

# N4

## Introductory Computer Practice

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## What is covered

In this module, you will learn about networks: what they are, where we find them, and what the advantages and disadvantages are of using networks. We are also going to look at the basic components and hardware that are required for network communications. Then, in the last unit, you will learn about the use, purpose, and operation of different types of networking hardware.

### Learning outcomes

#### After studying this chapter you should be able to:

##### Unit 1

- Define the term 'network'
- List and briefly describe common examples of everyday networks
- Understand the advantages and disadvantages of using networks
- Be able to describe the basic components and hardware required for network communications
- Differentiate between the use, purpose, and operation of different types of networking hardware

# Unit 1: Networks

## LEARNING OUTCOMES

- Define the term 'network'
- List and briefly describe common examples of everyday networks
- Understand the advantages and disadvantages of using networks
- Be able to describe the basic components and hardware required for network communications
- Differentiate between the use, purpose, and operation of different types of networking hardware

## Introduction

Technology today is constantly evolving and influences the way people and businesses communicate. Businesses rely on computers in order to share information and to communicate effectively in all fields, for example medicine, education, agriculture, etc. The establishment of a computer network is important for effective business operations. The size of a network can vary from a few computers in one building to millions of computers that are connected around the world.



Figure 2.1 Technology connects us

## The term 'network'

A network in computer terms can be defined as a cluster of two or more computers that are wired together. The main aim of a computer network is to access and share information using shared resources, such as the internet, a printer, etc. Computer networks are the basis of communication in Information Technology (IT).

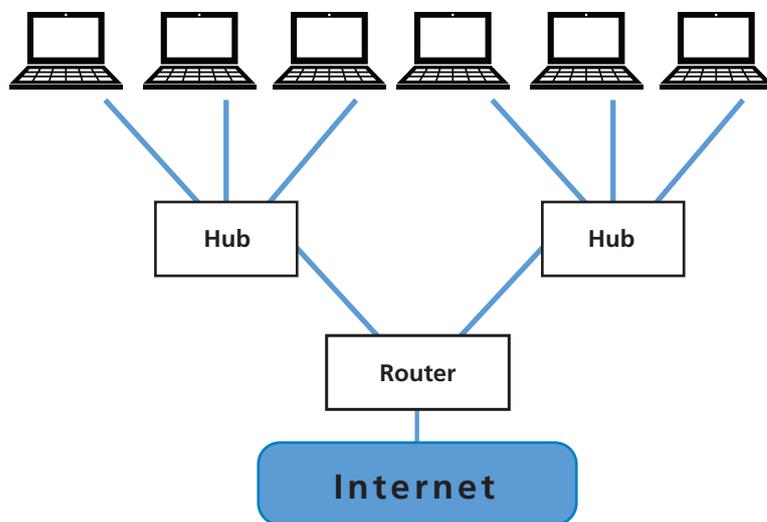


Figure 2.2 An example of a computer network

## Everyday networks

There are three main types of computer networks commonly used in organisations, namely LAN, MAN, WAN, etc. They have a few differences, but also some similarities. Let's look at them.



Figure 2.3 An office network

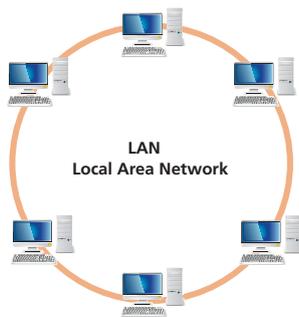


Figure 2.4 A local area network

## Local area network (LAN)

LANs enable computers to be wired close together in the same building, for example a school.

A LAN is a relatively private network. This means it is not controlled by outside governing bodies. These computers are linked to one or two printers, or a scanner. This means resources are shared and enables data storage. The sharing of resources is mainly used in an office building. A LAN can be assembled with low-cost hardware, such as hubs, network adapters, and ethernet cables. LANs depend typically on wired connections for faster speed and better security.

