

# LAN of action

**Networks often seem baffling to the uninitiated, but Local Area Networks are simply a common way for computers to share resources. Eleanor Turton-Hill takes the ghost out of the machines.**

Most areas of computing are shrouded in some form of technical jargon which they've developed over the years, and networks are no exception. They seem to have accumulated an air of mystique which makes them intimidating even to the most knowledgeable in the computer industry.

But as we all know, there's no such thing as "black art" in computers — just a list of nasty acronyms, a few underlying concepts and a vast amount of trivial information you acquire over time. The type of network you're most likely to have used is a LAN (Local Area Network), as this is the most popular network model. Here I'll give a brief overview of the LAN, as well as explaining some of the terms used in network technology.

## A cunning LAN

Computers are connected together into networks so that resources can be shared between groups of users in the most efficient way. They enable users to access and exchange information within a single office, as well as sharing programs and expensive devices such as laser printers. Without a network, each PC in an office is an island and the only way to pass files from one machine to another is by floppy disk.

The typical LAN setup has one central fileserver which holds all shared applications and data. The fileserver is usually a powerful PC with plenty of hard disk space to service client machines with limited storage capacity. Each PC attached to the network acts as a client, requesting services from the server. All the PCs on the network can see the server,

but none of them can see each other. Most LANs only have a few clients, but some are able to handle hundreds.

The fileserver holds the network operating system which controls all network operations. It manages users' access to the network's shared resources. For example, if two users request use of the printer at the same time, the network operating system will control the order in which the print jobs are processed. It also contains facilities which enable the network administrator to maintain security, and utilities such as electronic mail. Some LANs have more than one server, each dedicated to a certain function such as handling a database, controlling print functions or managing communications.

## On the buses or in the ring

Networks can be arranged in three different configurations or topologies. The simplest type of network is a "bus" network, where all network nodes are strung together in a line. This structure has some fairly fundamental drawbacks, the

most obvious one being that if the cable is broken in the middle, the network is split into two.

Another type of configuration, known as the "Star" network, is arranged with all nodes connected to a central hub or switching box forming a star shape. In effect, each node has an independent connection to the network, so that if one cable breaks, none of the other nodes has to be affected.

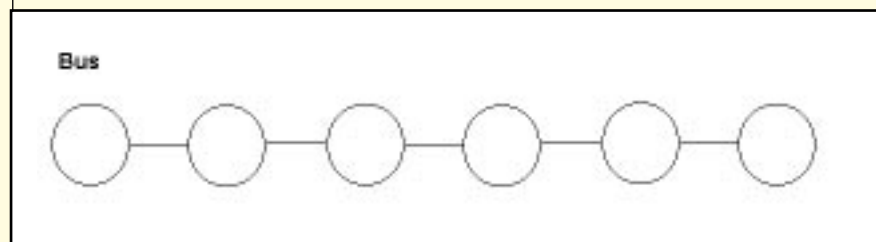
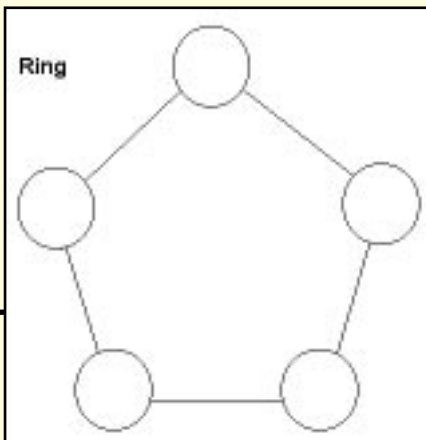
The third type of configuration is the "Ring" network. Here, the nodes are connected to each other along a single, circular path. This structure is very much like a bus, only there's no end to the line. The last node on the line is connected to the first node, forming an endless loop.

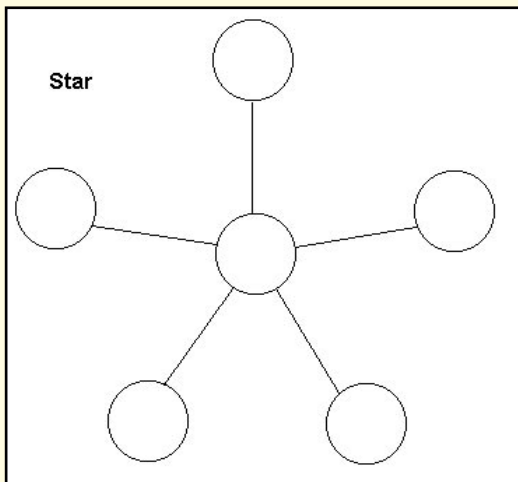
All members of a local area network must normally be positioned within 800 to 1,000 feet of each other, because the strength of the transmission signal decreases as it travels. Short distances therefore enable the signal to be received more clearly. Multiple LANs can be joined together in various ways, and LANs using different protocols can be connected by "bridges". "Gateways" connect different types of networks to each other, for example a PC LAN to a mainframe network, and "routers" are used to link together LANs with compatible protocols.

