 workgroup server which you probably will have seen advertised in the national press as starting at under £1,000. The unit I reviewed had a 166MHz Pentium Pro, 48Mb RAM, 1.6Gb SCSI drive and Compaq NetFlex-3 ethernet card pre-installed.

At this price I fully expected the system unit to be rather tacky, but I was proved wrong. The Prosignia has a very solid feel. To get at the inside you unscrew three thumbscrews at the rear — no messing around with screwdrivers, then slide the left-hand panel off. The internal layout is, well, pretty weird. The power supply, floppy drive, CD-ROM and SCSI drive(s) sit at the top of the unit, the motherboard is on the right-hand side with the Pentium Pro halfway up the board. To the rear of the motherboard is a riser board which has two PCI, one ISA/PCI and two ISA slots, but these are almost completely hidden from view by a metal supporting plate (or "expansion backplane brace") which runs the length of the unit.

To install a card you have to disconnect the fan and pull the whole riser sub-assembly out of the unit. This is the first time in six years of configuring servers that I've had to read the manual to install a network card.

Worse was to come when I tried to put the sub-assembly back in, as it needed quite a bit of pressure and I ended up laying the server on its side before applying a final shove to slot the riser board into the motherboard. I was terrified I was going to break something. The next daft thing is that the SIMM sockets are right at the bottom of the motherboard, so if you move *this* server, do it very carefully. With the power supply and drives at the top of the unit, it is top heavy (and there are no stabilising feet). In fact, the layout of the Prosignia 200 would make much more sense if you were to turn it upside down. No doubt this strange arrangement is the only way Compaq can produce a server at such a low price.

Inside the Prosignia packing there are three packages: one, labelled Server Set-up and Management, contains Compaq's SmartStart and Insight manager software. Another, labelled Software Products, contains versions of Novell's IntranetWare, Cheyenne ARCserve for NT and NetWare, Windows NT Server v3.51 (why not v4.0?), and SCO UnixWare and Netscape Servers, all on CD and optimised for Compaq's hardware. Of course, you will only be able to use the Compaq version of the NOS after you buy the appropriate licences from Compaq, which will then allow you to access the software via a CD key. I was provided with the SmartStart key for IntranetWare so I had to install that. The final package contains basic setup information.

Within the Set-up and Management package there is a SmartStart setup sheet. Once you have the appropriate activation keys, you boot the server from the SmartStart CD. SmartStart is a good idea both in theory and practice, as it will optimise your server operating system which will make a difference to your network's performance.

I did not have the Prosignia 200 on my network for long enough to get a good idea of its reliability, but being a Compaq it should be pretty stable. Would I spend my own money on one? No, I don't think so, because I have the feeling I would break something the first time I put a new expansion card in it.

PCW Details

Price £1,805
Contact Compaq 0181 332 3000
Good Points Integrated NOS installation with SmartStart. Price. Should be reliable.
Bad Points Stupid internal design. Installing network cards is a nightmare.
Conclusion Buy one if you are sure will never need to put in a new network card.

Another perspective

"I was interested to read your advice in PCW [April] that it is impossible to run a printer directly as a network device without any PC acting as a server. I can't fault your reasoning, but I can say that we are doing exactly that on our network. We run a peer-to-peer network over 10Base-T. An HP LaserJet 4 printer is connected to the hub via an HP JetDirect card in the printer. No PC is designated to 'serve' the printer, yet every PC can print to it using drivers supplied with the JetDirect card. I have often wondered where the print queue goes. Is it that each PC holds its own queue? Printing is so quick that one rarely sees a printer icon on the task bar. We use Windows 95 but the card claims to support all the main NOSs. I hope this helps your reader."
David Marshall

companies' web sites. Another useful source of hardcore technical information are books. Two which I swear by are *Understanding Data Communications and Networks* by William A. Shay (PWS Publishing 1995, ISBN 0-534-20244-6) and *Computer Communications* by Beauchamp and Poo (ITP 1995 ISBN 1-85032-168-X).

Making a connection

Q. *"What is the cheapest way to connect the two machines specified below for (preferably complete) access to each other's resources running Win95? What software is needed, and what are the potential pitfalls and problems (e.g. can both machines access the internet from the one card or print to either printer)? For example, would a pair of MediaFORCE BNC Network cards (ISA) from Choice Peripherals (£14 each) be sufficient ?*
• Machine 1 (four-year-old Dan for Windows) 486DX 33MHz not local bus or PCI, with free ISA slots, upgraded with two-speed CD-ROM, SoundBlaster, additional 1.2Gb hard drive, and now 20Mb RAM. Canon BJC-610E colour inkjet.
• Machine 2 (a soon-to-be-purchased Dan Ultimate) Pentium 200MHz (32Mb EDO RAM), free PCI and ISA slots, 28.8/36.6 fax modem, Iomega Zip drive, eight-speed CD-ROM, Wavetable sound card, Brother HL730 laser printer."
John Rowlatt

A. Consider what is the most hassle-free way of networking two machines together. Because they are so fundamental an item, network cards are the cause of about 80 percent of network problems, so it is well

worth paying a few extra quid and getting some good ones. I know of network managers who will buy an old clone PC yet insist on branded network cards.

Yes, in theory, a pair of MediaFORCE BNC Network cards plus a length of BNC cable would do the job, but I swear by two brands of card: SMC and 3Com. It is also worth buying what are known as Combo cards which have both BNC and 10BaseT connectors, so you can upgrade to a 10BaseT hub-based network without changing your cards. A 3Com or SMC Combo will cost you about £50 each and are well worth the money, believe me. I've suffered. If you *don't* take my advice and buy A.N.Other cards, then get ones that are at least software configurable. Once you have your cards installed, you can hang a printer off one machine and print to it from another using Win95 only. Accessing the internet is slightly more complicated because you will have to run the dreaded TCP/IP protocol, but get the basics up and running first and take it from there.

All in the game

Q. *"I want to set up a small LAN of three or four computers. They wouldn't be permanently linked as my friends would be bringing their computers round and it wouldn't be used much. I'm looking for a cheap way to network them, for a cost of £150 at most. They would really only be used for games like Quake or Duke Nuke 'em, which require quite fast connections."*
Neil Knapp *(Age 14)*

A At last, someone who wants to use a network for a real reason! Apparently, PC World superstores are now stocking the D-Link DE-905 networking starter kit which includes a small 10BaseT five-port mini-hub, two 16-bit ISA cards, two cables, documentation and software drivers for £99. D-Link will also give you free lifetime technical support. I have yet to get a networked version of Quake running on my own network, which is a pity because it's better than the standalone version.

Happy gaming!

PCW Contacts

Mark Baynes can be contacted by post via *PCW* or email **networks@pcw.co.uk**.

D-Link 0181 235 5555
PC World 0990 464464

SAPS up!

It's Spring again, the sap be risin' and it's a good time for Mark Baynes to review the SAPS modem sharing software kit for Windows, in addition to zapping your networking problems.

A t long last I have managed to get the SAPS modem sharing software reviewed, as promised. This is for those among you who were wondering how to share a modem using Windows NT.

Last month, I was having *big* problems with my server, "Pig", and as I write it is languishing in the corner, not sulking but dead. This has meant quite a few problems, as we have been getting up to speed with

our web work and so the use of a server was an imperative.

To get around the problem, I have simply used the most powerful workstation which is running NT Workstation 4.0 as a server, although as it is not a dedicated server, it is really peer-to-peer. However, this has proved not to be too much of a hassle as we are simply sharing files and do not use the "server" for anything else. Anyway, this is unlikely to be the case for much longer as

we get more work in and we just *have* to be able to work more efficiently.

This month, I have had some letters from people who want to get to grips with the very basics of networking, and I have received several others from people asking me to stick with the problems of smaller networks. But don't worry, I will.

For those of you who are concerned about getting started with networking, I would say (a) ignore my cynicism, and (b)

SAPS — SpartaCom Asynchronous Port Sharing kit

■ *The package reviewed here is the SAPS kit containing one server and five client licences.*

The way this product works is that it establishes a modem as a shared resource on the server and is accessed via the addition of a com port re-director on the clients. This version of SAPS supports either a single Windows NT or Windows 95/3.x server and five clients which can be either NT, Windows 95, Windows or DOS. SAPS supports all NetBIOS protocols such as TCP/IP, NetBEUI and IPX. I chose to install the server on a 133MHz Pentium running Windows NT Workstation 4.0 with 64Mb RAM and the client on a 100MHz Pentium running Windows 95 in 32Mb RAM, connected via thin Ethernet.

The first task was to remove the 28.8Kbps US Robotics Sportster which usually runs on the client and install this onto the NT box. Setup is simple apart from having to enter a serial number and software protection key, the only real choice being whether to install the SAPS Server and the SAPS Manager, or just the SAPS Server (I installed both).

Once this has been completed you will be presented with the main SAPS Server screen. Click on the familiar Microsoft share icon at the top of the screen and the Shares window will be displayed. Click New, then enter the new share name and an optional password. I entered Sportster and ignored

the password option. I added the available Com port shown and clicked On. And that's it (see Figs 1 & 2, opposite).

The next task was to install the client. You should check to make sure that the client can see the server over the network before installing SAPS. During installation you will again have to enter a separate serial number and software protection key. You will then be asked for the redirection path that will be connected to your new SAPS port. You can set up pools of modems on an NT server to operate with SAPS (it works with NT's Remote Access Services) but as I was only sharing the one modem, I didn't bother.

Next, you must undertake a standard Windows 95 modem install, making sure that you choose auto-detect. This checked Com 1 and Com 2 and then found the modem on the newly installed Com 4. You are then ready to go, simply specifying the modem on Com 4 for any of your dial-up needs (Figs 4 & 5).

The only problems I experienced were initially naming the shared modem in the NT server setup "USR Robotics Sportster", which SAPS did not seem to like, so I changed this to "Sportster" and all was well. The other glitch was that following the autodetect on the client, which found (as it always does with my Sportster) a "standard modem", I changed this to "USR Robotics Sportster" and, despite being able to undertake a complete diagnostics test of the modem over the network from the client, I

could not connect to the SAPS Server. I re-installed and this time did not change the modem detected from "Standard Modem": SAPS worked fine, and allowed me to connect to the net from my PC in the same way as if it were attached locally rather than via the network.

SAPS is a simple product, with no frills, which does exactly what it is supposed to. More software should be made this way. The documentation is simple and straightforward: it could do with a troubleshooting section, but that is my only minor criticism. I highly recommended it.

PCW Details

Price SAPS One: NT server plus five clients, as reviewed, £195. SAPS Small Office (not NT): one line plus five clients £115; two lines plus five clients £165; two lines plus ten clients £210. SAPS Server for Windows NT: £535 for 256 lines/users. (All prices ex VAT).

Contact Icon Technology 0181 357 3600. Email icon@icon-plc.co.uk. Web www.icon-plc.co.uk

Good Points Simple to install and use.

Bad Points None.

Conclusion The ideal product if you want to share a single modem in a small office with a minimum of fuss. Buy it now and save yourself a lot of hassle.
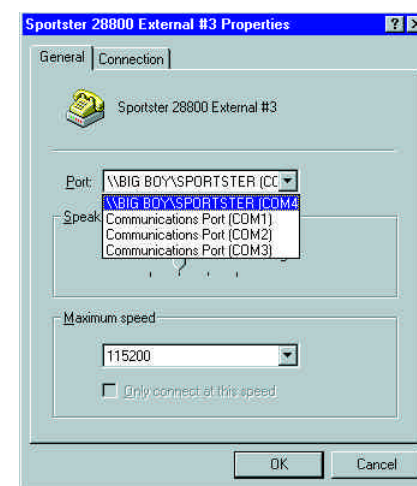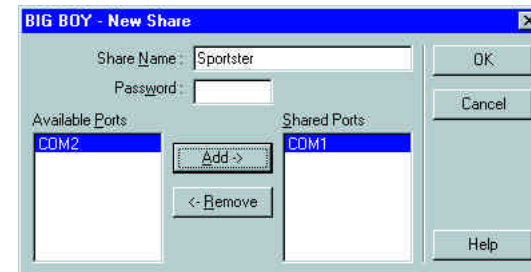
★★★★★

Fig 1 (top) Using SAPS Server Manager to establish a new shared Com port on NT Workstation 4.0
Fig 2 (above) Connecting to the shared modem on the SAPS server from the client workstation

means a couple of good SMC or 3Com cards and a length of thin Ethernet cable to connect the two together.

If you take things slowly and try not to run before you can walk, then it's not too much of a problem. The main thing to consider when setting up a network card is to make sure that it works properly before you try to do anything with it. There is no point in attempting to use a network card when you know you have an interrupt problem with it. Networks are layers built upon layers and if the foundations aren't right then everything else is going to fall down: I may get a couple of cards and go through the basics of setting them up.
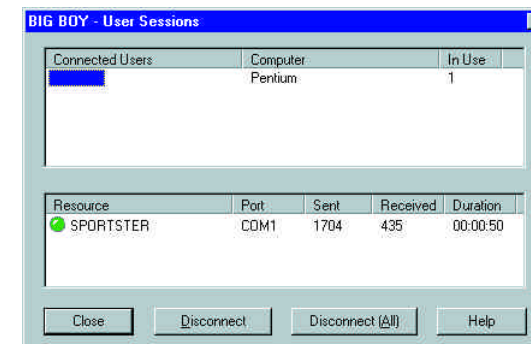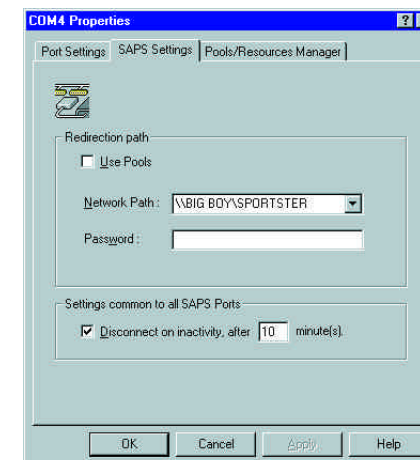
One of the letters I have received this month comes from Barry Phillips who has a small network running but wants to send email to his colleagues. While I was considering his question, it occurred to me that this might be a better way for me and my team to share each others' files at times, rather than simply saying "It's called snigger1.gif in AntWeb\Blue\Test\Final on Big Boy". So I may also go through the basics of setting up a Microsoft Mail PostOffice on our system in the near future and tell you how we get on.