## Metropolitan area network (MAN)

A MAN is a computer network system intended for a college, a huge company, town or city. The MAN network is bigger than a LAN, smaller than a WAN and restricted to a building or specific area. A MAN is mostly used to connect quite a number of LANs with cables or optical fibre to establish a bigger network. MANs provides high-speed communication. It remains a challenge to provide a secure system from hackers.

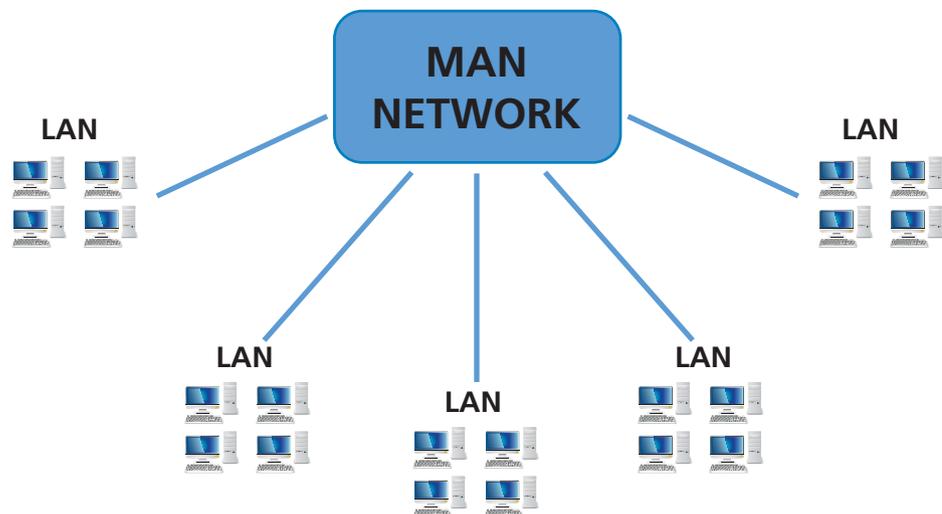


Figure 2.5 A metropolitan network



Figure 2.6 Gaming uses a WAN

## Wide-area network (WAN)

WANs are computer networks that are spread over a vast geographical area. The WAN network system is made up of numerous smaller networks, such as LANs and MANs. In order to connect LANs to a WAN, a network device called a router is needed. A network of ATMs uses a WAN.

WANs enable us to use computerised devices such as laptops, mobile phones, tablets, computers, gaming consoles (PlayStation or Xbox), etc.

The start-up cost is extremely high and the security risk is low in this type of network. This system requires skilful technicians, as more errors might have to be addressed because of the wide coverage area. A well-known example of a public WAN is the world wide web (internet). It is the biggest WAN covering the earth.

