

Theory Book

# INFORMATION TECHNOLOGY

# 10



**basic education**

Department:  
Basic Education  
**REPUBLIC OF SOUTH AFRICA**



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**Information Technology Theory Book Grade 10**

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# Dear Learner

Welcome to the *Theory Book for Information Technology Grade 10*. Please read the information below about the book before you start using it. This book provides you with all the information you need to cover the Grade 10 Information Technology curriculum. It will also help you develop the skills, attitudes and values you need to be successful in your studies.

Each chapter in the book has the following features, which are meant to help you learn:

## Overview

This is an overview of the contents and the units of the chapter

OVERVIEW	
Unit 1.1	General model of a computer
Unit 1.2	Hardware and software
Unit 1.3	Types of computers
Unit 1.4	Advantages and disadvantages of computers
Unit 1.5	Data and information management.

## Learning outcomes

These are the objectives that are addressed in the chapter. It states what you should be able to do by the end of the chapter and gives you an idea of what will be expected of you as a learner. After completing each chapter, ask yourself, ‘Am I able to do everything stated in the learning outcomes?’. If not, you should revise the content covered in the chapter.

Learning outcomes	Like
At the end of this chapter you should be able to:	
<ul style="list-style-type: none"><li>• define Information and Communication Technologies (ICTs) and Information Technology</li><li>• provide an overview of a general model of a computer</li><li>• provide an overview and concepts of the main components of a computer system</li><li>• define shareware, freeware, free open source software (FOSS) and proprietary software</li><li>• explain the interdependency of hardware and software</li><li>• state and differentiate between the types of computers</li><li>• categorise computers/classification of computers</li><li>• list the advantages and disadvantages of using computers</li><li>• explain and differentiate between data and information</li><li>• explain the information processing cycle</li><li>• provide an overview of uses and examples of information within an organisation</li><li>• explain why is information useful</li><li>• provide an overview of a general model of an ICT system.</li></ul>	

 WHAT MOST SCHOOLS DON'T TEACH

Before getting started, watch the video in the QR code



<https://www.youtube.com/watch?v=nKlu9yen5nc>

 PLAYLIST

Click on the QR code to access a playlist of videos that will teach you different skills you will need to know for this course.



[https://m.youtube.com/playlist?list=PLY8n0zQCEkppKq4Pe\\_LHzcxQIQSimwk4S](https://m.youtube.com/playlist?list=PLY8n0zQCEkppKq4Pe_LHzcxQIQSimwk4S)

## Introduction

The introduction is a brief summary of why you will be learning the content that is covered in the chapter. Sometimes it will give you a brief background of how far technology has come, while at other times it will just give you a short summary that introduces the content that will follow in the chapter.

### Learning outcomes



At the end of this chapter you should be able to:

- define Information and Communication Technologies (ICTs) and Information Technology
- provide an overview of a general model of a computer
- provide an overview and concepts of the main components of a computer system
- define shareware, freeware, free open source software (FOSS) and proprietary software
- explain the interdependency of hardware and software
- state and differentiate between the types of computers
- categorise computers/classification of computers



### New words

#### RSI (REPETITIVE STRAIN INJURY)

— a painful inflammation of the tendons that often results from overuse. A tendon is tissue that attaches muscle to the bone

**ergonomics** — the study of how humans interact with fabricated objects, the goal is to create an environment that is well suited to the users' physical needs

## Activities

These cover questions you have to answer based on the content presented before them. Activities will help you check whether you have understood the content presented in the book or not.

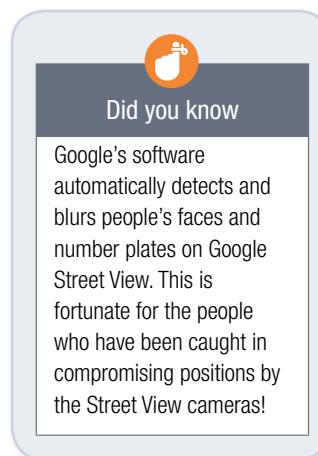
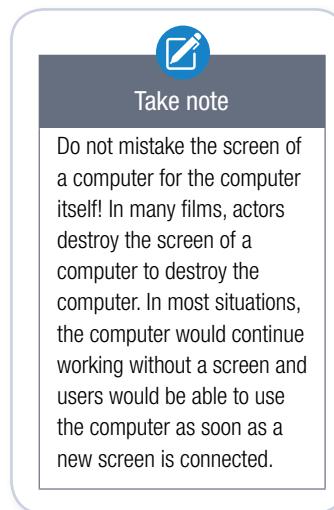


### Activity 1.4

- 1.4.1.** List any TWO advantages of computers.
- 1.4.2.** List any TWO disadvantages of computers.
- 1.4.3.** What do you use a desktop computer for?
- 1.4.4.** In two teams, debate for and against the use of computers. Support your answers.

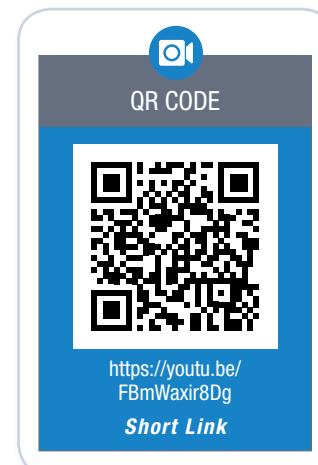
### 'Take note' and 'Did you know' boxes

The boxes provide extra, interesting content that might caution you to 'take note' of something important; or give you additional information. Note that the content in the 'Did you know' boxes will not be part of your exams.



### QR Codes, Videos and Screen captures

These will link you to online content. When you are in the eBook, you can easily access the links.



### Consolidation activities

This is a revision activity based on what you have covered in the chapter. Take time to answer the questions on your own. Your teacher may also use these to assess your performance during class.

#### CONSOLIDATION ACTIVITY

#### Chapter 1: Basic concepts of computing

1. Which ONE of the following options gives the CORRECT order of the information processing cycle?
  - a. Input, processing, output, storage
  - b. Input, output, processing, storage
  - c. Input, processing, storage, output
  - d. Input, storage, output, processing
2. Which one of the following best describes this definition: This is a combination of computer-based technologies (such as computers and smartphones) with communication technologies (such as telephones, cell phones and the internet).
  - a. ICT
  - b. Network

# BASIC CONCEPTS OF COMPUTING

## OVERVIEW



- Unit 1.1 General model of a computer
- Unit 1.2 Hardware and software
- Unit 1.3 Types of computers
- Unit 1.4 Advantages and disadvantages of computers
- Unit 1.5 Data and information management.

## Learning outcomes



At the end of this chapter you should be able to:

- define Information and Communication Technologies (ICTs) and Information Technology
- provide an overview of a general model of a computer
- provide an overview and concepts of the main components of a computer system
- define shareware, freeware, free open source software (FOSS) and proprietary software
- explain the interdependency of hardware and software
- state and differentiate between the types of computers
- categorise computers/classification of computers
- list the advantages and disadvantages of using computers
- explain and differentiate between data and information
- explain the information processing cycle
- provide an overview of uses and examples of information within an organisation
- explain why is information useful
- provide an overview of a general model of an ICT system.

## INTRODUCTION

**Information Communication Technologies (ICT)** is the combination of computer-based technologies (such as computing devices and smartphones) with communication technologies (such as telephones, cell phones and the internet). In practice, it refers to all the hardware, software, and systems essential to communicate electronically.

Over the last twenty years, the field of ICT has grown from a small niche field to one of the most important fields in the world. Refer to the YouTube video to see how ICT has changed over the years.

## HOW ICT HAS CHANGED OVER THE YEARS



[https://youtu.be/  
FBmWaxir8Dg](https://youtu.be/FBmWaxir8Dg)  
**Short Link**

## New words

**input device** – any hardware or peripheral device that allows you to enter data into a computer or interact with a computer

**storage device** – a hardware device that is used for storing data

**random-access memory (RAM)** – a hardware device, usually on the motherboard, that allows information and data to be temporarily stored and retrieved on a computer while it is on

**processing device** – a hardware device that receives the data, performs a set of instructions, and then returns the processed data to the RAM

**output device** – a device that formats and presents data in a form understandable to a user

**communication device** – a hardware device capable of transmitting a signal over a wire or wireless connection.

# 1.1 General model of a computer

In this unit, you will:

- define Information and Communication Technologies (ICTs) and Information Technology
- provide an overview of a general model of a computer
- explain the information processing cycle.

## ICT SYSTEMS AND IT

**Information and Communication Technologies** (ICT) refers to technologies that capture, transmit and display data and information electronically and includes all devices, applications and networking elements that allow people to connect in a digital world.

An ICT system refers to the overall set-up, consisting of hardware, software, data and its users. ICT systems as a whole include:

- **People** – to supply the data and to make decisions from the output supplied from the system information, which is based on the results from processing data and the output from an ICT system.
- **Hardware** e.g. input devices, storage, processor, output devices and communication devices.
- **Procedures** – to determine what needs to be done and when. This causes the passing of data or information between people.
- **Software** – the computer programs which provide the step-by-step instructions to complete the task.
- **Data** – raw material that is processed by the system to provide the information for the output provided by the system. Data can come in different formats, such as sounds, images, and videos, etc.

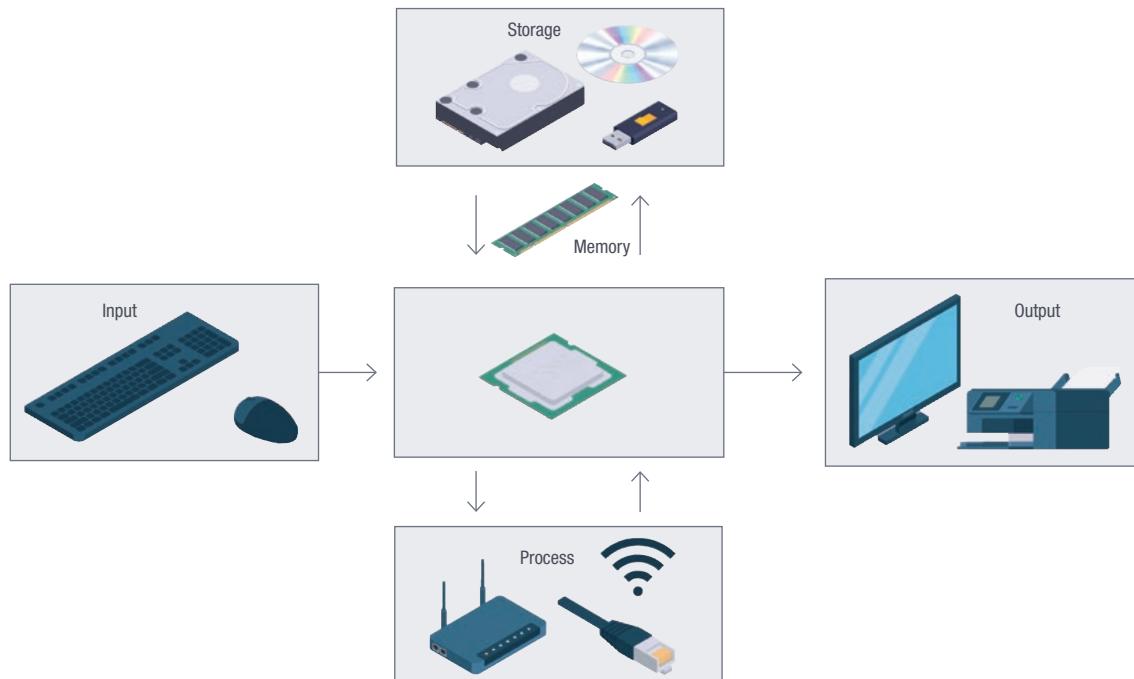
In order for an ICT system to function, it needs to receive, store, retrieve, manipulate and transmit data.

Computers are programmable electronic devices designed to accept data, perform prescribed mathematical and logical operations at high speed, and display the results of these operations. Computers are used in Information Technology (IT) – which is a subset of ICT. Computers store, transmit, retrieve and manipulate data for businesses and other enterprises. Computers refer to the hardware, and since computers cannot initiate functionality on their own, they start functioning as soon as they receive data to work with (to process). This data is then stored on the computer, the computer manipulates the data according to the instructions it has received, before sending the new information back to the user.

Thus, we can say that Information technology (IT) is the development, maintenance and use of computer systems, software, and networks for processing and communicating data.

## THE GENERAL MODEL OF A COMPUTER

The following illustration demonstrates a general model of a computer and shows that the functions of a computer are similar to the steps of the information processing cycle. All basic computers consist of four functions: input, storage, processing and output.



**Figure 1.1:** The general model of a computer

IPO is often called IPOS or **input**, process, **output**, storage. The computer receives input, processes the input as per user instructions and provides output and can be stored in a desired format. Computer input is called data and the output obtained after processing it, is called information. Raw facts and figures that can be processed using arithmetic and logical operations to obtain information are called data.

The general model of computers can be used to explain how each computer (or smartphone) works.

Once you understand how a computer operates, it becomes a lot easier to think about creating your own programs. When you begin learning about coding a program, you need to understand that you must create a set of step-by-step instructions that manages the flow of information: from when your program receives data from the user, up to the point when it returns output back to the user.



### Activity 1.1

- 1.1.1 Differentiate between ICT and IT.
- 1.1.2 List the output devices of your computer.
- 1.1.3 Follow the guidelines below to provide a diagrammatic example of the general model of computers.
  - a. Draw a diagram of the five steps of the general model of computers.
  - b. Define each step.
  - c. Think about when you send a WhatsApp message. How can you apply the general model of a computer to this?

**Hint:** Watch the video given in the QR code to help you answer this question.



### INTRO TO COMPUTER ARCHITECTURE



[https://www.youtube.com/watch?v=HEjPop-aK\\_w](https://www.youtube.com/watch?v=HEjPop-aK_w)

## 1.2 Hardware and software

In this unit, you will learn about the following:

- provide an overview and concepts of the main components of a computer system
- define shareware, freeware, free open source software (FOSS) and proprietary software
- explain the interdependency of hardware and software.

### HARDWARE VS. SOFTWARE

For a computer to function properly, it must consist of both hardware and software, because the hardware and software are interdependent. This means that the one will not function without the other.

- Hardware consists of the physical components of a computer, also referred to as the equipment of a computer. Hardware devices can be categorised according to their functionality on the computing device.
- Software Application software (Apps) and System software (Operating System ) refers to the programs used to direct the operation of a computer. It also contains the instructions for how to use the software.

### HARDWARE: THE PHYSICAL COMPONENTS OF A COMPUTER SYSTEM

The common physical components of a computer system that will be discussed are input (keyboard, mouse), storage (hard drive), memory (RAM), processing (CPU), output (monitor, printer) and communication (Network Interface Card, NIC).

- **Input devices** are any hardware devices that allows you to input data into a computer or interact with a computer. In the past, the most popular input devices included the mouse and keyboard. These days, however, there is quite a variety of input devices. One very popular example is the touchscreen keyboard on mobile smartphones.
- **A storage device** is a hardware device that allows you to store data for later use. There are many different storage devices, with each device having advantages and disadvantages. Some of the most popular storage devices include hard disk drives (HDDs) and solid-state drives (SSDs). The different storage devices will be discussed in more detail in later chapters.



**Figure 1.2:** The touchscreen is a popular input device



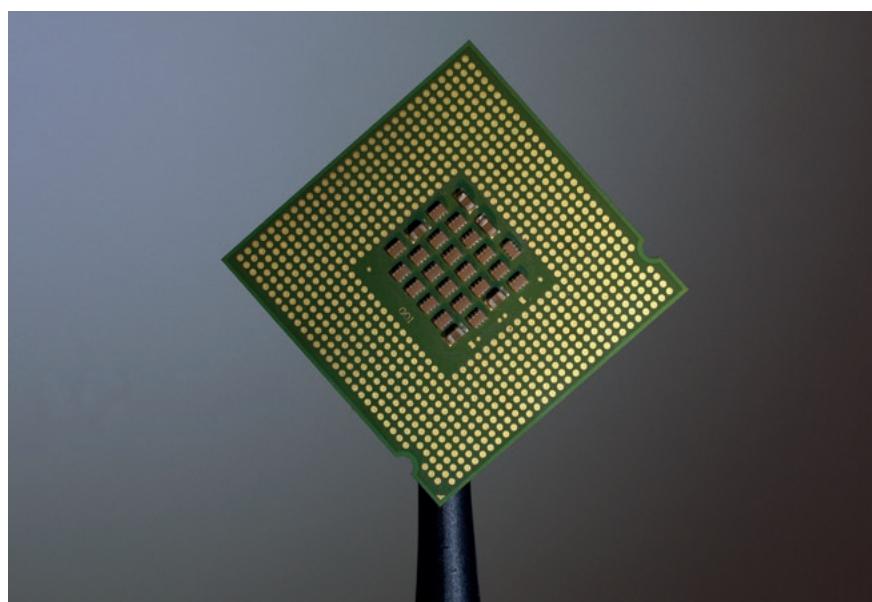
**Figure 1.3:** Hard disk drives mostly have large storage capacities

- **Random-access memory (RAM)** refers to a fast, temporary form of storage. All data and instructions that is currently being executed is stored in RAM. RAM is volatile, that is, all data is erased from your RAM when your computer is turned off. RAM is also referred to as memory.



**Figure 1.4:** Random-access memory (RAM)

- **Processing devices** receive the data from the RAM, perform sets of instructions, and returns the processed data to the RAM. The two most important processing devices in modern computers are:
  - **The Central Processing Unit (CPU)** is responsible for processing general instructions. Every application makes use of the CPU to collect, decode and execute instructions as required by the application.
  - **The Graphics Processing Unit (GPU)** is responsible for processing the instructions that create the pictures on your screen, for example, three-dimensional games rely heavily on the GPU to create their images.



**Figure 1.5:** The CPU contains the necessary circuitry to interpret and execute program instructions

- **Output devices** are devices that return the computer's instructions, as results, to the user. Popular output devices include monitors / screens and printers.



### Take note

Do not mistake the screen of a computer for the computer itself! In many films, actors destroy the screen of a computer to destroy the computer. In most situations, the computer would continue working without a screen and users would be able to use the computer as soon as a new screen is connected.

**Figure 1.6:** A laptop computer with a second screen connected

- **A communication device** is a hardware device capable of transmitting an analog or digital signal over a wired or wireless connection. Examples include, a modem and a network interface card (NIC) that can be either wired or wireless

## SOFTWARE: THE NON-PHYSICAL COMPONENTS OF A COMPUTER SYSTEM

**Software** refers to the set of instructions a computer uses to complete any instructed task. Software is the program that is operated by the hardware. These include programs such as, Microsoft Applications or InDesign Creative Suite. As a result, hardware and software are interdependent.

Remember that this interdependence means that neither the software nor the hardware can function without the other one. Hardware cannot do anything without software because it depends on the processed instructions to provide input, while software cannot function without hardware to process the user's instructions.

```

41      @classmethod
42      def from_settings(cls, settings):
43          debug = settings.getbool('SUPERVISOR_DEBUG')
44          return cls(job_dir(settings), debug)
45
46      def request_seen(self, request):
47          fp = self.request_fingerprint(request)
48          if fp in self.fingerprints:
49              return True
50          self.fingerprints.add(fp)
51          if self.file:
52              self.file.write(fp + os.linesep)
53
54      def request_fingerprint(self, request):
55          request_fingerprint(request)

```

**Figure 1.7:** Software refers to instructions that a programmer has created for hardware



### Did you know

One of the primary outcomes of this subject is to teach you how to write your own software. This will allow you to use the power of a computer to make your life, and the lives of the people all around the world, better and easier!

You will learn more about the different types of hardware and software and the relationship between them.

The two most important types of software are:

- system software (including the operating system)
- application software.

### SYSTEM SOFTWARE

System software is the specific type of software that manages the flow of data and the information contained on the computer. The operating system (OS) is the most important type of system software.

Examples of operating systems include Microsoft Windows, Linux, MacOS, iOS and Android. The OS is designed to control and coordinate the tasks and functions of computer hardware.

### APPLICATION SOFTWARE

Application software is a program that is built for a specific purpose, like sending a message, browsing the internet, or typing a document. Application software refers to any software that lets the user accomplish a function or create content. Application software requires system software in order to function. This type of software includes media players, spreadsheets and word processors. When multiple applications are packaged together it is called an application suite. Examples include Microsoft Office, Google Chrome, Mozilla Firefox and Skype. Games and mobile applications such as Spotify and Uber, are also considered application software.

### SHAREWARE, FREEWARE, FREE OPEN SOURCE SOFTWARE (FOSS) AND PROPRIETARY SOFTWARE

Let's have a look at the table on the next page. The table shows the differences and uses between shareware, freeware, free open source software (FOSS) and proprietary software.

When a program is developed, the developers decide whether the code is proprietary or open source software (OSS). The table below explains more about open source software.

**Table 1.1: Shareware, freeware, free open source software (FOSS) and proprietary software**

Type of software	Shareware	Freeware	Free open source software	Proprietary
Description	Shareware is copyright software distributed free of charge, but after a trial period it notifies the user that they might need to pay for the program if they want to keep it. Some developers distribute shareware with a built-in expiration date, for example after 30 days the user can no longer use the program, while other types of shareware are limited in terms of what functionality it offers unless you buy the complete program.	Freeware software is available to you, free of charge. However, the developers or company that distributes the software keeps the rights to the software.	Open source software has a source code that is available to the public or anyone that wants to use it. It also allows the user to change or modify the code itself if need be. You can also distribute this type of software to anyone and for any purpose.	All computer software is developed using a source code. This code is the original design or technical blueprint used to create the program. Proprietary software, is where the source code is not given to the public or the user. It still belongs to the distributor or developer, even if you have bought the program.
Examples	Examples of shareware would be DVD-Cloner, Total Privacy, Easy Movie Splitter and Adobe Acrobat Reader. Some computer games only give you access to the first three levels.	Examples of freeware is Mozilla Firefox and Google Chrome, the voice-over-IP service Skype, and the PDF file reader Adobe Acrobat	Linux kernel, Gimp, Firefox, Chromium and LibreOffice	Examples of proprietary software would be Microsoft Office, Windows, antivirus software and most computer games
Advantages	The advantage of shareware is that it gives the distributor exposure while giving the user time to decide whether they want to spend money on the program or not.	The main advantage of freeware is that it is free. It is also easily accessible and generally comes with the files you need in order to use the program.	It is free and you do not need to pay for using it, which saves you money. Since the source is available to anyone, the public can collaborate and fix bugs. Collaborators can improve the performance or even add features of good quality and well-designed software.	Proprietary software is more stable and technical support is easier to access.
Disadvantages	The main disadvantages are that it cannot be modified and may be a cut-down or allow for a temporary version.	It can contain viruses and Trojan horses that affect the way the computer functions.	Open software might not be as user-friendly especially to unskilled users. It is often difficult to find proper technical support or find drivers for some devices. The software can expose your computer to viruses and other cyber-attacks.	This software costs money, and if there are any technical issues, you will have to wait for the developer to address the problem.



### Take note

Keep in mind that there are safety precautions you should follow when downloading free or paid software. Nothing stops the developer from bundling the software with malicious software, malware (virus, worms, or spyware) and still make you pay for it. There is also a lot of freeware that is useless or ineffective and you need to be aware of the importance of practicing good software safety, so that you can choose the best software for your needs.



### Activity 1.2

- 1.2.1** Explain the difference between hardware and software.
- 1.2.2** Explain the interdependency of hardware and software.
- 1.2.3** Match column A with column B. Only write the question number and the alphabet letter, e.g. 1, M:

Column A	Column B
1. A hardware device that allows you to enter data into a computer or interact with a computer.	A. Monitor
2. An output device used by a music software.	B. Scanner
3. Most commonly used device to store information.	C. Keyboard
4. This type of software manages a computer and tells the hardware how to work together.	D. RAM
5. This is an example of an output device.	E. Storage
6. Keeps record of our programs and data permanently.	F. CPU
7. Software used for a specific purpose to carry out a task, such as word processing.	G. System software
8. This is responsible for processing instructions and performing calculations.	H. Application software
9. Storage used as temporary memory by the processor.	I. Speakers
	J. Hard drive
	K. Modem
	L. Flash drive
	M. Computer case

- 1.2.4**
  - a. Differentiate between system software and application software.
  - b. List two examples of operating systems.
  - c. List two examples of application software.
- 1.2.5**
  - a. Define shareware, freeware, free open source software (FOSS) and proprietary software.
  - b. Evaluate which categories given in question 1.2.4 a. above would most likely be used for the following:
    - i. a gamer
    - ii. a businessman who has online meetings
    - iii. a student researching for a project
    - iv. a teacher designing lesson plans
- 1.2.6**
  - a. Distinguish between the six main components of a computer system.
  - b. Provide an example for each of the main components of a computer system.



### WHAT IS OPEN SOURCE SOFTWARE



<https://www.youtube.com/watch?v=1ehpgbb3XD0>

<https://qrs.ly/3eab1zk>



### Activity 1.2

*continued*

- 1.2.7** What is a storage device? Give examples of those that you have in your computer lab.
- 1.2.8** Read the following article taken from an eNCA report and answer the questions that follow.

## Subdued growth to dominate SA's ICT market

By **KAUTHAR GOOL**

Johannesburg, 15 Feb 2018

**S**outh Africa's overall ICT market is expected to reach \$21.4 billion (R248 billion) by the end of 2018, and \$23.4 billion (R273 billion) by 2021, representing a compound average growth rate of 2.9%.

This is according to market research firm IDC, which hosted its IDC Directions 2018 event in Johannesburg this week.

Speaking at the event, Mark Walker, associate vice-president for Sub-Saharan Africa at IDC, said this is in line with overall macro-economic growth expectations which are relatively subdued.

According to Walker, IT services, software and infrastructure roll-out are the fastest growth segments in SA's ICT market.

'The government and financial sectors dominate spend in South Africa,' he noted. 'In finance, this is driven by investment in upgrading legacy systems, compliance, as well as risk mitigation and improving customer experience.'

He pointed out that government spend is focused on maintaining and upgrading existing systems while rolling out infrastructure and improving connectivity as progress is made on various discrete smart city initiatives.

*[Source: <https://www.itweb.co.za/content/xnkI0vzbkd8v4Ymz> [Last accessed April 2019]]*

- a.** ICT and IT are mentioned in the excerpt. Explain and describe the difference between these terms.
- b.** The term 'legacy systems' is used in the text. Research this term and explain its meaning in your own words.
- c.** Explain what is meant by ICT infrastructure.
- d.** What is meant by connectivity in this context?

## 1.3 Types of computers

In this unit, you will:

- state and differentiate between the types of computers
- categorise computers/classification of computers.

Wouldn't it be fantastic if each morning, 10 minutes before your alarm goes off, your coffee machine automatically pours you a cup of coffee, tea or hot chocolate, your toaster makes fresh toast, your lights slowly turn on and music starts playing?

Less than 15 years ago these concepts could only be found in science fiction films. Today, thanks to the development of affordable computers, all these smart devices exist and are ready to make your life more comfortable. These devices are generally called smart devices or embedded computers and are one of the five types of computers you can find today.

Supercomputers, mainframe computers, minicomputers, microcomputers and mobile computers are the main categories under which computers can be classified.

### CLASSIFICATION OF COMPUTERS

Computers can be classified as general-purpose computers, specific purpose computers or super computers.

General-purpose computers compute a range of tasks but lack super speed and efficiency. The purpose of computers in this category might differ from one another: Examples are:

- desktop computers
- laptops
- tablets
- smartphones.

Specific purpose computers handle a specific problem or task. It uses a high level of accuracy and processing power. Examples are:

- servers
- embedded devices.

Super computers are extremely expensive, and the applications are for specialised activities or tasks such as weather forecasting.

