FACTFILE:
GCSE
DIGITAL TECHOLOGY

Unit 1
NETWORK TECHNOLOGIES

Introduction

Learning Outcomes

Students should be able to:

- Describe the function of the following network resources: network interface card, network cables, switch and router;
- Describe the following network topologies: Bus, Star, Ring;
- Describe the advantages and disadvantages of using a network in an organisation.

Content

- Network hardware resources
- Network topologies
- Advantages and disadvantages of using a network

Network resources

To run a network efficiently, several pieces of hardware are required.

Network interface card
Any computer that is connected to the network by a cable must have a network interface card (NIC). The card allows the computer and the file server to communicate with each other. A network interface card will have a port for a network cable to be plugged into. Laptops will contain a wireless network interface card which will allow the laptop to connect wirelessly to a router but will often also have a port to allow a user to connect a network cable.

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Network cables

Cables within a local area network are typically copper based. There are some different types e.g. coaxial cable (has two conductors, a central single strand and several strands braided together and wrapped around the central strand), and twisted pair (insulated copper wires twisted together with an earth wire).

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Switch

A switch or switched hub is a connection point for a group of computers. The computers will be connected to the switch using network cables and the switch will be connected to the file server. The purpose of the switch is to organise communication between the file server and the computers on the network. When two computers are both connected to a switch, the computers can send data to each other through the switch.

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Router

A router is a sophisticated switched hub. It will hold information about the addresses of computers attached to the network and forwards data to the correct computers efficiently. They are usually used as gateways where a LAN is connected to a larger network (e.g. the internet). When used as a gateway, a router will monitor traffic and can limit access for certain sites or users.


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Network topologies

A network topology is the theoretical arrangement of the components of a network.

Bus network

A bus network has each of the devices connected directly to a main communications line, called a bus, along which signals are sent. Twin cable, for example coaxial cable, is usually used as the bus. The use of a bus network is suitable for small networks, as it is cost effective to implement on a small scale. If the bus cable has to carry traffic for a large number of devices, the efficiency of the network will drop. An additional disadvantage is that the network is dependent on the bus cable, and a fault in it will cause the network to fail. This type of network is less secure than a star network, because each device has access to the bus, and data could be intercepted during transmission.
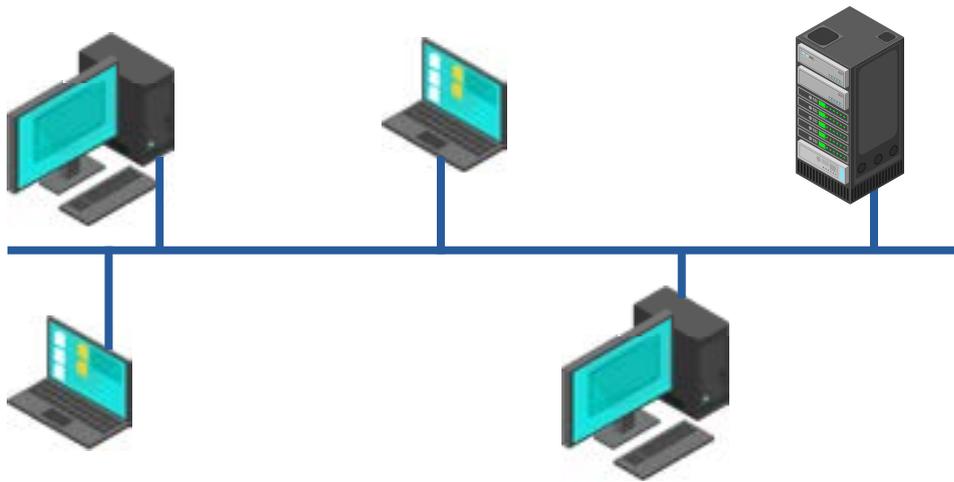