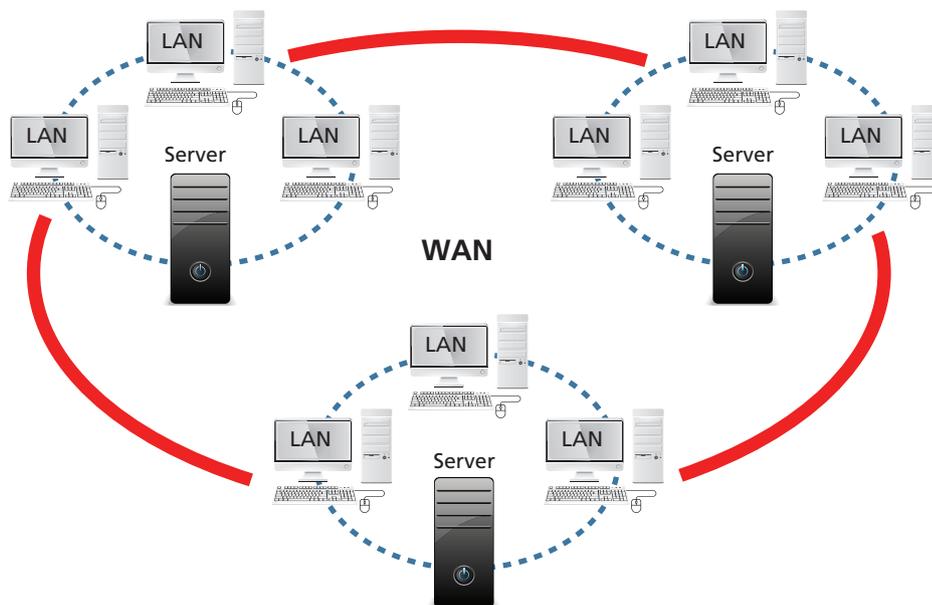


Figure 2.7 A wide-area network

## Other types of networks

### Personal area network (PAN)

A PAN is the smallest simplest form of a network. A PAN is controlled by one person from one computerised device. A printer is shared or information accessed via, for example, mobile phones, laptops or tablets. A wireless PAN is possible between Bluetooth devices or if connected to a wireless modem. This type of network can be used in a small office.



Figure 2.8 A personal area network

## Home area network (HAN)

A HAN is a typical home network used in individual homes. One or more computerised devices are connected to a person's digital device. This network creates a LAN network within the individual home. It enables participants in this network to share files, printers, etc.

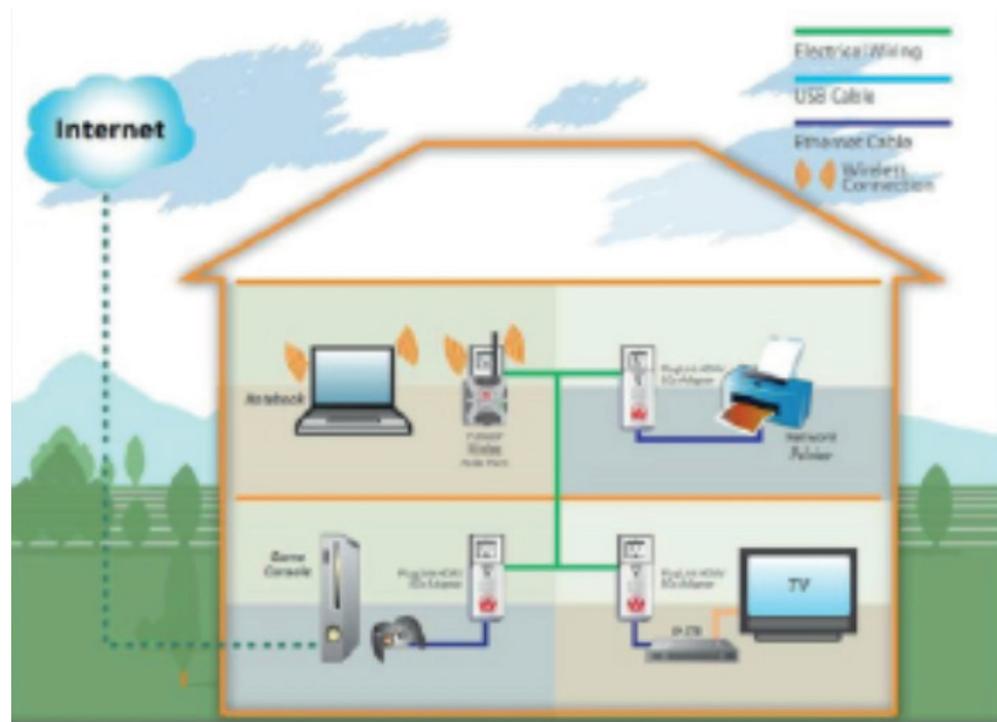


Figure 2.9 A home area network

## Campus area networks (CAN)

A CAN is a network system that allows various LANs to connect within a restricted geographical area. Examples are a military base or a university that can be connected to several campus buildings to enable connections to the different academic faculties.

### Did you know?

During the 2020 COVID-19 pandemic, all non-essential businesses were shut and those workers that could worked from home. Schools and universities switched to online learning. Businesses adapted and arranged for their employees to have access to the company networks so they could keep on operating.