Classification of computers in terms of data processing power and capacity could be done in the following grouping:

**Table 1.2: Types of computing devices**

PHOTO	COMPUTING DEVICE	USES	PROCESSING POWER	MOBILITY
	Laptops	Laptop computers are used for almost anything, from document processing in an office environment, to graphic design and video editing, to browsing the internet and playing games. However, laptop computers are easily moved around allowing you to work anywhere and anytime.	Medium to high processing power	Fully mobile
	Desktop computers	A desktop computer's uses are exactly the same as those of a laptop except that a desktop is not mobile.	Medium to high processing power	Minimal mobility
	Smart phones	Smartphones are better than desktops at tasks that require a very mobile device, like taking photos, setting alarms, navigating the roads, making calls and sending and receiving short messages.	Medium to low processing power	Excellent mobility
	Tablets	Info on keyboard, screen size and applications. Reading of books is better on a tablet than on a smartphone.	Medium processing power	Excellent mobility
	Servers	Servers are designed for managing networks, providing access to specific files and hosting websites, as well as processing huge amounts of data.	High processing power	No mobility
	Embedded computers	Embedded devices are devices designed for a fixed purpose, whether that purpose is to wake you up in the morning, control the temperature of the air conditioning or refrigerator, or any navigation system.	Low processing power	Varies depending on the device



### Take note

Examples of embedded computers are:

- ATM machines
- MP3 players
- DVD players
- Drones
- Anti-lock braking system
- Airbag control system
- Digital watches.



### WHAT IS AN EMBEDDED COMPUTER?



<https://www.youtube.com/watch?v=dS58AfaOAxk>

<https://qrs.ly/daab1zl>

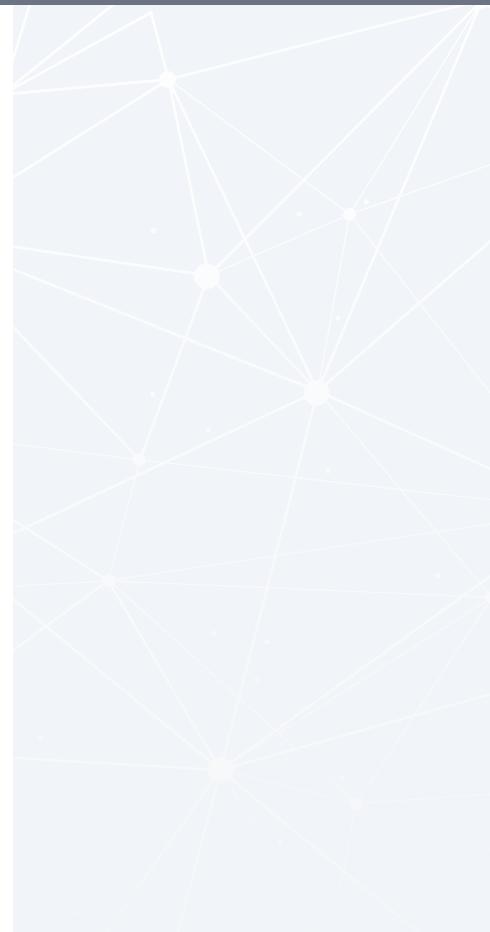


### Activity 1.3

- 1.3.1** Identify the different types of computers illustrated below.



- 1.3.2** Differentiate between the six types of computing devices.
- 1.3.3** Which of the devices below are examples of embedded devices? Support your answers.
- Mobile phone
  - Navigating system in a motor vehicle
  - A tablet
  - A robotic vacuum cleaner
  - Television decoder
- 1.3.4** Your school wants to upgrade their computers in the media centre. A debate has started about whether to replace the desktop computers with laptops or tablets. Critique the options and give reasons for your choice.



## 1.4 Advantages and disadvantages of using computers

In this unit, you will:

- list the advantages and disadvantages of using computers.

### ADVANTAGES OF USING A COMPUTER

There are many advantages of using computers. However, the following are some of the most important ones to know:

- Provides access to more information
- Completes tasks that might be impossible for humans to complete
- Saves time
- Automates repetitive tasks
- Allows for greater productivity
- Allows for better communication and connections
- Entertainment

### DISADVANTAGES OF USING A COMPUTER

Unfortunately computers also have some disadvantages. These disadvantages include:

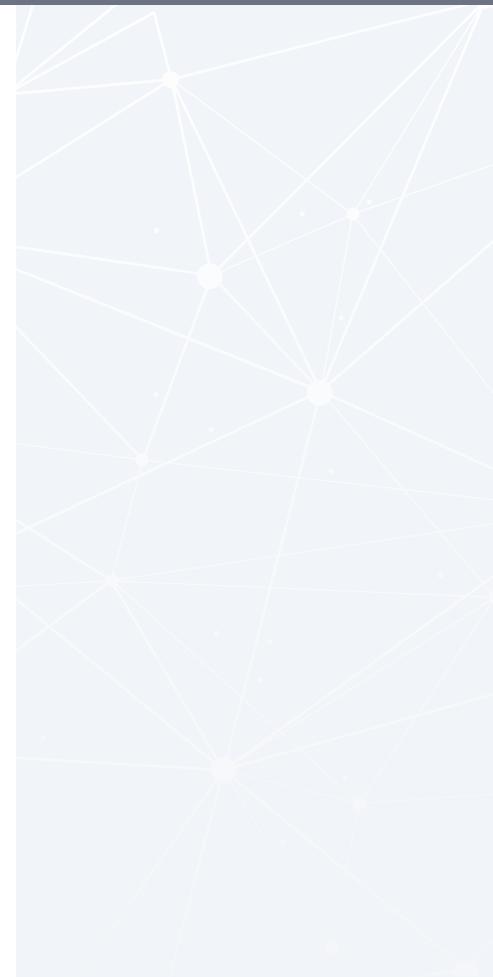
- Social risks:** computers provide humans access to social media, which can be addictive, make people less happy, lead to jealousy, and get in the way of real-world friendships. In fact, a study found that of 1 500 Facebook users interviewed, 62% said Facebook occasionally made them feel like they are not good enough, and 60% said that comparing themselves to other people on Facebook made them jealous.
- Health risks:** research has shown that excessive computer use can result in several medical problems, including back pain, eyestrain, obesity, carpal tunnel syndrome (CTS) and **repetitive strain injury (RSI)**. However, with good **ergonomic** practices, many of these health risks could be reduced or removed.



#### New words

**RSI (REPETITIVE STRAIN INJURY)** – a painful inflammation of the tendons that often results from overuse. A tendon is tissue that attaches muscle to the bone

**ergonomics** – the study of how humans interact with fabricated objects, the goal is to create an environment that is well suited to the users' physical needs

- 
- 3. Security risks:** computer security risk can be created by malware, that is, bad software, that can attack your computer system, destroy your files, steal your data, or allow an attacker to gain access to your system without your knowledge. Computers are programmed to follow instructions, and sometimes people program computers to act in a way that harms a user.
  - 4. High cost:** computers are expensive. Even the most affordable computers are still very expensive for the average person in South Africa. Since computers empower people, the high cost of computers puts pressure on people who are not able to afford them, and places them at a disadvantage.
  - 5. Distractions/disruptions:** if you have ever spent hours browsing the internet or watching videos on YouTube, then you know how distracting computers can be! Because of their high entertainment value, it is easy for computers to distract people and stop them from being productive.
  - 6. Environmental impact:** computers use a lot of electricity and in most cases the generation of electricity is harmful to the environment because of the carbon emissions. This has a huge impact on our planet.



#### Activity 1.4

- 1.4.1.** List any TWO advantages of computers.
- 1.4.2.** List any TWO disadvantages of computers.
- 1.4.3.** What do you use a desktop computer for?
- 1.4.4.** In two teams, debate for and against the use of computers. Support your answers.

## 1.5 Data and information management

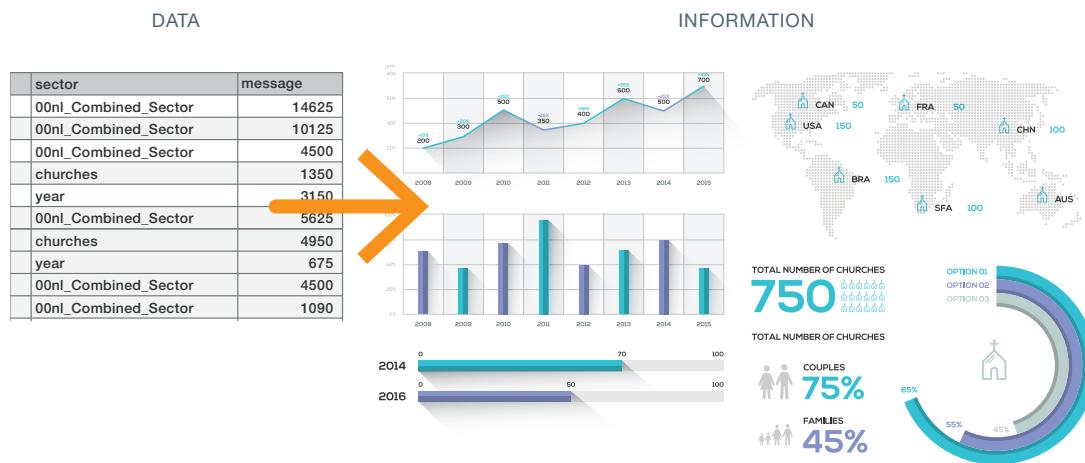
In this unit, you will:

- explain and differentiate between data and information
- provide an overview of uses and examples of information within an organisation
- explain why information is useful
- provide an overview of a general model of an ICT system.

So far, we have spoken a lot about computers receiving data, manipulating the data, and then turning data into useful information. But what exactly is data and how does it differ from information?

**Data** can be defined as unprocessed numbers, or facts. Without first processing or changing data, it is meaningless. For example, your school might have data on the names, surnames, addresses, contact details, as well as the results of every class test, assignment, test, and exam of all current and past learners stored on a computer somewhere. While this data is important to store, it could be hundreds or even thousands of pages long and very difficult to interpret!

**Information** can be defined as facts and numbers that have been organised / processed so that it is useful / meaningful to people. For example, if your mathematics teacher wanted to see how well your current class is performing compared to last year's class, she might ask your school's database administrator to process the available data into averages for the two years. In that way, all those thousands of pages of data are processed into two numbers that can be compared easily. Similarly, the report you receive at the end of each school year takes all the data that teachers have collected during the year and turns that data into a single report that you can use to measure your performance.



**Figure 1.8:** Data is unprocessed facts while information is organised

One of the main functions of a computer is to take unprocessed data (data that is useless to humans) and then turn it into something that is meaningful and easy to understand for humans.

### OVERVIEW OF AN ICT SYSTEM IN ORGANISATIONS

Information is useful in an organisation because it will speed up the decision-making process, and help the business to improve their business service offering.

For example, supermarkets and chain stores use ICT systems for a variety of reasons. Let's look at an example of a Point of sale (POS) system, paying special attention to the processes of receiving, storing, conveying, and manipulating data.

## EXAMPLE OF A POINT OF SALE SYSTEM PROCESS:

From the cashier and customer's perspective, a supermarket's ICT system is a standalone computer, called a cash register. However, it consists of much more than that.

Most products have a **barcode**, which is a pattern of narrow and wide stripes that is read by a barcode reader. The barcode consists of information about the product such as, availability in store, quantities, orders, etc. The scan reader will scan the barcode optically and convert the stripes into numerical data, which is then transferred automatically to the checkout computer (cash register). The barcode reader sometimes beeps after scanning an item to signal to the cashier that the item is now identified.

Look at the IPO table below to see how this process works:

 Barcode 0 123456789000	<ul style="list-style-type: none"><li>Identify product</li><li>Checks price</li><li>Checks stock availability and location</li></ul>	<ul style="list-style-type: none"><li>Returns price and item</li></ul>
INPUT	PROCESS	OUTPUT

**Figure 1.9:** An example of a POS sale system process



### Activity 1.5

Answer the questions, which are based on the three scenarios below.

#### Scenario 1

Increasingly, the internet and big data are combined with mobility and social networking to allow companies to respond speedily to customer demands. Let's use the *Red Robin* restaurant chain in the United States as an example.

A while ago, they tested a new hamburger across the chain and gave their frontline waiters devices on which to input customer feedback – likes and dislikes – about the burger. Normally the testing, feedback and response loop would have taken 12 to 18 months. This time round they were able to get a new, improved burger on to the menu within four weeks.

#### Scenario 2

In South Africa, the Johannesburg Road Agency's (JRA) *Find and Fix* app allows motorists to report issues such as potholes and broken traffic lights as they encounter them, with one or two clicks on a smartphone.

#### Scenario 3

The internet of things (IOT) is about four big trends: social, mobile, cloud and big data; by using data and information collected through things like mobility and sensors and the cloud to make smarter, better decisions or to provide better, quicker service. It helps to collect and analyse data faster, understand customers, make decisions faster, and provide better service to customers.

[Adapted from *The Mail and Guardian*, 4 June 2014 (<http://mg.co.za/article/2014-06-04-inside-the-internet-of-things>)]

- 1.5.1 Explain the term 'data'.
- 1.5.2 List the examples of data in each scenario.
- 1.5.3 List the examples of information in each scenario.
- 1.5.4 What device do you think the Red Robin restaurant gave their waiters to capture customer feedback?
- 1.5.5 Draw an input processing output diagram for each of the scenarios.
- 1.5.6 Explain the advantages of having information for each of the scenarios above.

**CONSOLIDATION ACTIVITY**

## Chapter 1: Basic concepts of computing

1. Which ONE of the following options gives the CORRECT order of the information processing cycle?
  - a. Input, processing, output, storage
  - b. Input, output, processing, storage
  - c. Input, processing, storage, output
  - d. Input, storage, output, processing
2. Which one of the following best describes this definition: This is a combination of computer-based technologies (such as computers and smartphones) with communication technologies (such as telephones, cell phones and the internet).
  - a. ICT
  - b. Network
  - c. Internet
  - d. None of the above
3. Which one of the following is NOT an output device?
  - a. Printer
  - b. Keyboard
  - c. Speakers
  - d. Monitor
4. Which ONE of the following is short-term memory?
  - a. Flash drive
  - b. ROM
  - c. Hard drive
  - d. RAM
5. Which type of software is built for a specific purpose, like playing a game?
  - a. System software
  - b. Application software
  - c. Utilities
  - d. None of the above
6. Choose the answer and write TRUE or FALSE next to the question number. Correct the statement if it is FALSE. Change the word(s) in bold to make the statement TRUE where necessary. (You may not simply use the word 'NOT' to change the statement.)
  - a. A **communication device** is a device that allows a computer to connect to a network.
  - b. **Hardware** refers to the set of instructions a computer uses to complete any task.
  - c. **Smartphones** and **tablets** have less processing power than notebooks. They also do not have a dedicated keyboard.
  - d. **Information** is defined as raw, unorganised numbers, signals, or facts.
  - e. **Supercomputers** are devices designed for a single purpose.
7. Fill in the missing information at a, b, c, d and e.

PROCESS	DESCRIPTION
Input	(a)
(b)	In the second step, the data is stored in the computer's temporary, short-term storage (called memory or RAM).
(c)	In the third step of computing, the computer follows the instructions programmed into it and manipulates the data in some way.
Output	(d)
Storage	(e)

**CONSOLIDATION ACTIVITY****Chapter 1: Basic concepts of computing *continued***

8. Look at the following input-process-output table.

The processes have been jumbled up. Copy the table and place them in the correct order.

<ul style="list-style-type: none"><li>Analyse GPS codes</li><li>Process request</li><li>Click and select location</li><li>Communicate online for weather</li><li>Display weather on current location live on your screen</li></ul>		<p>Open weather App</p>  <p>11:35 4 51% Locations Q :</p> <p>Roodhuiskraal Noord Wed, 04 September 11:35</p> <p>24°</p> <p>26°/11° Feels like 24°</p> <p>Fair</p> <p>Precipitation 0% UV index High</p> <p>Hourly</p> <table border="1"><thead><tr><th>12:00</th><th>15:00</th><th>18:00</th><th>21:00</th><th>00:00</th></tr></thead><tbody><tr><td>25°</td><td>25°</td><td>22°</td><td>18°</td><td>15°</td></tr></tbody></table>	12:00	15:00	18:00	21:00	00:00	25°	25°	22°	18°	15°
12:00	15:00	18:00	21:00	00:00								
25°	25°	22°	18°	15°								
INPUT	PROCESS	OUTPUT										

**Figure 1.10:** An example of a cell phone process

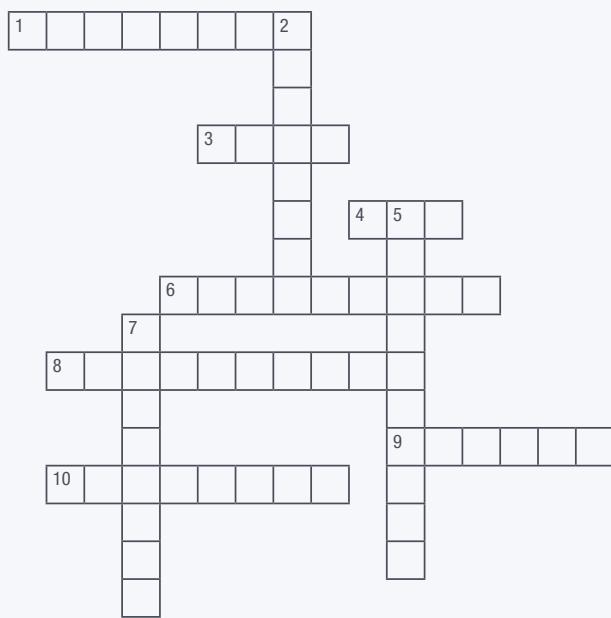
9. How do input and output devices differ from each other in terms of their function in a computing device?
10. Give TWO examples of a communication device.
11. What is the most popular input device on a smartphone?
12. What is the difference between data and information?
13. Briefly explain why software and hardware are interdependent.
14. Explain THREE disadvantages that computers have.
15. Explain what the function of a computer is in relation to data and information.

**CONSOLIDATION ACTIVITY****Chapter 1: Basic concepts of computing *continued***

- 16.** Your father has decided to buy the following computing device for his personal use. Use the specifications given to answer the following questions.



- What category of computing device did he purchase?
  - What type of CPU is specified?
  - Give a disadvantage of this computing device.
- 17.** Explain how an embedded computer differs from a general purpose computer. Give examples in your answer.
- 18.** Complete the crossword puzzle below:

**ACROSS**

- An example of a commonly used output device
- Text; number; images and sounds
- A device that handles all of the processing work
- An example of a communication device
- This type of computing device does not have a dedicated keyboard
- A type of computer that serves information to other computers
- A microwave oven is an example of this type of computer

**DOWN**

- A set of instructions a computer uses to complete any task
- The third step of computing; the computer follows the instructions programmed into it and manipulates the data in some way
- Social ICT network

# DATA REPRESENTATION STORAGE AND SOCIAL IMPLICATIONS

## CHAPTER OUTCOMES



- Unit 2.1 The link between data, information and knowledge
- Unit 2.2 Number systems
- Unit 2.3 Digital character and primitive data types
- Unit 2.4 File management
- Unit 2.5 Common file types and extensions
- Unit 2.6 Social implications

## Learning outcomes



At the end of this chapter, you should be able to:

- provide an overview and link between data, information and knowledge
- explain data representation and data storage?
- discuss bits and bytes
- provide an overview and convert between number systems: decimal, binary, hexadecimal
- provide an overview of digital character representation; ASCII/UTF-8, Unicode
- provide an overview of primitive data types and their storage
- provide an overview of data structures and collections of data storage
- explain computer file management processes
- explain the various software licence agreements
- discuss the social, ethical and legal issues pertaining to ICTs
- list the economic reasons for using computers
- explain the digital divide.

## INTRODUCTION

Data, in principal, is stored in 1s and 0s. Computers make use of data structures that describe a specific sequence for data to be organised. This allows the computer to understand how the different bits of data are related and to interpret the data correctly.

## 2.1 The link between data, information and knowledge



### EXPLAINING BINARY NUMBERS



<https://www.youtube.com/watch?v=LpuPe81bc2w>

<https://qrs.ly/6dab1zo>



### HOW COMPUTERS WORK



<https://www.youtube.com/watch?v=USCBCmwMCDA>

<https://qrs.ly/57ab1zm>

In the previous chapter, you learnt that data is unprocessed numbers, or facts.

In order to communicate data and instructions, data such as numbers, letters, characters, special symbols, sounds/phonics, and images are converted into computer-readable form (binary). Once the processing of this data is complete, it is then converted into a format that people can understand. The processed data becomes meaningful information. The information becomes knowledge when it is understood and used by people for different purposes.

### DATA REPRESENTATION

Data representation refers to the form in which data is stored, processed and transmitted. Digital devices store data using the binary number system.

#### BITS AND BYTES

You can combine several bits (0s and 1s). If you combine 8 bits together, it is called a “byte”. A byte can represent any number between 0 (represented in bits as 00000000) and 255 (represented in bits as 11111111).

1 B	8 b	b = bit
1 KB	1024 B	B = byte
1 MB	1024 KB	KB = Kilobyte
1 GB	1024 MB	MB = Megabyte
1 TB	1024 GB	GB = Gigabyte
1 PB	1024 TB	TB = Terabyte
		PB = Petabyte

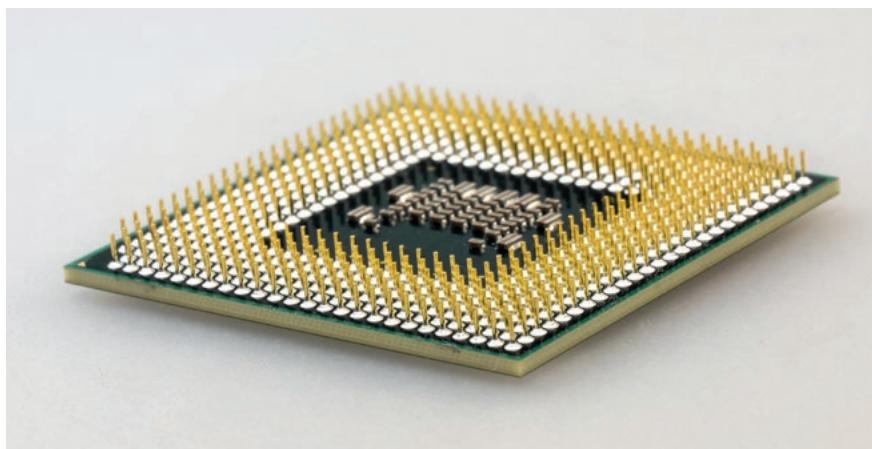
**Figure 2.1: Bits and bytes**

Have you ever heard someone saying that a movie is 700 megabytes (MB) big? Basically, what they are saying is that, the movie consists of 700 million bytes of data.

Some of these bytes tell the computer the:

- specific colour every pixel on the screen should be for every frame
- order in which to show the frames
- frequency and the time each different sound is played.

Bits and bytes also store information about the types of data stored. For example, if you are creating your own program, when coding, you work in sections to create the program. In your program, a few bytes might instruct the computer which sections of your program are text, whole numbers, and decimal numbers.



**Figure 2.2:** CPUs are made up of billions of micro-transistors. A single transistor represents 1 bit of information



### Activity 2.1

- 2.1.1** Differentiate between data, information and knowledge. Use an example to support your answer.
- 2.1.2** Explain data representation, in your own words.
- 2.1.3** Explain data storage.
- 2.1.4** Illustrate the difference between bits and bytes.
- 2.1.5** Decide for each of the following whether it represents data, information or knowledge. Give a reason for your choice in each case.
  - a. The marks for each learner in a recent mathematics test.
  - b. The tabulated results of research into bus transport options for a school tour.  
The table includes records of the safety history of each bus company.  
The school is able to choose the safest option that is the cheapest.
  - c. A comparison of the IT marks per learner for terms 1, 2 and 3 of a year.
  - d. A comparison table of a number of smartphone options in terms of features, price and contract options per mobile service provider.

## 2.2 Number systems

### DECIMAL, BINARY AND HEXADECIMAL

In this unit, you will learn how computer number systems work, and how you can calculate the value of a byte using basic mathematics.

#### DECIMAL NUMBERING SYSTEM (BASE 10)

The numbering system we use is called the decimal system because the prefix ‘deci’ means 10, and there are 10 numbers in the decimal system: 0, 1, 2, 3, 4, 5, 6, 7, 8 and 9.

In the decimal system, each time the value of a number increases by 1, you increase the size of the **digit** by 1. This works well until you reach the largest digit possible that is 9. Once you are at 9, there are no larger digits left, so the next time you increase the value of your number by 1, you need to add a new digit to your number. The value of this digit increases from 0 to 1, and you restart the first digit at 0:

...

07

08

09

10

When you reach the number 19 and increase the value by 1, the second digit goes up again, and you start with 20. This means that the value of any digit in the second position is 10, with 20 equal to  $2 \times 10$ . As you continue counting, the value of your second digit eventually reaches 9 (for example in 90), and when you need to increase it again, (for example when adding 1 to 99) you find that impossible, so you reset both 9’s to 0 and add a third digit, that is 100.



#### Take note

Any number raised to the power of zero, for example,  $10^0$ , equals 1. It does not matter how big or small the number is. So even  $1\ 000^0 = 1$ .

The place value of the third digit is thus always a 100, or  $10 \times 10$  or  $10^2$ . If you need to know the value of the number 742, you can calculate it as follows:

7	4	2
$7 \times 10^2 = 700$	$4 \times 10^1 = 40$	$2 \times 10^0 = 2$
$= 700 + 40 + 2 = 742$		

As your number increases in value, the value of each digit is 10 times larger than the values of the previous digit. The fourth digit is thus worth 1 000 (or  $10^3$ ), the fifth digit is worth 10 000 (or  $10^4$ ), and so forth.

So, to calculate the value of an eight digit number (for example, 51 240 887), you do the following:

5	1	2	4	0	8	8	7
$5 \times 10^7 =$ 50 000 000	$1 \times 10^6 =$ 1 000 000	$2 \times 10^5 =$ 200 000	$4 \times 10^4 =$ 40 000	$0 \times 10^3 =$ 0	$8 \times 10^2 =$ 800	$8 \times 10^1 =$ 80	$7 \times 10^0 =$ 7
$= 50\,000\,000 + 1\,000\,000 + 200\,000 + 40\,000 + 0 + 800 + 80 + 7 = 51\,240\,887$							

Once you understand that this is how counting works when you have ten unique numbers available, counting in any other numbering system is easy to grasp.

### BINARY NUMBERING SYSTEM (BASE 2)

The prefix bi- means two (as in bicycle, biplane, or bilingual), so the binary numbering system is a numbering system in which there are only two unique values: 0 and 1. To count in binary, you use the same logic you use to count in the decimal system. You increase the value of a digit until it reaches the largest digit possible (1), then add a new digit and restart the previous digit.

To see how this works, try to count from 0 to 16 in binary.

**Table 2.1:** Counting in binary

DECIMAL	BINARY	DESCRIPTION
0	$0_2$	Start with the lowest possible value. Note the subscript 2 to show we are working in base 2
1	$1_2$	You increase the value of the digit by 1.
2	$10_2$	Since you cannot increase the value of the first digit any more, you reset it to 0 and increase the value of the second digit.
3	$11_2$	You increase the value of the first digit by 1 again.
4	$100_2$	Since you cannot increase the value of the first digit any more, you try to increase the value of the second digit, but this is also impossible, so you reset both values and add a third digit.
5	$101_2$	You increase the value of the first digit by 1.
6	$110_2$	Since you cannot increase the value of the first digit, you reset it and increase the value of the second digit.
7	$111_2$	You increase the value of the first digit by 1.
8	$1000_2$	Since you cannot increase the value of any digits, you reset them all and add a fourth digit.
9	$1001_2$	You increase the value of the first digit by 1.
10	$1010_2$	You reset the first digit and increase the value of the second digit.
11	$1011_2$	You increase the value of the first digit by 1.
12	$1100_2$	You reset the first and second digit and increase the value of the third digit.
13	$1101_2$	You increase the value of the first digit by 1.
14	$1110_2$	You reset the first digit and increase the value of the second digit.
15	$1111_2$	You increase the value of the first digit by 1.
16	$10000_2$	Since you cannot increase the value of any of the digits, you reset all of them and add a fifth digit.

## CONVERTING FROM BINARY TO DECIMAL

How can you calculate the decimal (Base 10) value of an existing binary number? Although one could count to any number in this way, it is not very efficient and would take a long time with large binary numbers. A better way is to use the same technique you used with the decimal system and find out what the place value of each digit is before adding them all together.

To see how we do this, let us look at what the value of each of the digits is on their own.

**Table 2.2:** The place value of binary digits

BINARY	PLACE VALUE	DESCRIPTION
$000001_2$	$1 \times 2^0 = 1$	The place value of the first digit is 1.
$000010_2$	$1 \times 2^1 = 2$	The place value of the second digit is 2.
$000100_2$	$1 \times 2^2 = 4$	The place value of the third digit is 4.
$001000_2$	$1 \times 2^3 = 8$	The place value of the fourth digit is 8.
$010000_2$	$1 \times 2^4 = 16$	The place value of the fifth digit is 16
$100000_2$	?	Based on this pattern, what is the place value of the sixth digit?