I have most probably

apologised before about spending a lot of time talking about Microsoft products like NT and so on, but the simple fact is that

Fig 3 (below, top) The modem seen as a shared network resource from the client
Fig 4 (below, bottom) The SAPS Server Manager shows the activity of any open sessions

just get on with it. If you are running Windows 95 all you need is the networking hardware (all the essential software is included in the basic product) and this

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there's a lot of Bill's software out there and it seems sensible for me to write about what you are likely to be using. And, although I occasionally use NetWare for testing, I never, ever touch OS/2 in any shape or form. Sorry.

So last month, having shared the printer using the Intel Netport Express PRO/100 Print Server and then having shared a single modem using SAPS this month, the next may well involve my setting up an internal email system using MS PostOffice and Exchange.

Or, I might just take my dead fileserver, "Pig", down to the beach and set fire to it. We like burning things in Sussex. (Ever been to the Lewes Bonfire Festival? You should go, it's great.) Or there again, I may just change my mind. On the other hand...

Booking in

Q. *"Could point me in the right direction regarding the connection of two PCs I have at home? I know I can use a Null Modem cable (and have successfully done so) but I want to try using network cards and cables. Can you suggest any FAQs or good books on the subject?*

"By the way, is it possible to connect WFWG to a machine with Win95?"

Sanjay Patel

A. A reasonable book is *Nets and Intranets with Win95* by HD Radke (ISBN 1-55755-311-4), published by Abacus. Don't worry about "Intranets" being part of the title; it is much more about basic Win95 networking fundamentals, although you might find something just as good, or better, in your local book store.

I am not too hot on FAQs and newsgroups but a bit of net surfing might reap rewards. But be warned: I have found some stuff on the net which is just plain wrong. And yes, it is possible to connect a WFWG (Windows for Workgroups) machine to a Win95 machine. I do it all the time.

Exchange and start

Q. *"I have a LAN consisting of four computers running Windows 95. We can access one another's hard drive but that's all we can do between us. Is it possible to send memos, etc, to each other? Do we need particular software to do this?"*

Barry Phillips

A. As you will already have gathered, my approach to networking is KISS (which stands for "Keep It Simple, Stupid") even though the rest of my life seems amazingly complicated, so I would suggest that if you are running Windows 95 you use the basic tools that come with it and see how they work for you. If you really find that you need something more, then start looking around.

Every copy of Windows 95 comes with Microsoft Exchange which you can use for sending email to your colleagues or for sending faxes. However, I must confess that I only use it for the latter because I find it easier and far more satisfying to shout at my colleagues and/or write things down on bits of paper (...and then promptly forget about them!). But seriously, I reckon that you will find Exchange is reasonably easy to install and use.

A simple way to check whether or not Exchange is installed on your machine(s) is to see whether the Inbox icon is on your desktop; if it isn't, then it isn't, if you see what I mean.

It may well be that when you go into Exchange, you can only see Fax services. If this is the case, you will have to go into Control Panel, Add Remove Programs, Windows Setup, Microsoft Exchange and check Microsoft Mail Services.

However, before you do all the Exchange setup, you will have to set up a Microsoft Mail PostOffice. But this is fairly simple to do: go into Control Panel again, choose Microsoft Mail PostOffice and set up a new post office. Of course, the machine with the post office on it will need to be on all the time and will have a slightly heavier load than the other PCs in your organisation, but this shouldn't cause too much of a problem.

Once you have Mail and Exchange up and working, you can set up a Memo template in Microsoft Word (I am assuming that you are using Office like 95 percent of the rest of the world) then simply send these Memos to whoever you like, using the Send or Routing Slip option that you will find on Word's File menu.

As I say, there are other mail programs on the market, but as the Microsoft one is there, why not use it?

Pigs might fly

Mark Baynes finds hardware to be a boar, as he tries to install SAPS on Pig: even putting the boot in doesn't work. He's just in time to catch the Netport Express for a quick review, though.

Ever since I took over Hands On Networks I have had problem after problem with the hardware on my network, in particular a certain server which I shall refer to as "Pig". I would like to refer to it as "*!***?* !*?*" but apparently I can't, and anyway, if my Mum read it she would be a bit upset.

You may recall, in last month's column, I mentioned that Chris Langford emailed me to ask exactly *how* I was going to share a modem on NT Server over my LAN, and I replied that I was going to review a product called SAPS which does just this thing. So there I was, software in hand, all ready to demonstrate the wonders of SAPS, when Pig failed to re-boot. It was not resting … it was dead.

Now, this is not the first time I have had problems of this kind with Pig, so I knew it was a hardware problem and gave it a good kick, and I do mean a literal *kick*, not a metaphorical one. You should never treat hardware with too much respect and should always let it know who is boss whenever you have the chance. It responded slightly to the kick but because I was up against a deadline I had to review an Intel Netport instead. This was also somewhat problematic (as recalled here).

The funny thing was, I had copied all the data files on Pig to my other server "Big Boy" only two days before, because I wanted to reconfigure it with both NT and NetWare. Lucky, huh? The reason I mention this is that if you believe your server is going to last a lifetime, dream on. Mine is from a well-known manufacturer but has been on the blink for 12 of the 24 months I have been using it. I am not revealing the name

of the server because, to be fair, it does receive a lot of abuse — apart from me kicking it. But when I do get it back together, Chris, I will definitely review SAPS — honest.

So there I was, all ready to review the Intel Netport Print Server (*see page 315*). I had the hardware installed, with a test page printed. I decided to install it under Windows 95 because NT Server was down, but I found that the Netport management software, running under Windows 95, couldn't see the Netport so I couldn't configure it.

I turned it on and off several times and re-installed the software. I even read the Help file and realised that I needed NetBEUI installed. I re-booted but still got no joy, so I rang Intel tech support and spoke to two of their people for half an hour — very helpful but as baffled as I was — and then decided to attempt configuring from another workstation running Windows 95. Did this. Oops, same problem.

It seemed like a low-level protocol problem (it wasn't the physical media) and my instinct told me that the root of this problem was in Windows 95 itself, not with the Intel software. So I then installed the software onto another machine running NT Workstation 4.0: it instantly saw the Netport and allowed me to configure it.

I know I should really find out exactly what the problem was with Windows 95, but while my server may be a Pig, I also know that quite often, when networking, Windows 95 is a complete dog.

Next month: how to remove the impression of a size-ten boot from your server side panel.

Fig 1 The main screen of Intel Netport Manager *(see mini-review, page 315)*
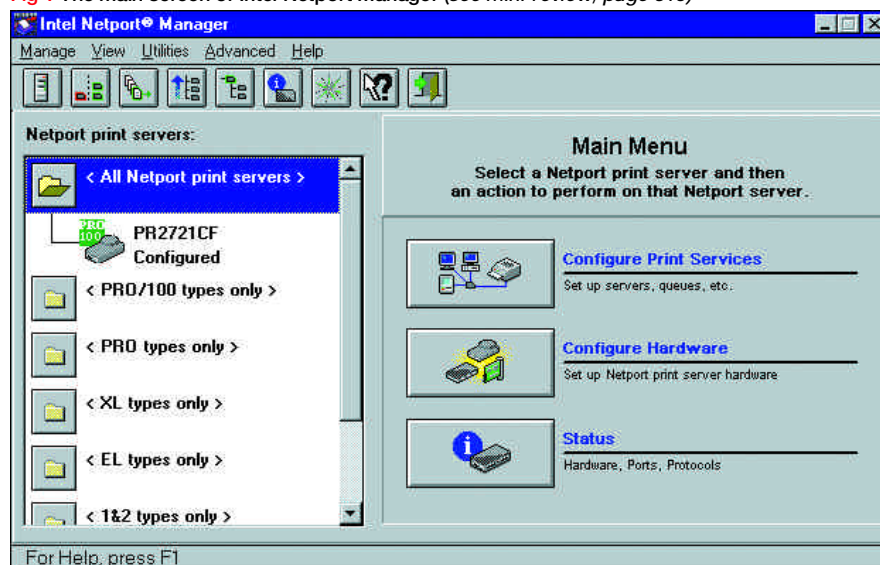
Mixed bag

A few words about correspondence: I am pleased to look at any queries you email me and find them very interesting, so please keep them coming. But I should point out that (a) due to lack of space I cannot print replies to them all, and (b) due to the lengthy process inherent in producing something the size of *PCW*, there is a significant delay between my receiving them and my reply appearing in this column, so don't wait for me to come up with a fix!

I will always tend towards answering the more generic questions as these are going to be of more use to more readers. And I will also favour those from individuals or those with limited backup support.

I received a query recently from someone working for a well-known IT consultant which charges hundreds of pounds a day for advice. I say to them: "Sorry, this column is for those of us who deal with little networks!"

OSI models and protocols

Q. "*It was good to see coverage of the OSI model in your column but I think you should make a distinction between the model, which applies to almost all comms protocol stacks, and the OSI protocols, which have a small user base, particularly now that the IP suite has taken over the world.*

"*Your example of two developers in California and Peckham being able to co-operate using the OSI model to interface network widgets would only work if they were using OSI protocols throughout. In fact, there is so much room for interpretation that the widgets would most likely interwork only if they were following a specific OSI profile such as GOSIP. Such profiles are the closest thing to 'an OSI stack', but to use the 'OSI stack' is seriously misleading.*

"*On the software side, there is also no reason why developers A and B should use even remotely compatible APIs. This has been a major problem with OSI and required the invention of things like System V Release 3 Streams and other models for the software side of protocol stacks.*

"*The API deficiencies of OSI are another reason why IP has taken over. The latter has a straightforward sockets API rather than a plethora of higher level APIs, and allows selection of suitable presentation/session layer functionality, depending on the application.*

"*For example, OSF DCE RPC has a very*

complex presentation layer function, while Telnet's is extremely simple, each being appropriate to the application domain."

richardd@cix.compulink.co.uk

A. Richard, thanks very much for your letter and for clearing this matter up. Any more questions about protocol stacks are coming directly your way!

Halfway house

Q. "*I was interested to read in the February issue of PCW that you intend to connect four PCs together using 10-Base T and to attach further resources straight to the hub. I have a similar situation. I have a 10-Base T network of four PCs plus two printers, and I would like to achieve independence of the PCs and the printers. We run a variety of software: at various times a machine might be running any of OS/2, Windows 95, Windows NT Workstation or Windows 3.x.*

"*The peer-to-peer style of networking permits each user to share resources such as printers, and to allow other workstations access. For example, workstation A has a printer and workstation B may use the printer as an output device. I do not like this example because the printer is owned by workstation A. I would like the printer to be a network device in its own right, and available to both workstations A and B. In the server style of networking the printer is owned by the server. The server is running permanently and allows workstations access to the printer.*

"*I want a halfway house situation where the printer is not owned by any workstation or server. I want the printer to be an independent network device in its own right. Any workstation may send work to the printer whenever it wishes.*

"*There are many sources of standalone box which will allow a printer to become a network device. All I have identified are intended for use with a server operating system. The printer, although connected as a network device, effectively becomes a slave of one particular server.*

"*Do you know of any software, or hardware/software combination, which will allow the same printer to be addressed as a network device from multiple workstations, with no server involved? I don't expect you to identify a solution for all of the software environments — any of them would be a start!"*

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Mini-review — Intel Netport Express PRO/100 Print Server

■ I have been trying to get my hands on one of Intel's Print Servers for quite a while now. I have reviewed a few print servers and, to be quite honest, a couple of them have been extremely poorly made. The Intel is quite the opposite, however, and is designed to withstand wear and tear.