### ACTIVITY 2.1

### Know your networks

Write the answers to this activity in a notepad.

Match the acronym in Column A with the statement in Column B.

COLUMN A	COLUMN B
1. WAN	The smallest simplest form of a network
2. LAN	A computer network system for a big business or town
3. PAN	Network system intended for a college, or a big business
4. MAN	Networks that are spread over a vast geographical area
5. HAN	Computers connected close together in the same building

## Advantages and disadvantages of using networks

Setting up a computer network system can be simple and easy. It is one of the most effective ways of sharing information.

### The advantages of using networks

- Anyone can connect to a computer network that is open to the public.
- Networks improve communication and accessibility of information. Simple and immediate messaging allows individuals to talk in real-time.
- It allows file sharing easily, as well as the sharing of data between various people.
- Resources such as software, printers, etc. can be shared with ease and this will cut costs.
- Networks allow a developing storage volume that enables people to connect to a network to access files and multimedia, such as images, music, etc.
- Networks enforce control over the storage of data. Company files can be stored in a file server. These files can be made available for sharing with every worker in the organisation.
- A well-secured network will protect the system against **computer viruses** and **phishing**.
- A great network system is reliable and will enable the backing up and proper storage of information.
- A well-managed network system will reduce errors, as this kind of system will have expert and well-trained technicians.

#### Keywords

**computer virus** a computer virus is created to cause harm to a computer system or programs, steal information, alter data, etc.

**phishing** a cybercrime in which a target is contacted via email, telephone or text message by someone pretending to be a real organisation to trick people into providing private information

### The disadvantages of using networks

- If the server or network breaks down or becomes defective, the whole network comes to a standstill.
- Workers are more dependent on computers than ever before. If the server becomes defective the workers will not be able to operate and this will cause production to slow down or stop.
- A computer virus infection can spread on a system and files can become corrupt. Therefore, regular scans must be performed on every network system.
- Setting up a network can be costly, as the network cabling and equipment are expensive.
- In a giant network system, there is always the challenge of keeping information secure.
- An effective network system needs great technical skill.
- An enormous network can encourage workers to engage in unlawful practices, such as sharing organisational files outside of the business. It may cause distractions during working hours, such as online gaming, spending time on social media sites or online shopping etc.

## The components and hardware required for network communications

A computer network consists of many components. Some of these are parts needed to install the software. Some of the important network components used in network communication are the NIC, hub, switch, router, server, cables, modem, and client.

Data can be transferred from one device to another and facilitates communication between different devices. Computer networks share common devices, functions and features, such as servers, clients, transmission media, shared data, shared printer, other hardware and software resources, etc. Figure 2.10 shows the basic components and hardware required for network communication.

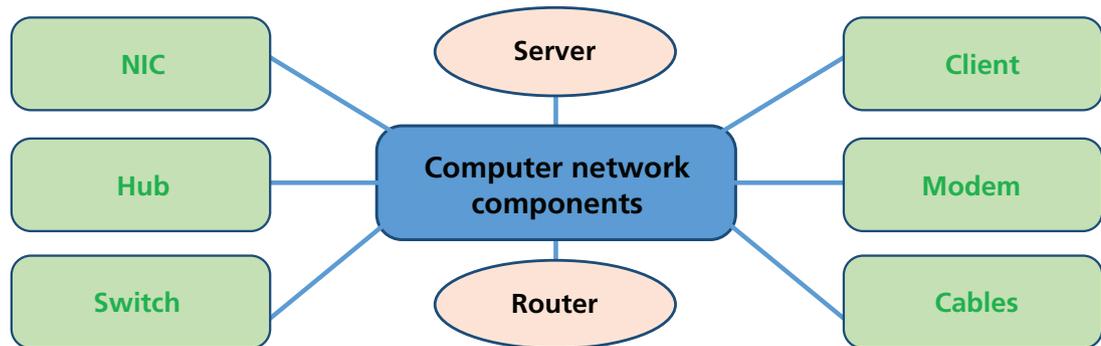


Figure 2.10 Computer network components

### Network interface card (NIC)

Every computer in a computer network must have a network interface card (NIC). It connects a computer to other computers in a network. An internal NIC slots into the motherboard of a computer that uses a cable and connectors. A laptop uses an external NIC. This is a wireless NIC that holds the antenna to acquire the connections over the wireless network.