In the **decimal numbering system**, each digit can hold **ten unique values** and each new digit has a place value that is ten times as large as the previous digit. In the **binary system**, each digit can only hold **two unique values**, so each new digit has a place value that is twice as large as the previous digit!

Just as with the decimal numbering system, you can calculate the value of a binary number by calculating the value of the individual digits and adding them together. Let's work through the following examples to ensure you understand how to do this.

### Example 2.1

Convert the binary number  $00101101^2$  to a decimal number.

To convert this binary number to a decimal number, you can use the following steps:

- Step 1: Start by calculating the place value of each position of the binary number.
- Step 2: Add the place values of the digits that are 1 together.
- Step 3: Ignore the place value of the digits that are 0.



### Did you know

Remember that multiplying any number with 0 is 0.

You can lay your working out in this manner:

Binary number	0	0	1	0	1	1	0	1
Place value	128	64	32	16	8	4	2	1
Computed value	0	0	32	0	8	4	0	1
Value base 10	$= 32 + 8 + 4 + 1 = 45$							

The binary number  $00101101_2$  is therefore  $0 + 0 + 32 + 0 + 8 + 4 + 0 + 1 = 45$ .

### Example 2.2

Convert the binary number  $11000011_2$  to a decimal number.

Using the same technique as in the previous example:

- Step 1: Start by finding the place value of each digit.
- Step 2: Add those place values together for the digits equal to 1.
- Step 3: Ignore the place value of the digits that are 0.

Binary number	1	1	0	0	0	0	1	1
Place value	$2^7 = 128$	$2^6 = 64$	$2^5 = 32$	$2^4 = 16$	$2^3 = 8$	$2^2 = 4$	$2^1 = 2$	$2^0 = 1$
Computed values	$1 \times 128$	$1 \times 64$	$0 \times 32$	$0 \times 16$	$0 \times 8$	$0 \times 4$	$1 \times 2$	$1 \times 1$
Decimal value	$= 128 + 64 + 2 + 1 = 195$							

The binary number  $11000011_2$  is therefore equal to 195.

### Example 2.3

Convert the binary number  $11111111_2$  to a decimal number.

In this example, all the digits are equal to 1. This means, you add the value of all the digits together.

1	1	1	1	1	1	1	1	1
$2^7 = 128$	$2^6 = 64$	$2^5 = 32$	$2^4 = 16$	$2^3 = 8$	$2^2 = 4$	$2^1 = 2$	$2^0 = 1$	
$1 \times 128$	$1 \times 64$	$1 \times 32$	$1 \times 16$	$1 \times 8$	$1 \times 4$	$1 \times 2$	$1 \times 1$	
Decimal value	$= 128 + 64 + 32 + 16 + 8 + 4 + 2 + 1 = 255$							

The binary number  $11111111_2$  is therefore equal to 255.

## CONVERTING FROM DECIMAL TO BINARY

To convert a decimal number into binary, you can use the following steps:

- Step 1: Find the largest power of 2 that is smaller than or equal to the decimal number.
- Step 2: Divide the decimal number by this power.
- Step 3: Write down the answer of the division (1) underneath the power.
- Step 4: Rewrite the decimal number in terms of the division and its remainder.
- Step 5: Repeat this process with the remainder until there is no remainder left.
- Step 6: Write down 0 under all the powers that were not used.

For example, to convert 37 into binary, start by writing down the factors of 2:

37 = ?								
$2^7 = 128$	$2^6 = 64$	$2^5 = 32$	$2^4 = 16$	$2^3 = 8$	$2^2 = 4$	$2^1 = 2$	$2^0 = 1$	

- Find the largest power of 2 that is smaller than or equal to 37.
- The answer is 32, since  $37 \div 32 = 1$  with a remainder of 5.
- Write the number 1 under 32 and rewrite 37 as  $1 \times 32 + 5$ :

37 = $1 \times 32 + 5 = ?$								
$2^7 = 128$	$2^6 = 64$	$2^5 = 32$	$2^4 = 16$	$2^3 = 8$	$2^2 = 4$	$2^1 = 2$	$2^0 = 1$	
				1				

- Find the largest power of 2 that is smaller than or equal to 5.
- The answer is 4, where  $5 \div 4 = 1$  with a remainder of 1.
- This means you can write a 1 under the number 4, and rewrite 5 as  $1 \times 4 + 1$ :

$37 = 1 \times 32 + 1 \times 4 + 1 \times 1 = ?$							
$2^7 = 128$	$2^6 = 64$	$2^5 = 32$	$2^4 = 16$	$2^3 = 8$	$2^2 = 4$	$2^1 = 2$	$2^0 = 1$
		1				1	

The final remainder is 1, and the power of 2 smaller than or equal to 1 is also 1.

Since  $1 \div 1 = 1$  with no remainder, you can write the number 1 under the 1 in the table.

You should also add 0 under all the powers of 2 you did not use.

The 1s and 0s you have written in your table gives you your binary number:

$37 = 1 \times 32 + 1 \times 4 + 1 \times 1 = 00100101_2$							
$2^7 = 128$	$2^6 = 64$	$2^5 = 32$	$2^4 = 16$	$2^3 = 8$	$2^2 = 4$	$2^1 = 2$	$2^0 = 1$
0	0	1	0	0	1	0	1

Work through the following examples to make sure you understand how to convert a number from decimal to binary.

#### Example 2.4

Convert the decimal number 71 into a binary number.

**Step 1:** To convert the decimal number into binary, start by drawing the power of 2 table.

**Step 2:** Work your way from the left of the table until you find the first power of 2 that is smaller than or equal to 71.

**Step 3:** Once you have this power, write a 1 under it, and rewrite the decimal value as the sum of this power and a remainder.

**Step 4:** Next, you need to find the largest power of 2 that is smaller than or equal to the remainder.

Continue this process until there is no remainder left.

$71 = 1 \times 64 + 1 \times 4 + 1 \times 2 + 1 \times 1 = 01000111_2$							
$2^7 = 128$	$2^6 = 64$	$2^5 = 32$	$2^4 = 16$	$2^3 = 8$	$2^2 = 4$	$2^1 = 2$	$2^0 = 1$
0	1	0	0	0	1	1	1

#### Example 2.5

Convert the decimal number 168 into a binary number.

**Step 1:** Using the same process as in the previous example, you will find that the first power smaller than 168 is 128, which leaves a remainder of 40.

**Step 2:** The largest power that goes into 40 is 32, which leaves a remainder of 8.

**Step 3:** Since 8 is a power of 2, you know what the value of all the binary digits are and can thus find the binary number.

$168 = 1 \times 128 + 1 \times 32 + 1 \times 8 = 10101000_2$							
$2^7 = 128$	$2^6 = 64$	$2^5 = 32$	$2^4 = 16$	$2^3 = 8$	$2^2 = 4$	$2^1 = 2$	$2^0 = 1$
1	0	1	0	1	0	0	0

### Example 2.6

Convert the decimal number 241 into a binary number.

**Step 1:** Any decimal number between 0 and 255 can be represented using 8 binary digits.

**Step 2:** Since 241 is smaller than 255, you know that it can be represented using the powers you have been using until now.

**Step 3:** If it was larger than 255, you would have needed to include more digits in your binary number.

**Step 4:** Working through the powers from the left-hand side, you will find that the value of the binary digits is 128, 64, 32, 16, and 1.

$$241 = 1 \times 128 + 1 \times 64 + 1 \times 32 + 1 \times 16 + 1 \times 1 = 11110001_2$$

$2^7 = 128$	$2^6 = 64$	$2^5 = 32$	$2^4 = 16$	$2^3 = 8$	$2^2 = 4$	$2^1 = 2$	$2^0 = 1$
1	1	1	1	0	0	0	1



### Activity 2.2

**2.2.1** Explain in your own words what the decimal numbering system is.

**2.2.2** Explain in your own words what the binary numbering system is.

Work on your own to complete the following two activities, then review your work with a partner. Compare your answers and if they differ, try to find out where the mistake occurred and correct it.

**2.2.3** Convert the following binary numbers to decimal numbers:

- a.  $00001001_2$    b.  $10001011_2$    c.  $01001110_2$    d.  $10001000_2$   
e.  $00010001_2$    f.  $11101111_2$    g.  $01010100_2$    h.  $10011001_2$   
i.  $11000001_2$    j.  $00010100_2$

**2.2.4** Convert the following decimal numbers to binary numbers:

- a. 9   b. 17   c. 93   d. 128  
e. 127   f. 254   g. 144   h. 58  
i. 210   j. 237

## HEXADECIMAL NUMBERING SYSTEM

The last numbering system you will learn about in this unit is the hexadecimal numbering system. The suffix -decimal means ten while the prefix hexa- means 6 (as in hexagon, which is a shape with six sides). The hexadecimal numbering system thus has 16 unique numbers.

**Table 2.3:** The hexadecimal numbering system

HEXADECIMAL DIGIT	DECIMAL NUMBER	BINARY NUMBER
$0_{16}$	0	$0_2$
$1_{16}$	1	$1_2$
$2_{16}$	2	$10_2$
$3_{16}$	3	$11_2$
$4_{16}$	4	$100_2$
$5_{16}$	5	$101_2$
$6_{16}$	6	$110_2$

**Table 2.3:** The hexadecimal numbering system ... continued

HEXADECIMAL DIGIT	DECIMAL NUMBER	BINARY NUMBER
7 <sub>16</sub>	7	111 <sub>2</sub>
8 <sub>16</sub>	8	1000 <sub>2</sub>
9 <sub>16</sub>	9	1001 <sub>2</sub>
A <sub>16</sub>	10	1010 <sub>2</sub>
B <sub>16</sub>	11	1011 <sub>2</sub>
C <sub>16</sub>	12	1100 <sub>2</sub>
D <sub>16</sub>	13	1101 <sub>2</sub>
E <sub>16</sub>	14	1110 <sub>2</sub>
F <sub>16</sub>	15	1111 <sub>2</sub>

The hexadecimal system uses the first six letters of the alphabet in its numbering system, with A equal to 10, B equal to 11, C equal to 12, D equal to 13, E equal to 14 and F equal to 15.

To count using hexadecimal, you follow the same rules as you do when counting in the decimal or the binary numbering systems. You continue increasing the value until you reach the largest possible digit (F), then reset this digit back to 0 and add a second digit.

Every time you pass the maximum of the first digit, you increase the value of the second digit until both the first digits are equal to F, in which case you reset both digits and add a third digit.



### Case Study

#### Why do we use the hexadecimal system?

The reason programmers need to understand the binary system is clear: computers represent all data using binary. However, when programmers need to speak to computers, giving instructions in binary would be incredibly time consuming. Imagine trying to write an essay, but for every letter you wanted to write, you needed to write down a binary code that is 8 digits long! Even a short essay would be multiple pages long.

Instead of writing in binary, programmers have taught computers to understand the hexadecimal system. This works incredibly well, since any byte of data (a binary number made up of 8 bits) can be represented using exactly 2 hexadecimal digits. In mathematical terms,  $2^8 = 16^2$ . As a result, a large binary number like 11110001 can be written as F1 in hexadecimal.

For example, if you wanted to tell a computer to show you a specific colour, you need to tell it how much red, green and blue there is in the colour. To show a light pink colour in binary, you would tell the computer that the colour is equal to 11110010 10011110 10110001. In hexadecimal, the colour is equal to F2 9E B1. If you wanted to show the colour white, the binary would be 11111111 11111111 11111111 or FF FF FF in hexadecimal.

## CONVERTING FROM HEXADECIMAL TO DECIMAL

To convert a number from hexadecimal to decimal, you need to know what the place value of each digit is. Since there are 16 unique numbers in the hexadecimal system, the place value of each new digit in a hexadecimal number increases by 16. The place value of the first digit is thus 1 ( $16^0$ ), while the place value of the second digit is 16 ( $16^1$ ), and the place value of the third digit is 256 ( $16^2$ ).

**Table 2.4:** The place value of hexadecimal digits

HEXADECIMAL	PLACE VALUE	DESCRIPTION
1	$1 \times 16^0 = 1$	The value of the first digit is 1.
10	$1 \times 16^1 = 16$	The value of the second digit is 16.
100	$1 \times 16^2 = 256$	The value of the third digit is 256.
1000	$1 \times 16^3 = 4\,096$	The value of the fourth digit is 4 096.

To find the decimal value of a hexadecimal number, we multiply each digit by their position/place value and add all the values together.



### Take note

Don't get confused between decimal numbers and hexadecimal numbers. Even though they look the same,  $22_{16}$  in hexadecimal and 22 in decimal do not have the same value. Note the base indicator subscript 16



### Take note

$A = 10$  in the hexadecimal numbering system. Refer to the hexadecimal table.

For example, to find the value of the hexadecimal number  $3A_{16}$ :

3	A
$16^1$	$16^0$
$= 3 \times 16^1$	$= A \times 16^0$
$= 3 \times 16 = 48$	$= 10 \times 1 = 10$
	$= 48 + 10 = 58$

To make sure you understand how to convert from hexadecimal to decimal, work through the following examples:

### Example 2.7

Convert the hexadecimal number 65 to a decimal number:

1. Since both digits in the hexadecimal number are less than 10 (6 and 5), we know what their values are.
2. All that is left to do is thus multiplying the two digits with their positional values (16 and 1, respectively) and adding the values together:

6	5
$16^1$	$16^0$
$= 6 \times 16$	$= 5 \times 16^0$
$= 6 \times 16 = 96$	$= 5 \times 1 = 5$
	$= 96 + 5 = 101$

The hexadecimal number  $65_{16}$  is thus equal to the decimal number 101.

### Example 2.8

Convert the hexadecimal number  $F9_{16}$  to a decimal number.

1. To convert the hexadecimal number  $F9_{16}$  to a decimal number, you first need to find the value of F as a decimal number.
2. According to the table showing the 16 hexadecimal numbers, F is equal to 15.
3. Now that we know the value of F, we can multiply the two hexadecimal digits by their position values and add them together:

F	9
$16^1$	$16^0$
$= F \times 16^1$	$= 9 \times 16^0$
$= 15 \times 16 = 240$	$= 9 \times 1 = 9$
$= 240 + 9 = 249$	

The hexadecimal number  $F9_{16}$  is thus equal to the decimal number 249.

### Example 2.9

Convert the hexadecimal number  $2BC_{16}$  to a decimal number.

1. In this example, there are three hexadecimal digits.
2. According to the previous table, the decimal values of 2, B and C are 2, 11 and 12, respectively.
3. Their position values are 256, 16 and 1.
4. Multiplying the hexadecimal digits by their position values, you find:

2	B	C
$16^2$	$16^1$	$16^0$
$= 2 \times 16^2$	$= B \times 16^1$	$= C \times 16^0$
$= 2 \times 256 = 512$	$= 11 \times 16 = 176$	$= 12 \times 1 = 12$
$= 512 + 176 + 12 = 700$		

The hexadecimal number  $2BC_{16}$  is thus equal to the decimal number 700.

## CONVERTING FROM DECIMAL TO HEXADECIMAL

To convert a decimal number into a hexadecimal number, you can use the following steps:

**Step 1:** Find the largest power of 16 that is smaller than or equal to the decimal number.

**Step 2:** Divide the decimal number by this power.

**Step 3:** Write down the answer of the division underneath the power. If the answer is larger than 9, write it down using the appropriate hexadecimal digit.

**Step 4:** Rewrite the decimal number in terms of the division and its remainder.

**Step 5:** Repeat this process with the remainder until there is no remainder left.

**Step 6:** Write down 0 under all the powers that were not used.

For example, to convert 94 into hexadecimal, you can start by writing down the factors of 16:

94 = ?		
$16^2 = 256$	$16^1 = 16$	$16^0 = 1$

The largest power of 16 that is smaller than 94 is 16. Since  $94 \div 16 = 5$  with a remainder of 14, you can write a 5 under 16, and rewrite the decimal in terms of the division and remainder.

94 = $5 \times 16 + 14$		
$16^2 = 256$	$16^1 = 16$	$16^0 = 1$
	5	

The largest power of 16 that is smaller than 14 is 1. Since  $14 \div 1 = 14$ , and 14 is larger than 9, you need to look at the hexadecimal table to find the hexadecimal value that is equal to 14. This is E. You can thus write down E under the 1 in the table and rewrite the decimal number in terms of the division.

94 = $5 \times 16 + 14 \times 1$		
$16^2 = 256$	$16^1 = 16$	$16^0 = 1$
	5	E

Since there is no remainder left, you know that the decimal number 94 can be written as  $5E_{16}$  in hexadecimal.

### Example 2.10

Convert the decimal number 37 to a hexadecimal number.

**Step 1:** The largest power of 16 that is smaller than 37 is 16, and  $37 \div 16 = 2$  with a remainder of 5.

**Step 2:** The largest power of 16 that is smaller than 5 is 1, so  $5 \div 1 = 5$  with no remainder.

**Step 3:** The decimal number 37 is therefore equal to  $25_{16}$  in hexadecimal.

37 = $2 \times 16 + 5 \times 1$		
$16^2 = 256$	$16^1 = 16$	$16^0 = 1$
	2	5

### Example 2.11

Convert the decimal number 222 to a hexadecimal number.

**Step 1:** 16 is the largest power of 16 that is smaller than 222.

**Step 2:** Since  $222 \div 16 = 13$  with a remainder of 14, you first need to convert 13 to a hexadecimal digit before writing it into the table.

**Step 3:** Once this is done, the next largest power of 16 is 1:  $14 \div 1 = 14$  with no remainder.

**Step 4:** Converting 14 to hexadecimal, you will find that it is equal to E.

**Step 5:** Therefore, the decimal 222 is equal to DE<sub>16</sub> in hexadecimal.

$$222 = 13 \times 16 + 14 \times 1$$

16 <sup>2</sup> = 256	16 <sup>1</sup> = 16	16 <sup>0</sup> = 1
	D	E

### Example 2.12

Convert the decimal number 2 060 to a hexadecimal number.

**Step 1:** The largest power of 16 smaller than 2 060 is 256, therefore,  $2\ 060 \div 256 = 8$  with a remainder of 12.

**Step 2:** Since 16 is larger than 12, you should write a 0 under the 16 in the table.

**Step 3:** The largest power of 16 that is smaller than 12 is therefore 1, so:  $12 \div 1 = 12$  with no remainder.

**Step 4:** Since 12 is equal to C in hexadecimal, the decimal 2 060 is equal to 80C<sub>16</sub> in hexadecimal.

$$2\ 060 = 8 \times 256 + 12 \times 1$$

16 <sup>2</sup> = 256	16 <sup>1</sup> = 16	16 <sup>0</sup> = 1
8	0	C



### Activity 2.3

Complete the following activities on your own, then work with a partner to verify your answers. If your answers differ, try to find out where the mistake occurred and correct it.

**2.3.5** Convert the following hexadecimal numbers to decimal numbers:

- |                      |                      |
|----------------------|----------------------|
| a. DB <sub>16</sub>  | b. 29C <sub>16</sub> |
| c. 48 <sub>16</sub>  | d. F0 <sub>16</sub>  |
| e. C9F <sub>16</sub> | f. 8A <sub>16</sub>  |
| g. 55 <sub>16</sub>  | h. 73 <sub>16</sub>  |
| i. 101 <sub>16</sub> | j. AC2 <sub>16</sub> |

**2.3.6** Convert the following decimal numbers to hexadecimal numbers:

- |        |         |
|--------|---------|
| a. 15  | b. 16   |
| c. 81  | d. 49   |
| e. 172 | f. 252  |
| g. 391 | h. 77   |
| i. 200 | j. 3751 |

**2.3.7** Convert the following hexadecimal numbers to binary numbers, and binary numbers to hexadecimal numbers:

- |                          |                          |
|--------------------------|--------------------------|
| a. 17 <sub>16</sub>      | b. A2C <sub>16</sub>     |
| c. 00110011 <sub>2</sub> | d. 10000010 <sub>2</sub> |

**Hint:** First convert the numbers to decimal and then to the appropriate number.

## 2.3 Digital character and primitive data types



### New words

**ASCII** – American Standard Code for Information Interchange. The ASCII originally used seven bits to encode each character; the modern version uses 8 bits that assign numeric values to letters, digits, punctuation marks, and other characters

In 1963, the American Standards Association published a table that linked 127 different letters and symbols to numbers. The table is known as the American Standard Code for Information Interchange (or **ASCII**) table.

In the previous unit, you observed how computers could represent numbers using binary systems. But what about letters? Fortunately, no mathematics is required to convert numbers into letters.

If a computer knows that the information stored in a byte is a letter rather than a number, it can simply search for the character assigned to that number in the table and display the character, with ASCII, the first 32 characters in the table are programming characters that cannot be shown on the screen. These include characters like a *carriage return* character (which shows where a new line should start) and a *horizontal tab* character (which adds some horizontal space).

The ASCII value 65 is equal to the uppercase character ‘A’ whereas the ASCII value 122 is the lowercase character ‘z’. ASCII has a limitation of 128 characters.

Universal Code Character Set (Unicode) was created to unify all the encoding schemes so that confusion between computers could be limited as much as possible.

Unicode Transformation 8-bits (UTF-8) is another format to take a value and represent it as a character.

### PRIMITIVE DATA TYPES AND THEIR STORAGE

The primitive data types used when programming are described in the table below.

**Table 2.5:** *The primitive data type*

NAME	DESCRIPTION	REPRESENTATION	EXAMPLE
<b>Boolean</b>	A data type that can only be <u>TRUE</u> or <u>FALSE</u> .	Boolean values can be represented by a single bit of data that is either ON or OFF.	TRUE or FALSE 1 or 0 YES or NO
<b>Integer</b>	An integer is any positive or negative <u>whole</u> number.	Any integer up to 255 can be represented by one byte of data. Larger integers require more bytes of data.	1 or 82355 or -59
<b>Float</b>	A float refers to any <u>number</u> <u>with a decimal</u> value.	To represent floats require multiple bytes of data.	82.355 or 0.55 or -10.02
<b>Char</b>	A char is a data type that can store a single character. This includes letters, numbers, and symbols.	Each char requires one byte (8 bits) of data.	‘A’ or 5 or ‘!’ or ‘@’

## ADDITIONAL DATA TYPES

NAME	DESCRIPTION	REPRESENTATION	EXAMPLE
String	A string refers to <b>several</b> characters, <b>letters</b> , or <b>numbers</b> . Strings are always surrounded by quotation marks to show where they begin and end. <b>NB:</b> if numbers are represented as a string, you cannot use them in your calculations.	Each character in a string requires one byte of data.	'Tel: 082 111 2222' 'Hello, World!' 'Maria Maseko'



### Activity 2.4

- 2.4.1** Boolean refers to:
- A data type that can only be TRUE or FALSE.
  - Any positive or negative whole number.
  - A data type that can store a single character.
- 2.4.2** A float is represented by:
- A single bit of data
  - One byte of data
  - Multiple bytes of data
- 2.4.3** Which data types refer to several characters, letters, or numbers?
- Char
  - String
  - Float
- 2.4.4** Which of the following is an example of a Char?
- '!'
  - True/False
  - 'Hello World!'
- 2.4.5** The terms 'information' and 'data' are often used in IT. Which description best fits these terms?
- Information is understood by non-technological people, on the other hand ASCII code is data that can only be read and understood by IT professionals.
  - Information is the result of data that has been processed into something that is meaningful.
  - Data is the result of information *supplied by the user*.
  - Data and information are the same; it only depends on the device that it is created for.
- 2.4.6** Write down the data type that would be used to store each of the following items:
- '1'
  - FALSE
  - 'Perhaps'
  - 85
  - 75,299
  - '43,0'
  - 'True'
  - 'a'
  - 0,851
  - 4951327
- 2.4.7** Write down the correct primitive data type for each item described:
- The average of the marks that a class of 21 learners obtained in a test.
  - The answer to the question: Do you like chocolates?
  - The millilitres of milk required in a cake recipe.
  - A cell phone number.
  - The price of oil per litre.
  - The name of your pet dog.
  - The number of eggs in a tray.
- 2.4.8** Research and write your own name and your partner's name using the ASCII value and binary. Once complete, compare your answer with your partner's answer, and fix any mistakes.

## 2.4 File management

In this unit, you will learn about the requirements needed for a computer to store and organise data.

Computers store data for a number of reasons. The data:

- contains the instructions that a computer uses to function and run applications
- is loaded into memory, RAM, that the computer is currently using in its applications
- storage allows users to keep information that they would like to access on the computer (be it short-term or long-term).

Two structures are commonly used to store data. These are databases and files.

### DATABASES AND FILES

The manner in which data is represented on the computer can be seen as a hierarchy. In this unit, we will discuss databases and files.



**Figure 2.3: Hierarchy – data representation**

Data is saved in memory while in use by an application. Information needed for later access is stored in a database or file. These are saved on the more permanent storage devices.

#### WINDOWS REGISTRY (HIERARCHICAL DATABASE)

Anybody who has ever used a computer to create something – an image, a spreadsheet, a text document – has saved their data as a file on their local hard drive. Each file type has its own unique data structure that records all the information in a format only the software can understand. FAT, or the file allocation table, is a database that keeps track of every file on your hard disk.

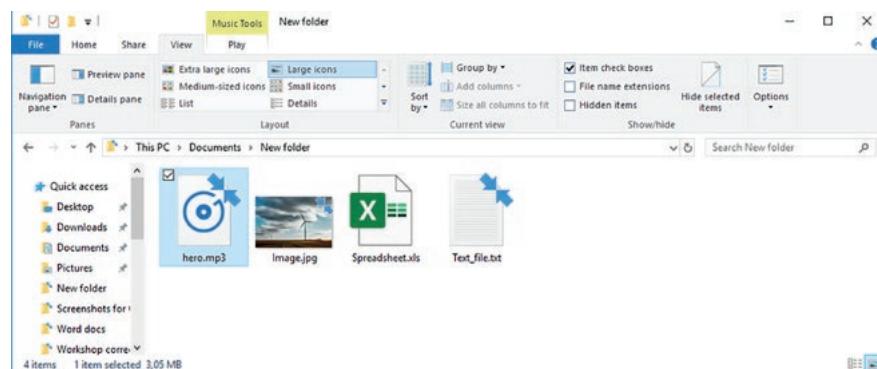
The Registry is a hierarchical database that stores low-level settings for the operating system and for applications. The Registry is used to store much of the information and settings for software programs, hardware devices, user preferences, operating system configurations, and much more.

A Database is a collection of organised data that can be accessed electronically and is designed for rapid search and retrieval by a computer. Databases are structured to facilitate the storage, retrieval, modification, and deletion of data in conjunction with various data-processing operations.

## FILES

On a computing device it is common for data to be grouped into files and folders, with each file being a single collection of data. A document stored on your computer is an example of a file. For example, in the ‘My documents’ folder on your computer, a number of files (of many different types) are saved. The operating system can save data on all of the available storage devices connected to the computer. These storage devices are called drives. On each drive, files are grouped in separate containers called folders.

It is important to place files in folders and label (name) them accordingly. When a file is created, it is saved on a storage device. It remains on the device until the user decides to remove it. Files will remain on the storage device after the computer is turned off, or the storage device is removed from the computer.



**Figure 2.4:** Four different types of files stored on a computer

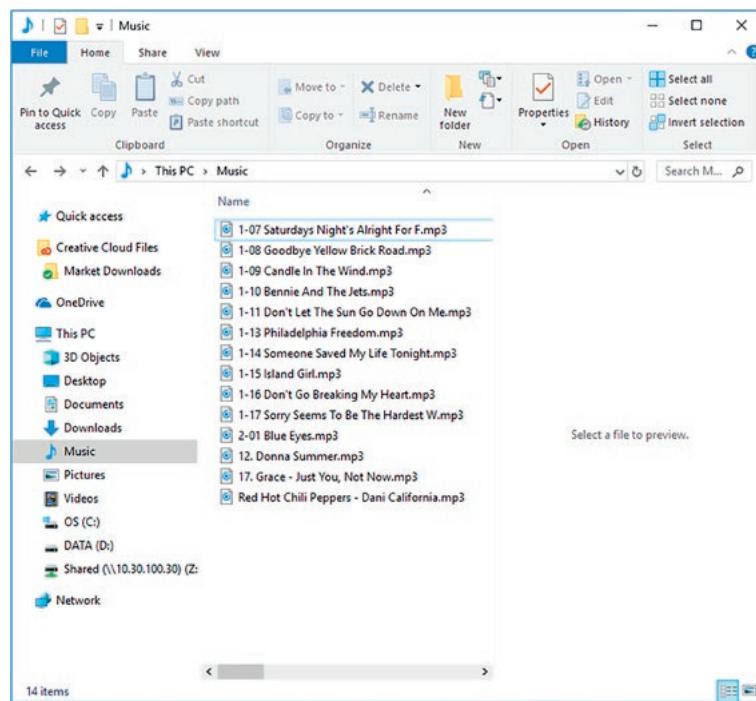
In the next section, you will learn more about how files work and how they can be organised on a computer.