At the front of the unit are the three printer ports, two parallel ports and one serial port, and on the left-hand side is an RJ-45 socket for a length of 10BaseT. There are a couple of recessed DIP switches, a diagnostics button and the connector for the power supply. The documentation is good, the first page of the Quick Start guide showing

Fig 2 (right)
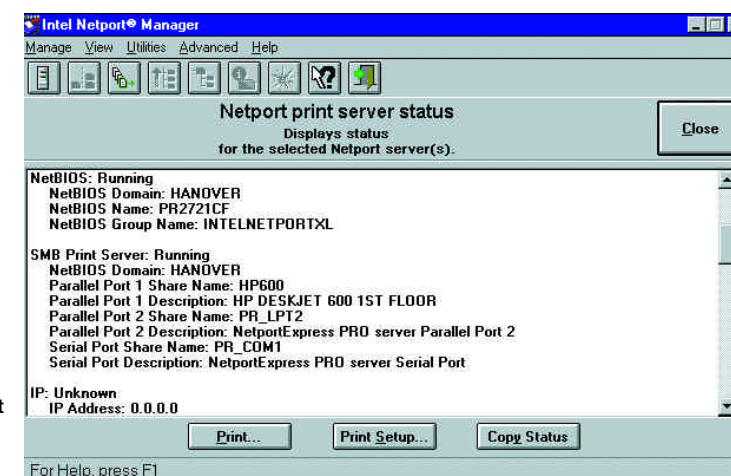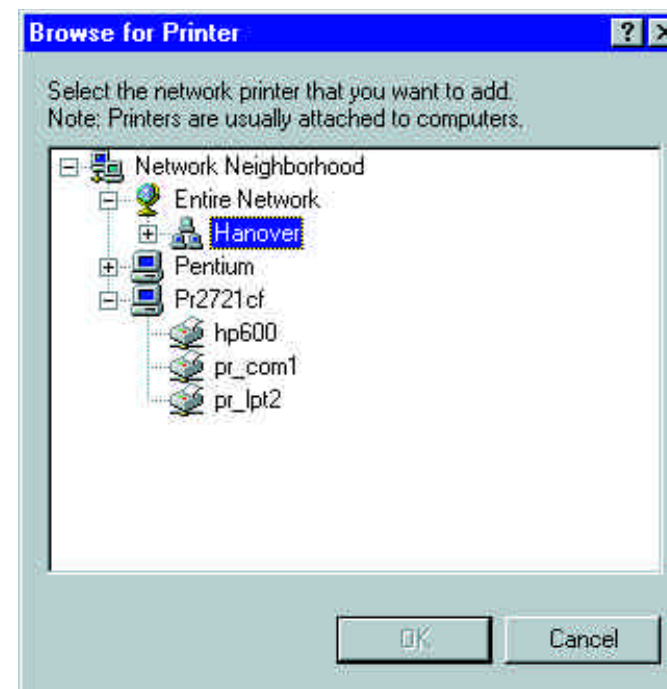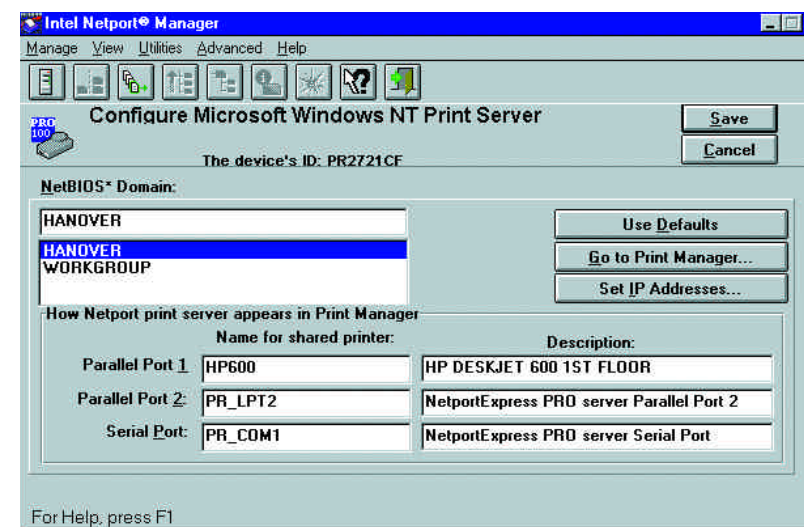**The Netport print server status**

Fig 3 (right)
Basic identification details of my DeskJet 600 attached to the Netport

Fig 4 (below)
At last! The Netport seen as Pr2721cf under Windows 95

how to connect your printer(s) to the network.

I plugged in the Netport Express and the Activity, Transmit and Receive lights on top of the unit began to flash. I connected the existing printer cable from my tried-and-tested HP DeskJet 600 into parallel port one on the Netport Express and

plugged a length of cable into the RJ-45 socket. It will auto-detect if your ethernet network is running at 10 or 100Mbits/sec. To test that all is well from a hardware point of view, you simply press the diagnostics button on the side of the Express and it should print a diagnostics report. Hardware setup time is three minutes.

I next installed the software. Network operating systems supported are Novell, NT, Windows 95, Windows for Workgroups, LAN Manager, IBM LAN Server and AppleTalk (Unix is also supported). I chose to install a 100MHz Pentium PC running Win95 and this is where my problems started — I could not get the Netport software (running under Win95) to see the Netport, but I eventually installed the software onto another PC running NT Workstation 4.0 and this went very smoothly indeed.

This is a nice, high-quality piece of hardware, but it's not cheap.

PCW Details

Price £468.82 (£399 ex VAT)
Contact Intel 01793 431155
Good Points High-quality, good management software but…
Bad Points …potential problems installing under Windows 95.
Conclusion Handy piece of kit for the small-to-medium-sized ethernet network.

A. This is an interesting one! I have the feeling that what you are after does not exist, although I could be wrong.

In a peer-to-peer situation, a printer hangs off a specific PC which is, in fact, a print server for that PC dealing with the print queue. In a server-based LAN, the printer can hang off the server or, more likely, be an independent physical network device in its own right (*see mini-review of Intel Netport Print Server, page 315*) but — and it is a big "but" — the print queue has to be managed somewhere by the NOS. In a server LAN, this is going to be the NOS running on a server.

So your ideal of "a halfway house situation where the printer is not owned by any workstation or server" is not really possible because it has to be managed by something.

There goes the Neighbourhood

Q. "*I have a 486 DX4 100 running Windows 95 and a Pentium 75 with NT W/S 4.0.*

"*Things ought to be going smoothly — after all, this sort of setup is Microsoft's dream, is it not? Well, unfortunately, the Windows 95 machine shows no computers in Network Neighbourhood — not even itself — even if the 'T-piece' on that machine has a terminator on both ends. The Entire Network icon exists but when attempting to open it I get the message: 'Unable to browse the network … it is not accessible'.*

"*The NT machine allows browsing of the network, but the other PC (the only other one on the network) does not show. I have toyed with the idea of a hardware fault, but I have tested everything I can think of and that appears not to be the case.*

"*I am a newcomer to networking and can't be sure all the settings on either machine are correct, but I am fairly confident. Any ideas? (The protocol I am using is TCP/IP, but I have also installed NetBEUI.)*

"*If I enable file/print sharing on the Win95 machine, it does appear in Network Neighbourhood although it takes a couple of minutes for this to happen, during which time it is still unable to browse the network.*"
alexi@margo.demon.co.uk

A. It is nice to know that this happens to other people apart from me! Don't worry about being a networking novice: I have been doing this stuff for over five years now and I still often find that after zapping my PC's hard drive and carrying out a reinstall (which I do on a regular basis to clear out all the dregs of software I have reviewed), I still get this problem from time to time.

I cannot tell you definitely what the problem is but try this:

1. The first thing to do when you have any network connection problems is to check the physical media — do you know for certain that the network cable works properly? Can you borrow another one on a working system for a while and try it with that?

2. Are you certain that the network cards in each machine work? If not, get their installation disks and run the self-test diagnostics. Then double-check to make sure there are no interrupt clashes; you can do this by looking in Settings/Control Panel/System.

3. Have you tried the Network troubleshooter in Windows 95 Help? This is quite good and has saved my bacon a couple of times.

4. Remove all your network software components and start again, but to start with try just running something simple like IPX or NetBEUI, before trying TCP/IP which is about as much fun to configure as putting your hand into a waste disposal unit and turning it on.

5. Have you tried Find Computer from either the Start menu or Windows Explorer? I have found in the past that although a computer will not show up in Network Neighbourhood you can "Find" it. Strange but true.

6. Zap both PCs and start again. It's a drastic measure but it often works. It depends how much software you have installed on them because some programs can, for no obvious reason, have side effects on others.
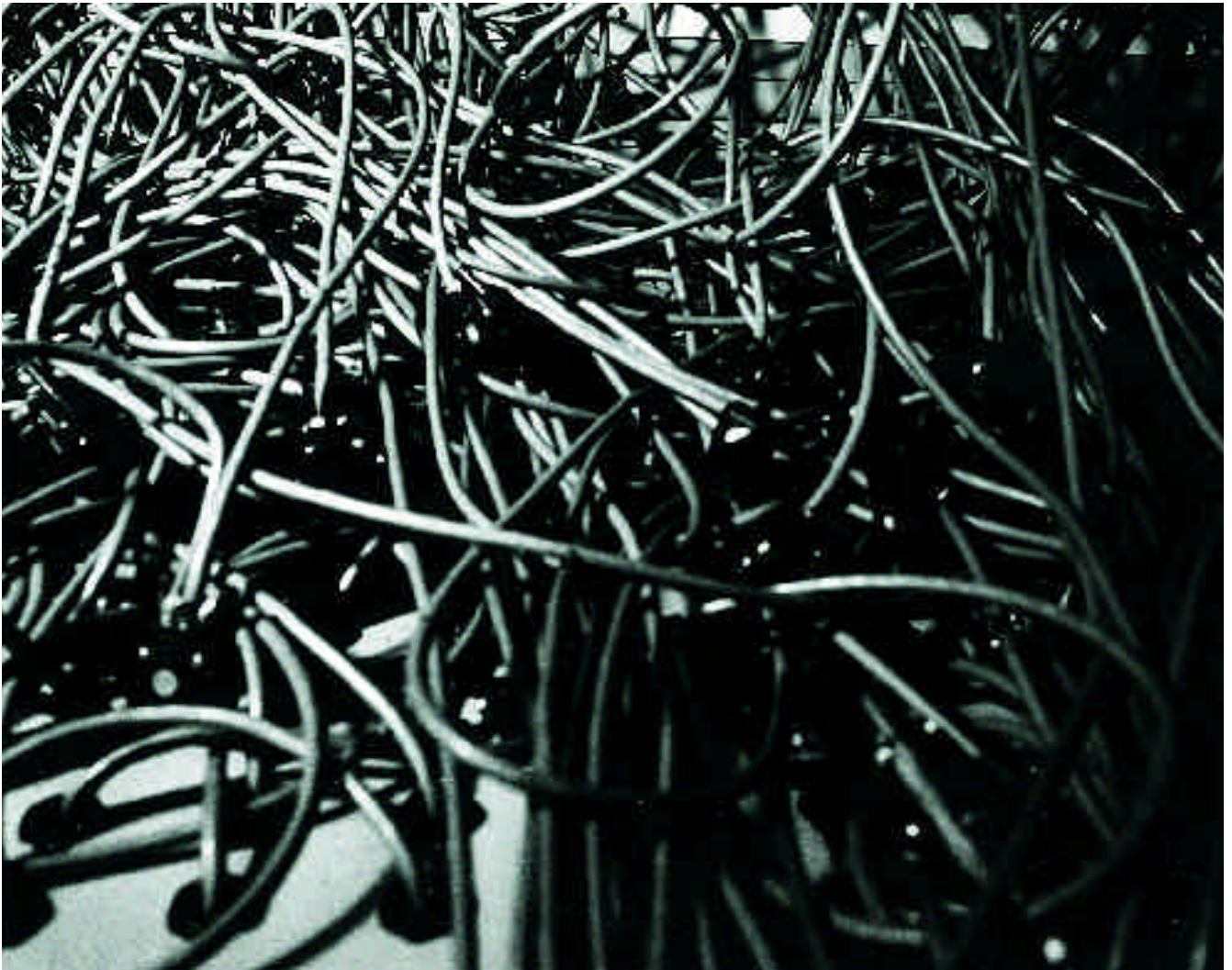
Cabling for company

Mark Baynes and his colleagues have a new office. All they need now is to get it networked. Mind you, there's always the good old shouting-up-the-stairs routine to fall back on. Plus, The Squirrel tries LAN management, and Dell's PowerEdge serves up a treat.

During the past few weeks I have been running around like a mad thing cabling up the office so that my colleagues and I could enjoy basic networking comforts like sharing a printer and sharing files on the file server as we get our first few web sites under way.

We all met while taking an MA in Multimedia at Sussex University and, in the multimedia lab at that time, we did not have a file server or any form of networking apart from internet access. The main reason we were not networked to each other was because the university systems staff thought that we would start sending multi-megabyte multimedia AVI files to each other (and yes, we would have); this potential problem being exacerbated by our position

on the university system. So what we did was simply shove files onto the PD drives with which the PCs were equipped and transferred them from one machine to another in this fashion — fine, but at times a bit of a pain.

Of course, the first day in the office, one of my colleagues could be seen wandering from one networked PC to another with a floppy disc in his hand because his files were in different places. I must admit I did wait until 5.00 p.m. until I explained that because all the files were on the file server, and that all the PCs were connected to the file server, he did not need to do this… Well, it kept me amused.

Another communications problem we have is that our offices are on three separate floors. We do not have an internal telephone system installed, so this leads to us conducting conversations while leaning over the banisters and shouting at each other. Someone suggested that we should get some whiteboard software installed on the LAN but I think it might be a lot cheaper and more efficient to buy an intercom. The low-tech solutions are usually the best. Or we could move to a single, larger office. But then we would have no good reason to shout at each other — not.

Getting kitted out

A friend of mine, with whom I occasionally undertake network consultancy (aka The Squirrel), has been tearing his hair out trying to make a newcomer to the wonderful world of LAN management understand that running ten networked PCs is ten times as complex as running ten standalone PCs (although you get far more than ten times extra productivity from the networked system), but to little avail.

This LAN newbie is a real gadget freak whose main goal in life seems to be to spend as much money as possible on a new 18-node network that he wants installed, irrespective of what he and his company actually needs to get the job done. (At the moment every PC has its own printer— honest.) Unfortunately some other networking firm, the employees of which all wear Stetsons, shoot from the hip and call their company cars Tonto, are intent on fulfilling the newbie's dreams and letting him spend about £30,000 more than he needs.