Figure 2.11 A network interface card

### Hub

A hub is a hardware device that splits the network connections among several devices. It is used to link all the computers to each other in a computer network.

### Switch

A switch is a hardware device that links several devices on a computer network. It is similar to a hub, but with more advanced features. A switch will send the message directly to the computer device that needs it or that requested data.



Figure 2.12 A hub



Figure 2.13 A switch

## Clients

A client is a computer that is linked to other computers in the network and can receive data shared by other computers. In many businesses, each employee will have a client computer that enables them to access files from the company's server. The server provides resources for sharing and internet access.

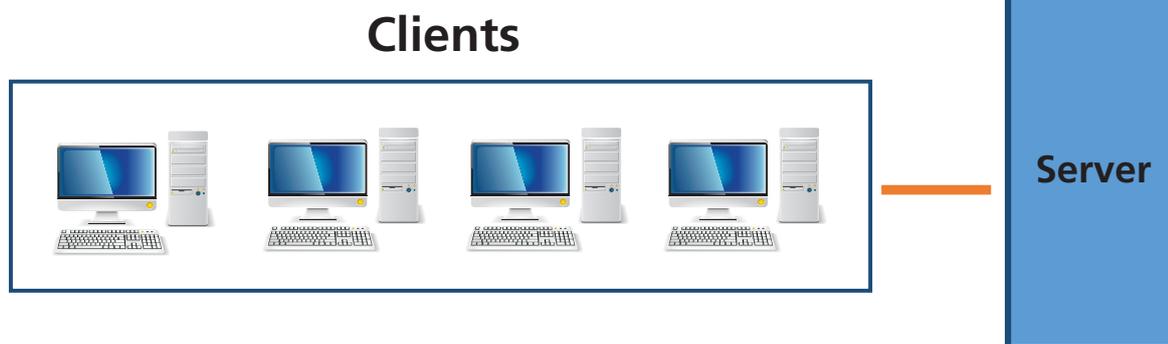


Figure 2.14 A Client-Server network

## Modem

A modem uses a telephone cable and is used as a hardware device for a computer to connect to the internet. A modem stands for *Modulator/Demodulator*. It alters the digital data into an analogue signal over a telephone cable.



Figure 2.15 A modem

## Router

A router is a hardware device used to link a LAN with an internet connection. A single internet connection can be shared with a number of computers in a network. A router can be programmed to comprehend the manipulation of data and is able to respond to the data it handles.



Figure 2.16 A router

## LAN cable

The LAN cable is a wire that is used to link more than one computer or other devices, such as printers and scanners, to each other. A LAN cable is also called an ethernet cable.



Figure 2.17 A LAN cable

## Server

Servers are an essential part of any IT infrastructure. A server is a computer utilised in a network that offers a service to a client. It processes and stores data that can be shared over a computer network or the internet.

A computer device can serve both the purpose of a server and a client. It can run resources and use them from another system at the same time. Demand for servers is constant. This is why most servers are never switched off, only in situations where there is a major problem with the server or during power outages. Switching off a server causes massive problems for network users and businesses.



Figure 2.18 A server

## Different types of networking hardware

There are different types of networking hardware. This hardware can also be called network equipment. These consist of electronic devices required for communication and interaction in computer networks.



Figure 2.19 Servicing network equipment

### NIC (network interface card)

The NIC is also called the ethernet card and network adapter. Without the NIC, a computer cannot be linked over a network.

The main purpose of the NIC is:

- The NIC links a computer to the internet or a local data-sharing network, for example a home network.
- The NIC enables both wired and wireless communications.
- The NIC decodes computer data into electrical signals. It arranges or formats the data, then sends the data to the receiving computer.
- The NIC controls the data flow between computers.