## COMPUTER FILE MANAGEMENT

### ORGANISING FILES

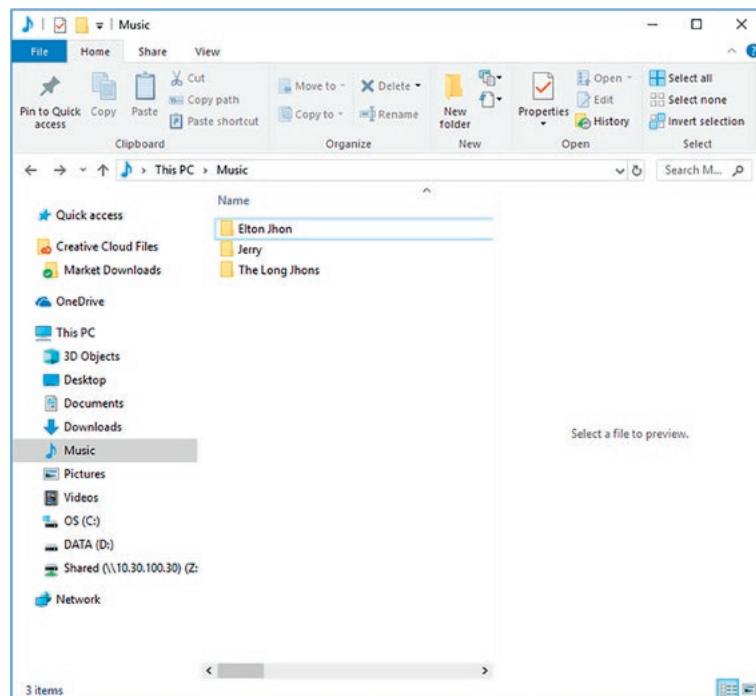
Files are stored on a computing device in folders or directories. These folders are used to help organise the computer’s files so that they can be easy to search and locate. Each folder can contain either files or different subfolders each containing files.

Figure 2.5 shows a music folder containing music files created by a user.



**Figure 2.5:** Folder containing music files

Figure 2.6 shows a more organised way of storing files. A user might have a music folder as the first folder, and then sub-folders for each artist.



**Figure 2.6:** Folders can contain both files and subfolders

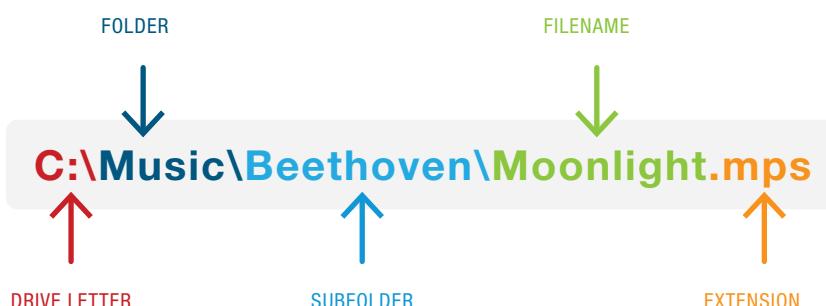
## FILES, FOLDERS, AND DRIVES

A similar strategy can be used on all storage devices to make it easier to find important files and folders.

## FILE SPECIFICATIONS

The location that a file is saved in is recorded in the file path for that file. This file path tells you on which storage device the file is saved (the drive letter), in which folder and subfolders the file is saved, the name of the file, and finally, the type of file (given by the file extension).

Figure 2.7 below shows an example of a file path.

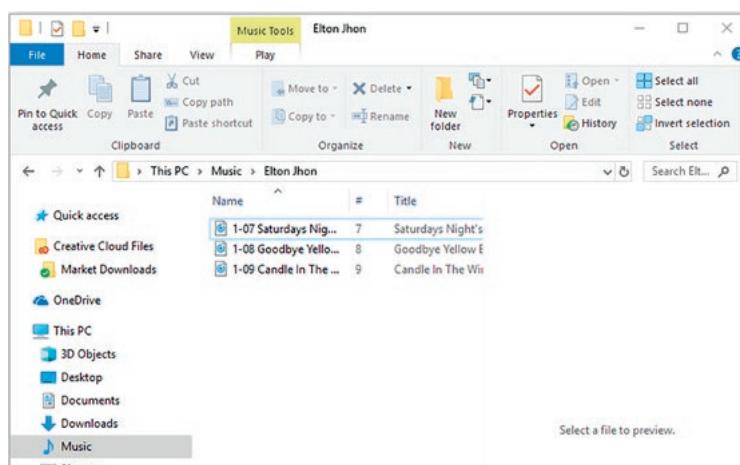


**Figure 2.7:** An example of a file path

Each file has a unique file path that starts with the storage device's drive letter (C: or D: drive). After the drive letter is the name of the file's folders and subfolders. A backslash ('\') is used to separate the drive letter and the different folders and files. Finally, the file path ends with the name and extension of the file (for example, .mp3, .PDF, .JPEG). The extension in these examples consist of a full stop followed by a combination of letters and numbers (you will learn more about this later in this chapter).

You can find the file path of a folder by clicking on the Address bar in File Explorer.  
To do this:

- open the Computer window from the Start menu
  - browse to the folder you want the file path for
  - click on the address bar to see the folder's address.



**Figure 2.8:** The address bar gives the folder path

## MANAGING FILES AND FOLDERS

In order to make sure your computer is organised and that you can easily locate the files you are searching for, it is important that you save files in folders and give them useful names. In Microsoft Windows, this can be done in several ways.

The following section will describe the easiest ways in which files can be renamed, deleted, copied or moved between folders.

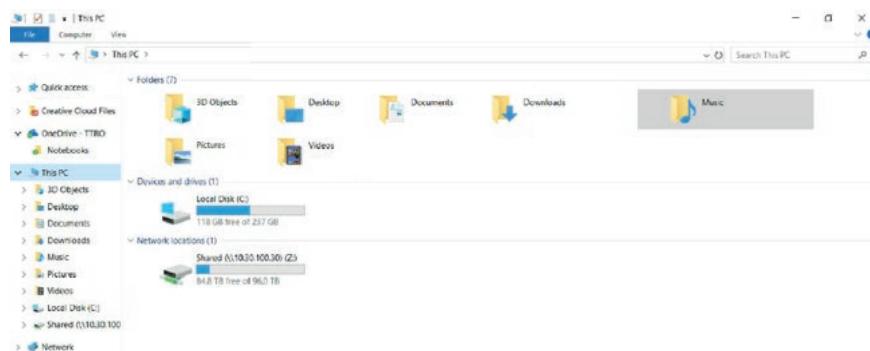


### Take note

The shortcut key to open File Explorer window: Press the Windows key on your keyboard and the letter 'E' at the same time.



- Press the Windows key on your keyboard.
- Type the word 'explorer' and you should see a File Explorer option appear in the start menu.
- Click on the File Explorer option and your computer's File Explorer should now open.
- Click on the This PC option in the left panel. This will take you to the very lowest folder in your computer's folder hierarchy. From here, you can explore your computer's organisational system by browsing through the folder structure.



**Figure 2.9:** The File Explorer screen in Windows

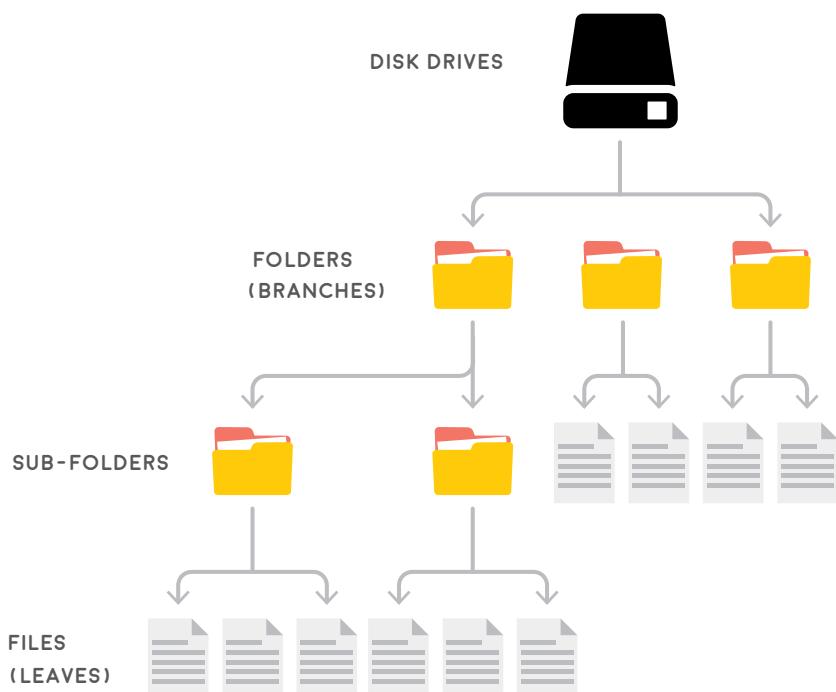
In the screenshot above, there are two storage devices: *Computer (C:)* and *DVD RW Drive (D:)*. By double-clicking on any of these devices, you can open it and examine the files and folders stored on this device.

Once you are comfortable with exploring your computer, you are now ready to begin organising the files on it.

## HIERARCHICAL STRUCTURE: REASONS FOR A FILE STRUCTURE

In the following example, we will explain a directory comparing it to a tree. The structure is the shape of a pyramid, where each row of items is linked to the items beneath it. Because of this pyramidal structure, this hierarchical structure is also known as an inverted tree.

A Windows operating system organises its drives, folders, and files in a **hierarchical tree structure**. Files are stored on a drive within **directories**; also known as folders in Microsoft Windows. Folders organise files on a drive so that they can be found more easily. A folder can contain many levels of subfolders.



**Figure 2.10:** An example of an inverted hierarchical tree

In the diagram above the root of the tree is not at the bottom but at the top, and hanging from the root there will be the drives, folders, sub-folders, and files. The folders linked to the specific drives are the root folders.

Any sub-folders and files found in the folder appear in the next row. This pattern continues until the final row only contains files. All files in a hierarchical tree are known as leaves because they are found at the bottom of the tree, without any rows below them.

The highest level of the tree structure of a drive is the **root directory**. The root directory of the main drive is usually named the C:drive, written as C:\.

## REASONS FOR HAVING A FILE STRUCTURE

A file structure:

- increases efficiency when retrieving files and data
- guarantees high levels of productivity
- helps user to organise data
- helps user to easily identify files
- ensures that related data are organised and grouped together.

## MANIPULATING FILES AND FOLDERS

### COPYING FILES

When a file is copied, a duplicate of the file is created, it is archived and stored in the computer's clipboard. This duplicate file can then be placed on any storage device connected to the computer using the paste command. There are numerous ways you can copy and paste files, here are two examples.

**Table 2.6:** How to copy and paste files

DRAG AND DROP	SHORTCUT KEYS
<ul style="list-style-type: none"><li>• Left-click on the files you would like to copy.</li><li>• While pressing the <i>CTRL</i> key on the keyboard, drag the file/s from the source folder to their destination.</li><li>• Drop the file/s once they are in the destination folder.</li></ul>	<ul style="list-style-type: none"><li>• Select the file you would like to copy.</li><li>• Press <i>CTRL-C</i> on the keyboard.</li><li>• Navigate to the folder where you would like to place the copied files.</li><li>• Press <i>CTRL-V</i> on the keyboard to paste the files.</li></ul>

### MOVING FILES

When you move files, the selected files are copied to the new destination and then deleted from their original destination. This means that you have not created a duplicate file, but instead moved a file from one folder to a different folder. To move files, you need to cut and paste them rather than copy and paste them.

**Table 2.7:** How to move files

DRAG AND DROP	SHORTCUT KEYS
<ul style="list-style-type: none"><li>• Left-click the file you would like to move.</li><li>• In a different file explorer window, navigate to the folder where you would like to place the copied files.</li><li>• Drag the file/s from the source folder to their destination.</li><li>• Drop the file/s once they are in the destination folder.</li></ul>	<ul style="list-style-type: none"><li>• Select the file you would like to move.</li><li>• Press <i>CTRL-X</i> on the keyboard.</li><li>• Navigate to the folder where you would like to place the copied files.</li><li>• Press <i>CTRL-V</i> on the keyboard to paste the files.</li></ul>

### RENAMING FILES

This command allows you to change the name of files.

- Left-click on the file you would like to rename
- Using the mouse, click on the name of the selected file
- Enter a new name for your file and press the *ENTER* key.

When naming files it is important that you choose clear, descriptive names for files. You can use the following tips to make your files easier to find:

- never use a complicated structure
- ensure that you can distinguish between similar files based on the file names
- use the dash symbol to separate different elements in a file name (for example, the name, and date)
- files are usually organised alphabetically, so carefully consider with which letter or number to start a file name.



## Did you know

Even 'permanently' deleted files are not necessarily gone forever. If you have not stored too many new files on the storage device, it is often possible to recover the deleted files using specialised recovery (or un-deleting) software.



## RECOVERING DELETED FILES



[https://www.youtube.com/watch?v=NVy\\_2TADSis](https://www.youtube.com/watch?v=NVy_2TADSis)  
<https://qrs.ly/xlab1zp>

## DELETING FILES

The *Delete* command allows you to remove files from your storage device. This can be used to remove files you no longer need or to make space on your storage device to store new files.

In Microsoft Windows, all deleted files are first moved to the *Recycle Bin*. The *Recycle Bin* is a temporary folder where files are stored, until such time you decide to permanently remove them from your computer. However, files that you delete from flash drives or network drives are permanently deleted and are not moved to the *Recycle Bin*.

### SEND FILES TO THE RECYCLING BIN

- Left-click on the file you would like to remove.
- Press the *DELETE* key on the keyboard.

### EMPTY THE RECYCLING BIN

- Right click on the *Recycle Bin* icon and select the 'Empty' *Recycle Bin* option.
- Click on the Yes button to remove the files.

## FILE NAMING CONVENTION

Individuals and organisations may decide on a naming convention for their files, for example, *Tuckshop January final* and *Tuckshop Report ver. 2*. If used consistently it makes it easier to find the files when needed.

A File Naming Convention (FNC) helps keep the computer clutter-free and allows you to:

- know the contents of a file before you open it
- navigate through long lists of files for the one that you are looking for
- store different versions of the same document by naming them according to date.

### GUIDELINES TO DEVELOP GOOD FILE NAMING CONVENTIONS

- Keep file names short but meaningful.
- Include useful information such as the name of the project or document you are working on.
- Include the version number (e.g. V1 or -v1) and the date if there is more than one version.
- Dates should always be in the format yyyy-mm-dd so that the files will be organised in date order.

### THINGS TO AVOID WITH FILE NAMING CONVENTIONS

- Symbol characters such as '\ / < > | ' ? [ ] ; = + & \$ α β'
- Abbreviations that are not easy to understand
- Non-specific words such as 'draft, current or document.'



## Activity 2.5

- 2.5.1** Choose a concept from COLUMN B that matches a description in COLUMN A. Write only the letter next to the question number (e.g. 1–A). There can be more than one answer to a question.

COLUMN A	COLUMN B
1. The structures used to store data.	A. Directories
2. The data in _____ is stored in table structures, with each database containing multiple tables.	B. Files and databases
3. The location that a file is saved in is recorded in the _____ for that file	C. Extension
4. _____ are data structures that are stored on a computer's storage devices and that contain rows of information.	D. Folders
5. To copy a file, you should use the _____ shortcut key (hotkey) on the keyboard.	E. File path
6. Files are stored on a computer inside _____ or _____	F. Databases
7. In Microsoft Windows, all deleted files are first moved to the _____ .	G. CTRL-X
8. The file path always ends with the file _____ .	H. CTRL-C
9. To move a file, you should use the _____ shortcut key (hotkey) on the keyboard.	I. Recycle Bin
	J. Files

- 2.5.2** Rasheed can never find any of the files and folders he is looking for; as a result, he has sent you the incorrect files more than once when working together on group projects. When you had a chance to work on Rasheed's computer, you realised that most of the files on his computer had never been organised and are simply in the *Downloads* folder. This included television series and movies, music, games, school projects from the current and previous years, and his programming projects from this year.

To help Rasheed solve this problem, answer the following questions.

- Suggest a system Rasheed could use to better organise his files.
- Write down the file paths you would use to organise Rasheed's files.
- What drive letter would you use and why?
- What is the purpose of the backslash (\) in the file path?
- Explain how to move a file from one folder to another.

- 2.5.3** Complete the following tasks on a computer, using the folder and files given to you.

- Create a new folder. The folder name should be your name followed by the date.
- Copy all the files you have received into this folder.
- Inside your new folder, create a folder called 'Duplicates'.
- Look at the pictures you have received and move any duplicated pictures to the 'Duplicates' folder.
- Delete the 'Duplicates' folder to the *Recycle Bin*.
- Write down how many pictures there are left in your folder.

## 2.5 Common file types and extensions

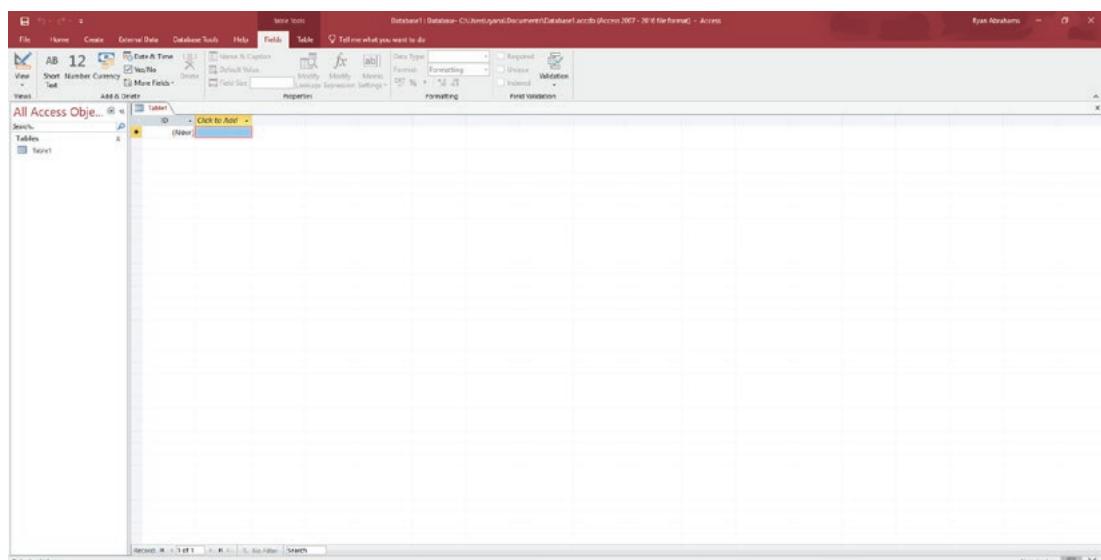
Files do not only store data, they also contain information on how the data should be interpreted by a computing device. Every file contains a file extension that determines the type of file it is and how the operating system should interpret it.

A .text file, for example, is a basic text document that only contains words without any formatting, while the .doc type allows for more complex documents that include different fonts and images.

In this unit, we will look at the following types of files:

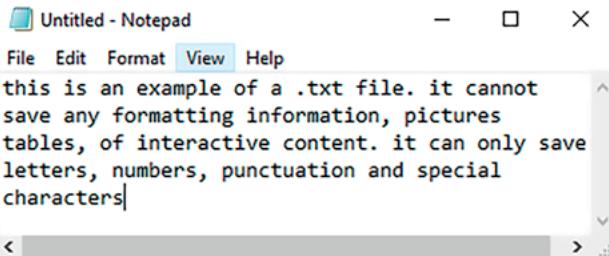
- compressed
  - text
  - databases
  - spreadsheets
  - presentations
  - word processing
  - images
  - videos
  - audio
  - animations
  - fonts
  - source code
  - object code
  - executables
  - shared libraries

FILE TYPE	APPLICATIONS	EXTENSIONS	EXPLANATION
Compressed	<ul style="list-style-type: none"><li>WinRAR</li><li>WinZip</li><li>7-zip</li></ul>	<ul style="list-style-type: none"><li>.zip</li><li>.rar</li><li>.7z</li></ul>	Compressed file types combine and compress different file types into one container file. For example, when you need to send 100 files in an email to a classmate, it might be easier to first combine and compress the files into a single .zip file before sending the files. This single file will be easier for your classmate to download, because the single compressed file will be smaller than the individual files sent separately. Your classmate can then decompress the files, which will give them access to all the files you sent.
Database	<ul style="list-style-type: none"><li>Microsoft Access</li><li>LibreOffice Base</li></ul>	<ul style="list-style-type: none"><li>.mdb</li><li>.accdb</li></ul>	Databases work like spreadsheets, except that the different sheets (called tables) of the database are connected to each other.  Most programmers make use of databases to store important data for their software.



**Figure 2.11:** Databases can store related information on different tables

FILE TYPE	APPLICATIONS	EXTENSIONS	EXPLANATION
Text	<ul style="list-style-type: none"> <li>● Notepad</li> <li>● Notepad++</li> </ul>	<ul style="list-style-type: none"> <li>● .txt (text)</li> <li>● .rtf (rich-text format)</li> <li>● .csv</li> <li>● .html</li> </ul>	<p>Text files (.txt) are used to store text. They do not have any information about the fonts, font sizes, or <b>multimedia</b>, such as photos and videos.</p> <p>Rich-text format files (.rtf) can save more information including different formatting options such as bold, italic, font size and font colour, as well as images and drawings. Rich-text can be opened in <b>Microsoft WordPad</b>.</p> <p>Comma separated value (or CSV) files are text files that can be used to store tables of information. Each line in the CSV file represents one row of data, while the data from the different columns are separated using commas. Since CSV files only contain text, they cannot include any type of formatting that you might be familiar with from spreadsheet applications like Excel.</p> <p>Hypertext Markup Language file .html contains text, text references to other external files, like images in the article and references other files like video, CSS, or JS files.</p>

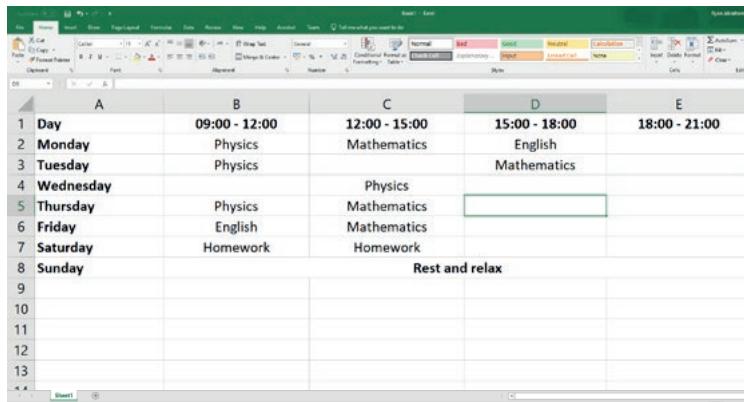


**Figure 2.12:** Text files are used to store plain text without formatting

CONVERTING TO RICH TEXT FORMAT

<https://www.youtube.com/watch?v=1er5baxb8bE> <https://qrs.ly/uxab1zq>

Spreadsheet	<ul style="list-style-type: none"> <li>● Microsoft Excel</li> <li>● Google sheets</li> <li>● LibreOffice Calc</li> </ul>	<ul style="list-style-type: none"> <li>● .xls</li> <li>● .xlsx</li> <li>● .ods</li> </ul>	<p>A spreadsheet file stores information in a large table. Spreadsheets are commonly used in businesses to do calculations and analyse large sets of data. They are used to store information that is best presented in a table, such as timetables and checklists.</p>
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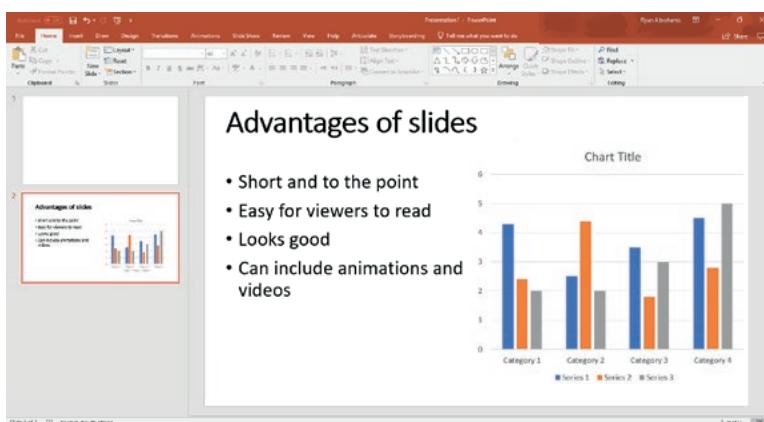


Take note

A single spreadsheet file can contain many sheets. Each of these sheets is a separate page that contains its own information. These sheets can be linked to one another, as well as to other spreadsheets.

**Figure 2.13:** Excel spreadsheets store information on different tables called sheets

FILE TYPE	APPLICATIONS	EXTENSIONS	EXPLANATION
Presentation	<ul style="list-style-type: none"> <li>● Microsoft PowerPoint</li> <li>● Google Slides</li> <li>● LibreOffice Impress</li> </ul>	<ul style="list-style-type: none"> <li>● .ppt</li> <li>● .pptx</li> <li>● .odp</li> </ul>	A presentation file stores information using slides that can be shown one after the other. Slides are usually set up as discussion points, look attractive, and can contain animations.



**Figure 2.14:** Slide shows contain one or more slides

Word processing	<ul style="list-style-type: none"> <li>● Microsoft Word</li> <li>● Google Docs</li> <li>● LibreOffice Writer</li> </ul>	<ul style="list-style-type: none"> <li>● .doc</li> <li>● .docx</li> <li>● .odt</li> </ul>	Document files store formatted formatting information that is more complex. This includes information such as styles colour information and advanced page layout options.
Image	<ul style="list-style-type: none"> <li>● Microsoft Paint</li> <li>● Adobe Photoshop</li> </ul>	<ul style="list-style-type: none"> <li>● .bmp (bitmap image)</li> <li>● .gif (graphics interchange format)</li> <li>● .jpeg or .jpg (Joint Photographic Experts Group)</li> <li>● .png (portable network graphics)</li> <li>● .tiff (tagged image file format)</li> </ul>	Photos taken by a camera or pictures created using software like Microsoft Paint or Adobe Photoshop are often saved in one of these formats. The difference between these formats is the way in which the raw data is stored and how the image is compressed.