Star network

A star network has all the network components connected to one central computer, which is often used as the file server. The computer at the centre of the star network is sometimes referred to as a hub, nexus or central node. The network is therefore reliant on the central node, and if it malfunctions the whole network will fail. Conversely, the advantage is that if one of the computers is not working, the rest will not be affected. This network is more expensive to install than a ring network because it usually requires more cabling and a file server capable of servicing the network requests from each computer.
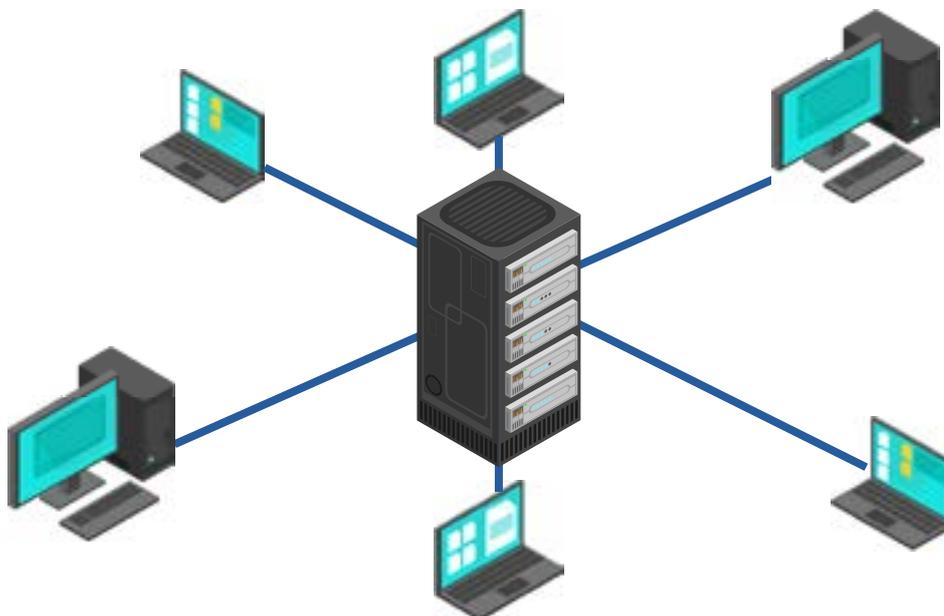
Ring

A ring network has each of the devices on the network connected to a ring communications line around which signals are sent. This type of network can be implemented in two ways. Traffic around the network can pass through the network interface of each device, which may require that all devices are functional for traffic to flow. Alternatively, the network devices can be connected to the central ring by spurs, which allows the system to continue to work even when some devices are not switched on.
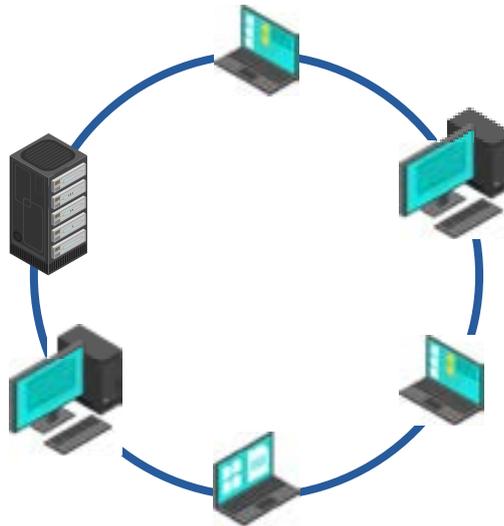
Advantages and disadvantages of using a network in an organisation

The use of networks is widespread in schools, businesses and at home. There are clear advantages to organisations, often having financial implications. There are also disadvantages to consider, with the potential for network break down or security threats.

Advantages of using a network

By using a network, it is possible to share peripheral devices such as printers and scanners. In addition to being more environmentally friendly, this helps to reduce costs. Users can access their files from any workstation, allowing flexible working environments. This is particularly useful in schools, where students and teachers might want to access their work from different rooms. Software can also be shared, as software licences can be purchased for the whole site, rather than stand-alone licences for each computer or device. The use of a network allows users to communicate easily using a variety of methods including email, instant messaging and video conferencing.

A network that runs using a file server has the benefit of providing the users with a central back-up of all files. This is advantageous to the organisation, as lost files could impact on the efficient running of a company, for example an organisation losing customer address details would hold back delivery of their product. Use of a file server provides a level of security by ensuring that users access their own files when they log on, but not files belonging to other users. This would not be the case if the organisation relied on stand-alone machines because files could be saved locally and accessible to all. Along with centralising files, networks centralise some of the processes carried out within an organisation, for example virus protection can be managed consistently rather than on each individual computer or device.

Disadvantages of using a network

The initial costs of installing a network for an organisation can be high, as it might require the purchase of cabling and at least one file server. The running costs can also be high for large networks, and the organisation may decide that they require a network manager to ensure the smooth and efficient use of the network resources.

There are risks while using a network. The reliance on a file server to provide access to software and files could mean that a failure in the server will result in widespread breakdown. For this reason, in large networks, multiple servers are used and may be housed in separate parts of a building. While efforts can be made to secure a network against viruses, a breach could give a virus or hacker access across other computers. Procedures can be put in place to help minimise these risks, for example, the use of a firewall.