### The HUB

The HUB is a device that links several network-enabled devices in a local area network (LAN). The HUB's main purpose is to form a single network on which all devices can interconnect directly with each other.

#### Operation of the HUB

- A computer requests data/information from a computer network.
- Data transmission will take place through electrical signals.
- The computer will first send the request to the HUB via a cable.
- The HUB will transmit the request over the whole network in order for the correct server to respond and receive the request.
- HUBs are also called 'dumb' devices as HUBS transfer anything received.
- The **transmission speed** of the HUB is 10 Mbps.
- A HUB is mainly used in a small LAN network.
- A HUB is inexpensive.

#### Keywords

**transmission speed** the speed at which data is moved across a communication channel

**Mbps** megabytes per second

**Gbps** gigabytes per second

## Switches

- A switch runs a direct connection between the source and the destination.
- A switch does not transmit the message to the whole network like the HUB.
- It instructs the computer device to whom the message has to be communicated to.
- The switch diffuses an incoming data request by using the actual device address (where the device is located) in the incoming request.
- The request will then be transferred to the correct server computer. Therefore, a switch is more efficient than a HUB.
- The switch is mainly used in a LAN network.
- The speed of transferring data is 10–100 **Mbps**, 1 **Gbps**.
- Switches are also called semi-intelligent devices. The switch determines the proper location of the devices it is connected to almost instantly.

### Keywords

**Mbps** megabytes per second

**Gbps** gigabytes per second

## Routers

- Routers link several computer networks to each other.
- A router aids the movement of data between computerised devices and networks.
- The main purpose of the router is to transfer data from the modem to computerised devices.
- For example, in a household a parent can be on a computer in the home office and the children on their tablets or smartphones in their rooms. All in the same household will be able to connect to the internet simultaneously using the same internet connection with the support of a router.
- Data can also be transferred between several computer networks.
- Routers offer access to a laptop, smartphone and other wireless devices as well.



Figure 2.20 A home network with devices all connected via a Wi-Fi router

## Modem

- A modem is a device that makes it possible for a computer to communicate data over the telephone line or cable line.
- A benefit of the modem is that it enables an individual device or network to access the internet and communicate with the world.
- There are two types of modems:
  - Dial-up modems that use the telephone line
  - Modems for satellite and fibre optic cable networks.
- Modems are not that secure, as they can permit viruses and hackers to enter a network.

## Clients

A client is a computer device that uses the resources on a server by connecting to the server.

## Servers

The main purpose of a computer server is storage. It is also used to retrieve and send computer files and data from one computer to another on the same network. A server also issues work to clients and shares resources. There are many ways in which a server can be utilised. Some servers are dedicated to a specific task.



Figure 2.21 A computer server room at a data centre

There are different types of servers:

- **Application server:** Host web applications so that network users can use them without having to install a copy of the computer program on their computers. A great number of users share resources on an application server.
- **Webserver:** Clients get access via the webserver to the internet's web pages using a web browser.
- **File server:** Share and store files through a network. Files can be accessed by multiple users and share stored files on the server.
- **Client-server:** A central server that provides data for clients to allocate work and share resources. For example the internet, where millions of servers are linked together.
- **Mail server:** This is an application server that receives mail sent to users and stores them until requested by a client.
- **Database server:** Companies use large amounts of data. Many clients need to access databases anytime. Databases thus need large amounts of disk space. For this reason, database servers run database applications and respond to several requests from clients.
- **Proxy server:** This is a computer device that enables you to go on the internet under a different **IP** address. An IP address assists in linking your computer to other devices on your world-wide network. A proxy server will be used, for example, when you are travelling to another country and the technology set up in this country stops you from connecting to a website in your home country.
- **LAN cable:** A LAN cable connects computers, switches, routers, etc. to a LAN. The LAN cable is limited in length and strength. This means if a LAN cable is too long, it is not able to transmit a good and stable network signal. The ends of the cable must be close to each other to be able to receive signals swiftly. Wireless technology, for example Bluetooth and Wi-Fi, have replaced cables in businesses and homes.