FILE TYPE	APPLICATIONS	EXTENSIONS	EXPLANATION
Video	<ul style="list-style-type: none"> <li>● Microsoft media player</li> </ul>	<ul style="list-style-type: none"> <li>● .avi (audio video interleave)</li> <li>● .flv (Flash video format)</li> <li>● .mov (QuickTime file format)</li> <li>● .mp4 (Moving Picture Experts Group 4)</li> <li>● .webm (WebM)</li> <li>● .wmv (Microsoft Windows media video)</li> </ul>	<p>A video that is streamed is still downloaded to your computer. Once you have watched the video, it is automatically removed from your computer. This means that downloading and streaming a video uses the same amount of data from your <b>internet service provider (ISP)</b>.</p> <p>By using several advanced programming techniques, video encoders can compress a 50 GB video into 700 MB without losing too much quality.</p>
Audio	<ul style="list-style-type: none"> <li>● Microsoft media player</li> </ul>	<ul style="list-style-type: none"> <li>● .aac (advanced audio coding)</li> <li>● .flac (free lossless audio codec)</li> <li>● .mp3 (Moving Picture Experts Group layer 3 audio)</li> <li>● wma (Microsoft Windows media audio)</li> </ul>	<p>Audio files are usually compressed before they are stored on a computer. This means that an album that is stored on a 700 MB CD will only use 100 MB of storage space after it has been compressed.</p>
Animation	<ul style="list-style-type: none"> <li>● Media player</li> <li>● Adobe Animate</li> <li>● Flash</li> </ul>	<ul style="list-style-type: none"> <li>● .gif (graphics interchange format)</li> <li>● .swf (small web format)</li> </ul>	<p>Animation files are files showing moving images. Even though both these formats create animations, they do so in a very different way. GIF animations show normal GIF images one after the other to create the animation, while SWF files use programming to move shapes on the screen, creating an animation.</p>
Font	<ul style="list-style-type: none"> <li>● Microsoft Office</li> </ul>	<ul style="list-style-type: none"> <li>● .fnt</li> <li>● .pfb</li> <li>● .otf</li> </ul>	<p>Fonts change the way in which the characters in your documents are written. There are hundreds of different types of fonts, including sans serif fonts (like Arial), serif fonts (like Cambria and Garamond), script fonts (like Brush Script), and monospaced fonts (like Source Code).</p> <p><b>This is Arial</b></p> <p><i>This is Brush Script</i></p> <p><b>This is Cambria</b></p> <p><b>This is Comic Sans</b></p> <p><b>This is Garamond</b></p> <p><b>This is Source Code</b></p> <p><b>Figure 2.15:</b> Fonts determine how the letters in your documents look</p>

FILE TYPE	APPLICATIONS	EXTENSIONS	EXPLANATION
Source code		<ul style="list-style-type: none"> <li>• .c (C/C++ file)</li> <li>• .pas (Delphi)</li> <li>• .java (Java file)</li> <li>• .js (JavaScript)</li> <li>• .py (Python)</li> </ul>	<p><b>Source code files</b> contain instructions to create a computer program. Unlike other file formats, the raw data for most source code files is in plain text. They can usually be opened in a normal text editor like Notepad. The file extensions of source code files are used to tell programmers which programming language the files are written in.</p>

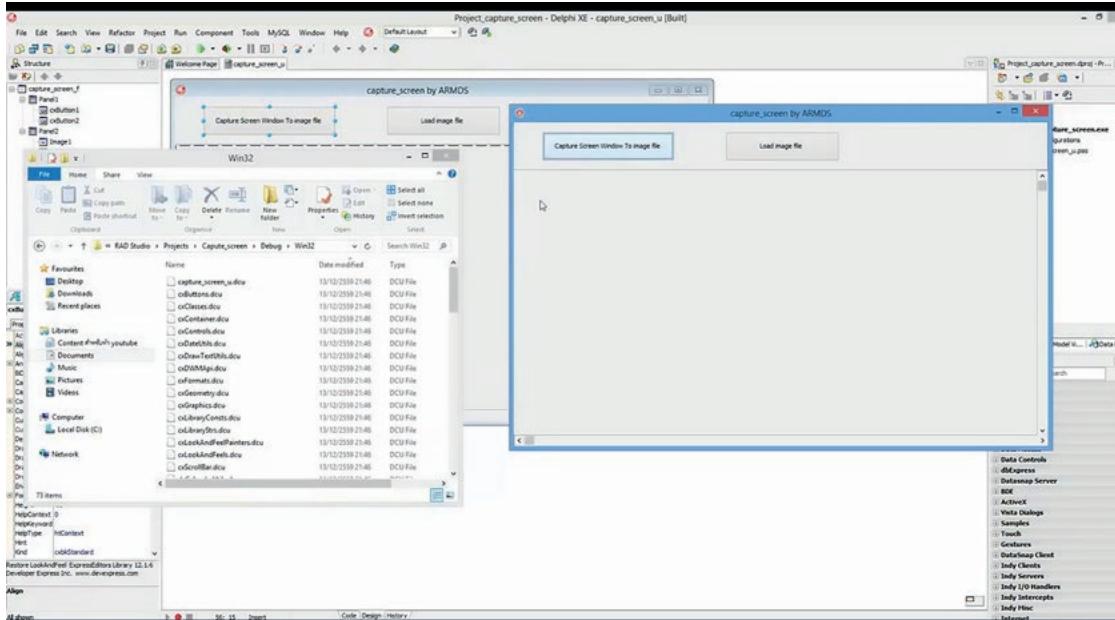
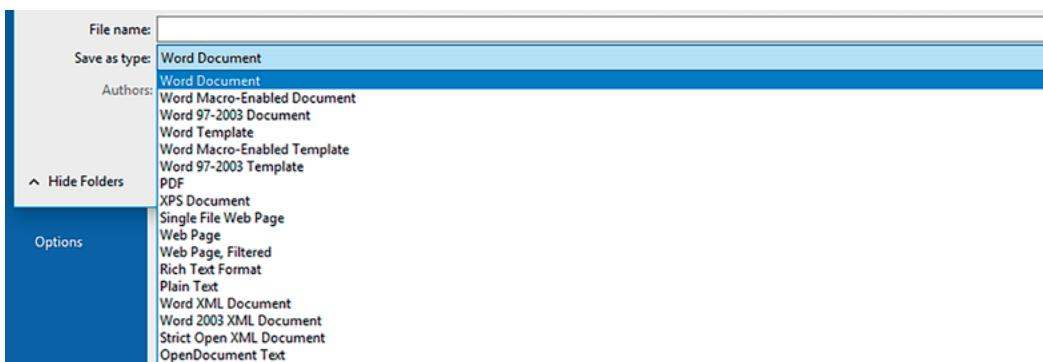


Figure 2.16: Source code files are often stored in plain text

Object Code	<ul style="list-style-type: none"> <li>• Delphi</li> <li>• C/C++</li> </ul>	<ul style="list-style-type: none"> <li>• .dcu</li> <li>• .obj</li> </ul>	Object code is the machine language, (also known as machine code) that a central processing unit can understand. A compiler produces object code when it translates the programming source code.
Executable	<ul style="list-style-type: none"> <li>• Delphi application</li> </ul>	<ul style="list-style-type: none"> <li>• .exe</li> </ul>	<b>Executable files</b> launches an application or program.
Shared library	<ul style="list-style-type: none"> <li>• Microsoft Windows</li> <li>• MacOS</li> <li>• Linux</li> </ul>	<ul style="list-style-type: none"> <li>• .dll</li> <li>• .lib</li> </ul>	<b>Shared library files</b> contain several useful instructions that your programs can use. Rather than including these instructions in a single executable, they are saved as separate files so that the instructions can be used by more than one program. This reuse of programs saves time and money in the development process.

Converting between file types consists of saving the file in a format that can be read by other types of programs. This is often done to share data, access the data with another program or access data with an older version of the software program.



**Figure 2.17:** Converting a Word document by saving it as another type



## Activity 2.6

- 2.6.1** List five types of image files. Give the name and extension for each file.
- 2.6.2** Give an example of an animation file extension. How does an animation differ from an image?
- 2.6.3** What is a source code file? Give two examples of a source code file type.
- 2.6.4** How are shared library files used?
- 2.6.5** What is the difference between text files and document files?
- 2.6.6** How can CSV files be used to store tabular information?
- 2.6.7** Nosipho has been organising her computer. Unfortunately, after moving some of her files to new folders, she can no longer find them! See if you can help Nosipho by answering the following questions.

THE FILES SHE IS LOOKING FOR	FILE PATHS
1. A presentation that she created for her biology class.	D:\Music\Ariana Grande\fav1.mp3
2. The Microsoft Word executable file.	C:\Users\Shelley\Documents\School\20190201 - bio.pptx
3. A funny animated picture that she would like to send to a friend.	D:\Games\game_stats.csv
4. A text files containing her list of to-do tasks.	C:\Users\Shelley\Downloads\t-d.txt
5. A table with information on her win percentages in games.	C:\Users\Shelley\Downloads\cat.gif D:\Games\Origin Games\Apex\r5apex.exe C:\Program Files\Microsoft Office\root\Office16\WINWORD.EXE

- a. Match the files Nosipho is looking for with the file paths.
- b. Give the file extension and file type for each of the file paths above.
- c. Based on the file paths above, do you think Nosipho has finished organising her computer? Give reasons for your answer.
- d. Nosipho used a CSV file to store tabular data. What is the difference between a CSV file and an XLS file?
- e. Can you think of any reasons why Nosipho's games and music would be on her D:\ drive?
- f. Why is it not a good idea to change the file extension?

- 2.6.8** Give two advantages of DLL files.
- 2.6.9** Explain the difference between source code and machine code.
- 2.6.10** Describe a situation where you would find it necessary to convert from one file type to another. For example from a Word document to a text file or from a spreadsheet to a CSV file.

## 2.6 Social implications

The introduction of computers in our daily lives has created various issues in our society. These include, legal, ethical, economical and the digital divide issues. In this unit, we will look at each of these social issues. This will include:

- license agreements, copyright, piracy and copyleft
- social, ethical and legal issues on ICT
- economic reasons for using computers
- the digital divide.

### SOFTWARE LICENSE AGREEMENTS

When a user pays for proprietary software, they pay the rights to use it while the software still belongs to the developer. When you install proprietary software, you have to agree to terms and conditions in the license agreement. This is an actual agreement and can contain information such as:

- No changes or modifications can be made to the software.
- No copies of the software can be distributed.
- The software can only be installed and used on a specified device.

The license agreement is better as the **EULA** (end user license agreement) and has three types of agreements:

- Single-user license means that the software is for a single-user/device
- Multi-user license means that the software is for multi-users/multi devices or computers
- Site license means that use of the software is unlimited, however, it is usually installed on a common group of users/devices belonging to an entity, for example, a company, school, etc.

### PIRACY

Piracy is the illegal copying, distribution or use of software. These illegal copies are sold at a low price, which is normally a fraction of the price of the original legal copies.

There are different types of software piracy, for example:

- **Softlifting:** When a software program with a legal license is copied with the main purpose of providing it to multiple users, rather than to sell copies for profit.
- **Client-server overuse:** When more users than stipulated in the licensing agreement are using a central copy of a program at the same time.
- **Hard disk loading** happens when illegal copies of software are loaded onto the hard disks of new computers to make the purchase more attractive.
- **Counterfeiting** is the illegal duplication, distribution, and/or sale of copyright material with the intent of imitating the copyright product.
- **Online piracy:** When proprietary software is illegally downloaded from the internet.



#### Did you know

According to the Business Software Alliance (BSA) in South Africa, about 36% of software that is used is pirated. Software piracy causes monetary loss for developers and this makes the legal copies more expensive.

## COPYRIGHT

**Copyright** is the legal right granted to duplicate and make copies of intellectual property. Creators decide on whom and under what circumstances interested users may copy their invention.

For example, if you create a new music album, you can sign a contract with a music label that allows them to copy and sell the album, as long as they pay you for every album they sell. The primary goal of copyright is to give people a reason to create and invent new things, since it allows creators to make money from their creations.

Unfortunately, the internet has complicated questions of copyright. Anyone can copy, for example, music from an album loaded on to the internet to their computer and share it with thousands of people from around the world. This is called copyright infringement or **piracy** and is a crime in many countries (including South Africa). Unfortunately, this crime is so easy to commit that hundreds of millions of people commit it each year! Piracy is not limited to music either, every day people illegally download, stream or copy television shows, movies, games and software from around the world.

## COPYLEFT

Many creators are no longer licensing their creations using copyright. Instead, they are using licenses such as Creative Commons and Copy left to protect their works. These licenses allow other people to copy and use the creation, as long as they follow certain rules. This can include one or more of the following rules:

- **Attribution:** Whenever the creation is used, you must give credit to the original creator.
- **Non-commercial:** The creation can be used for any purpose not aimed at making money (that is, non-commercial use).
- **Share-alike or copy left:** The creation can be used for any purpose, but the new work must be shared with the exact same license as the original work. This ensures that the creation stays free for anyone to use.
- **Non-derivative:** The creation can be copied and used as it is but cannot be changed in any way.

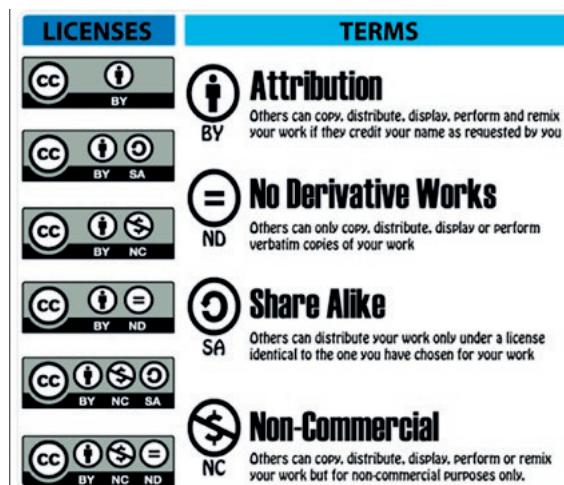


Figure 2.18: Different Creative Commons licenses available

These licenses have become more popular recently, with websites like Wikipedia offering all their information using a Creative Commons license.

## SOCIAL, ETHICAL, AND LEGAL ISSUES PERTAINING TO ICTS

There are also difficult **ethical** questions to answer about piracy:

- Piracy is often seen as theft, but with theft, the original owner loses the item that was stolen. With piracy, however, the original owner still has the item that was pirated, and other people now have it. Is piracy, therefore, the same as theft?
- Since people are supposed to pay for music and movies, many people have argued that piracy steals this money from the creator's hands. However, if someone never intended to pay for the stolen item or was unable to pay for it, does the creator still lose this money?
- Many studies have shown that rather than decreasing the sales of music and games, piracy can increase the games and music sold, therefore directly helping the creator. How does this affect the ethics of piracy?
- Other studies have found that pirates spend considerably more money on music than normal consumers do. What does this mean for piracy?
- If you believe that people have the right to good and happy lives, then piracy can give billions of people access to high quality entertainment that only the richest people could previously afford, is this not morally or ethically good?

These questions are incredibly complex and difficult to answer. Rather than directly combating piracy and trying to arrest the hundreds of millions of people committing piracy, many companies have realised that providing an easy, fair, and legal alternative to piracy is their best option. Streaming services like Spotify (for music), Netflix (for movies and television series) and YouTube, have allowed creators to make money from their creations while giving people free or affordable access to their sources of entertainment.

## PRIVACY

In many countries (including South Africa), people have the right to privacy, which means they can choose what they tell people about themselves. This right becomes incredibly complex because of the use of computers and the internet, computers can record and analyse everything you do. For example, if you use Google to research the rules of netball and then watch YouTube videos about how to play netball, your web browser, and search engine may record this information. Without you telling them, they have now learned that you like netball and might be interested in playing it. This information is very valuable to people who make netball equipment, so Google takes this information (and all the information it records about the billions of people who use their software) and sells it to advertisers. The next time you open a website, you will suddenly see an advertisement for brand new netball balls in your web browser!



WHY THERE'S NO STOPPING PIRACY

<https://www.youtube.com/watch?v=SbfL9hVhK0>

<https://qrs.ly/c6ab1zr>



INTERNET PIRACY

<https://www.youtube.com/watch?v=a0tdm-gODCg>

<https://qrs.ly/2kab1zs>



Did you know

Today, unless you are told differently, it is safe to assume that most websites you visit and internet tools you use will collect some information about you.

With this scenario in mind, try to think about the following ethical questions:

- Should the average person be concerned about privacy?
- By entering your interests on a search engine, do you give a company the right to sell that information?
- By entering your private information on a social network, does that give the company the right to sell your information?
- What about the information entered on a smartphone?
- Should companies be allowed to sell this information if they inform you?
- Is it good or bad that you receive advertisements that match your browser history?
- Would you allow data collection if it allowed complex services (such as Google Maps) to remain free?

These are just some of the many privacy questions that using the internet raises.



### Case Study

#### Google Maps in Germany

One of the greatest features of the Google Maps navigation tool is called *Street View*. It allows you to see 360° photos of most towns or cities, so that you can see exactly what the place you are travelling to will look like. However, for five years, this feature was not available in Germany (one of the world's most technological countries). Why?



**Figure 2.19:** A street view of Menlyn Shopping Centre in Pretoria



#### Did you know

Google's software automatically detects and blurs people's faces and number plates on Google Street View. This is fortunate for the people who have been caught in compromising positions by the Street View cameras!

Germany is more concerned with privacy than many other countries in the world. When the Germans heard that Google would be driving through their cities, taking photos of all their houses, many people were outraged. While not technically against the law (the photos are taken from the streets, which are public property), the people felt that Google was invading their privacy. This issue became so serious that, when asked about it, the German Foreign Minister said, 'I will do all I can to prevent it'.

To solve the problem, Google gave German households the option to have their houses 'blurred-out' on *Street View*, before it was released to the public. Almost 250 000 households decided to do this, which forced Google to blur the houses every time they updated their pictures. In 2011, Google decided to remove the *Street View* feature from Germany due to the costs of repeatedly blurring the houses. The *Street View function* was only re-introduced in 2016.

## FREEDOM OF EXPRESSION

In a famous cartoon from *The New Yorker magazine* in 1993, one dog is sitting in front of a computer and says to another dog ‘On the Internet, nobody knows you’re a dog.’ This cartoon perfectly captured the way in which the internet allows people to recreate themselves. On the internet, no one knows who you are, so you can be, or say, almost anything.

This can be incredibly empowering for people across the world. It allows people to express their opinions and find communities in which they feel safe. It can even be used to organise a rebellion and eventually overthrow a corrupt government and dictator, as occurred in Egypt in 2011.

Unfortunately, these same freedoms allow people to speak without fear of consequences. This can result in people saying all the hateful, racist, homophobic, and sexist things they normally keep to themselves. It can also result in cyberbullying and it has been directly linked to the suicide of teenagers who experienced severe cyberbullying.



ON THE INTERNET,  
NOBODY KNOWS  
YOU'RE A DOG



[https://en.wikipedia.org/wiki/  
On\\_the\\_Internet,\\_nobody\\_knows\\_you%27re\\_a\\_dog](https://en.wikipedia.org/wiki/On_the_Internet,_nobody_knows_you%27re_a_dog)

<https://qrs.ly/wqab1zv>



### Did you know

While it is generally considered ethically wrong to make offensive comments, under certain circumstances, it may even be illegal. People from all over the world have been jailed for their comments on social media, including threats and bomb threats, sexual harassment and racist comments. Consider the following questions:

1. Do you think people's personal details such as names, identity number, address, etc., should be linked to their internet use, or should the internet stay anonymous?
2. If the internet is anonymous, how should racist, sexist, and homophobic messages be treated?
3. How can online bullying (cyber-bullying) be reduced?
4. Are there any situations in which people should be sent to jail for their social media messages?

## ECONOMIC REASONS FOR USING COMPUTERS

Computers have offered people many significant advantages, including:

- **Saving paper:** Previously all documentation was paper-based but with the use of computers, paper has (in most cases) been replaced by electronic versions.
- **Labour:** The use of computers has increased the production of all goods and many large factories today only need a few workers to manage operations. Unfortunately, it also resulted in unemployment because machines have replaced workers. However, the inclusion of computers in our daily lives has also created many new jobs but at a higher skill level.
- **Communications costs:** As you learned in Chapter 1, ICT has dramatically changed the way in which people can communicate. Thanks to the ease of electronic communication, it is now possible to sit in Limpopo developing websites for clients from all over the world. This ease of communication has also allowed businesses to expand and open new offices around the world – something that was previously very difficult or expensive. Can you imagine



## New words

**nanometre** – one thousand-millionth of a metre

trying to send the newest technical designs or financial statements to your company's office in a different country before email existed?

- **Efficiency:** Computers dramatically increased the information available to companies and people, which simplified their jobs and allowed for better decision making.
- **Accuracy:** One of the advantages of computers is that they increase accuracy for both people and machines. For example, computer-guided equipment can make cuts that are accurate to the nearest **nanometre**. Similarly, people who are guided by the information on computers can find problems more quickly, make decisions that are more accurate and obtain the training they need to improve their own accuracy.
- **Reliability:** Thanks to computers, businesses have become more reliable in several ways, this includes, producing products that are more reliable, becoming more responsive to customer complaints and adhering to rules and regulations more stringently. Because of ICT, machines have also become more reliable, with detailed sensors and computers informing maintenance staff whenever a problem is detected. Because of these improvements, consumers can expect higher quality products from companies.

## DIGITAL DIVIDE

Digital divide refers to the growing gap between those people with access to and knowledge of using digital technology ("haves") and those people without access or knowledge to digital technology ("have-nots"). The digital divide is believed to reinforce social inequalities and to cause a persisting information or knowledge gap.

Factors attributing to the digital divide include:

- Education – Households with higher levels of education are increasingly more likely to use computers and the internet.
- Income – Due to lower income levels, disadvantaged neighbourhoods lack the infrastructure available in wealthier areas.
- Location – Households that are in rural areas may have very little access, exposure or need for technology.



## Activity 2.7

- 2.7.1** As a young, up-and-coming musician, Bibi has just released his first album. While the album is regularly played on the radio and Bibi often hears taxi drivers playing his music, he has sold very few copies of the album to date. While working in Johannesburg, Bibi sees a street vendor selling a copy of his album for R30.

Based on this information, answer the following questions.

- a. Why do you think Bibi's music is played everywhere without any albums being sold?
- b. Do you think the street vendor has the legal right to sell Bibi's album? Give reasons for your answer.
- c. What are the possible legal consequences for the street vendor if he is committing copyright infringement?

- 2.7.2** One of the big trends in online computing is called the Internet of Things (or IoT). This refers to the increasing number of appliances and gadgets that are now connecting to the internet, including alarms, fridges, lights, air conditioning, televisions, security cameras, baby monitors, and even doorbells. However, one of the main concerns regarding the Internet of Things is that the data sent and received by these appliances may not be private.

Based on this information, answer the following questions.

- a. What is the right to privacy?
- b. In your own words, how have computers and the internet affected privacy? Give an example to support your answer.
- c. What do you think the advantages are of having security cameras or baby monitors that are connected to the internet?
- d. Why do you think people are concerned about privacy about the IoT?

- 2.7.3** In a group, discuss how you feel about the following topics, paying careful attention to the questions posed in the chapter.

- a. Copyright and piracy
- b. Privacy
- c. Freedom of expression

If group members disagree with your opinion, try to find out why they disagree and why they see things differently.

## CONSOLIDATION ACTIVITY

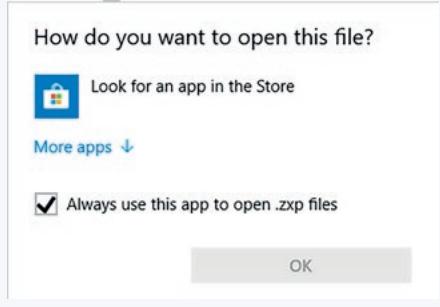
## Chapter 2: Data representation and storage

Answer the following questions by choosing the correct answer for each one.

- Computers have offered people many significant advantages. Which of the following is not an advantage?
    - saving time
    - automating non-repetitive tasks
    - connecting people
  - Automation refers to ...
    - the use of automatic equipment to complete a job.
    - the use of computers to complete a job.
    - increasing economic competition.
  - One of the advantages of computers is that they increase the accuracy for ...
    - people
    - machines
    - both people and machines.
  - How has the internet increased economic competition?
    - Shops can now charge more for their products.
    - Buyers must now compete with other buyers for the same product.
    - Consumers can now compare a shop's prices to other prices.
  - Thanks to computers, businesses have become more reliable. This statement is ...
    - True
    - False, because computers are unreliable and often crash.
    - False, because most businesses do not use computers.
  - Thanks to the internet, it is possible for anyone to teach themselves new skills. This includes ...
    - creating a website.
    - becoming a plumber.
    - studying medicine.
    - all the above.
  - What is a single switch in a computer known as?
    - Bit
    - Byte
    - Megabyte
    - None of the above
  - Which one of the following is the correct data type that can store a single character? This includes letters, numbers, and symbols.
    - Float
    - Char
    - String
    - Integer
  - Which one of the following is the correct answer when converting the decimal number 921 to hexadecimal?
    - 450
    - 126
    - 399
    - 349
  - In the file name: C:\Documents\School\MathsAssignment.docx. What does .docx tell you?
    - File name
    - Folder
    - Extension
    - Drive letter
  - Which ONE of the following options describes the type of devices used to keep an electronic record of work done on a computer?
    - Input
    - Output
    - Processing
    - Storage
  - Ricky grew up in a poor area and his family did not own a personal computer. His parents also did not believe that children or teenagers should have personal phones. As a result, Ricky's only interaction with computers and the internet was at school. After completing school, Ricky received a bursary to study engineering at University. He moved in to a room at residence and lived on his own. Based on this information, answer the following questions.
    - What is the digital divide?
    - How do you think Ricky's lack of computer experience and knowledge will affect his studies? Give reasons for your answer.
    - Ricky wants to purchase a computer for his studies. In your opinion, what device do you think he should purchase; a smartphone, a tablet, a desktop, or a notebook? Give at least three reasons for your answer.

**CONSOLIDATION ACTIVITY****Chapter 2: Data representation and storage *continued***

- d. How do you think access to the internet will help Ricky in his studies?
- e. Do you think Ricky has a disadvantage at university compared to students who have more experience with computers and the internet? Motivate your answer.
- f. In small groups, discuss the impact or the potential impact of computers on your life and that of your family. You can include improvements that computers have made, improvements that you hope computers will make, problems that you have experienced, or you can simply describe the factors above in relation to yourself.
13. Choose the answer and write TRUE or FALSE next to the question number. Correct the statement if it is FALSE. Change the word(s) in bold print to make the statement TRUE if necessary. (You may not simply use the word 'NOT' to change the statement.)
- Computers use billions of tiny ON and OFF switches called **transistors**.
  - A **float** refers to several characters, letters, or numbers.
  - Files** are data structures that are stored on a computer's storage devices.
  - A **presentation** file is a file that stores information in a large table.
  - A single switch (called a **byte**) can represent the value 1 (when it is switched ON) and 0 (when it is switched OFF).
14. Answer the following questions.
- What is a float?
  - List TWO reasons why computers store data.
  - What are folders used for?
  - List ONE difference between a bit and a byte.
  - What window should you use to find out what a file's unique path is?
  - What is a source code file?
  - Give TWO extensions for a source code file.
  - Differentiate between files and folders.
  - Briefly explain how data is stored in a database.
  - Describe what compressed documents are.
  - Give TWO examples of a text file.
  - Draw a diagram to indicate the following folders and sub-folders in a structure (use these names to create folders and subfolders): You have files for school, sports, entertainment (series, music), and personal files.
15. In the figure below, identify the five the different parts of a file path.
- D:\Movies\Superheroes\Blackpanther.mp4
16. You created a document in Word for your father and saved it as 'benefits.dox'. When he wanted to open it, Windows displayed the following message.
- Explain the importance of file extensions by referring to the scenario described here.
  - What file extension did you use to save the file?
  - What file extensions should be used to save document files?
  - Why does Windows sometimes ask you how to open the file?



**CONSOLIDATION ACTIVITY**Chapter 2: Data representation and storage *continued*

- 17.** Your brother usually downloads movies and music from the internet without paying for them; this can be considered as unethical.
- Explain the concept, Ethics.
  - What crime is your brother committing?
  - Briefly explain your answer in (b).
  - If your brother copies work from a non-commercial CC licence. What does it mean?
  - Give your brother ONE tip on how to practice ethics when using the internet.
- 18.** In 2017, the People's Republic of China banned all websites containing images of Winnie-the-Pooh after Chinese internet users compared the Chinese president to Pooh Bear. As a result, Chinese internet users would receive an error message whenever they tried to visit webpages showing Winnie-the-Pooh. Based on this information, answer the following questions:
- What is freedom of expression?
  - In general, how has the internet given people more freedom of expression?
  - Do you think freedom of expression is important for people?
  - What are some of the disadvantages of freedom of expression on the internet?
  - Do you think governments (like China) should limit freedom of expression on the internet? Give reasons for your answer.
- 19.** Convert the given numbers:
- $100111100_2$  to decimal.
  - $5E8_{16}$  to binary
  - Convert the decimal number 100 to hexadecimal.

# BASIC CONCEPTS OF HARDWARE

## CHAPTER OVERVIEW



- Unit 3.1 Types of hardware
- Unit 3.2 Output devices
- Unit 3.3 Storage devices
- Unit 3.4 Motherboard
- Unit 3.5 Computer or smartphone



## Learning outcomes

At the end of this chapter, you will be able to:

- describe the different types of hardware, their usage and where they are used
- describe the difference between memory and storage
- compare the hardware components of a computer and a smartphone.