I have this nasty feeling that if everybody only bought the amount of networking kit they needed, rather than what they wanted to play with, then the network industry

would be only half the size it is. We have mixed feelings about Mr LAN Newbie. Yes, we could get a nice contract, recommend and install kit for only half his budget which would do the job he wants it to do, and we could make a profit; but would he actually realise that it was capable and that we had done a professional job for him?

There is the occasional temptation to agree to install the massive file server this guy has wet dreams about, and the extra 16Mb RAM in every PC he insists is necessary, but we both think it would make for a much easier life to just forget about the whole thing.

Server sense

Anyway, back to the subject of this month's column, which was going to be "Ethernet and Fast Ethernet explained". But it ain't, for the simple reason that a Dell PowerEdge server has turned up for review (see the separate review, opposite) so I am going to talk about file servers instead.

Exciting, huh? Well, more interesting than a load of theory about collision detection, anyway. I have fond memories of Dell servers because the first EISA server I ever configured was a Dell and somehow I managed to do it without (a) the manuals and (b) any knowledge of what an EISA server was.

One of the first things to bear in mind when buying a server is that it is not a go-faster PC. Yes, it may have a faster CPU, more RAM and more hard disk space, but the main requirements of a server are that it is built like a tank and that it is reliable. If someone tries to sell you a server on the basis that it's got a really high-end graphics card, walk away: you only need a basic colour monitor and they do not know what they are talking about.

If the system unit cover is a pain to remove, then it is highly likely that the whole system has not been designed very well. Look inside the unit and see if the wiring is carefully arranged and tied back so that you can access the cards and system board. Can you upgrade the RAM without having to remove any of the network cards? Are the standard hard drives from a good-quality company? Can you buy a RAID system from the same manufacturer?

Ignore any benchtests. Benchtesting of PCs such as you find in *PCW* or other mags are usually good indicators of performance, but benchtesting file servers is complete and utter nonsense. Most benchtests of file

Dell PowerEdge 2100/200

The Dell PowerEdge 2100/200 arrived for review installed with a 200MHz Pentium Pro with 256Kb cache, 64Mb EDO RAM and 2Gb Seagate SCSI drive, and integrated Adaptec AIC-7880 ultra-fast and wide SCSI controller. There was also an NT Server v3.51 (4.0 by the time you read this) and an Intel LANDesk Server Manager v2.5 pre-installed. Integrated server management circuitry monitors the state of the system fan as well as other critical system voltages and temperatures in conjunction with LANDesk, so you can find out exactly how hot your Pentium runs (Fig 1), the activity of installed network cards and protocols (Fig 2) and just about everything else.

The PowerEdge has a mini-tower type of system unit which is quite wide; a minor but important point as it is quite difficult to accidentally tip a unit with the dimensions 44.45 high x 24.13 x 41.91cm deep and weighing 17.68kg. The front of the unit is dominated by a large ventilation grille which, in conjunction with the large and noisy fan at the rear of the unit, should maintain the airflow over the system board and the hard drives.

There are the usual floppy and eight-speed CD-ROM drives and one free bay for a tape device. Plus points to Dell for taking the trouble to recess both the power and reset buttons so that there is no way they can be hit in error. Between them there is a SCSI drive activity light. The rear of the unit is fairly unexceptional, with the usual I/O ports and such like, except for a blanking plate where you can install a

system cabling which is neatly bundled together and attached to the top of the unit. There are three EISA/ISA and three PCI slots available. One of the PCI slots is occupied by an Intel EtherExpress Pro/100 Ethernet adaptor which can auto-sense whether you have a 10Mbps or 100Mbps network connection.

Although NT Server has always had basic system management software included, you really need a third-party solution and Intel's LANDesk Manager is a good option. The amount of detail it provides you with is more than adequate for the majority of daily LAN management tasks you will undertake, and if you take the time to configure it properly, you will have a comprehensive system available

Fig 2 (below) LANDesk Server manager showing the activity of the network card
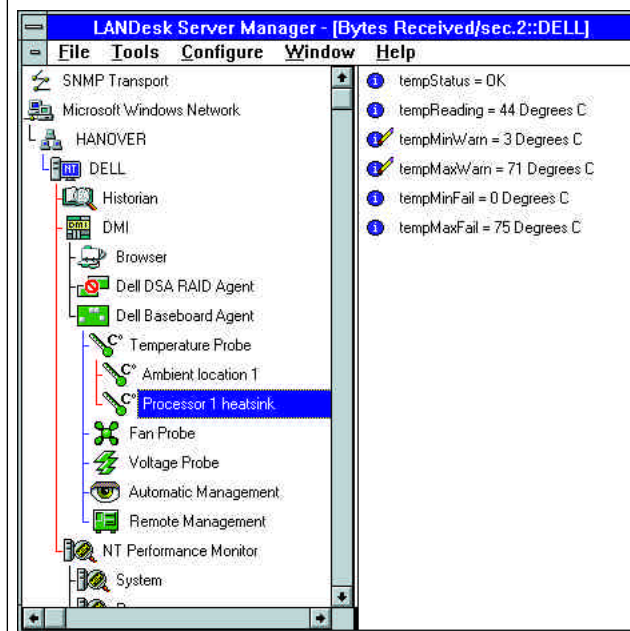

Fig 1 (above) LANDesk Server manager showing Dell Baseboard Agent details of Pentium Pro temperatures

server management unit if required. Removing the rear casing is fairly straightforward because once the security lock has been removed there are only four screws to be undone and the cover slides off easily to the rear.

Inside, the unit is neat and tidy with plenty of room to work when installing extra network cards. The Pentium Pro itself is hidden beneath a massive heat sink at the top of the system board. The four RAM slots are easily accessible and are not obscured by any of the
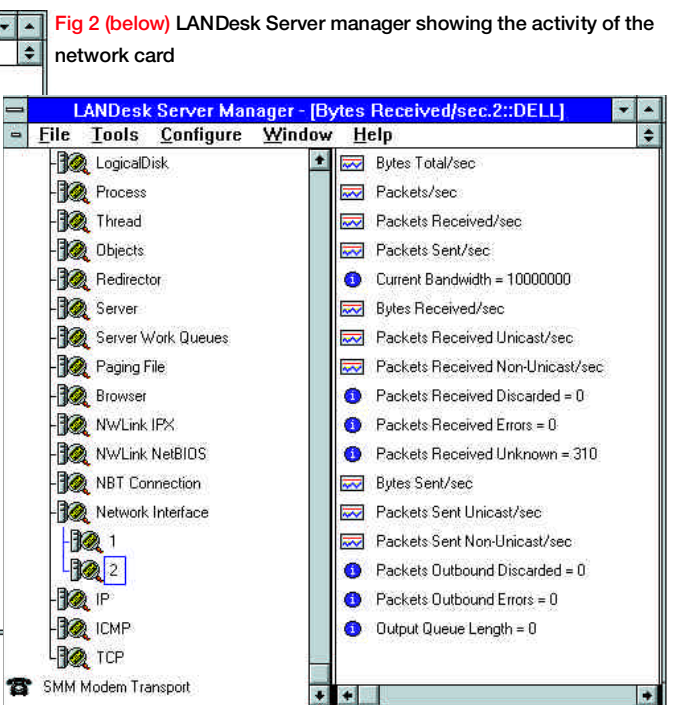
which should make your working life more bearable. Documentation is very good — just about the best I have seen.

I attached the PowerEdge to my system and used it as an auxiliary server for several weeks, and found it to be tough and reliable. Pricing for the system specification reviewed here at the time of writing was £3,878 inclusive of 15in colour monitor, NT Server and LANDesk Manager, so the PowerEdge should be near to the top of your list when considering a new server for your LAN.

■ Dell Computer Corporation 01344 724883
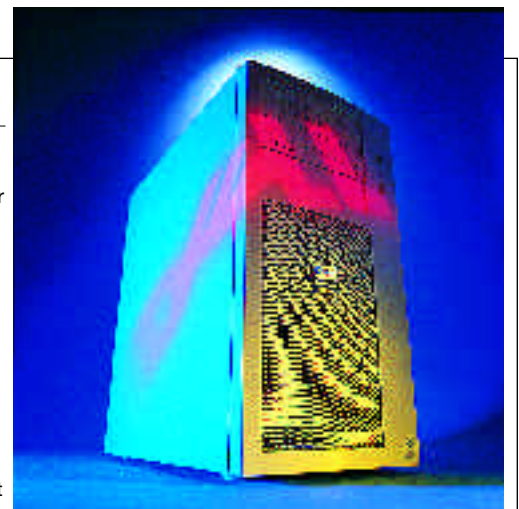
servers are usually just tests of the network card. But even if there were such a thing as a valid benchtest of a file server, it would still be of dubious value because the benchtest was not undertaken on your particular network.

Think of your LAN as one big distributed computer of which the file server is one (but not necessarily the most) important component. A benchtest of your file server is rather like benchtesting the latest Pentium CPU without reference to the system within

which it will run. If it is put in a well-organised system, a fast CPU will improve performance. But put the same CPU in a badly organised system and it may not improve performance at all. Get the idea? The same is true of file servers within a LAN.

Which brings me to my final point. If your LAN is running slowly, do not think that merely buying a new server is going to make it run faster. You would probably be better off taking the time to analyse the performance of your LAN over a few weeks and properly identifying the cause of the problem. If you then find that the server *is* the problem, analyse server performance for a while.

If you have exhausted all possibilities, then think about buying a new one, but not before. You could find that spending £150 on a new network card would give your LAN just as much of a performance boost as a new server.

But now I must turn my attention to the most fundamentally important LAN management task that I have yet to undertake — getting the first networked game of Quake under way!

Questions & Answers

I have just started to receive the first of your letters and have been intrigued by the variety among them. If I cannot find an answer to one of your queries, I will let you know, but I hope that I will be able to help in the majority of cases.

Don't be afraid to ask really simple questions because quite often these are the ones that other people would like to ask if they were not so shy. And, if you have any useful information you would like to share, do let me know.

A modem shared

Q. "I read in your Networks column in the December issue of Personal Computer World that you were installing a modem as a shared device on an NT Server. How is this done? I can't find any option in NT Server to allow you to share a modem."
Chris Langford

A. NT's Remote Access Service (RAS) is primarily designed for remote access by remote nodes and does not support a dial-out modem pool for users on a LAN (which is what you and I want to do) but there are third-party products which allow you to do this. One of these is SAPS modem sharing software from SpartaCom (tel 0181 357 3600; web address www.spartacom.nl) and costs around £95 for the single-modem NT server licence and £195 for five-client licences. I reviewed a previous version about 18 months ago and remember it as being simple to install and effective. However, I have the latest version on order and I hope to review it in Hands On soon.

Home network

Q. "I am an avid reader of Personal Computer World and enjoy your Hands On Networks section, even though I don't yet run a network! I would nevertheless appreciate some advice on a networking issue. I am a student attending Nottingham Trent University, taking a computer science degree course. We have just started to learn Java for producing client/server software for a distributed systems module. In order to be able to do this work at home, I need to set up a TCP/IP network on my Windows 95 machine. I do not have a network card, but was wondering if it were possible to set up a form of network on a standalone PC?"
Mark Jessop

A. You cannot really set up a network on a single PC, but then, this doesn't matter because for your purposes you don't need to. In order to be able to access the internet from a Win95 PC you have to set up TCP/IP (via the Microsoft network client) on it, as this is the protocol on which the net runs. When you connect to the net, your PC becomes part of the network. The reason you can do this is that a modem is regarded by Windows 95 as a "dial-up adaptor" and this is what TCP/IP is binding to. However, I do not know the full details of what you want to do with yummy Java (although I am running a web design company, I am avoiding having to learn it — I found Prolog was bad enough) but I suspect this might take you part of the way. If you do not have a modem, however, you may well be stuffed. Sorry!

PCW Contact

Mark Baynes is a web developer and IT journalist based in Brighton. He can be contacted by post at the usual *PCW* address, or email networks@pcw.vnu.co.uk

Transmission
without tears

Mark Baynes tackles the serious subject of organising communications for his own business. He eases himself into ISDN, and gets to the nub of some networking basics.

The more networking I do, the more I realise how little I know. While many networking professionals can specialise in their particular area (Banyan Vines, routers, ISDN, and so on), I feel that I am more akin to those lucky people within companies throughout the UK who have had responsibility for networking thrust upon them — in other words, you have to be a "Jack of all trades". Yet what this person becomes, however, is a master of one subject; delivering the right mix of PC networking technology which is right for their company.

At the moment I am in the early stages of establishing my web design company, Ant Web at www.ant.uk.com, and am therefore considering the basics of what myself and my business partners need in terms of networking. For the past few months, while we have been in the brainstorming and planning stages, we have been able to work at home, meet up on a regular basis and communicate via email and the telephone, but as we now have some real sites to build, we soon realised that we needed to be in the same place at the same time.

Home truths
There is an awful lot written in the various magazines and IT sections of the national newspapers about home working and telecommuting but a lot of it is complete nonsense. The first thing is that the people who write this stuff frequently get seduced by the technology (I, too, have been guilty of this in the past) and forget the obvious; like the fact that it is much simpler to collaborate on a project with a person who is in the same room as you. Yes, if that person is on the other side of the world and you cannot be in the same room then technology may be the answer, but it is still nevertheless second best. Videoconferencing, groupware, email, whiteboarding and all the other wonderful techno-goodies are really useful but we should remember that these are substitutes.

The reason I raise this is that, for the last few weeks, I have been meaning to get around to establishing a remote access server to which we can all dial in, but fortunately, like most of my bright ideas, I never quite got down to it. But I will, at some time or other, because there is no doubt that we will have a need to access centrally-held data, either from our homes or while on the road. But it is not the priority it once was.