### Keywords

**IP** internet protocol address

**ACTIVITY 2.2****Advantages and disadvantages of networks**

Write the answers to this activity in a notepad. Determine if the following information is an advantage or a disadvantage of networks.

1. A computer virus infection can spread on a system and files can become corrupt.
  2. Networks enforce control over the storage of data.
  3. A well-managed network system will reduce errors, as this kind of system will have expert and well-trained technicians.
  4. Workers are more dependent on computers than ever before.
  5. An enormous network can encourage workers to engage in unlawful acts.
  6. Setting up a network can be costly.
  7. Networks allow file sharing easily, as well as the sharing of data between various people.
  8. Networks allow a developing storage volume.
  9. If the network server breaks down, the network comes to a standstill.
  10. Resources, such as software, printers, etc. can be easily shared.
- 

**ACTIVITY 2.3****True or false?**

Write the answers to this activity in a notepad. The following statements are false. Correct the statements so that they are true.

1. A proxy server is a computer that is linked to other computers in the network and can receive data shared by other computers.
  2. A switch will transmit data through electrical signals.
  3. A hub will send the message directly to the computer device that needs it or that requested data.
  4. The router communicates data over the telephone line or cable line.
  5. A web server hosts web applications so that network users can use them without having to install a copy of the computer program on their computers.
  6. The database server is a computer device that enables you to go on the internet under a different IP address.
  7. A network intervention card is also called the ethernet card and network adapter.
  8. A VGA cable is a wire that is used to link more than one computer, or other devices such as printers and scanners to each other.
  9. The mail server shares and stores files through a network.
  10. A HAN is network system that allows various LANs to connect within a restricted geographical area. Examples are the military base or a university.
-

## Module summary

- We now know that computers have the ability to send and receive information over a world-wide telecommunications network. This forever changed the way individuals and businesses communicate in the world.
- The LAN (local area network) can be two computers in a home office or a university with various faculties that has hundreds of computers connected to each other. Computer networks have the ability to share or exchange information and resources. There are different types of networks, each with various benefits and disadvantages. The most common network is the LAN which expands to a MAN, followed by a WAN. The PAN is the smallest network but used every day by ordinary people through Bluetooth and Wi-Fi connections.
- There are basic hardware components needed to connect to a network and enable it to function effectively. These components are the NIC, hub, switch, client (computer station), server, router, modem and network cables. Networks are constantly being created every day and are a significant role-player in the future of individuals, businesses and the world.

## Exam practice questions

Write the answers to these questions in a notepad.

1. Match the statement or definition in Column A with the word in Column B.

COLUMN A	COLUMN B
1. Connection of computers and devices over a small geographical location	MAN
2. Connects to home devices such as a few personal computers, phone and printers	PAN
3. Connection of computer and devices that are close to a person	LAN
4. The connection of loads of devices that span large cities over a wide geographical area	CAN
5. The connection of devices, printers, phones and accessories within a campus which links to other departments within the same campus	WAN
6. Connects devices, phones, printers, scanners, etc. over a very wide geographical location which may range to connect cities, countries and even continents	HAN

(2 × 6 = 12)

2. Fill in the missing word:
- a) A \_\_\_\_\_ is hardware that allows for storage of programs, information and resources.
  - b) A \_\_\_\_\_ is hardware that joins multiple computers together within one local area network (LAN).
  - c) When two or more computers are connected via software and hardware to communicate they create a \_\_\_\_\_.
  - d) A \_\_\_\_\_ is hardware that connects an analogue phone line to a digital computer network. (3 × 4 = 12)
3. List five advantages and five disadvantages of using computer network systems. (10 × 1 = 10)
4. What is a network interface card and what is its purpose? (6 × 1 = 6)

**Total: 40 marks**