## Making contact

In order to connect a PC to the network, you must first install a network adapter or interface card. This goes inside the PC and controls the physical transmission of data over the LAN. The network cable is

**Right and Below: Ring and Bus Networks are both decentralised network topologies. Each workstation can access the network independently**





*In a Star topology, all the nodes are operated from a central server. With this type of configuration, a defective workstation won't bring down the entire network*

the definitive standard set up by the Institute of Electrical and Electronics Engineers (IEEE). The standards are designed to ensure compatibility between different bits of equipment made by different manufacturers. Without using this standard, it would be impossible to

mix and match Ethernet components from different sources.

As well as defining the practical building blocks for LANs, Ethernet also specifies the techniques used to control the flow of information over the network cables. The technique Ethernet uses is called CSMA/CD (a memorable little acronym) which stands for "carrier sense multiple access with collision detection". Because several devices may try to communicate at any given time, access methods need to be established. Using CSMA/CD, a device first checks to see if the cable is free from other carriers. It then transmits while continuing to monitor the cable. If a collision is detected, the device stops transmitting and tries again later. On a CSMA network with collision detection, all stations can sense traffic on the network so that individually, they can identify the right moment to transmit. Without collision detection it is possible for two stations to transmit simultaneously.

### Client-server, at your service

Client-server is one of those trendy computer terms which means slightly different things to different people. Strictly speaking, client-server is an architecture in which processes running independently of each other, send requests, and provide each other with services. The roles of *client* and *server* are defined by the type of process they perform; a process that sends a request is a client, and a process that fulfils the request with the required service is the server. A single process can be both a client *and* a server — it may be both a service provider and a service requester.

If you don't agree with this definition, it's because the meaning of the term has shifted over the past couple of years to mean something slightly different. The definition provided above is a logical

definition in which "client" and "server" are understood in terms of their relative functions. These days, most people understand "client" to mean any machine which sits in front of the user, and "server" as any machine *not* in front of the user. In other words, client-server is understood in hardware terms rather than as a model of related processes.

In general, the hardware conception of client-server makes some sense. The user's client machine provides the appropriate user-interface logic to make server requests, and the server responds accordingly. But in practice, the hardware conception does not fit all cases because there are so many different client-server architectures. It is possible for the server process to sit on the same machine as the client. Client-server software usually shields the user from knowing the physical location of the server by redirecting service calls appropriately, and an individual program can be a client, a server, or both.

The basic idea behind client-server is to distribute the processing power and storage space required to run a given application. This is not a new idea by any means; in fact, Local Area Networks have been used over the past ten years to provide many kinds of software solutions. The most basic form of client-server system is where a client (typically a PC) passes requests to the server for file records over a network. In this scenario, the file server is being used to perform a very simple service and the requested data is generally found using many message exchanges.

A database server is more sophisticated. The client's request for data is made in the form of SQL (Structured Query Language) commands, and the results of these requests are returned over the network. Code residing on the fileserver processes the SQL commands, and the requested data is filtered out and passed to the client. This provides a much more efficient system than the basic fileserver model described above, because the code which processes the SQL command sits in the same place as the data and filters out the appropriate data in response to *ad hoc* queries.

attached to the interface card at the back of each PC. Some network cards provide two or three different types of connector, so that you have the choice of different cabling methods. The most common network adapters are Ethernet, Token Ring and ARCnet. The Ethernet variety can be cabled together directly, using "T" connectors which fit to the jack at the back of the adapter. All computers can then be connected by joining "T" connectors to each other.

Different network adapters access the network in different ways, and their raw data transmission speed varies. Token ring, for example, waits for a special signal known as a "token" before transmitting, whereas Ethernet adapters just wait until the network is clear. With Ethernet adapters, two packets of data will periodically collide, and both adapters will time out for a random period.

### An Ether world

The vast majority of LANs use Ethernet. Essentially, Ethernet is just a standardised way of connecting computers together to create a network. It specifies what kind of cables to use, how long the cables can be, how they should be connected together and how computers transmit data to one another using the cables. One of the reasons for its popularity is the fact that Ethernet is remarkably cheap compared to ARCnet.

Ethernet defines the infrastructure upon which the network is built: it does not define the type of network operating system. All commonly-used network operating systems can work on an Ethernet network, and if the network is built using a solid Ethernet base, then the operating system can always be changed later.

Ethernet is often referred to by network administrators as 802.3, because that's

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