The basic jobs I have to do are: (a) establish a LAN in our office; (b) ensure that shared resources such as fax, email and web access facilities are available; and (c) devise the world's best data backup system for the LAN.

To a certain extent, I regard the provision of a basic LAN as pretty straightforward in terms of connecting four PCs together, as I will simply hook them up using 10BaseT via an Ethernet hub and attach further resources such as a server, printer and ISDN router, straight off the hub.

For the past couple of years I have been able to configure my own LANs just as I want them, but this is a bit different as I have to cater for the tastes and needs of three other people, so no doubt you will be hearing a lot about this on a regular basis.

Into ISDN
Last month, as regular readers will remember, I was due to have my Basic Rate ISDN installed. This has now been achieved with a lot less fuss than I thought. You can read a feature on ISDN basics elsewhere in this issue [page 106] so I won't bore you with the details again here; suffice it to say that there is more to ISDN than mere speed and I am carefully considering just how I can make the best use of ISDN's flexibility for my business.

One of the many different ISDN access devices that came my way was a beautifully-built 3Com OfficeConnect Remote 530 ISDN router. Within minutes I was fiddling around, unsuccessfully, trying to use this to connect to Pavilion Internet, my ISP. One of the main reasons I could not get it to connect was that to use a router for ISDN access you need rather more than one dynamically-allocated IP address.

For a network ISDN connection you need a bunch of 16 "class C" addresses. The first and last of these addresses are reserved. You will need one for the connection to your ethernet LAN so you

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Baynes on books

■ Nets and Intranets with Win95
Author HD Radke
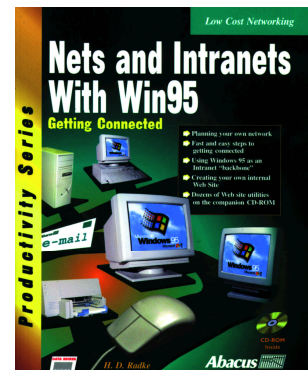**Price** £37.49 (CD included)
Publisher Abacus
ISBN 1-55755-311-4

For those who are new to networking, a single source of the most basic information is frequently hard to find, but *Nets and Intranets with Win95* might fit the bill. This 319-page book provides a basic approach to networking small LANs without talking down to the reader.

The first chapter, entitled "What Should Your Network Look Like?", is concerned with planning and deciding what type of network you should aim for: direct cable connection, Ethernet with Win95, a Dial-Up system or a server-based LAN; and provides you with "what you need to know" to get you started. Another chapter moves on to upgrading PCs and the basics of installing network cards. Although the accompanying photographs are not very clear, they are adequate. A useful flowchart, which guides you through the installation process, is a great help. Elsewhere, the book moves on to the subject of configuring Win95 networking and installing Microsoft Exchange.

The basics of sharing resources across a LAN, how an office works using a LAN, and mobile computing are also covered. The only weak part of this book is the final chapter, providing only a cursory explanation of intranets, but this doesn't really detract from the overall usefulness of the book. The focus on Microsoft products such as Exchange and MSN can also be forgiven. Recommended for the first-time networker.

■ Using Windows NT Workstation 4.0 Special Edition
**Author** Paul Sanna *et al*
Price £46.99 (CD included)
Publisher Que
ISBN 0-7897-0673-3

This is a monster 1,198-page book with a price to match. NT Workstation 4.0 is gaining popularity as a robust OS with the ease of use of Win95 and none of the hassle of Unix. But Microsoft's documentation is not extensive (although there is a lot of on-line help) so you are really going to need a book like this one, to be able to make the most of Workstation 4.0.

The first chapter is the usual introductory stuff and it is not until you get into chapters two and three that the really useful information is provided, which will give the Win95 user a reasonable understanding of why NT Workstation 4.0 could be described as "Windows for Adults v1.0".

The networking section is okay and a reasonable description of TCP/IP configuration is provided, prior to the chapter on using Windows NT with the internet. Using Internet Explorer, Mail and News is covered in succeeding chapters, although only v2.0 of Explorer is dealt with. The accompanying CD is stuffed with useful shareware and some sections will also be of use to advanced Win95 users. This book is worthy of consideration if Workstation 4.0 is becoming a part of your network.
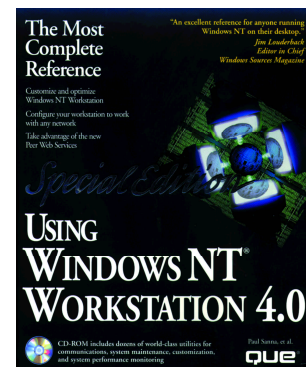
Review books supplied by Computer Manuals. Telephone 0121 706 6000

have 13 remaining which you can allocate to users. Some vendors are advertising these small ISDN routers as being ideal for the home worker, but quite how it can be economical to supply one homeworker with an ISDN router costing £800 when a TA or card will do the job for £200 is rather beyond me. But then, what do I know?

Transmission threesome

But before I get carried away with the delights of routing let's get down to some networking basics. Why not start at the bottom of the OSI stack with the actual physical transmission media itself?

There are essentially three different types of transmission media. The first of these, and the most common, is a conductive metal such as iron or copper. The second type is optical fibre and the third type is not physical at all but, literally, wireless.

Apart from the actual costs of installing and using different network media types there is the all-important issue of bandwidth. To be really technical you should talk about the data rate of a particular media as being the number of bits (not bytes, remember) that can be transmitted per second, and the bandwidth as being the difference between the highest and lowest frequencies that can be transmitted, the frequencies being measured in hertz (Hz).

In practice, the data rate of a network: 128Kb/sec for two, bonded, ISDN B channels; 10Mb/sec for Ethernet; and

Different types of datacommunications — an overview

	Twisted Pair	Coaxial cable	Optical fibre	Microwave	Satellite
Data rate	Dependent on cable run length	10Mbps	400-500Mb/sec up to several Gigabits/se.	200-300Mb/sec	1-2Mb/sec
Susceptible to interference from:	Nearby wires and monitors	Well-shielded. Not much of an issue but use common sense	Immune to electrical interference	Solid objects, so line of sight is required	Atmospheric conditions
Maximum theoretical distance	Up to one mile between repeaters but dependent on data rate required	2-3 miles between repeaters	20-30 miles between repeaters	20 - 30 miles between microwave towers but dependent on positioning of antenna	Worldwide
Typical use	10Base-T/server-based LANs	Peer-to-peer LANs	Network backbone	Where laying of cable is not a practical option	Primarily used for broadcast and telephony systems
Practical benefits	Very flexible in terms of topology	Simple to install. Reasonably robust	Very high data rates	Good for links between sites where disruption of environment is an issue	Worldwide communications
Practical drawbacks	Easily damaged	Not very flexible in terms of topology	High costs	Needs line of sight	Not cheap

A short guide to datacomm terms

■ **Asynchronous transmission** A scenario where the data stream is sent, typically one byte at a time, and the receiver does not know when it will arrive. A start bit and stop are used to indicate the beginning and end of the data transmission. It is typically used where high speed is not an issue.

■ **Synchronous transmission** Where much larger quantities of data need to be transmitted and so, instead of sending characters separately, they are sent in groups known as data frames or frames.

■ **Simplex communication** Where communication occurs only in one direction; your TV, for instance.

■ **Half-duplex communication** Where data devices at either end of the network link can both send and receive but *not* simultaneously; a two-way radio, for example.

■ **Full-duplex communication** Where a data device can both send and receive *simultaneously* (say, a computer) and, as it can become more than a little complicated, this is where protocols come into their own.

155Mb/sec for ATM is usually referred to as its bandwidth.

Twisted pair is one of the most common and certainly most flexible (in all senses of the term) varieties of cabling media used for LANs which are our primary concern here. It is so called because insulated copper wires are twisted around each other and then encased in a protective shield. The twisting reduces the interference and good-quality network cabling actually consists of several pairs of wire (e.g. "four-pair"). You will find twisted pair in your telephone socket as well as in any big computer network.

Coaxial cable (or "coax") comprises of an inner copper or aluminium core which is the actual conductor of the signal, an insulating layer around this, then a wire mesh shield and an outer protective shield. Coax can transit information in either baseband mode (where the whole cable is devoted to a single data stream, which is what happens on a LAN) or in broadband mode where several different data streams are carried simultaneously (cable television is an example).

Optical fibre is something that is much talked about but rarely seen as it is typically used as the backbone of a network. That is, the main network from which the other, smaller networks (typically using twisted pair) feed into. As such, it is usually hidden in the very structure of a building or run down a lift shaft.

One of the main benefits of fibre-optic is that because it uses light (rather than electricity) to transmit data, it is immune to electrical interference. And because of this it can transmit huge amounts of data. When you first see a fibre-optic network cable it's slimness is quite awe inspiring, especially when you realise that most of its bulk is just a plastic shield. In an ideal networking world all cable would be fibre-optic and then we would all be able to enjoy the benefits of immense bandwidth. But there is a cost hit with fibre because the equipment required to convert an electrical signal to light and back again is the expensive part, rather than the cable itself.

Satellites and microwaves

Wireless networking has often been hyped as the answer to all problems. The reality is that it is only cost-effective in specific scenarios, typically where there is the need for a short-distance network link and it is not feasible to install a permanent cable: between two buildings, for instance, or where great distances need to be covered and it is not known where one end of the network will be situated (say, a mobile link).

For short distances, microwave links are used where two or more microwave devices are installed in line of sight of each other. For greater distances, the wireless link is established using a satellite to act as the signal repeater. However, *PCW* readers are advised to forget about using satellite links as part of their standard network installation — it is not cheap and not that practical either.

Next month we will take a look at how Ethernet and fast Ethernet work.

●PCW Contacts

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Stack 'em high

Mark Baynes' new guide to networking terms begins with an explanation of the OSI stack: it puts the 'work' in networks.

Panic over! No sooner had the HP Colorado T4000-S tape drive arrived than I ran down to the shop and bought a TR-4 Travan mini cartridge. I slammed — sorry, I mean carefully installed — the T4000-S into my dodgy server, Palace Pier, and within a few minutes was happily backing up three years' work. Actually, when I say "slam", I mean fiddle around for 20 minutes or so.

The T4000-S comes as a kit with DOS, Windows 3.1 and Win95 software (for more details on the T4000-S see my review panel, page 328) but I wanted to run and install it on Palace Pier under NT Server 3.5. The network card on Palace Pier wasn't working so there was little point in installing the T4000-S on my PC, and even if the network card in Palace Pier *was* working, the T4000-S is a SCSI-2 device and, firstly, my PC isn't SCSI-enabled, and secondly, I didn't have a SCSI-2 card to make it so.

I first had to go to HP Colorado's web site to download the appropriate NT drivers. Having got these, I realised that I needed to upgrade the server firmware, and having got the necessary utility from the same site, ran it and then installed the NT driver. Next, I used the standard backup facility, which comes with 3.51, to backup all my data files to the tape. I could then begin to breathe again and set about scrubbing the server hard disk, removing the T4000-S from Palace Pier and installing it into West Pier, then restoring the files from the tape to the server's hard disks so I had two copies.

There was still the problem with the network card on Palace Pier. Because the card had given me no trouble whatsoever for the last 18 months until, that is, I started faffing about with Palace Pier, I should have reasoned that the cause of the problem was Yours Truly. But I didn't. It wasn't until I was on the phone to technical support that I realised the cause of the problem was that I had somehow managed to set the interrupt for the card to 15 — which the on-board Adaptec SCSI rightfully wanted all to itself. Setting the card interrupt to 5 duly solved the problem and I was ready to install NT Server 4.0. At some point, I had managed to set the PCI configuration to its default

setting — pretty stupid really, so please don't tell anyone.

Even though I now have a tape drive in place, I still don't have a proper backup routine. I would prefer to get the tape drive out of any one network node and hang it directly off the wire. I have the same situation with my HP DeskJet 600 which has done sterling service in the last few months, printing off five 20,000-word dissertations without a glitch. At the moment, it is directly attached to my main PC which acts as a print server, but I would prefer to use a separate print server and be able to hang it straight off the network rather than having to attach it via another device. More on this next month.

Danger — philosophers at work

I am a great believer that people who are into the technicalities of computers and networks are rather like philosophers: although they quite often use terms they do not understand, they are still capable of having meaningful conversations; and because everyone thinks that everybody else *does* know what they are talking about, they are afraid to ask the really basic questions. The problem is that some people go on for years using terms which they cannot explain.

Working on this basis, I thought I would devote some time over the next few issues to explaining some of the really basic networking terms. If you are a real expert or just a plain smart-arse, you can devote your attention to other parts of *PCW*; but if there are gaps in your knowledge, read on. I will not attempt to give complete explanations of every networking term and concept, but I will do my best to provide enough information to provide you with a basic understanding which will hopefully improve both your theory and practice of networking.