## INTRODUCTION

In 1969, the Apollo 11 spacecraft blasted off from Earth to the moon. Four days later, the spacecraft landed on the moon. Neil Armstrong became the first man to set foot on the moon and history was written. In order, to guide the spacecraft from the Earth to the moon, the National Aeronautics and Space Administration (or NASA) made use of five state-of-the-art computers (for 1969). Each of these computers were as large as a refrigerator and had only 1 MB of memory. Can you even imagine that?

This incredible improvement in the power of computers was first measured and predicted in 1965 by a computer scientist called Gordon Moore. According to Moore's Law, it states that the number of transistors that can fit onto a circuit board with a fixed size, doubles every two years. As a result, computers become **exponentially** faster each year.

This chapter will look at the hardware and the improvements in hardware that made these improvements possible.



**Figure 3.1:** Today, this phone could put thousands of spacecrafts on the moon

## 3.1 Types of hardware

Computer hardware refers to the physical parts of a computer and related devices. The internal hardware parts of a computer are often referred to as components and the external hardware devices are usually called peripherals.

In this unit, you will learn more about the types of hardware found in a computer. These are:

- Input
- Output
- Memory
- Storage
- Processing
- Communication.

### INPUT DEVICES

An input device allows the user to interact directly with a computer. The devices give data and instructions to the computer, such as:

- keyboards
- pointing devices (mouse)
- touchscreens
- touchpads
- tablet/pen input devices
- game controllers
- cameras
- microphones
- video capture devices
- scanners
- optical readers
- biometric devices
- data collection devices

**Table 3.1: Hardware of desktop computers**

COMPUTING DEVICE	ADVANTAGES OR DISADVANTAGES	ADAPTED FOR DISABILITY
<b>Keyboard</b>  <p>Today, not all keyboards are physical devices with the same layouts. Computers and smartphones make use of touchscreen keyboards.</p>	<p><b>Advantages:</b></p> <ul style="list-style-type: none"> <li>Most computers come with a keyboard supplied.</li> <li>People are used to using keyboards to enter data, they need very little training.</li> <li>A skilled typist can enter data very quickly.</li> <li>Specialist keyboards, such as, ergonomic or gaming keyboards, are available.</li> </ul> <p><b>Disadvantages</b></p> <ul style="list-style-type: none"> <li>It is easy to make mistakes when typing in data.</li> <li>If you can't touch type, it can be time consuming to enter data.</li> <li>Disabled people often find keyboards difficult to use.</li> <li>Excessive use can lead to health problems, such as, repetitive strain injury (RSI).</li> </ul>	<p><b>Keyguards:</b> Small plates that allow users with a disability to rest their hands on the keyboard without pressing any keys.</p> <p><b>On-screen or virtual keyboards:</b> Displayed on a user's screen and used with gesture-controlled pointers or joysticks</p> <p><b>Braille keyboards:</b> Keyboards with Braille lettering, which can be used by blind or visually impaired users.</p>



#### Did you know

Throughout this book, you will be presented with keyboard shortcuts (or hotkeys). These shortcuts are made up of a combination of keys that you can press at the same time to complete a specific task. Try to remember these shortcuts as they will save you a lot of time!

COMPUTING DEVICE	ADVANTAGES OR DISADVANTAGES	ADAPTED FOR DISABILITY
<b>Mouse</b>  <p>A mouse is a common type of pointing device. Computers are generally sold with a mouse and a keyboard.</p>	<p><b>Advantages:</b></p> <ul style="list-style-type: none"> <li>Ideal for desktop and laptop computers.</li> <li>Most computer users are familiar with them and require little training.</li> <li>Works well in conjunction with a keyboard for data entry.</li> <li>Usually supplied as part of a new computer system.</li> </ul> <p><b>Disadvantages</b></p> <ul style="list-style-type: none"> <li>They need a flat space close to a computer to operate.</li> <li>Older style mice, which have roller balls, can become clogged with grease and grime and lose their accuracy until cleaned.</li> <li>Excessive use can lead to health problems, such as, repetitive strain injury (RSI).</li> <li>If the battery wears out in a wireless mouse, it cannot be used until it has been replaced.</li> </ul>	<p><b>Head-mounted pointers:</b> Controlled by switches to simulate the function of a mouse. These switches can be on hand or foot pads, or pedals or sensors that detect eye movement or facial expressions.</p> <p><b>Gesture-recognition devices:</b> Recognise hand gestures, head or eye movements, or read lips or sign language to input information into a computer.</p> <p><b>Sip-and-puff devices:</b> A switch that operates the computer when users breathe into (puffing) or through (sipping) special tubes. Special software is used to interpret the sips and puffs and turn them into data the computer can use.</p> <p><b>Mouse trackball:</b> A stationary ball that can be spun in different directions to move the mouse. This allows users to move the mouse by making very small hand gestures.</p>



#### Did you know

Trackballs, joysticks, touchpads, and light pens are all similar to a mouse.

COMPUTING DEVICE	ADVANTAGES OR DISADVANTAGES	ADAPTED FOR DISABILITY
<b>Touchscreens</b>  <p>Most modern smartphones and tablets rely exclusively on touchscreens.</p> <p>There are also some notebooks and computers that have touchscreens.</p> <p>When they are available, touchscreens can replace computer mice.</p> <p>POS (point of sale) systems refer to the place where a sales transaction is completed, for example at cash registers in retail stores and shops, at bars and restaurants, hair salons and spas, etc. Restaurant POS systems allow waiters to process orders.</p> <p>These systems consist mostly of payment terminals, touchscreens, and a variety of other hardware and software options.</p>	<p><b>Advantages:</b></p> <ul style="list-style-type: none"> <li>Easy to use – intuitive, don't need much training.</li> <li>No extra peripherals such as a mouse are needed.</li> <li>Software can alter the screen while it is being used, making it more flexible than a concept keyboard which has a permanent overlay.</li> <li>Can make use of finger gestures to make sophisticated actions such as zooming and selecting.</li> <li>Excellent for selecting and controlling applications that have been designed with a touch screen in mind.</li> </ul> <p><b>Disadvantages:</b></p> <ul style="list-style-type: none"> <li>Not suitable for inputting large amounts of data.</li> <li>Not very accurate – selecting detailed objects can be difficult with fingers.</li> <li>Tiring to use for long periods.</li> <li>Less useful as a control input to a standard computer that makes use of the mouse/keyboard combination, for example, laptop, desktop, pc.</li> </ul>	<ul style="list-style-type: none"> <li>Entering commands by voice</li> <li>Entering commands by pressing the controls with a mouth stick, headstick, or stylus.</li> <li>Through variations in the device's touch sensor technology such as resistive touchscreens, capacitive touchscreens, infrared touchscreens and surface acoustic wave (SAW) technology.</li> </ul>
<b>Touchpad</b>  <p>Touchpads (or touch sensitive pads) are small, square pads. By moving your fingers across the touchpad, you can move the mouse pointer on the screen.</p>	<p><b>Advantages:</b></p> <ul style="list-style-type: none"> <li>Useful for laptops when using a mouse isn't practical.</li> <li>The pad's position is fixed in relation to the keyboard.</li> <li>Very short finger movements are required to move the cursor.</li> </ul> <p><b>Disadvantages:</b></p> <ul style="list-style-type: none"> <li>Takes practice and skill to control the position of the cursor using the touchpad.</li> <li>Moist, sweaty or calloused fingers can disrupt the signals picked up by the sensors.</li> </ul>	<p>Touch pads are useful to people who cannot hold a device such as a mouse in their hands but can press on the touchpad with a finger or an eraser pointer.</p>

COMPUTING DEVICE	ADVANTAGES OR DISADVANTAGES	ADAPTED FOR DISABILITY
<p><b>Tablet/pen input device (pointing device)</b></p>  <p>Tablets are accurate and, when combined with the interactive pens, allow artists to create art as if they were using a pen and paper.</p> <p>A Wacom tablet is a graphics tablet that is generally used in the graphic design industry or by digital artists. Wacom tablets allow a person to draw by hand, capturing an image or graphic in digital form. The drawn image or graphic is then displayed on the monitor of a connected computer.</p>	<p><b>Advantages:</b></p> <ul style="list-style-type: none"> <li>• Tablets are easy to handle.</li> <li>• It is much more natural to draw diagrams with a pencil type implement (the stylus) rather than with a mouse.</li> <li>• A great level of accuracy can be achieved.</li> </ul> <p><b>Disadvantages:</b></p> <ul style="list-style-type: none"> <li>• Weaker capabilities than a laptop or desktop.</li> <li>• The screen size is small.</li> <li>• Fewer ports.</li> <li>• No fixed keyboard.</li> </ul>	<p>Tablets are devices that can be used by people without hand function. This is done using a stylus or a splint that can be inserted into a vertical holder or strapped to the wrist.</p>



### New words

**eraser pointer** – a pointing device that looks like a joystick or pencil eraser head and sits between the G, H and B keys. When the eraser pointer is pushed in one direction, the cursor moves in the same direction

**resistive touch screen** – pressure sensitive touch screens that can be operated with any input device

**capacitive touch screens** – offer higher clarity for the visually impaired but cannot be operated using other input devices

**infrared touch screens** – can be operated by either human touch or stylus and have high clarity

**surface acoustic wave (SAW) technology** – provides better image clarity, resolution, and higher transmission of light. The technology has the longest life span and quick response time. It recognises the location and amount of pressure applied

**Table 3.2:** *Input devices*

DEVICE	USES	PHOTO
Game controllers	Game controllers are input devices designed specifically for use in games. They have directional inputs as well as action buttons linked to specific actions inside a game.	
Cameras	Cameras allow you to capture images. They are used for making video calls, participating in video conferences and recording videos from your computer.	
Microphones	Microphones allow you to record sounds and interact with a computer using your voice.	
Video capture devices	Video capture devices allow you to record a live video stream using your computer.	
Scanners	Scanners allow you to scan pictures of pages (such as, photos or contracts) directly onto your computer. Scanners are often packaged with optical character recognition (OCR) software that converts the text on a picture to text that can be used in a word processing application.	
Optical readers	Optical readers are devices that can read data from a physical object (such as, a QR code, barcode or a magnetic strip) into a computer.	
Biometric devices	These devices read data presented to a computer and compare it with the saved data. Biometric devices include fingerprint, iris and retina scanners, but these are not commonly used with desktop computers.	
Data collection devices	Data collection devices obtain data directly from a location where an event or transaction takes place.	



### Activity 3.1

- 3.1.1** Define an input device.
- 3.1.2** Critique the virtual keyboard of a computer by comparing it with the touchscreen keyboard of a smartphone.
- 3.1.3** Do you use shortcut keys? Why or why not? If so, which shortcut keys do you use the most?
- 3.1.4** List three advantages and three disadvantages of using a computer mouse.
- 3.1.5** List and describe four pointing devices.
- 3.1.6** Define a touch-sensitive pad and state one use.
- 3.1.7** Define pen input and state one use.
- 3.1.8** Which hardware device(s) would you use for the following tasks and why?
  - a.** You are going on a cricket tour, and you want to be able to take photos, upload them to social media and send a few to your friends.
  - b.** You have a desktop computer and monitor. You were given the task to type an essay for homework on your computer. What additional hardware would you need to do this?
  - c.** You have a disabled friend who cannot use his arms. Which five products would you recommend your friend uses to ensure computers are more accessible to them?
  - d.** You want to register for the IT Olympiad that will be held in Johannesburg this year. You remember the night before registration closes that you must still complete all the registration forms by hand and send it to the organisers of the event before 6 a.m. Which hardware device can you use to get the forms in a digital format so that they can be emailed?
  - e.** Which hardware device can you use to sign digital forms so that they can be emailed?
- 3.1.9** Which input devices have you used?
- 3.1.10** Which input devices do you think are found in high-end smartphones today?

## 3.2 Output devices

An output device is any device that takes data stored on a computer and makes it available to the user in an easy to understand way. This data may be made available using pictures (such as on a monitor or printed to a page) or using sounds (such as with speakers and earphones). The output devices can be divided into the following:

- display devices – monitors (LCD, LED)
- printers (Inkjet, Ink tank, Laser, 3-D)
- data projectors (HDMI, VGA)
- speakers.



**Figure 3.1:** LED display matrix using LED lights



**Figure 3.2:** LCD monitor (some LCD monitors have LED backlighting and is commonly referred to as LED monitors)

### DISPLAY DEVICES

#### MONITORS

All computer software is built around a visual representation of data, therefore the monitor is one of the most important output devices for any computer. To check the quality of a monitor, we need to look at some important characteristics.

These are:

- **Number of pixels:** Each pixel can be seen as a tiny dot of colour on the monitor. Pixels put together creates the picture that we see on the monitor. The more pixels there are, the more detailed a picture can be. A good monitor is a full HD monitor with 1 920 pixels across the width of the monitor by 1 080 pixels across the height of the monitor. Some modern monitors can have up to  $3\ 840 \times 2\ 160$  pixels (called 4K).
- **Screen size:** The size of a monitor is measured diagonally (that is, from the top left corner to the bottom right corner) and the size is given in inches.
- **Refresh rate:** The refresh rate of a monitor determines how quickly the image on the monitor can be updated with the newest information. Most monitors have a refresh rate of 60 Hz.
- **Contrast ratio:** A measure of the number of shades the monitor can show between its blackest black and brightest white. The higher the number of shades, the clearer and sharper the images will be, and the brighter and truer to life the colours will be.
- **Aspect ratio:** This is the basic shape of the screen based on the ratio of the width to the height measured in inches. For example, if a screen is 16 inches (40,6 cm) wide and 10 inches (25,4 cm) tall, the aspect ratio is 16:10.



#### Did you know

One inch is roughly 2,5 cm long, so a 24-inch monitor has a diagonal length of  $24 \times 2,5$  cm = 60 cm.

- **Brightness:** Brightness is the perception of how intense or bright the light coming from a screen is. The brighter the light, the more power will be drawn from the computer.



**Figure 3.3:** The monitor is the most important output device

## PRINTERS

A printer allows a computer to use data and output it to paper. There are three main types of printers. These are:

- **Dot-matrix printers:** These printers use a series of small pins to strike a ribbon coated with ink, causing the ink to transfer to the paper at the point of impact. Dot-matrix printers are mostly outdated as a personal printer but are still used in banks and manufacturing businesses where it is necessary to use **carbon paper** to produce multiple copies of a document.
- **Ink-jet printers:** An inkjet printer operates by painting an image using a spray of ink. This is done by hundreds of tiny nozzles that spray drops of ink directly onto the paper while moving across it. There are two types of ink-jet printers: continuous printers that are usually used for commercial purposes; and on-demand printers. It is a good, all-round printer that is most commonly used for smaller jobs. They are however slightly less reliable.
- **Laser printers:** A laser printer is a popular printer for personal use. These printers use **electrostatic technology**. To start the process, the drum is given a positive electrical charge and while it rotates, the printer shines a narrow laser beam over its surface, drawing or projecting the letters and images to be printed as a pattern of electrical charges onto the surface of the drum. When the pattern is set, the drum is rolled in **toner**, which sticks to certain parts of the drum, that is, the image. When rolled over a piece of paper, this image is ‘burned’ into the paper with heat and pressure. When the printing is done, the electrical charge is removed from the drum and the excess toner is collected. Laser printers are used for mass production printing because they are generally faster and more reliable but with worse quality prints.
- **Ink-tank printer:** These printers have print heads built into the printer and use an integrated bulk ink system. This means that ink is supplied continuously to the print head from an ink tank within the printer itself, no expensive cartridges are needed. When the ink is finished, it can be refilled from an ink bottle. Because of this, printing costs are much lower. They produce low-cost, high volume printing.



### New words

**tactile device** – a device that makes use of touch

**carbon paper** – thin paper coated with carbon or another pigmented substance, used for making a second impression of a document as it is being written or typed

**electrostatic technology** – uses stationary electric charges instead of electric currents

**toner** – a very fine, dry, black powder-type of ink



**Figure 3.4:** A 3D printer



**Figure 3.5:** Printers allow you to output data to paper

- **3D printers:** 3D printing is a process of making three dimensional solid objects from a digital file. The creation of a 3D printed object is achieved by laying down successive layers of material until the object is created. Each of these layers can be seen as a thinly sliced horizontal cross-section of the eventual object e.g. prosthetics and movie props.

When evaluating printers, it is important to know what the printer will be used for because different printers are good at different things.

Factors to consider when looking for a printer are whether it is black and white and/or colour, how quickly it can print, and how much it costs to print a page.

Other factors to consider include:

- Dots per inch (DPI) measures how many dots a printer can print in one inch (or 2.54 cm). The higher the DPI, the more detailed the prints.
- Pages per minute (PPM) measures how many pages of black text a printer can print in a minute. The higher the PPM, the faster the printer can print.

## DATA PROJECTORS

Projectors use a bright light to project the content displayed on a computer monitor onto any flat surface. One example of where projectors are used is at the cinema. They use large, high quality projectors to display the movie on the screen in front of you. However, projectors can also be connected to computers at home or in office settings, to display your computer's screen on a wall or screen.

There are two types of cables connecting video output devices:

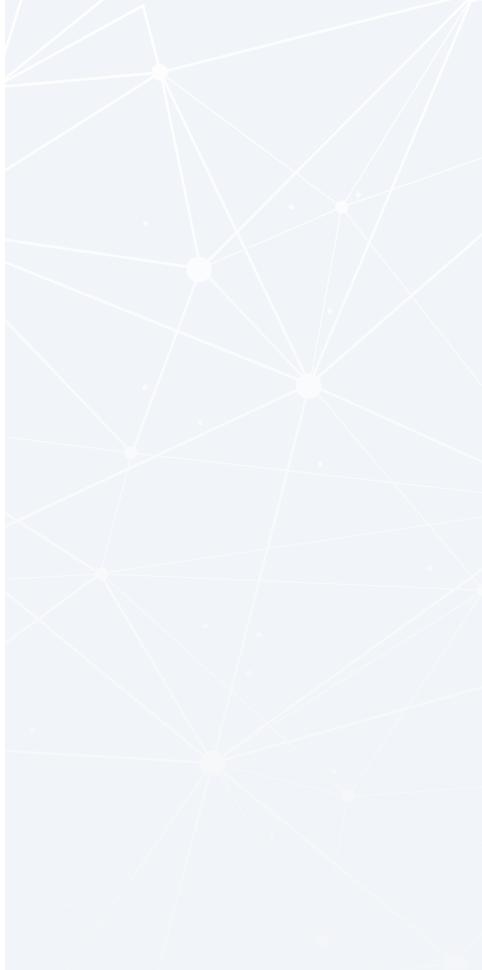
- **VGA** – an analog video-only connection.
- **HDMI** – a digital video audio connection.

Projectors provide the following advantages:

- they are easy to carry around
- they display the content from your computer at a large size.



**Figure 3.6:** A projector projects an image onto a flat surface



However, projectors also have disadvantages:

- replacing the lamps is expensive
- low-quality projectors can show washed-out or faded images
- low-brightness projectors need to be placed close to the screen, decreasing the size of the image
- low-brightness projectors may require a dark room.

The quality of a projector can be measured using three main factors:

- **Lumens**, which measures the brightness of the projector.
- **Resolution**, which determines how many pixels can be displayed.
- **Contrast ratio**, which measures the difference between the darkest and lightest parts of the image (that is, the contrast).

## SPEAKERS AND HEADPHONES

Advantages of speakers:

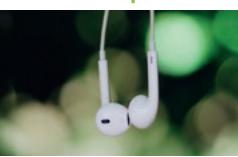
- they can be useful for alerting computer users of events using audio notifications, even when they're busy
- text can be converted into sound.

Disadvantages of computer speakers:

- they can take up a fair amount of desk-space, compared to headphones.

## HEADPHONES

There are many different types of headphones, let's look at a few popular choices:

<b>Closed-back headphones</b> 	It creates an isolated audio experience so that only you can hear the sounds you want to hear.
<b>In-ear headphones</b> 	Known for portability, versatility, and convenience. They go a little more deeply into the ear to provide comfort, sound isolation, and sound accuracy.
<b>Bluetooth headphones</b> 	Offer wireless connectivity to various devices through radio transmitter technology (RF). They have a small computer chip inside of them that allows you to pair with the device you are playing music from.



## INPUT/OUTPUT DEVICES

An input/output device is any hardware used by a human operator or other systems to communicate with a computer. They are capable of sending data (output) to a computer and receiving data from a computer (input).

An interactive whiteboard is a board that combines the technologies of a computer, touchscreen, projector and whiteboard. You can connect an interactive whiteboard to one or more laptops, a PC, tablet, or other electronic devices.

When used in a classroom environment, they give learners and teachers opportunities to interact more than the traditional blackboard ever could.

## ACCESSIBILITY DEVICES FOR THE DISABLED USER

Alternatives to audio output can assist the computer user who is hearing impaired. For example, a speaker can be useful for visually impaired people in terms of text-to-speech systems.



### Activity 3.2

Choose the correct answer from the alternatives given.

**3.2.1** What is a pixel?

- a. Something that determines the brightness of the light coming from the screen.
- b. Something that determines the shades the monitor can show.
- c. A tiny dot of colour on the monitor.

**3.2.2** What does NOT determine the quality of a projector?

- a. Resolution
- b. Lumens
- c. PP

**3.2.3** How is the quality of a computer speakers measured?



## Activity 3.2 *continued*

**3.2.4** Compare the following four printers by:

- a. how they work
- b. what they are usually used for (more specifically than saying they are used to print).

PRINTER	HOW DOES THE PRINTER WORK	WHAT IS IT USED FOR SPECIFICALLY
Dot matrix		
Ink-jet printer		
Laser printer		
Ink-tank printer		

c. You want to buy a new printer on which to print your homework. What are the three main factors that you should take into consideration to determine its quality, and what does each factor measure?

**3.2.5** In preparation for your school's athletic competition, you need to ensure that the school's computer has all the output devices you will need to use during the competition. Which output devices would you use to output the following information:

- a. the audio commentary of the event.
- b. paper certificates for the winners.
- c. video highlights that can be viewed by the crowd.

**3.2.6** If you need to print high-quality paper certificates, would you recommend a dot-matrix printer, Laser printer or an ink-jet printer? Give at least two reasons for your answer.

**3.2.7** Name and compare two types of cables connecting video output devices.

**3.2.8** Name and compare two types of headphones.

**3.2.9** Consider an interactive whiteboard. Is it an input or output device or both? Provide reasons for your choice.

### 3.3 Storage devices



#### New words

**volatility** – something unstable or changeable

**reliability** – the ability to consistently perform according to its specifications

**durability** – how long something can last

**secondary storage device** – holds data for the long term. Data stored on secondary storage devices can only be removed by deleting it



#### Take note

A 1-terabyte (TB) drive has a capacity of 1024 gigabytes.

1 gigabyte (GB) = 1 billion **bytes**.

Storage devices all serve the same general purpose: to store data. Because of the differences in storage capacity, portability and speed, different storage devices are generally used for different reasons.

When evaluating any storage device, there are certain things that you must take into consideration. These are:

- function – that determines whether you need an SSD or an HDD.
- storage capacity – that determines how much information you can save on the device.
- portability – that determines how easily it can be carried around and moved from one computer to another.
- use – that determines what the storage device will most likely be used for. This includes transferring files and running applications.
- **volatility** – that determines if the device will lose the data when turned off. You do not want a device that will lose all data in case of a power outage.
- **reliability** and **durability** – that determines how likely the device is to break down.

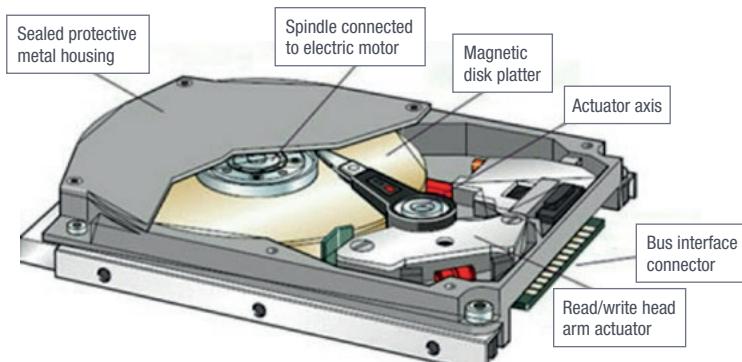
In the section that follows, you will learn more about the differences between storage devices.

## TYPES OF STORAGE DEVICES

### HARD DISK DRIVE (HDD)

A computer hard disk drive is a **secondary storage device** consisting of magnetic disks or platters that rotate at high speed. Its main function is to store data permanently by controlling the positioning, reading and writing of data onto the hard disk.

Currently modern hard drives can have huge storage space and are either internal (fixed), or external (portable).



**Figure 3.7:** An example of an internal hard drive

## EXTERNAL (PORTABLE) HARD DRIVES

Portable (or external) hard drives are used outside of the computer case.

Portable hard drives are a lot easier to move around than fixed hard drives. However, thanks to USB connectors, they can quickly be connected to different computers and are ideal for transferring large amounts of data or backing up data outside of your computer. They are sensitive to rough handling.

## SOLID-STATE DRIVE

**Solid-state drives (or SSDs)** are a type of storage device that, unlike hard drives, do not have any moving parts. Instead, SSDs make use of special floating gate transistors to store data electronically. Solid state drives (SSDs) are generally many times faster than normal hard drives. Since SSDs have no moving parts, they are much quieter, more reliable and robust than HDDs. They also generate less heat, thus increasing their life span, and uses less power than an HDD, which means they are more suitable for mobile devices.

## HYBRID STORAGE DEVICE

A hybrid storage device is a storage device that combines an HDD with an SSD. By doing this, the hybrid storage device can take advantage of the storage capacity of the HDD as well as the speed of the SSD.

Hybrid drives work by storing commonly used files that require high speeds (such as operating system files) on the faster SSD storage, while storing large, less commonly used files (such as media files) on the high capacity HDD.

## FLASH DRIVES (DISKS)

Flash drives are very small, portable storage drives that store information using a similar method to SSD. Flash drives connect to a USB port, which makes it easy to transfer data quickly between devices.

## SD/MEMORY CARDS

SD/Memory cards (especially MicroSD cards) are tiny electronic storage devices. Because of their small physical size, SD cards are often used in portable devices such as smartphones, tablets and cameras to provide storage capacity.

## CD, DVD AND BLU-RAY DRIVES

CDs (compact discs), DVDs (digital versatile disc) and Blu-ray discs are popular portable forms of storage that can be read using a dedicated CD, DVD or Blu-ray drive. These discs store information optically, which means the information is stored using lights or electromagnetic waves.

The advantage of writing data to CDs or DVDs is that the discs are affordable. These optical drives are also backwards compatible. This means that a newer optical drive (like a Blu-ray drive), can read all older optical forms (like CDs and DVDs). However, an older optical drive (like a CD drive) can only read CDs.



### Did you know

CDs (compact discs), DVDs (digital versatile disc) and Blu-ray discs are all examples of **optical disks**.



**Figure 3.8:** An example of an external hard drive



**Figure 3.9:** An example of an SSD



**Figure 3.10:** An example of a flash drive



**Figure 3.11:** An example of an SD/Memory card



**Figure 3.12:** An example of a CD/DVD writer



### Activity 3.3

- 3.3.1** Evaluate three types of storage in a table format, looking at the definition, its use and function.
- 3.3.2** Indicate whether the following statements are TRUE or FALSE. Write 'true' or 'false' next to the question number. Correct the statement if it is FALSE. Change the word(s) in bold text to make the statement TRUE where necessary. You may not simply use the word 'NOT' to change the statement. NO mark will be awarded if only FALSE is written down.
- Because of the differences in storage capacity, portability and speed, different storage devices are generally used for **different reasons**.
  - When evaluating any storage device, you must take its volatility into consideration. This determines if the device will lose the data when turned **on**.
  - An internal hard drive** is the main storage device in computers due to its high speed, high storage capacity and low cost per storage space.
  - Flash drives are very small, portable storage drives that store information using a small **HDD**.
- 3.3.3** Which storage device (HDD or SSD) will you use in each of the following situations? Give a reason for your answer.
- You are an enthusiastic multimedia user and download many files.
  - You need a storage device for your computer, but you do not have a lot of money.
  - You are always on the go. Sometimes you do not take good care of your laptop. When in a hurry, you will often put it in your carry-bag without securing it or shutting it off.
  - You are a general user that likes to stream your music online.
  - You must use a PC for your exams, for which you have a limited time. Which storage device would you prefer?
- 3.3.4** How does a hybrid drive work?
- 3.3.5** What does it mean when we say that optical drives are backwards compatible? Explain this in your own words.
- 3.3.6** Which storage device would you use for the following tasks and why?
- Copying your assignment to a different computer to be printed.
  - Backing up all your images, videos and music files.
  - Storing your programs and games.
- 3.3.7** Itumeleng has recently bought a new external hard drive for his laptop because it has started running out of space. The laptop has an SSD with a storage capacity of 128 GB while his new external hard drive a storage capacity of 1 TB.
- Which of Itumeleng's devices has the highest storage capacity?
  - Which of Itumeleng's storage devices has the longest lifespan? Give ONE reason for your answer.
  - Which device would be best suited to store the following information:
    - a large collection of movies and music
    - an operating system that requires high-speed reading and writing
    - documents that will be used on more than one computer?

