

# Networking Basics



## Networking Basics

A computer network consists of a collection of computers, printers and other equipment that is connected together so that they can communicate with each other (see Advice Sheet 17).

Broadly speaking, there are two types of network configuration<sup>1</sup> — a peer-to-peer network and a client/server network.

**Peer-to-peer networks** are more commonly implemented where less than ten computers are involved and where strict security is not necessary. All computers have the same status, hence the term 'peer', and they communicate with each other on an equal footing. Files, such as word processing or spreadsheet documents, can be shared across the network and all the computers on the network can share devices, such as printers or scanners, which are connected to any one computer.

**Client/server networks** are more suitable for larger networks. A central computer, or 'server', acts as the storage location for files and applications shared on the network. Usually the server is a high-performance computer. The server also controls the network access of the other computers, known as the 'client' computers. Typically, teachers and students in a school will use the client computers for their work and only the network administrator (a designated teacher) will have access rights to the server.

## Advantages and Disadvantages

Peer-to-Peer Networks	Client/Server Networks
<ul style="list-style-type: none"> <li>▪ Easy to set up</li> </ul>	<ul style="list-style-type: none"> <li>▪ More difficult to set up</li> </ul>
<ul style="list-style-type: none"> <li>▪ Less expensive to install</li> </ul>	<ul style="list-style-type: none"> <li>▪ More expensive to install</li> </ul>
<ul style="list-style-type: none"> <li>▪ Can be implemented on a wide range of operating systems</li> </ul>	<ul style="list-style-type: none"> <li>▪ A variety of operating systems can be supported on the client computers, but the server needs to run an operating system that supports networking</li> </ul>
<ul style="list-style-type: none"> <li>▪ More time consuming to maintain the software being used (as computers must be managed individually)</li> </ul>	<ul style="list-style-type: none"> <li>▪ Less time consuming to maintain the software being used (as most of the maintenance is managed from the server)</li> </ul>
<ul style="list-style-type: none"> <li>▪ Very low levels of security supported or none at all. These can be very cumbersome to set up, depending on the operating system being used</li> </ul>	<ul style="list-style-type: none"> <li>▪ High levels of security are supported, all of which are controlled from the server. Such measures prevent the deletion of essential system files or the changing of settings</li> </ul>
<ul style="list-style-type: none"> <li>▪ Ideal for networks with less than 10 computers</li> </ul>	<ul style="list-style-type: none"> <li>▪ No limit to the number of computers that can be supported by the network</li> </ul>
<ul style="list-style-type: none"> <li>▪ Does not require a server</li> </ul>	<ul style="list-style-type: none"> <li>▪ Requires a server running a server operating system</li> </ul>
<ul style="list-style-type: none"> <li>▪ Demands a moderate level of skill to administer the network</li> </ul>	<ul style="list-style-type: none"> <li>▪ Demands that the network administrator has a high level of IT skills with a good working knowledge of a server operating system</li> </ul>

## Components of a Network

A computer network comprises the following components:

- Computers (at least two)
- Cables that connect the computers to each other, although wireless communication is becoming more common (see Advice Sheet 20 for more information)

<sup>1</sup> Thin-client networks are another type of network configuration, but these are sometimes considered a variation of client/server networks. Thin-client networks are discussed in more detail in Advice Sheet 19.

- A network interface device on each computer (this is called a network interface card or NIC)
- A switch (note hubs are no longer recommended)
- Network operating system software
- Uninterruptible power supply (optional)

### (1) Cabling

There are three types of cable (or media) that can be used to connect computers.

*Coaxial cable* is similar to TV cable, but normally can only transmit data at speeds of up to 10Mbps. It is not, therefore, recommended for new installations.

*Twisted-pair cable* consists of strands of copper wire pairs twisted together. This is the industry standard in new installations. There are several international standards for twisted-pair cable, e.g., unshielded twisted-pair category 3 (or UTP Cat 3) is used for phone wires, whereas Cat 5e is the most popular category for networking as it can support data transmission of up to 1000Mbps. Cat 6 and Cat 7 are also available, but are still more expensive.

*Fibre-optic cable* is made of strands of high quality glass and uses light pulses instead of electricity to carry data. However, it is the most expensive form of cable and is usually only used when connecting larger networks together.

### (2) Network Interface Card (NIC)

A NIC (pronounced 'nick') is also known as a network card. It connects the computer to the cabling, which in turn links all of the computers on the network together. Each computer on a network must have a network card. Most modern network cards are 10/100 NICs and can operate at either 10Mbps<sup>2</sup> or 100Mbps. Older cards that operate at only 10Mbps are still available (they usually have a socket to connect to a coaxial cable), but they can be more difficult to integrate with more recent equipment and are much slower when working with large files containing audio or video.

Computers with a wireless connection to a network also use a network card (see Advice Sheet 20 for more information on wireless networking).

### (3) Hub or Switch

Hubs are no longer recommended for schools, though older hubs may still be in operation in many schools. As they are inefficient in terms of directing network traffic, and can possibly slow down the network, it is recommended that where possible, that they be replaced by switches. As switches are a 'better and more efficient hub' both are described here.

A *hub* is a device into which all other devices on the network connect. The function of a hub is to direct information around the network, facilitating communication between all connected devices. To do this the hub sends the information it receives from one device to *all* devices on the network, thereby ensuring that the information gets to its intended destination. However, as the information must also travel to all other devices, there is some inefficiency in the process. If the amount of information flowing over a network increases, it may be more appropriate to use a switch instead.

A *switch*, which is often termed a 'smart hub', provides the same basic function as a hub, but it forwards the information flowing from one device on the network directly to the intended recipient without sending it to all other devices.

### (4) Network Operating System (NOS)

This usually refers to the software running on the server in a client/server network. It can also refer to the operating system running on the client computers.

### (5) Uninterruptible Power Supply

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<sup>2</sup> The amount of information that can be sent across the network is measured in bits per second or bps. As networks transmit many bits per second, it is more common to refer to megabits per second or Mbps. (1Mbps is a little over 1 million bps.)

An uninterruptible power supply (UPS) consists of a set of batteries that are continuously recharging. When an interruption to the power supply occurs, the UPS ensures that the system continues to operate for several minutes, allowing time for it to be shut down correctly and preventing data loss. The UPS may also provide protection against power surges.

### Relevant Web Sites

NCTE Web site Networking Guidelines:

[www.ncte.ie/SchoolNetworking](http://www.ncte.ie/SchoolNetworking)

This web site provides a range of essential and suitable information and advice to schools on all aspects of school networking.

*Note: While the advice sheets aim to act as a guide, the inclusion of any products and company names does not imply approval by the NCTE, nor does the exclusion imply the reverse. The NCTE does not accept responsibility for any opinions, advice or recommendations on external web sites linked to the NCTE site.*

This Advice Sheet and other relevant information are available at:

[www.ncte.ie/ICTAdviceSupport/AdviceSheets](http://www.ncte.ie/ICTAdviceSupport/AdviceSheets)