OSI Seven-Layer Protocol

One of the most common terms that is bandied about, yet poorly misunderstood, is the dreaded OSI (Open System
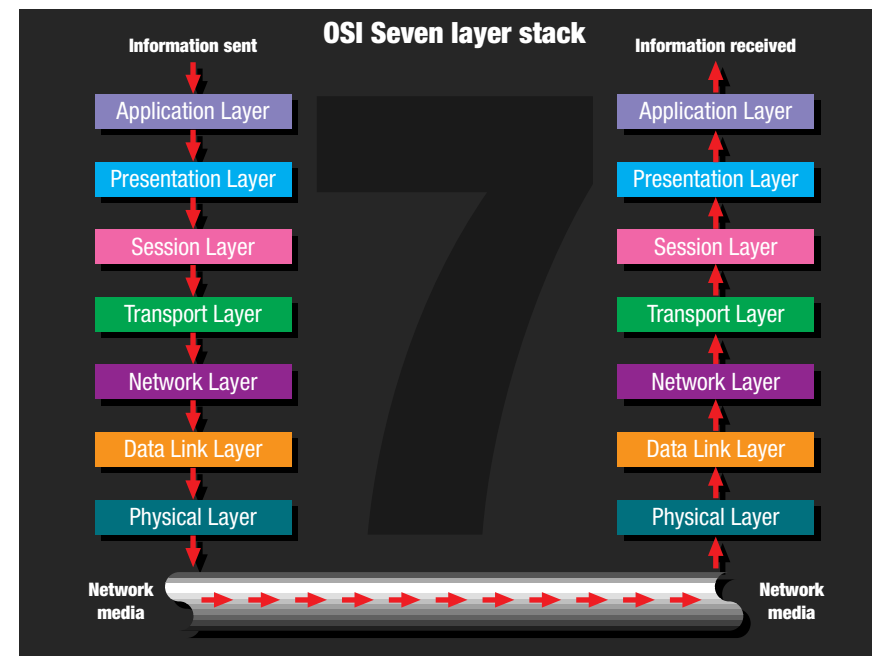
Interconnect) stack a.k.a. the OSI Seven-Layer Protocol defined by the ISO (International Standards Organisation). If you spend your days running and building LANs, you won't need to know a great deal about this. The simple fact is that without it, networks would not network. It is the most basic networking standard that allows one system to talk to another.

A developer, developing the latest and greatest networking widget in the sunshine state of California, knows their widget will work with the next latest and greatest networking device being built by a developer working underneath a railway arch in Peckham because they will be designing them to work with the OSI stack.

Networking life would be much easier if every network used the same protocol but, in the networking industry, getting everyone to agree to using the same data-communications protocol would be like getting all the hardware manufacturers to agree on the same hardware architecture — impossible. The pragmatic alternative is to have a standard way of translating between different protocols and hence the OSI stack.

Fig 1
MS Backup is plain and simple but it does the job… just about

Fig 2 The OSI stack: if it didn't exist, we'd have to invent it

Standards Committees

■ American National Standards Institute (ANSI): members of ANSI are manufacturers, users and other organisations with an interest in standards. They devise stuff likel ASCII (American Standard Code for Information Exchange). ANSI is a member of the International Standards Organisation (ISO).
■ Comité Consultatif Internationale de Télégraphique et Téléphonique (CCITT): an agency of the ITU whose members include telecommunications agencies, scientific and industrial organisations and the ISO. Some of its most well-known and commonly-used standards are the X series which is concerned with network interfaces and public networks like X.25 and X.400, and the V series which deals with telephone communications like V.21 and V.22 modem standards and such like.
■ Electronic Industries Association (EIA): members manufacture telecommunications and electronic equipment. The EIA is a member of ANSI and sets standards such as the much-loved RS-232.
■ Institute of Electrical and Electronics Engineers (IEEE): usually known as the "I triple E", its members are computing and engineering professionals and it is responsible for setting standards such as the 802 series for local area networking.
■ International Standards Organisation (ISO): international body whose members include other standards organisations and whose most important work in the computing and datacommunications field is on open systems, including the OSI stack.
■ National Institute of Standards and Technology (NIST): a US Government agency which develops a variety of standards, including the data encryption standard (DES).
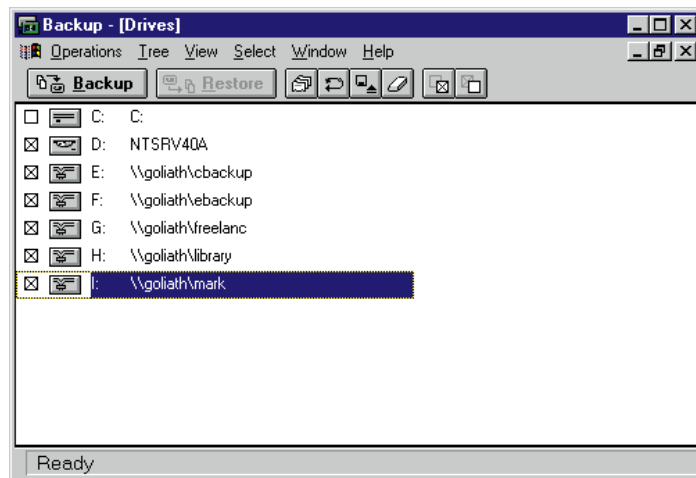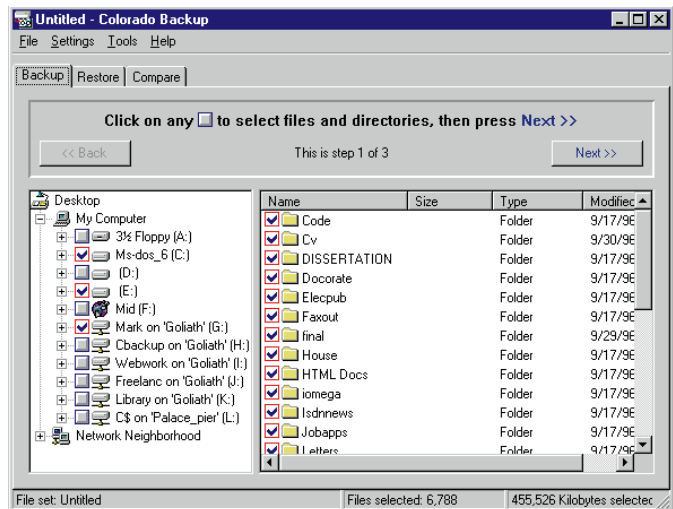

HP Colorado T4000-S

Colorado Memory Systems is a division of Hewlett-Packard, hence the slightly confusing product name. The T4000-S comes as part of a kit which includes the tape drive itself (standard 5.25in size), four installation screws, and two installation disks with DOS, Windows 3.1

and Win95 software. There is a 66cm long SCSI cable, software and installation guides and, according to the blurb on the box, a free tape (which mine didn't have). The default SCSI ID setting is four but if you need to change this the manual shows you how to reset the jumpers on the drive. If the tape drive needs to be flagged as unterminated, you have to remove three sets of terminating resistors from beneath the rear of the drive, for which you will need a pair of needlenose pliers, then slide it into a spare bay in your PC or server, connect the power and SCSI cables and reboot. I discovered that once I had the correct NT 3.51 drivers installed, using the vanilla NT backup software was quite straightforward. NT 4.0 recognised the drive immediately and I encountered no problems with the T4000-S during the month that I carried out backups at least once a day.

Whether you install this tape drive on a networked PC or a server you will, of course, be able to back up data from right across the network. And, having a capacity of 4Gb uncompressed and 8Gb compressed, it should be able to cope with most small LANs. There are also external, dedicated network and parallel port versions of the T4000 available.

•PCW Details

HP Colorado T4000-S

Price £321 (plus VAT)
Contact Hewlett-Packard 0990 474747

A good analogy for a data-communications protocol is a letter. Everyone knows that the agreed format for a letter is the address at the top (43 Acacia Avenue), the salutation (Dear Frank…), the main message (I want to thank you for…) followed by the signature (Yours faithfully…). This is a simple protocol, in the same way that you say "Hello" when you meet someone rather than when you are just about to leave them. Datacommunications protocols are set by standards committees (see the panel, "Standards Committees", on the previous page) who spend many a happy hour doing the boring work so our networks can talk to each other. Essentially, if the OSI stack did not exist, we would have to invent it.

Stack 'em high
Every layer in the OSI stack communicates directly only with those layers directly above and below it (Fig 2): the highest layers

dealing with user services and the lowest layer dealing with the physical nature of the transmission medium itself.

The seven layers of the OSI stack can be sub-divided into two groups, with the transport layer acting as a bridge between them. The application, presentation and session layers deal with end-to-end communications and are not bothered with the minutiae of the details of data transmission. The network, data link and physical layers at the bottom of the stack deal with the nitty-gritty of specific network communications, and the transport layer is the bridge between the two groups.

The OSI stack is a model and as such not all protocols adhere to it precisely, but it does provide a common reference model:
■ 7 Application Layer. This is not a user application (such as Word, Notes, and so on) but it does deal directly with applications in terms of providing services such as email and file transfer.

Dear Santa…

I know you are getting on a bit now and you are very busy at this time of year, but do you remember what I wished for last Christmas? What I wanted was a cut in the cost of Basic Rate ISDN (also known as ISDN-2) installation by BT from a rip-off £400 down to something a bit more realistic so I could actually surf the net instead of doing doggie-paddle. Of course, I didn't want the cut in installation costs just for me and my friend up the road, but for the whole of mankind or anyone with a vested interest in networking in the UK. I reasoned that if the price of ISDN-2 was reasonable, loads of keen individuals and businesses would get it installed and it would really get the UK networking scene moving. Not just the business side of things but also stuff like community networks.

What did you get BT to do, you old duffer? Yeah, so they cut the prices of *some* ISDN-2 installations from £400 to £199 but then they put the cost of the rental up! What were you thinking of? I know that, at BT, those in charge of ISDN have their Christmas wish lists as well, but as I got mine in early (around February if I remember rightly) I thought I would get priority treatment. I did leave you those really nice sandwiches and that glass of sweet sherry out on Christmas Eve. By the way, sorry about leaving the fire blazing away in the grate.

So this year, I want broadband modems for every house in the land. Yep, more bandwidth than you can shake a stick at, for everyone, right into their home via their cable television set-up. If you can do this, then within a few months most families will be interacting with each other in real time and putting their holiday videos up on the web for everybody else to see. Now wouldn't that be interesting?

At the moment, the craze is for 33.6Kbits/sec modems, the trouble with this being that a 28.8Kbits/sec modem is pushing the capacity of an ordinary telephone line to the limit so buying a 33Kbits/sec version is pretty much a waste of money. However, if you ask BT nicely it will tweak your line for you. Broadband modems, on the other hand, can shove huge amounts of data around: a cable modem can do 30Mbits/sec, while ADSL (Asymmetric Digital Subscriber Line) modems using the telephone lines can do 9Mbits/sec which is still pretty quick. The trouble is, there is no point in you delivering a neat little black box to everybody on Christmas Day if the communications infrastructure isn't there to support it. But when it is, just think — neighbourhood pitted against neighbourhood in the ultimate game of Quake!

■ 6 Presentation Layer. Carries out formatting and security tasks. The presentation layer at one end of a secure file transfer would encrypt data while the presentation layer at the other end would decrypt it with the user being unaware this was happening.

■ 5 Session Layer. Deals with starting, maintaining and stopping sessions between network nodes, especially synchronisation of sessions and error recovery.

■ 4 Transport Layer. Lowest layer that deals with communications — the three layers below deal with the network itself.

Sorts out which particular way to transport data and packet transmission.

■ 3 Network Layer. This sorts out routing strategies. It is fundamental to the efficient working of complex topologies as it works out the best route through the system.

■ 2 Data Link Layer. Uses error detection and correction techniques to ensure that transmissions between network nodes are error-free either by correcting the error or requesting a new transmission.

■ 1 Physical Layer. The lowest layer needs to know the physical nature of the transmission media. For example, is this communication being transmitted over copper or fibre-optic? Sends and receives bits without comprehension of their validity and passes them up to the Data Link Layer.

Bandwidth on demand?

I have finally taken the plunge and allowed BT onto the premises to install my ISDN-2 line. Sod's Law says it looks like I will have to lift up the floorboards in the living room again to run the cable through to my study, but fortunately, the fact that I cannot afford a new carpet yet means that I will just have to shove a couple of rugs out of the way. Will ISDN-2 be worth it? Will my ISP be able to satisfy my insatiable bandwidth demands? Does anyone *care* apart from me?

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Tales from the **black hole**

Our new networks man, Mark Baynes, kicks off his series by shining a bright light into the depths of network problem-solving.

If you are new to networking, do not make the mistake of thinking that looking after ten networked PCs is just the same as looking after ten standalone PCs. It isn't. It should be simpler because, with the right management tools, you can control everything from one network node; but it never seems to work like that.

Planning your network system before you implement it helps, but my experience of networks is that they tend to evolve of their own accord and network management soon turns into fire fighting, IPX driver disk in one hand, screwdriver in the other.

One of the most important pieces of advice I can give when problem-solving on networks is to always avoid the "black hole". This is a situation where in order to solve problem A, you have to solve problem B. In order to solve problem B you have to solve problem C which in turn depends on having fixed problem D. Get the picture?

At all times ask yourself why you are trying to fix something. Are you sure it needs to be done or have you disappeared down the black hole of problem solving? Have you checked for the obvious answer first? A good example of this is when you lose a network connection. Before you question the integrity of your network operating system, check the physical integrity of your network. Is everything connected to everything else and in the proper manner? Do all the cables work?

A classic example of not doing this was the first time I tried to connect four PCs to a NetWare 3.12 server using 10Base2. Whatever I tried, the server remained invisible. Network cards were installed and re-installed, IPX drivers were configured and re-configured, Windows for Workgroups settings changed, Ethernet frame types examined, lengths of 10Base2 inspected, changed and swapped around. This went on for about three days before I admitted defeat and rang the manufacturer who sent an engineer to fix the problem.