## 3.4 Motherboard

A computer's motherboard is a large **printed circuit board** that physically connects all the different components. On the motherboard, there are specific positions where the CPU, GPU and RAM can be inserted. There are also connectors that allow you to connect a power supply to a computer. Finally, the motherboard has several ports that allow you to plug in devices, such as keyboards, speakers and monitors easily.



**Figure 3.13:** An example of a motherboard

The functions of the motherboard is to:

- provide a place for other devices or interfaces to be connected to (such as more memory or another graphics cards)
- distribute power to the various components
- act as a communication hub as the components send and receive information through the motherboard.

## PROCESSING DEVICES

Processing devices are responsible for carrying out instructions and performing calculations.

In this section, you will learn about the most important processing devices:

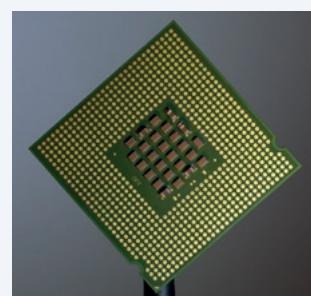
- central processing unit (CPU)
- graphics processing unit (GPU).

### CENTRAL PROCESSING UNIT (CPU)

The central processing unit (CPU) is located inside the computer case on the motherboard. It is the part of a computer responsible for receiving and carrying out computer instructions (processing).

Each CPU can be made up of multiple cores, which are independent processing units that can complete tasks on their own (multithreading vs multiprocessing). By adding multiple cores to a CPU, the processing power available to the computer can increase dramatically, with little heat gain. These types of processors are called multi-core processors.

The CPU contains a control unit (CU) that coordinates all activities in the CPU, and an arithmetic logic unit (ALU) where the logic operations and arithmetic calculations are carried out.



**Figure 3.14:** A central processing unit



**Figure 3.16:** An example of RAM



### HOW IT'S MADE – COMPUTERS



<https://www.youtube.com/watch?v=w5m84nStlIM>

<https://qrs.ly/izab209>

## GRAPHICS PROCESSING UNIT (GPU)

The graphics processing unit (GPU) is located on plug-in cards on the motherboard or in the same chip as the CPU. It is responsible for creating and doing the calculations needed to display images on the screen.



**Figure 3.15:** An GPU inside a computer

## MEMORY

Random-access memory (or RAM), is physical hardware that temporarily saves data. It serves as the computer's 'working' memory. RAM provides space for your computer to read and write data to be accessed by the CPU.

RAM is volatile, meaning that all data is lost once the electricity is disconnected or the power is lost.

### MEMORY VS. STORAGE

When comparing memory and storage, we first need to identify the role of the components. The computer's main memory is the RAM. You can think of RAM as a workspace or workbench the computer uses to get work done. When you double-click on an app, or open a document, or do almost anything on your computer, RAM gets used to store the code of the app and the data while the processor (CPU) is working on it. The storage unit i.e. HDD, SSD or Flash drive, by contrast, is the cupboard or storage shelf you might use to permanently store your tools, apps, data and completed work. So, when the task is complete and you click save in the app, the resulting output is stored permanently on the storage unit.

## PORTS

The following are some of the most important ports found on the motherboards.

**Table 3.3:** Ports found on a motherboard

PORT NAME	COMPATIBLE DEVICES	PURPOSE
USB	Most input and output devices, flash disks and smartphones connect to the motherboard.	To transfer data and instructions to and from the computer.
HDMI	Monitors, projectors, televisions and speakers.	Designed to transmit high-definition audio and video signals.

PORT NAME	COMPATIBLE DEVICES	PURPOSE
3,5 mm	Speakers, earphones and microphones.	To enable these devices to produce sound.
Ethernet	Network (Ethernet), UTP cable with RJ45 plug.	Ethernet port allows the motherboard to connect to a wired network and to send and receive data within the network.

Thunderbolt port. Input and output devices. To connect high-speed devices to the motherboard for data transfer to and from the device.



### Activity 3.4

- 3.4.1** Choose a term/concept from COLUMN B that matches a description in COLUMN A. Write only the letter next to the question number (e.g. 1–A). There can be more than one answer to a question. Some descriptions (column A) can have more than one answer (column B).

COLUMN A	COLUMN B
1. This device has connectors that allow you to connect a power supply to a computer as well as several ports in the back that allow you to easily plug in devices like keyboards, speakers and monitors.	A. Processing devices
2. Most input devices, most output devices (excluding monitors), flash disks, printers and smartphones can plug into this type of port.	B. cores
3. These devices are the computer devices responsible for carrying out instructions and performing calculations.	C. USB
4. You can increase the processing power that is available to the computer by adding multiple _____ to the CPU.	D. RAM
5. Monitors, projectors, televisions and speakers can plug into this type of port.	E. CPU
6. _____ are independent processing units that can complete tasks on their own.	F. CPU (control unit)
7. _____ is volatile, meaning that all data is lost once the electricity is disconnected or the power is lost.	G. Motherboard
8. The _____ is located on plug-in cards, in a chipset on the motherboard or in the same chip as the CPU and is responsible for creating and doing the calculations needed to display an image on the screen.	H. GPU
9. This unit coordinates the activities of all the other units in the system by controlling the transfer of data and information between various units and initiating the appropriate actions by the ALU.	I. HDMI

- 3.4.2** Indicate whether the following statements are TRUE or FALSE. Write 'true' or 'false' next to the question number. Correct the statement if it is FALSE. Change the word(s) in bold to make the statement TRUE where necessary. You may not simply use the word 'NOT' to change the statement. NO mark will be awarded if only FALSE is written down.

- a. The function of the **motherboard** is to provide a place for other devices or interfaces to be installed.
- b. By adding multiple cores to a CPU, the processing power available to the computer can **decrease** dramatically.
- c. All the arithmetic and logical operations are performed on the data that is available in the main memory and sent back to the **main memory** after processing is done.
- d. **RAM** provides space for your computer to read and write data to be accessed by the CPU.



### Activity 3.4 *continued*

**3.4.4** For each of the hardware devices below, state whether it is an input, output or processing device.

- a. Mouse
- b. GPU
- c. Monitor
- d. Touchpad
- e. Speakers
- f. CPU
- g. Keyboard

**3.4.5** The following is an advertisement for two computers.

COMPUTER 1	COMPUTER 2
Intel Core i5 CPU (2.5 GHz)	Intel Core i7 CPU (3.8 GHz)
4GB 2133 MHZ RAM	Nvidia GeForce RTX 2060 GPU
1 TB HDD	8GB 2400 MHZ RAM
Windows 10	256 GB SSD
Mouse, keyboard and speakers	Windows 10
21" HD monitor	Mouse, keyboard and speakers
2-year warranty	27" Full HD monitor
	2-year warranty

Based on these advertisements, answer the following questions.

- a. The first computer does not include a separate GPU. Will this computer be able to display 3D graphics? Give reasons for your answer.
- b. What is the function of the Intel Core i7 CPU in the second computer?
- c. The second computer has more RAM than the first computer. How do you think this will benefit the second computer?

**3.4.6** In modern games, the entire gaming world is created using three-dimensional (or 3D) characters and objects. The effect of different light sources on these characters need to be calculated, as well as the effect these characters have on light sources (such as casting shadows). To do this, your computer needs to have a powerful GPU.

With this information in mind, answer the following questions.

- a. Expand the acronym GPU (i.e. what does GPU stand for)?
- b. What is the role of the GPU?
- c. Why does the GPU often use more processing power than the CPU in 3D games?
- d. For each of the following instructions, state whether the CPU or GPU is responsible for carrying out the instructions and give reasons for your answer.
  - i. Instructions related to the way the sun reflects from a car in a 3D racing game.
  - ii. General instructions related to the gameplay of a 3D racing game.

**3.4.7** Compare and contrast the roles of memory and storage.

## 3.5 Comparing a computer to a mobile device

### MOBILE DEVICE

A mobile device performs many of the functions of a computer, such as browsing the internet and running basic software programs. The majority of mobile devices like smartphones, make use of a touchscreen to allow the user to interact with the programs and applications on the phone.

The following tables compare various aspects of a smartphone and a desktop computer.

**Table 3.4:** Comparison of input devices

HARDWARE	DESKTOP	SMARTPHONE	DISCUSSION
Keyboard	Full size keyboard	Small, touchscreen keyboard (USB On The Go (OTG) or Bluetooth)	The world typing record on a full-size keyboard is 216 words per minute, compared to 100 words per minute on a smartphone.
Mouse	Mouse, touchpad, touchscreen, stylus	Touchscreen, stylus	Computers allow more accurate input using a mouse. While smartphones rely on a touchscreen for input. A stylus can be used with a touchscreen to improve the accuracy of the input.
Cameras	Purchase extra	Built-in	Most modern smartphones have high quality cameras built-in, allowing you to make video calls and take photos.
Microphone	Purchase extra	Built-in	Since microphones are needed to make a call, all smartphones have microphones built-in.
Biometric devices	Purchase extra	Built-in on some models	Many high-end smartphones are released with fingerprint readers, retina scanners or face identification. These items are expensive additional purchases on computers.

Desktops have larger output devices that are easier to use, but smartphones often have very high-quality output devices.



### Did you know

Some devices allow you to connect your smartphone's display to a computer monitor, allowing you to work on a larger monitor.

**Table 3.5:** Comparison of output devices

HARDWARE	DESKTOP	SMARTPHONE	DISCUSSION
Monitor	19" – 34"	3" – 6"	While the monitors of desktop computers are much larger than those of smartphones, the small monitors of smartphones often have a higher resolution, making them incredibly high quality.
Speakers	Purchase extra	Built-in	While smartphones have built-in speakers, these speakers are usually of very low quality, because of their limited space.

**Table 3.6:** Comparison of storage devices

HARDWARE	DESKTOP	SMARTPHONE	DISCUSSION
Internal storage	Large built-in HDD or SSD	Very small built-in NAND chips	Desktop computers are significantly better in terms of storage space. The average desktop computer has almost 40 times more storage space than a smartphone.
External storage	Purchase extra	Purchase extra	External storage can be purchased for both desktops and smartphones, although it is more affordable for desktops. Some smartphones do not allow you to add additional storage.
CD/DVD	Built-in or purchase extra	Purchase extra	While it is possible to purchase a CD/DVD reader for some brands of smartphones, it is expensive and not easy to use.

Desktop computers are considerably more powerful than smartphones in processing power. While high-end smartphones have the power needed to perform any tasks on the smartphone quickly and efficiently, there are many processing intensive tasks that cannot run on smartphones. These include complex mathematical **simulations**, video editing or **rendering** and certain games.

**Table 3.7:** Comparison of processing devices

HARDWARE	DESKTOP	SMARTPHONE	DISCUSSION
CPU	Built-in	Built-in	Even though smartphone processors can be very fast, they are still considerably slower than desktop processors. These are also easily upgradeable or replaceable with a faster version.
GPU	Built-in or purchase extra	Built-in	Not only are built-in desktop GPUs much faster than smartphone GPUs, you can pay extra to purchase an even faster GPU for a desktop computer.
RAM	Built-in	Built-in	While high-end smartphones can have the same amount of RAM as average desktops, the RAM will be a lot slower than general desktop RAM.

Smartphones are generally designed to be used on their own without any additional devices. As such, smartphones have fewer ports (making it harder to connect smartphones to other devices like speakers or monitors). However, this also means smartphones have all the important devices built-in to them. This includes a wide variety of communication devices.

**Table 3.8:** Comparison of connectivity options

HARDWARE	DESKTOP	SMARTPHONE	DISCUSSION
Motherboard	Built-in	Built-in	While desktop motherboards may have additional features, both desktop and smartphone motherboards serve the same core function: connecting the hardware.
Communication	Ethernet, purchase others extra	GSM, 2G, 3G, 4G, Wi-Fi, Bluetooth, NFC	As smartphones need to be able to make calls and browse the internet from anywhere, they come with more communication devices built-in.
Ports	Many different ports	USB 3,5 mm (some phones) Docking station	Computers have a wide variety of ports for different devices, while most smartphones only have a single USB port. Some smartphones have a 3,5 mm sound port, but many high-end phones do not.



### Activity 3.5

- 3.5.1** Compare the input, processing, output and storage devices of a desktop computer with a mobile device.

	DESKTOP COMPUTER	MOBILE DEVICE
<b>Input devices</b>		
<b>Processing devices</b>		
<b>Output devices</b>		
<b>Storage devices</b>		

- 3.5.2** In what ways is a desktop computer similar and in what ways is a desktop computer different when compared to a mobile device. Support your answers.

**CONSOLIDATION ACTIVITY****Chapter 3: Basic concepts of hardware**

Choose the correct answer for each of the following by writing down only the letter of the correct option.

- 1.** Define hardware?
  - a.** A group of two or more computing devices that are connected allowing the computers to communicate electronically.
  - b.** Computer hardware refers to the physical parts of a computer and related devices.
  - c.** The part of a computer responsible for receiving and carrying out computer instructions.
- 2.** Which of the following is one of the functions of an input device?
  - a.** It allows you to interact directly with your computer.
  - b.** Any device that takes data stored on a computer and makes it available to the user.
  - c.** A device used to store data.
- 3.** Which of the following are examples of ONLY output devices?
  - a.** Monitor, printer, projector
  - b.** Monitor, touchpad, DVD
  - c.** Monitor, speaker, CPU
- 4.** Which statement best describes a hard disk drive (HDD)?
  - a.** A storage device without any moving parts and with a low storage capacity.
  - b.** A storage device without moving parts and where the data is written and stored onto.
  - c.** A storage device that consists of moving parts and stores data permanently.
- 5.** Where are touchscreens usually NOT used?
  - a.** On a tablet.
  - b.** On a smartphone.
  - c.** By a cashier in a restaurant.
  - d.** On a desktop monitor.
- 6.** Which processing device is described by the following statement: \_\_\_\_\_ is located inside the computer case on the motherboard and is responsible for receiving and carrying out computer instructions.
  - a.** GPU
  - b.** CPU
  - c.** ALU
- 7.** What is the main function of RAM?
  - a.** It permanently saves data.
  - b.** It can hold data without power.
  - c.** It temporarily saves data, serving as the computer's working memory.
- 8.** Which piece of hardware is described as a large printed circuit board that physically connects all the different components.
  - a.** Motherboard
  - b.** Solid state drive
  - c.** Central processing unit

**CONSOLIDATION ACTIVITY**Chapter 3: Basic concepts of hardware *continued*

9. What does DPI measure?
- It measures how many pages of black text a printer can print per minute.
  - It describes the number of square pixels that show up in an inch of digital screen.
  - It measures how many dots a printer can print in one inch (or 2.54 cm).
10. Which of the following is an advantage of a touchpad?
- People with hand injuries can use it without difficulty.
  - Usable when there is no flat surface for a mouse.
  - Enables the user to control the cursor better and do options such as drag and drop fast.
11. Indicate whether the following statements are TRUE or FALSE. Write 'true' or 'false' next to the question number. Correct the statement if it is FALSE. Change the word(s) in bold text to make the statement TRUE where necessary. You may not simply use the word 'NOT' to change the statement. NO mark will be awarded if only FALSE is written down.
- A person can type **faster** on the keyboard of a smartphone than on a desktop computer's keyboard.
  - External storage can be purchased for both desktops and phones, although it is **more** affordable for desktops.
  - Smartphone processors are considerably **faster** than desktop processors.
  - Smartphones have a **greater** variety of ports for different devices than computers.
12. Give a definition for a device which is both an input and an output device.
13. Give at least TWO examples of I/O devices.
14. Explain why you think learners often believe that a smartboard is an input and output device.
15. You have a friend with very bad eyesight. Although he is not blind, he can only vaguely make out letters and shapes when looking at a desktop monitor.
- What would you recommend he gets for himself so that he will be able to do his IT work on a computer?
  - List and explain any THREE devices that may help him.
16. Peter wants to buy a new monitor so that he can work on the desktop given to him by his brother. Going to the closest computer shop, he starts looking at the monitors that are available. To his shock, he realises that there are many different monitors, and that he has no clue what to look for. You are the salesperson and decide to explain to Peter what the important characteristics of a monitor are.
- How will you explain to Peter what FIVE of the important characteristics of a monitor are and how they affect the quality of the monitor?
  - After telling Peter what to look for in a monitor, he tells you that he wants a monitor that can be used to watch movies in the living room. In your opinion, which TWO of the characteristics are the most important for him, and why do you say so?

**CONSOLIDATION ACTIVITY**Chapter 3: Basic concepts of hardware *continued*

17. Here are the advertisements of two computers; Siphiwe's brother wants to buy one of them.

COMPUTER A	COMPUTER B
Intel I3 2.8 GHz	Intel I5 3.6 GHz
500 GB HDD	1TB HDD
4 GB RAM	16 GB RAM
21" LCD colour monitor	24" Monitor, 1920 × 1080 Resolution
DVD/CD Writer Combo-Drive	Blue Ray Combo Drive
Microsoft Windows 10 Home	Microsoft Windows 10 Home
Optical Mouse	Wireless Mouse and Keyboard
Free Zeon Ink-jet printer	Free: Multifunctional Laser Printer,
Free Flatbed Scanner	20 MP digital Camera,
An Ergonomically designed QWERTY Keyboard	5 in 1 card reader
Free Digital Camera	With USB Hub included

To help him decide, he has asked you the following questions:

- How can the screen size of a monitor measured?
- Which of these computers has the largest monitor? Give the size of the monitor, as well as its resolution.
- What is the speed of the CPU given in the specifications of Computer B?
- In what units is the CPU speed measured?
- What is the main function of the hard drive?

18. Complete the table categorising hardware.

	HARDWARE	EXAMPLE OF TWO DEVICES
Input		
Output		
Storage		
Processing		

19. Your school is hosting a large, inter-school athletics competition. You have been asked to record the results from the competition using a desktop computer. Based on this information, answer the following questions.
- Which device is better suited to capturing many competitors' names and times? Give at least two reasons for your answer.
  - Which input devices could you use to capture the following:
    - a photograph of the competition winners.
    - the audio commentary of the event.
    - an image of the certificates handed out during the event.
  - What are some of the disadvantages of using a touchscreen for data entry?
  - Your school wants to capture images from the event and immediately place them on several social media platforms. Which device is most suited to carrying out this task and why?

# BASIC CONCEPTS OF SYSTEM SOFTWARE

## CHAPTER OUTCOMES



- Unit 4.1** System software concepts
- Unit 4.2** Types of operating systems
- Unit 4.3** Utilities and drivers

## Learning outcomes



At the end of this chapter, you will be able to:

- define system software
- identify the different types of operating systems
- describe the role of utility programs and device drivers

## INTRODUCTION

In this chapter, you will learn about system software and the different operating systems such as Microsoft Windows, Linux, iOS and Android. You will learn about an ‘operating system’, the different functions that are carried out by an operating system, and how they help the user in operating a computing device.

```
cmd Command Prompt
For more information on a specific command, type HELP command-name
ASSOC      Displays or modifies file extension associations.
ATTRIB     Displays or changes file attributes.
BREAK      Sets or clears extended CTRL+C checking.
BCDEDIT    Sets properties in boot database to control boot loading.
CACLS      Displays or modifies access control lists (ACLs) of files.
CALL       Calls one batch program from another.
CD         Displays the name of or changes the current directory.
CHCP      Displays or sets the active code page number.
CHDIR     Displays the name of or changes the current directory.
CHKDSK    Checks a disk and displays a status report.
CHKNTFS   Displays or modifies the checking of disk at boot time.
CLS        Clears the screen.
CMD        Starts a new instance of the Windows command interpreter.
COLOR      Sets the default console foreground and background colors.
COMP       Compares the contents of two files or sets of files.
COMPACT    Displays or alters the compression of files on NTFS partitions.
CONVERT   Converts FAT volumes to NTFS. You cannot convert the
          current drive.
COPY       Copies one or more files to another location.
DATE      Displays or sets the date.
DEL        Deletes one or more files.
DIR        Displays a list of files and subdirectories in a directory.
DISKPART   Displays or configures Disk Partition properties.
DOSKEY    Edits command lines, recalls Windows commands, and
          creates macros.
DRIVERQUERY Displays current device driver status and properties.
```

**Figure 4.1:** An example of what the MS-DOS command line interface, one of the first operating systems, looked like

## 4.1 System software concepts

In Chapter 1 you learnt that software refers to the lines of code and computer instructions that tell the hardware of a computing device what to do. In this unit, we will learn more about system software and its other components, namely, operating systems, utility programmes, and device drivers.

### SYSTEM SOFTWARE

A system software is a specific type of software that manages a computing device. The system software comprises the operating system, utility programmes, and device drivers. We will look at each of the three parts.

### AN OPERATING SYSTEM

An operating system is software that manages hardware, software and other applications on a computing device. The operating system has different functions and tasks it carries out on a computing device. In order to make these functions easy to understand, they are grouped into the following categories:

- **Disk management:** Used to manage the drives installed in a computer e.g. partition drives, format drives, assign drive letters.
- **Hardware management:** Managing the interaction between hardware and software, as well as the different hardware devices.
- **Graphics User Interface (GUI) management:** Provides and manages the user interface that interacts with graphics and visual content on a computing device.
- **I/O management:** Managing the signals received from an input device and sending the correct signals to an output device.
- **Process management:** Managing the applications and the resources used by applications (Apps) on a computing device.
- **File management:** Managing the storage of files and folders on your storage device.
- **Memory management:** Managing the data stored on a computing device's memory and once the processing is complete, this function tends to free up some space.
- **Storage management:** Processes used to improve the performance of data storage resources.

#### New words

**GUI (or graphical user interface)** – a visual way in which users can interact with a computer (including windows, buttons, menus, images, and text)



### Activity 4.1

#### System software

**4.1.1** Define each task in your own words and provide an example.

TASK	DEFINITION AND EXAMPLE
Hardware management	
Graphics User Interface (GUI) management	
I/O management	
Process management	
File management	
Memory management	
Disk management	
Storage management	

**4.1.2** What is the advantage of the storage management system recording the date that a file was changed?

**4.1.3** Use your computer to complete the following activity.

- a. List the steps you should follow to see your computer's performance (using the *Task Manager*).
- b. Open the *Task Manager* on Microsoft Windows and write down your computer's current usage for the following hardware.
  - i. CPU
  - ii. Memory
  - iii. Primary HDD
  - iv. Network

## 4.2 Types of operating systems

Up to now, you have been learning about and working with Microsoft Windows as an example of an operating system. This particular type of operating system is commonly known as a stand-alone operating system. In this unit, we will focus on the following three types of operating systems namely, stand-alone, network and embedded operating systems.

### THE STAND-ALONE OPERATING SYSTEM

These operating systems function entirely independently from a network on a computer or mobile device. This ensures that the tasks of an operating system can be performed on the device.

### THE NETWORK OPERATING SYSTEM

**Network or server operating systems** are operating systems designed to help computers work together on a network, rather than used in a stand-alone mode. For example, a large company may have a server running the Windows Server operating system in the organisation. A computer can connect to the same network to gain access to its information, resources, etc. Examples include: *Windows Server, Red Hat Enterprise, Ubuntu Server, and UNIX*.

### THE EMBEDDED OPERATING SYSTEM

The embedded operating system is designed for a specific purpose e.g. Smart TVs that connect to the internet, a video camera (Wi-Fi) that can stream live footage and the GPS system that is installed in most mobile devices.



#### Activity 4.2

- 4.2.1** Indicate whether the following statements are TRUE or FALSE. Correct the false statements. Change the word(s) in bold text to make the statement TRUE where necessary.
- Embedded operating systems** help computers work together on a network.
  - A **network operating system** is an operating system that is designed to be used on its own.
  - Stand-alone operating system** is designed to be used on a single device with a very specific purpose.

- 4.2.2** Compare the following operating systems by completing the table.

OPERATING SYSTEM	DESCRIPTION OF THE SYSTEM	EXAMPLE
Stand-alone operating systems		
Network operating systems		
Embedded operating systems		

## 4.3 Utilities and drivers

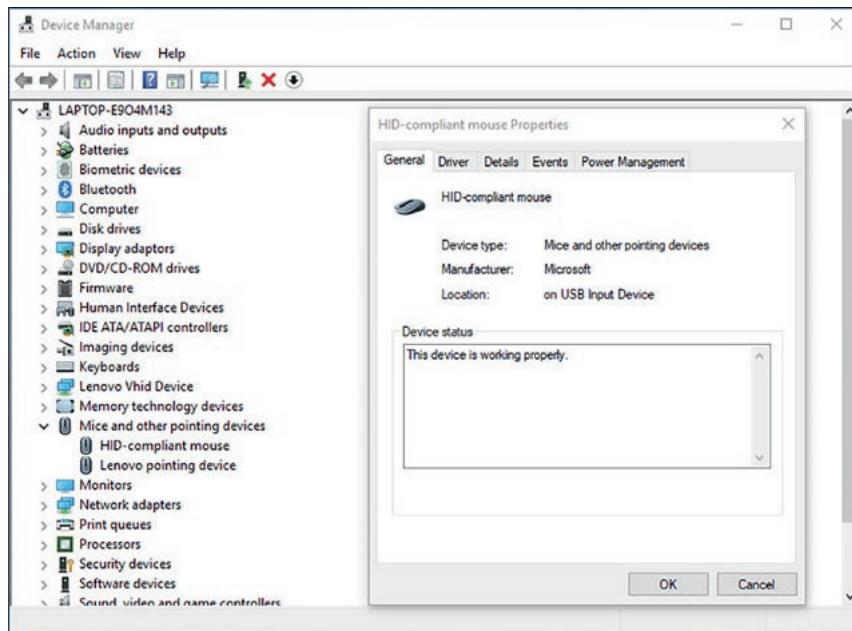
Operating systems are not the only type of system software in the IT field. There are other additional types of system software. In this unit we will look at the following two types:

- utility programs
- device driver programs.

### UTILITY PROGRAMS

A utility program is system software that helps users to analyse, configure, monitor, or help maintain their computers. Most operating systems include a set of basic utilities for users, and additional utilities that could be downloaded if needed. Examples of utilities include:

- back-up software that helps a user create back-up copies of the files on their computer
- a device manager that helps a user install new hardware such as a mouse, USB, etc.



**Figure 4.2:** This is a device manager indicating that a device has been installed and is working properly

- disk cleaners that helps a user to free up space on a storage device
- file managers that allow users to manage the files that are stored on their computers
- system (Task Managers) monitors that summarise a computer's performance for the user.

Without these utilities it would be a lot harder for users to manage and keep their computers running optimally.

## DEVICE DRIVER PROGRAMS

A device driver is software that contains a set of instructions that command a computer's operating system on how to communicate with the hardware so that it can function properly. Device drivers allow communication between the operating system and all the devices, such as the mouse, keyboard, printer, etc.

The field of IT is forever changing, so it would be impossible to create an operating system that knows how each device functions or works (especially devices those that have not yet been invented). It is for this reason that each hardware manufacturer is responsible for developing drivers for their own manufactured devices.

### INSTALLING OF DEVICES (USING PLUG & PLAY)

Each time new hardware is connected to a computer, the operating system detects and identifies the hardware. Installation of a new device can then happen in either of the following manners:

- **Automatic driver installation**

The operating system locates the correct driver for the identified device in its driver database. Then it installs them automatically, allowing the computer to communicate with the new device without having to reboot the computer.

- **Manual driver installation**

If a driver is not available from the operating system, a manual installation is required. A manual installation is usually done in Windows via the device manager or the file set-up. This can be found on the hardware's accompanying DVD or downloaded from the manufacturer's website. The DVD will include the driver for that hardware, and it will allow it to function and communicate with the operating system.