Path of least resistance

The engineer walked into the office, traced the ends of the 10Base2 cable run and examined both the terminators. He changed one and solved the problem. All the PCs could now see the server. This took about three minutes. The problem? One of the 10Base2 terminators was of 70 Ohm resistance instead of the standard 50 Ohm. The engineer had driven all the way from Birmingham to London to do this and now he was going to drive all the way back. Since then, I have always carefully checked the resistance of terminators on 10Base2 before installation.

One way around this is not to use 10Base2 Ethernet but go for 10BaseT. 10BaseT topology involves the use of a hub, but as these are cheap now, around £10 per port or less (price per port is simply the total cost of the hub divided by the number of ports), or the cost of a couple of adaptor cards, the flexibility you get from 10BaseT is worth the extra cost.

If you have to use 10Base2 for some

A personal word from Mark Baynes…

Asking me whether I would be interested in writing the Hands On Networks section of *PCW* was rather like asking a small child whether it would like to be let loose in a toy shop. "When can I start?" was my only reply. The question I found harder to answer was the one I asked myself: "What does networking mean?" A few years ago, state-of-the-art networking was running NetWare 3.12 over 10Base2 to access file and print sharing on a 386 fileserver with a whopping 12Mb RAM and a huge 60Mb hard drive. But now, networking means different things to different people. The only thing of which I am sure is that as 1997 approaches, networks of all sorts and all sizes will converge to completely change the way we live and work… well, a bit. Convergence is what it is all about.

My first introduction to networking was as an undergraduate studying computing and artificial intelligence. I would like to say that I was immediately enthralled by the power and mystery of Unix, but I hated it. Fate decreed that five years later I would find myself editor of a magazine dealing with local area networking. But I soon discovered that while standalone computers can be tricky, it's only when you try hooking them together that you can really test your technical ability. Designing and installing the VNU Labs' network testing facility proved to be as "hands on" a networking task as you could hope for. Three months ago I completed an MA in Multimedia at Sussex University which gave me the opportunity to step back and look at the concept of networking from a broader perspective. Now I find myself running a web development company, developing virtual reality systems for a variety of clients, and reviewing network hardware and software for magazines. So the issues you will be reading about in Hands On Networks in the next few months will be varied to say the least.

A BEGINNER'S GUIDE TO RAID
(Redundant Array of Inexpensive Discs)

RAID levels 1 to 5 were originally described in a paper published at Berkeley University in 1988. RAID levels 0 and 0 + 1 were added by the computer industry. There is not an optimum RAID level; you just have to consider whether you want to trade speed for security of data.

LEVEL	CHARACTERISTICS
0	**DATA STRIPING**
	Data is striped across multiple discs at the bit or block level which is very fast but provides no fault tolerance.
1	**DISK MIRRORING**
	Mirrored fault tolerance — the array of discs is split into two and one group mirrors the other. The second set of discs can be on the same host adaptor or a separate one (duplexing).
0 + 1	**DATA STRIPING ON MULTIPLE MIRRORED DRIVES**
	Stripes data across two mirrored banks — a combination of RAID 0 and 1.
2	**BIT INTERLEAVING/MULTIPLE CHECK DISCS**
	This level is not commercially available for file servers or PCs so forget about it.
3	**BIT INTERLEAVING/SINGLE CHECK DISC**
	Data is written across several discs at the byte level and a separate disc is used for storing parity bits.
4	**BLOCK INTERLEAVING/SINGLE CHECK DISC**
	Same as RAID 3 but the data is striped across all of the drives at the block level, parity information again being stored on a single check disc.
5	**BLOCK AND PARITY INTERLEAVING/NO CHECK DISCS**
	Both data and parity information is striped across all disks at the block level so multiple drives can fail, but data can still be retrieved.

FASTEST

MOST SECURE

RAID 0 is frequently used for non-critical servers as the server will give better performance with four 500Mb discs than one large 2Gb disc.

Another term you may hear in relation to RAID is JBOD. This stands for Just a Bunch of Discs and is what you have in a typical PC with separate drives (C:, D:, etc) where data is only written to a single drive.

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reason then buy combination cards which can take either 10Base2 or 10BaseT so it is easier to upgrade in future. The most immediate benefit to be gained from the 10BaseT star topology is that if you have a dodgy connection on a network node, only that node will be affected. With 10Base2, because of its peer-to-peer topology, if a cable is damaged, nothing can get past it. The nodes either side of the break may continue to operate but if they do, they will only be able to talk to each other.

By wiring everything into the hub, you are, of course, relying on that hub always working. But these are pretty reliable and there's nothing wrong with putting all your eggs in one basket as long as you make sure it is a damn good basket.

LAN of sorrows
On first considering writing Hands On Networks I was worried that I would not have enough hands-on network issues to write about, but within a week I had more disasters happen to my LAN than in the whole of the past year.

The first was when two drives on West Pier, one of my NT Servers, decided to give up the ghost. Fortunately, this server has a RAID (Redundant Array of Inexpensive Discs) system which I had set at RAID 5 to provide me with redundancy in case the

worst should happen. Not that it would happen to me, of course. Because data has to be written to multiple discs, RAID 5 is pretty slow at I/O, but it's safe and I had been considering reconfiguring the server to RAID 0 for maximum I/O for the previous month. I had considered getting a proper data backup policy in place. *Considering,* you notice — not actually *doing*.

One morning, the server started to make nasty sounds as if someone had given the hard drives a good scrubbing with wire wool. Maybe they had? A reboot provided me with a system message that one drive was dead and another was critical, so I needed to back up everything… and *fast*! If I had put a data backup policy in place I need not have worried. But I hadn't, so I did. The only device with enough spare capacity was my other server, Palace Pier, also running NTS 3.51, but this capacity was in the form of the NetWare 4.1 partition which I rarely use.

The ability of NT to provide a simple multiple boot setup is very handy provided you do things the right way, but I had configured this server as having a C: FAT partition consisting of 41Mb for MSDOS 5.0 with NetWare 4.1 taking up the remaining 500Mb, and a D: NTFS partition of 500Mb for NTS. Ah, I thought, just zap the NetWare partition, give that to NTS and use that to back up the other server, happily reconfiguring and formatting the "unrecognised operating system on C:" from within the NTS Disk Administrator.

NTS recognised the new space and I copied the data from the RAID server across my Ethernet network, downed the server, junked the two dodgy drives and rebuilt the remaining drives. I had to do all this in a hurry because Sod's Law decreed that this was the day I had to do some VRML work for a company in the US, within the next twelve hours. Still, I got the job done.

Several days later, my 14.4 modem started to make a continuous whining noise. As it had been playing up recently, I decided to set up one of my servers with a modem that could be shared across the network. Having bought myself a Motorola 3400 Pro 28.8 external modem from my local computer shop, I downed Palace Pier (which, you will remember, had recently had its C: partition hurriedly zapped) in preparation to installing this modem as a shared device. But then I realised I had to finish some copy which was on the server, so I rebooted.

Sorting it with the Squirrel

This was the first time I had downed Palace Pier since the hurried backup of West Pier. But on trying to reboot I was shown the message "invalid partition table" and nothing else. Seven attempts at recovering the NTS installation all failed and my NT Emergency Disc had also been corrupted. It took me a whole hour and several phone calls to my colleague Dave the Squirrel before we realised what I had done.

Normally I would realise that formatting

the C drive on a server is pretty silly, but in my rush to back up the other server I had acted without thinking.

I finally re-installed NTS 3.51 to D: and, strangely enough, I could still see and boot the NetWare installation on C:, while the NTS installation on D: was seeing C as NTFS partition E — and it still had all my data on it. Sadly, there now seemed to be a problem with the network card in Palace Pier. I could see my data was there, but I could not access it across the network.

Having to get this column out within a couple of hours, I attached the Motorola 3400 Pro to my PC and it promptly made the same whining noise as its predecessor. I then did what I should have done before I bought it. I checked the telephone line by attaching a telephone to it which promptly rang… and rang… and rang. The problem was the line, not the modem. What was I saying about avoiding black holes?

Stay tuned

My immediate problem is to access the data on Palace Pier, back it up, then re-configure Palace Pier. I will probably create even more problems for myself by going for an NT Server 4.0 install, but at least I will have something to write about.

Once Palace Pier is resurrected, I then need to get a proper data backup policy in place sooner rather than later, because although I have had some problems I have not actually lost any data — yet.

A Hewlett-Packard Colorado T4000-S

Baynes on books

■ *Internet Information Server*

The internet may be dominated by a variety of Linux and Unix servers, but Microsoft's Internet Information Server (IIS) is riding the NT wave despite Netscape's best efforts. IIS fully integrates into other Microsoft BackOffice products and its familiar user interface makes configuration reasonably painless, but its documentation is not that good.

This book tries to rectify this fault. It is aimed both at users and providers of information on the internet and is divided into six sections: creating your site, installing and developing your web site , installing and developing your FTP site, installing and developing your Gopher site, server security and site management. The first chapter is wasted on descriptions of system requirements for NT Server, being a result of the dual nature of its intended audience. Chapter 2 continues with more unnecessary descriptions (we know what File Manager is, thank you). Even as far in as Chapter 7, the basics of HTML publishing are still being described. It is only in Chapters 8 and 9 (working with scripts and ISAPI) that any useful information is revealed so you can begin to investigate the guts of IIS.

This is a good introduction to IIS but it would have been better had it assumed a greater knowledge of NT Server among its readers from the outset. It's reasonable value for a general introduction to IIS, but once you get up to speed you are likely to outgrow it very quickly.

■ *Strategic Networking: From LAN to WAN to Information Superhighways*

Networking means many things to many people. The term covers such a range of technologies and concepts that it is hard to keep up. This book should help if you want to learn more or place your own speciality in context. It is written for business executives and network practitioners. Chapter 1 begins with the basics of different types of transmission media and cabling standards, and Chapter 2 describes and clearly illustrates different topologies. Some chapters cover operating systems, network services, network design, protocols and network applications. Others cover system administration, internetworking, disaster recovery, organisational and social issues. Each chapter has a list of web references for further research.

The book doesn't attempt to treat any area in great detail but it does give a good overview of networking in the mid-nineties and will be of use to a range of personnel, especially those who want a better understanding of what the different technologies actually do.

■ *Internet Information Server* by Allen Wyatt. Price: £36.99 (478pp). Published by Prima. ISBN: 0-7615-0693-4.

■ *Strategic Networking: From LAN to WAN to Information Superhighways* by Paul David Henry and Gene De Libero. Price: £25.95 (498pp). Published by International Thomson Computer Press. ISBN: 1-85032-203-1
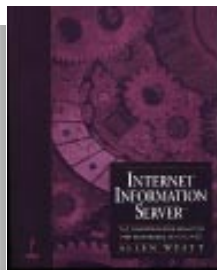
tape drive with 4Gb capacity (8Gb compressed) has just arrived so I have no excuses. Other immediate technical issues are to delve into the mysteries of routers as I have a Proteon Globetrotter sitting in my "to-do" corner, and also to decide whether I really am going to get ISDN-2 installed.

I don't mind the time I devote to sorting out my email and surfing the web but I am getting fed up with spending most evenings downloading files. I start the bigger downloads of many megabytes before I go to sleep and set Windows 95 to kill the connection after an idle time of 20 minutes so the file should be there in the morning.

However, working with a client in the US on VRML work, I find I need to send and receive large files within minutes rather than hours. Also, the client has mentioned the possibility of using video conferencing so I may have to deny all my beliefs and give BT some money now that the installation costs of ISDN-2 have fallen to £199. Pity I had to buy that new modem, really.

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Stephen Rodda: As Stephen hands over his Networks column this month, he would like to extend his thanks to past readers. If you would like to contact him, he can be reached at **the_bear@cix.compulink.co.uk**

Rules of the road

Stephen Rodda customises a highway code for networks. And, slave to his readers' requests, turns from Windows to OS/2 to install IBM's new Warp Server 4.0.

I have been criticised for not mentioning IBM's products in my networking column. So when IBM issued a new version of its Warp Server (hitherto called LAN Manager), I decided that I should get a taste of it.

When I attempted to install the package, this is what I got: "*WARNING: The OS/2 Installation program has found some hidden Microsoft** Windows** files on drive C. If you continue to install OS/2 on drive C, you will not be able to start Windows NT after installation. If you continue, you must use OS/2 to format drive C. You can choose to exit, and then install OS/2 on any drive other than drive C.*" Since this was on a system bootable into either Windows 95 or NT, all the stupid installation program had to do was take a copy of the boot sector and then pretend that it was a DOS disk, using the boot program as usual.

Not one to be dissuaded from my intentions, I copied the boot sector using an old version of Peter Norton's Utilities 4.5. I'm afraid I am a bit of a Luddite about these things — and that's some confession, coming from a technology journalist. But when all I want to do is read a bit of disk and save it as a file until the MS-DOS format changes, I'll carry on using Norton 4.5.

I rebooted but OS/2 still didn't like the hidden NT files. I took a directory listing, using DIR/B and wrote it to a file, then used ATTRIB to flag all files -R -S -H and had another try. I thought "thank goodness I'm writing about it while I'm doing it". At least I got something productive done while "fiddling" around (*I had considered using another word instead, but you can fill it in for me according to your sensitivities*). It still stated that I had some hidden files in the

directory, which was patently not true. So I telephoned IBM support and within a few minutes they'd confirmed my suspicions that it wasn't just the NT files but the whole VFAT (Windows 95's method of putting long file names on a FAT partition) structure which OS/2 didn't like. My first reaction to being told that I should repartition or reformat the disk was "I don't believe it!" I know MS and IBM have been having an extended war where each has worked hard to prevent its own product running under the other's operating system (Windows 3.11 upgrade being a case in point) but IBM not supporting VFAT, which has been out since NT 3.1, seems a bit thick to me.

Since I was using a review machine (the AMD K5-100) and there was nothing important on the hard disk I decided to overwrite the hard disk contents. Once I'd decided not to keep any of the old data, installation went like clockwork, although I was surprised that there was no Novell/Eagle NE2000 adaptor. The NE2000 Plus was supported, so I tried using that instead despite the thought that I'd probably have to do something about it later. Something which surprised me was the fact that nowhere in the documentation did I find a mention of Apple Macintosh file sharing — and this from a server package.

As far as the Novell NE2000 driver is concerned, I had forgotten that OS/2 automatically takes note of the fact that the adaptor card isn't an NE2000 Plus and configures itself from there.

The AMD K5-100

Do you want an 80586-100 for the price of an 80586-75? …doesn't everyone? I had a loan machine from AMD, complete with one

of their 80586 clones. I use the term 80586 rather than Pentium, because the Pentium is a trademarked name and a series of numbers isn't.

The clone makers have had to resort to all sorts of tactics to make their chips seem different (branding, I think it's called). AMD has an 80586 chip which performs (from my usage tests) every bit as well as an Intel Pentium P-100. The AMD K5-100 sells for within a pound or two of the Intel P75, so you really do get more bangs per buck!

I've also been trying to get hold of the new Cyrix 686-in-a-586-package chip as I've heard good things about it, but as yet I seem to be getting nowhere, fast.

Letters

This month I'm devoting the letters section to Windows 95, and you'll find that some of the enquiries come from someone you already know!

Q. "*My installation of Windows 95 seems to be running slower (especially when browsing the machine). Can you suggest anything to improve the speed of the program?*"

Stephen Rodda

A. If you've got the hard disk space, I'd suggest that you reinstall Windows 95 into a different directory (or folder) to see whether slow-down occurs then. It is possible, if you install and test many different programs, for the registry to become corrupted or overloaded.

A fresh installation of Windows 95 should sort out the slow-down. Make sure the slow-down isn't due to trying to access a CD. Your search path could possibly be pointing there.

Networking Rules

I was flying back from the UK to the Netherlands the other day and as the aeroplane was preparing for landing the thought struck me, seeing all the little drainage channels and noting how orderly everything was, that networks also need order imposed on them to operate properly. "Why not set out the bones of a networking rule book?" I thought. So here is my own version of a set of guidelines to which you can add or delete from, as you see fit, to create your own networking rules.

1. **Use easily-remembered passwords which are changed monthly.** Depending on the sensitivity of your data, you may be prone to a dictionary-type password attack. There are two ways to defeat this: firstly, make sure that a type of "three strikes and you're out" password checking is enabled and secondly, make sure that all passwords are made up of two common words, concatenated. The first method will disable an account for a set period if an attacker (or even the user) types the wrong password for the account a number of times in a preset period. See the screen shot from NetWare (Fig 1) showing this form of lockout. The second ensures that the password is easily remembered but unguessable. A password in this vein could be sausageprinter. Certainly it's easily-remembered but it's also a totally illogical series of characters.

2. **Back up your data at least once a day.** Even if it's only an incremental or differential backup, please do it! Remember to make a full backup every week and to keep it and your end-of-the-month backup tape in a safe place (preferably off the premises).The reason that I recommend a full backup once a week is so that you don't end up having to fish out a hundred different tapes containing the past four months' incremental backups.

3. **Don't allow unauthorised or unknown programs to be run on your network.** You don't want to risk getting attacked by "Trojan horse" type programs (i.e. those which pretend to be
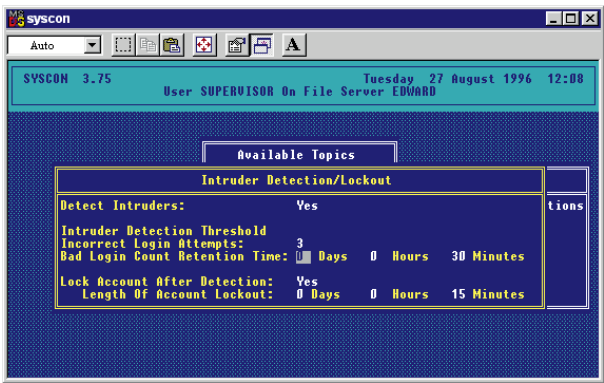

Fig 1 NetWare's intruder detection lockout enabling screen

one sort of program and end up formatting your hard disk accidentally-on-purpose). Believe it or not, there is one which masquerades as a version of PKZIP. Make sure that you only use programs from recognised and responsible sources (cover disks are usually fine, as is Cix and such
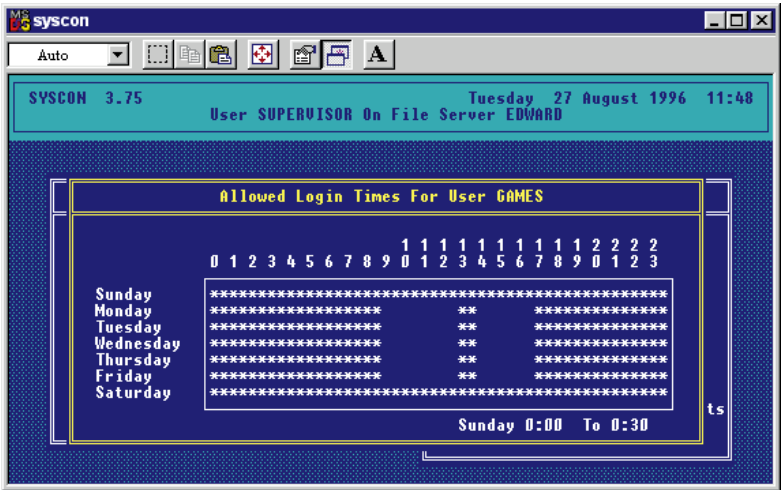

Fig 2 How a login can be configured so it's available throughout what *isn't* the working day

places where all programs are scanned before being made available).

4. **Scan all disks from outside, for viruses.** Although this is obvious, it's surprising how many times people get caught out by viruses. Don't just assume that a large company site is free of viruses. We've been caught napping by a virus which was widespread throughout the reprographics industry at that time. Remember that bureaux and the like can be hotbeds of infection and always make sure that you scan your floppies and removables before using them if they've been off your premises.

5. **If you must connect to the internet, make sure that you do so safely.** Remember that a firewall is the safest method of connecting to the internet but if your connection is only temporary in nature (like a dial-up connection), then it'll take someone with real determination to stay on a leased line, keeping a look-out for you, and then to attack your system while you're there on the dial-up link. Not a common problem I should have thought, but one worth bearing in mind.

6. **Don't allow people to let a third party log in under their names and passwords.** Apart from the fact that this is sloppy practice, it also defeats the advantages of email and so forth and exposes a password to (possibly) an outsider.

7. **Enforce logging out when the workstation is unattended for a significant period of time.** This can stop people leaving their machines logged on all night, allowing passers-by access to sensitive data. It can also get people into the habit of switching their machines off at night, which is good for the ecology.

8. **Stress to everyone that data which they wish to be backed up is stored on the network.** Some server-based backup programs will back up workstations, provided they are switched on. Save lots of electricity by backing up the server only.

9. **Impress upon everyone that despite their data being stored on the same machine(s) as everybody else's, as long as their data is stored in their own home directory it is secure.** People don't seem to realise (notwithstanding rule 12) that if a networking system allowed people, apart from the administrator, to wander through others' data then the company selling the networking system would very quickly go out of business.

10. **Negotiate and enforce a company-wide policy on playing (network) games.** People will probably want to play Doom and Quake. If you can arrange that these are available perhaps through special games logons but also outside working hours, this will probably remove the temptation to bring in their own games from outside (Fig 2).

11. **Since they're bound to do it anyway, impress upon people the correct method of moving their machines.** This is useful if you're using 10base2 (coaxial Ethernet) because if the cable is broken for a significant length of time the whole segment of the network is disabled. This is not such a necessity with 10baseT and token ring and their variants but as long as users understand how the network is cabled, callouts will probably be minimal.

12. **Keep the file server in a locked room.** There is no good method of preventing someone with physical access to the machine from reading the data on the storage system. Remember that the security inherent in NetWare or NT does not prevent someone with a suitable boot disk from accessing the system as an administrator. The safest place for data is on a disk which is attached neither to a computer nor a network and which is stored in a strongroom. Disk encryption hardware does exist but it is far from commonplace. We must therefore compromise.

Q. *"I've been trying to share my fax or connect to another, shared fax. I don't seem to be getting anywhere. Windows 95 won't recognise the shared fax on another machine. Can you help, please?"*
Jeff Sanders

A. This is a problem which Jeff, my business partner, has been having. It's always a bad sign when he starts cursing, because I know he's starting up a PC. Actually, I think he likes to have something to complain about.

He's been asked to design a book for a charity and, of course, he decided to use Ventura Publisher. In our experience, it's the only reasonably ordinary program specifically designed for book publishing. So in order to send proofs to the client he needed to use a fax. His machine has only one communications port (for a

variety of reasons, mainly to do with the fact that it uses an old NE2000) and that is taken up by the mouse. We decided to use Windows 95's built-in fax sharing, so I could get on with my work while he faxed the document through my machine.

Firstly, we had to make sure that the machine (where the fax is installed) had got file sharing enabled and accessible via the Network control applet in the Control Panel (see Fig 3). Of course, on my machine, I was sure that this was the case.

Secondly, Microsoft Exchange does get its knickers in a twist occasionally and you can do far worse than removing all the exchange components, rebooting and reinstalling from the CD once again. Another thing you could check is whether the machine is actually visible on the network. If not, a simple network diagnosis should sort out any problems you may be having.
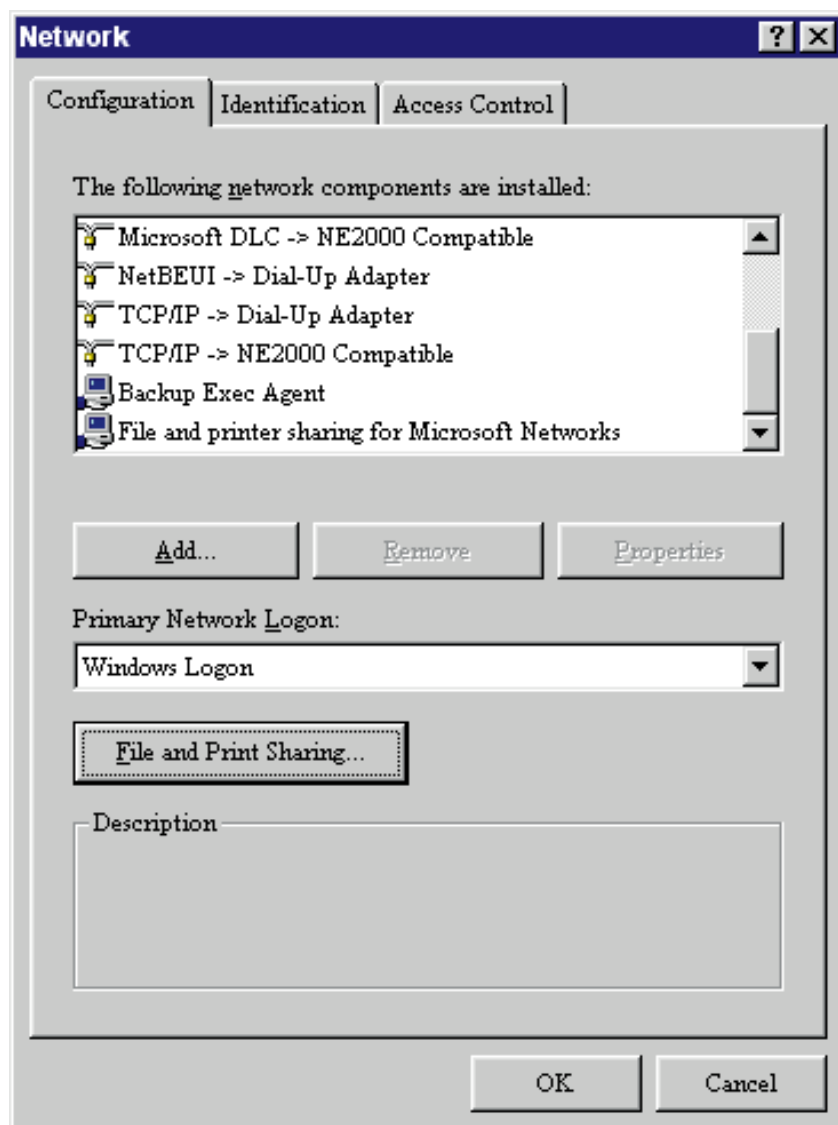
I removed Exchange, rebooted my machine and reinstalled it. What a total pain in the fundament that was! I remembered that removing Exchange would remove Microsoft Fax but I'd forgotten how heavily-intertwined the comms part of Windows 95 actually was — until I discovered I'd removed the Microsoft Network as well.

Coming soon

I was chatting in the pub to a mate who is an avid reader of my column the other day and he mentioned that he hasn't yet come across a very simple explanation of how to put together a small network. So next month, I shall be concentrating on this, if only to shut him up.

Quick tip

I gather from my sources that many Macintosh LC475s are starting to show errors on booting, giving the same signs as would a dead motherboard. Apparently it's the PRAM battery which, once changed, restores the machine to its original working state. I also hear that some less-reputable or knowledgeable repairers are replacing the motherboard (and charging for this repair) when all that's needed is the battery replacement. You have been warned!

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