How do you want to search for driver software?

→ **Search automatically for updated driver software**

Windows will search your computer and the Internet for the latest driver software for your device, unless you've disabled this feature in your device installation settings.

→ **Browse my computer for driver software**

Locate and install driver software manually.

Cancel

**Figure 4.3:** The installation of a USB connected device



## Activity 4.3

- 4.3.1** What does the term, utility, refer to? Explain this term using your own words.
- 4.3.2** Which utility program would you use in the following scenarios?
- a. You want to prevent a virus and other dangerous programs from damaging your computer.
  - b. You need to install new hardware on your computer.
  - c. Your computer is slow, and you need to solve this problem.
  - d. You need to ensure that you do not lose any important information and files because there have been more and more error messages on your computer. These error messages tell you that you cannot save your files, and you realise that your hard drive is busy breaking.
  - e. You want to keep an eye on how your computer performs.
- 4.3.3** What role does a device driver play.
- 4.3.4** Why is a device driver necessary?
- 4.3.5** Illustrate the steps to install a device, manually and automatically.

**CONSOLIDATION ACTIVITY****Chapter 4: Basic concepts of system software**

Choose the correct answer.

- 1.** Embedded computers are found in ...
  - a.** IOT devices
  - b.** motor cars
  - c.** all of the above.
- 2.** A device manager is ...
  - a.** an application programme
  - b.** a utility programme
  - c.** an application tool
- 3.** A desktop computer will typically have ...
  - a.** a stand-alone operating system
  - b.** a server operating system
  - c.** none of the above.
- 4.** Storage is usually associated with an ...
  - a.** HDD
  - b.** SSD
  - c.** all of the above.
- 5.** What is your option should your computer not have an automatic driver?
  - a.** Download the driver from the manufacturer's website.
  - b.** Install the driver from the CD/DVD that comes with the hardware.
  - c.** Both A and B.
- 6.** A driver's role is to \_\_\_\_\_
  - a.** explain to your operating system how to communicate with the plug-and-play device.
  - b.** explain to your operating system how to communicate with the hardware device and make it function properly.
  - c.** explain to your operating system how to communicate with the software device and make it function properly.
- 7.** The following operating systems work directly on computers to ensure sure that the tasks of an operating system are completed.
  - a.** Stand-alone systems
  - b.** Embedded operating systems
  - c.** Network operating systems

**CONSOLIDATION ACTIVITY****Chapter 4: Basic concepts of system software *continued***

8. In order to optimise your computer by playing music and using another application for your essay, you want your operating system to allocate the exact number of resources to these applications that they need to run so that they can both run at the same time. We call this the \_\_\_\_\_.
- Process management system
  - I/O management system
  - Hardware management system.
9. Choose a term/concept from COLUMN B that matches a description in COLUMN A. Write only the letter next to the question number (e.g. 1–A). There can be more than one answer to a question. Some of the questions (column A) may have more than one correct answer (column B).

COLUMN A	COLUMN B
1. Manages hardware, software and other applications on a computing device.	A. Storage management system
2. Managing the signals received from an input device and sending the correct signals to an output device.	B. Utility program
3. Lines of code and computer instructions that tell the hardware of a computing device what to do.	C. Embedded
4. Managing the applications and the resources used by applications (Apps) on a computing device.	D. I/O management system
5. Software that contains a set of instructions that command a computer's operating system on how to communicate with the hardware.	E. Software
6. An operating system designed for a specific purpose.	F. Operating system
7. Processes used to improve the performance of data storage resources.	G. Process management
8. System software that helps users in maintaining their computers	H. Device driver

10. Indicate whether the following statements are TRUE or FALSE. Write 'true' or 'false' next to the question number. Correct the statement if it is FALSE. Change the word(s) in bold text to make the statement TRUE where necessary. You may not simply use the word 'NOT' to change the statement. NO mark will be awarded if only FALSE is written down.
- The **I/O manager** makes sure that files are stored correctly.
  - File managers** allow users to manage files that are stored on their computers.
  - Embedded** operating systems form the backbone of the internet.
  - RAM** is responsible for keeping information that the computer is currently using.
11. In your own words, explain why it is important to use drivers.

**CONSOLIDATION ACTIVITY****Chapter 4: Basic concepts of system software *continued***

**12.** Look at the following advertisements for two computers and answer the questions below:

COMPUTER 1	COMPUTER 2
Intel Core i5 CPU (2.5 GHz)	Intel Core i7 CPU (3.8 GHz)
4GB 2133 MHZ RAM	Nvidia GeForce RTX 2060 GPU
1 TB HDD	8GB 2400 MHZ RAM
Windows 10	256 GB SSD
Mouse, keyboard and speakers	Windows 10
21" HD monitor	Mouse, keyboard and speakers
2-year warranty	27" Full HD monitor
Norton anti-virus standard	2-year warranty

- a.** Your friend wants to play a game on his computer, but the game keeps crashing with the following error message – “Error: Insufficient Memory”.
  - i.** Which of the two computers advertised above will most likely solve this problem?
  - ii.** Explain the reason for your choice.
  - iii.** What does it mean when we say that the operating system is responsible for the memory management in a computer?
- b.** The advertisements states that, one computer has 8 GB RAM and a 256 GB SSD and the other has 4GB RAM and a 1 TB HDD. What do RAM, SSD and HDD mean?
- c.** Explain the role of a device driver.
- d.** Explain system software in your own words.
- e.** Every computing device must have an operating system loaded, whether it is Windows, Linux, macOS, or Android.
  - i.** Which operating system is used by both computers in the advertisements?
  - ii.** What is the main role played by a computer’s OS?
  - iii.** Utility programs are included when an OS is pre-installed on a computer. Give an example of a utility program that is preinstalled.
- f.** Which computer has another type of system software loaded apart from the operating system?
  - i.** Write down the computer number.
  - ii.** Write down the name of the system software referred to.

# NETWORKS

## CHAPTER OUTCOMES



Unit 5.1: Uses of networks

Unit 5.2: Components of a network

Unit 5.3: Types of networks and client-server and peer-to-peer networks

## Learning outcomes



At the end of this chapter, you will be able to:

- describe a network
- describe reasons for using networks
- identify advantages and disadvantages of networks
- list the essential basic network components
- provide an overview of different communication media (wired/wireless)
- describe different types of networks
- differentiate between client-server and peer-to-peer networks
- explain the reasons for logging into a network and connecting to a server.

## INTRODUCTION

The global internet is powered by thousands of interconnected networks in countries around the world. In order for South Africans to connect to these networks, undersea fibre optic cables are needed. These networks are all connected, but if a person wants to get information from overseas the data traffic must be carried over a submarine (underwater) cable (or in rare cases, a satellite connection). Telecoms infrastructure from local providers connect a person's device to a local network. This will change internet connectivity, bandwidth and the way we play online games. A few companies plan to build their own internet submarine cable between Africa and Europe to increase the internet connectivity.

In this chapter, you will learn more about computer networks (including the internet). This chapter focuses on the different types of networks as well as the advantages and disadvantages of networks. You will learn about the different components needed for these networks, the different sizes of **local area networks (LANs)** and **wide area networks (WANs)** and about network architectures. You will also learn more about communication over networks and how it changed our lives.



## New words

### local area networks

(**LANs**) – a computer network that covers a small area like a home, office, or building. The network usually has a limited number of computers on it (between 2 and 25), although there is no absolute limit

### wide area networks

(**WANs**) – a network that covers a large area. This could include all the people in a suburb or city, but it is most often used to refer to the internet, the world's largest WAN

## 5.1 Uses of networks

In this unit, we will briefly look at each network's uses. You will also learn more about the advantages and disadvantages of networks.

### WHAT IS A NETWORK?

A computer network refers to a group of two or more computing devices that are connected by a communication medium allowing the computers to communicate electronically. A computing device on a network is usually referred to as a node, being connected to one another, it allows nodes to exchange data with one another using a connection media between them. The links can be established either over cable media such as wires or via a wireless media such as Wi-Fi.

The following are reasons for using networks:

#### 1. COMMUNICATION

Everything, from the world wide web to online banking to multiplayer computer games, depends on the ability of computers to communicate. However, it is not just computers that communicate with each other, computer and telecommunication networks also connect people. Whether this is through video calls on a smartphone, emails from your computer, instant messaging services or social networks, computer networks allow people from across the world to easily communicate with one another.

#### 2. ACCESSING RESOURCES

Networks allow computers to share and access resources with other computing devices connected to it.

- **Data and information:** Networks allow computers to share data and information. This can most easily be seen on the internet, where websites like Wikipedia share information on millions of different topics, but is also true for smaller home and business networks.
- **Printers and scanners:** Hardware devices like printers and scanners are not used that frequently by any single computer. A network allows several people to be connected to one printer or scanner, thus making optimal use of these resources.
- **Software:** Networks also allow people and computers to share software. Online applications like Office 365 and Google docs are examples of applications installed on only a few servers and shared by people around the world.
- **Labour and money:** Resources are not just restricted to computer resources but can also extend to real world resources like people and money. By seeking advice on the internet, you can gain access to experts from all over the world who can help you to resolve an issue you may be experiencing. Banking sites, investment sites and crowdfunding sites like GoFundMe.com gives you access to information on how to access funding and fundraising opportunities.
- **Other hardware resources:** Equipment such as portable disk drives, portable DVD drives, and plotters can be shared amongst many users on a network.

### **3. CENTRALISATION OF DATA**

Data can be stored on one server instead of several devices. For example, on a small home network, all the data can be centralised by using a server. By doing this, anyone with access to the network can work with the data stored on the central server without needing to connect several external hard drives or flash drives to a computer.

### **4. TRANSFER OF FILES**

One way in which data and information can be shared on a network is by sharing files. By sharing files, you allow users connected to the same network (whether that is a local network or the internet) to gain access to specific files.

Files can be shared in several different ways. These include:

- using the operating system's file sharing utility
- placing the files on a Network-attached Storage (NAS) device or file server
- uploading the files to a website
- sending an e-mail with the files as attachments
- using file sharing websites like Google Drive, One Drive and Dropbox.

Most of these services not only allow you to share files, but also give you the option to limit how these files are used. For example, you may want to share the files for a group project in such a way that all the group members can amend them. In contrast, you may not want group members to change the details of, for example, a shared birthday invitation, so the invitation can be shared using the *View only* option.

### **5. INCREASED PRODUCTIVITY**

The use of networks allow most people to work and study more productively.

This is achieved by allowing people to:

- collaborate more easily.
- share files, thereby preventing work from being duplicated.
- share resources and information.
- quickly find answers to their questions by centralising useful information.

For example, as a programmer you might not be able to solve a programming problem. By using the internet you can speak to experts live and they would be able to guide you in solving the problem you may be experiencing. You could also look at the files of similar applications that have been developed to see how their creators solved a problem. Or you could work through several free, online programming courses and permanently improve your productivity. The same is applicable for most fields of study and work.

### **6. LEISURE**

Access to the internet provides access to an almost unlimited amount of entertainment. Examples include:

- games
- multimedia
- books

## ADVANTAGES AND DISADVANTAGES OF NETWORKS

The table below compares some of the advantages and disadvantages of connecting to a network.

**Table 5.1:** Comparison of the advantages and disadvantages of connecting to a network

Advantages to connecting to a network:
<ul style="list-style-type: none"><li>• allows people to share resources and expensive devices.</li><li>• connects individuals to friends, family and colleagues who are located in a different region, province or even country.</li><li>• increases opportunities for self-improvement by providing access to knowledge and information.</li></ul>
Disadvantages to connecting to a network:
<ul style="list-style-type: none"><li>• can expose you to online crimes such as, identity and credit card theft; and scams such as, email phishing.</li><li>• can expose you to cyberbullying and abuse (especially on social media platforms).</li><li>• can be addictive and waste large amounts of time.</li></ul>



### Activity 5.1

**5.1.1** Choose a term/concept from COLUMN B that matches a description in COLUMN A. Write only the letter next to the question number (e.g. 1–A). There can be more than one answer to a question.

COLUMN A	COLUMN B
1. A group of two or more computing devices that are connected allowing the computers to communicate electronically is called a _____	A. centralisation
2. Data and information, printers and scanners, software, labour and money are examples of _____ that can be shared over a network.	B. allowing people to collaborate more easily.
3. Placing the files on a NAS or file server is one of the ways to _____ on a network.	C. self-improvement
4. Computer networks also help people to work together to organise information by recording it in a central location. This is called the _____ of data.	D. computer network
5. Productivity can be increased using networks by _____	E. resources
6. Networks also allow people to get access to _____	F. can be addictive and waste large amounts of time
7. One of the disadvantages of a network _____	G. share files
8. An advantage of networks is that it can increase opportunities for _____	H. entertainment.



## Activity 5.1 *continued*

- 5.1.2** Think about how you use networks. Write one paragraph about the biggest advantage and the biggest disadvantage of networks for you.
- 5.1.3** You are working on a school project with two of your classmates; you need to determine how technology affected people's lives. This project includes a number of research activities, interviews with people, sharing this information with each other and writing a report on your findings, recommendations and conclusion. As you do not live close to each other, you decided to use a network to communicate with each other about the project when needed.
- Unfortunately, you do not yet have a network, and you must explain to your father why it is important to install a network.
- In your discussion, give at least FIVE reasons why having a network installed will make your life easier or better.
  - Give at least ONE counter argument to each of the following disadvantages he gives back to you:
    - It can be addictive and waste large amounts of time.
    - It can expose you to online crimes like identity theft and frauds.
    - It can expose you to cyberbullying and abuse.
- After the discussion, your dad saw your point and installed a network at home.
- In order to complete your project, which tasks will you be able use a network for?
  - Describe an example of how you and your two class mates could collaborate on the project using the network in order to produce a better end product.
- 5.1.4** Your school is hosting a large athletics event with four different schools participating. There is a large outdoor screen that will provide updated results and other announcements. Describe how using a network will be beneficial for each of the following:
- Inputting the athlete's position and performance as they come in from the various events.
  - Being able to display results in real time on the big screen.
  - Proving results that can be used to update the social media platforms of the four schools.

## 5.2 Components of a network



**Figure 5.1:** Thousands of interconnected networks connect countries using a network of undersea fibre optic cables

To create any type of network you will need networking equipment. The networking equipment needed will, however, depend on the type of network you wish to establish. This unit will look at the different components needed to create wired and wireless networks.

Basic network components include the following:

- **Nodes:** This refers to a device connected to a network which is able to send and receive data. Examples of nodes include:
  - printers
  - servers
  - workstations (PC's or laptops)
  - access points.

A network connecting three computers and one printer, along with two more wireless devices, has a total of six nodes.

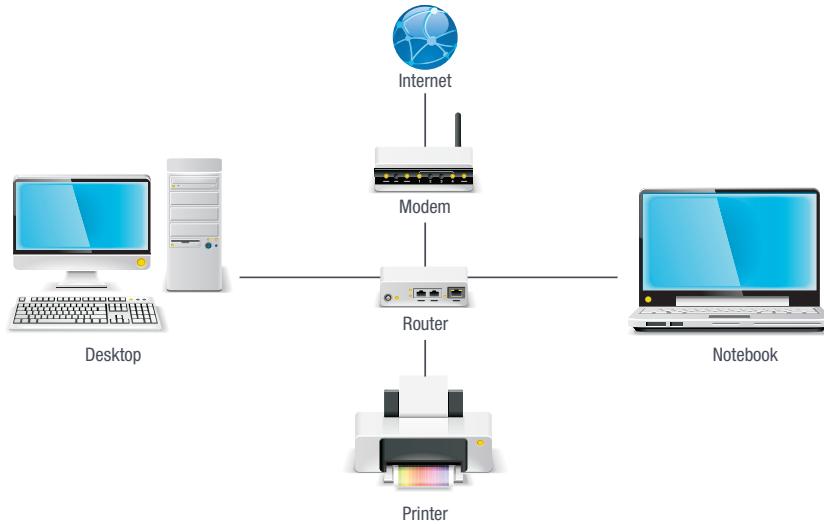
- **Network Interface Controller (NIC):** Examples of NICs include:
  - a wired NIC
  - a wireless NIC.
- **Communication media (wired and wireless):** This refers to the physical channel through which data is sent and received.
- **Network Operating System (NOS):** A specialised operating system that allows additional security and settings.

### OVERVIEW OF DIFFERENT COMMUNICATION MEDIA

#### WIRED NETWORK

A wired network is a network that uses a physical media to transfer data between two or more nodes. The transmission media for wired networks are:

- Unshielded Twisted Pair (UTP) and
- Fibre optic cables.

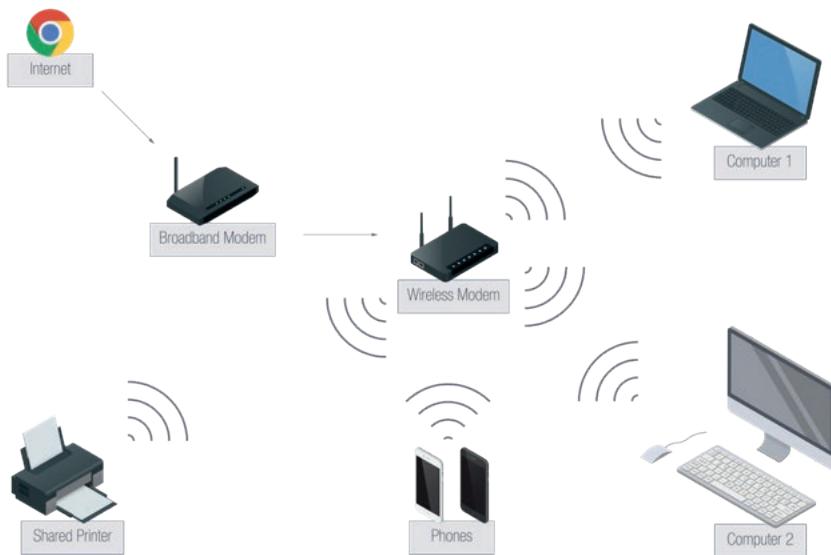


**Figure 5.2:** A typical wired network

## WIRELESS NETWORKS

A wireless network is a network that uses non-physical components to transfer data between two or more nodes. Local area networks are often wireless LANs (WLANS). Transmission media include:

- radio waves (wireless network)
- infrared signals (wireless network).



**Figure 5.3:** Wireless home network

## COMPARING COMMUNICATIONS MEDIA

DEFINITION	COST	ACCESSIBILITY	COVERAGE	SECURITY
UTP uses electricity to move the signals from a sender to a receiver.	The most popular type of cabling because the material used to set it up is relatively cheap.	Relatively simple to install, with minimal equipment and technical expertise.	It can only connect devices up to 100 metres.	Prone to electrical wave interference and has weak security.
Fibre optic uses light to move the signals from a sender to a receiver.	The materials (a transmitter, cable and a receiver) used and the installation is expensive.	Difficult to install due to equipment and technical expertise.	Fibre optic covers longer distances.	Immune to electromagnetic interferences and it carries a low security risk.
Radio waves uses radio waves.	Relatively cheap to install and minimal expertise required to set up.	Relatively simple to install, with minimal equipment and technical expertise.	Can cover very short to very long distances depending on the device used.	Prone to interference and security risks are influenced by the device used.
Infrared (IR) technology	No cost involved.	Allows computers and other electronic devices to communicate via short-range light signals.	Limited to very short distances.	Carries a low security risk.

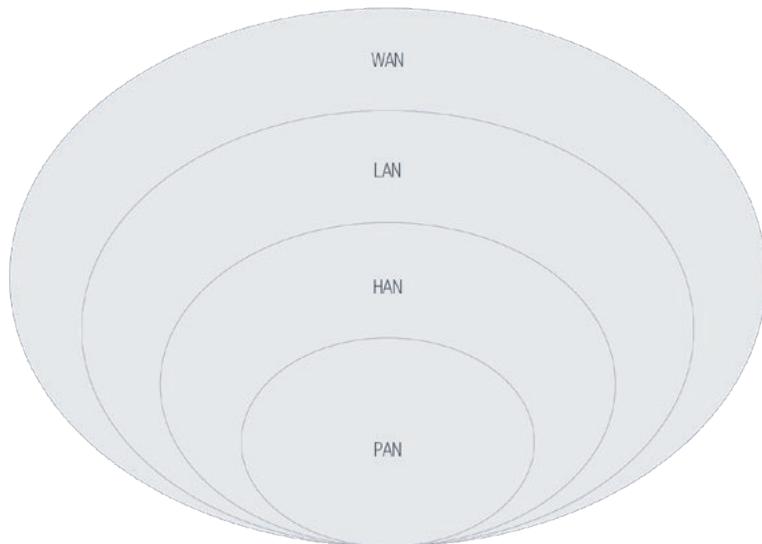


## Activity 5.2

- 5.2.1** List and describe the essential basic network components.
- 5.2.2** Compare wired and wireless networks.
- 5.2.3** State which communication medium would benefit each situation and support your answer.
  - a.** Air traffic controller
  - b.** A gamer
  - c.** An office with several employees working at fixed workstations
  - d.** Watching TV

## 5.3 Types of networks

In this unit we will look at the different types of networks namely, personal, home, local and wide area network.



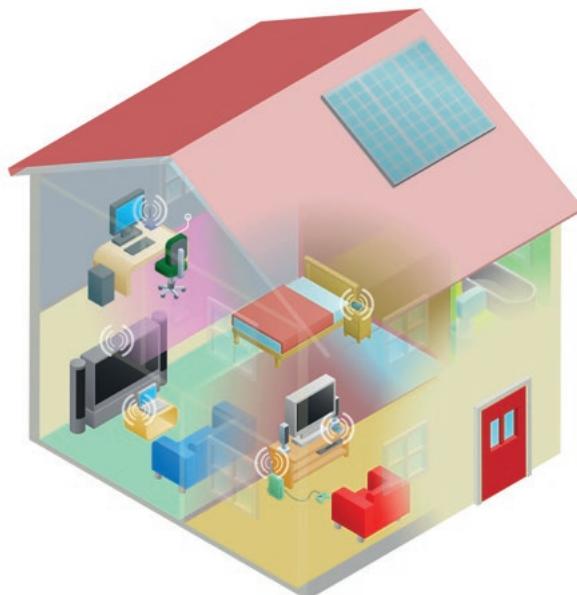
**Figure 5.4:** Types of networks according to hierarchy

### PERSONAL AREA NETWORK (PAN)

A personal area network (or PAN) covers a very small area. This type of network connects devices within a certain range and if you move outside of that range, the connection can be lost. For example, connecting your smartphone to a wireless speaker, headphones, or other wireless device.

### HOME AREA NETWORK (HAN)

A home area network (or HAN) is a computer network that covers a larger area like your home. For example, connecting to a printer from anywhere in your house.



**Figure 5.5:** A Home Area Network



### Did you know

In 2011, DreamHack hosted a gaming convention in which 13 000 devices connected to the LAN at the same time.

## LOCAL AREA NETWORK (LAN)

A local area network (or LAN) covers a larger area like an office or a bigger premises. These computers can be connected to the network using either a wired or wireless connection media. Once connected, the computers on the network can share resources, information, transfer files and communicate with each other via email or web-based instant messaging channels.

The network LANs usually have a limited number of computers connected to them (between 2 and 25). However, there is no absolute limit. Because companies and homes usually create LANs for their personal use, the networks are configured to prevent outsiders from connecting to the network using security settings that require configuration for the network.



**Figure 5.6:** A LAN in which computers are connected in the same room during a LAN party



### New words

**LAN party** – describes a get together of individuals and their computers to play network games with other individuals

**Access control** – any system designed to prevent and restrict access to specific users

LANs have different uses, including transferring files and sharing network resources (like software and hardware). They are also used to play computer games competitively (called a **LAN party**), since the fast network allows the players on the network to play games without experiencing delays in the game (or lag time).

## WIDE AREA NETWORK (WAN)

A wide area network covers a very large area – that could include all the people in a suburb, city or country. It is often used to refer to the internet, the world's largest WAN.

Unlike a local area network, WANs are not private but are instead organised by communities or businesses. In order to join a WAN (like the internet) you need to seek permission from a company that manages the service. For example, to connect to the internet, you need to subscribe and pay a mobile network provider (MNP) like Vodacom or Cell C; or an internet service provider (ISP) like MWeb or WebAfrica, a monthly fee.

In the previous section we discussed a WAN and we learned that the internet is an example of a WAN. Let's take a closer look at this.

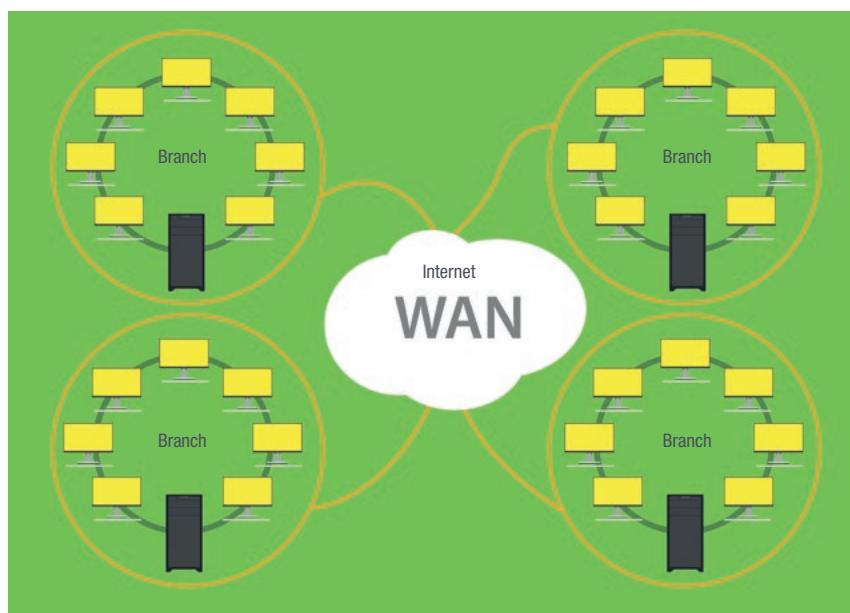
## THE INTERNET AS AN EXAMPLE OF A WIDE AREA NETWORK (WAN)

### LOGGING ON TO A NETWORK

There are several reasons why we would want to log into a network or connect to a server. These allow you to share:

- files and data
- expensive devices
- backups and network security.

Anyone connecting to this network will have access to your resources (such as an internet connection and printer). In order to prevent unauthorised people from connecting to your network, you need to control who can and cannot access your network. To do this, you need something called **access control**. Access control is a security concept by which you increase the security of a network by tightly controlling the resources people have access to.

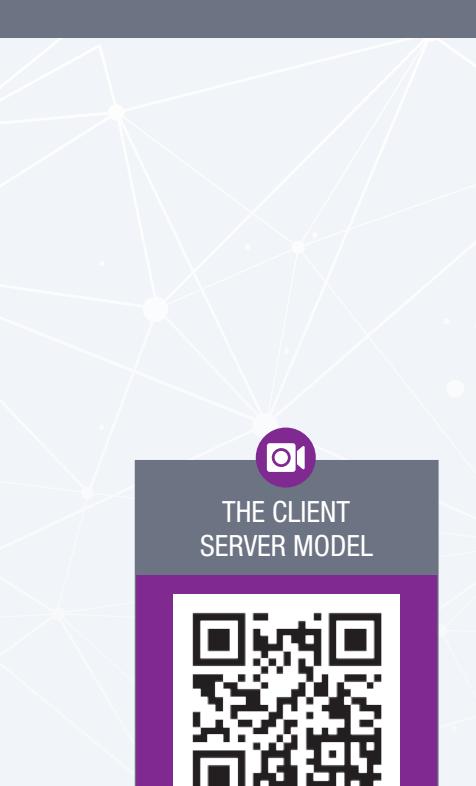


**Figure 5.7:** The internet as WAN

There are several different ways to implement access control, from requesting people to plug a network cable into a router to access the network (a form of physical access control) to using a log-on system that allows users to have a username and password to login to your network.

In South Africa, most internet connections make use of some form of access control. On mobile phones, this access control is linked to a SIM card, with limits set on the amount of data access you can use based on the account linked to your SIM card. When connecting to the internet through a wired connection (like DSL or fibre optic), your ISP may require you to enter a username and password which allows you to connect to their servers. Without an authenticated SIM card or a username and password, you cannot gain access to the internet.

Rather than simply allowing or blocking people from connecting to a network, access control gives you very specific control to manage how people can use the resources on your network. For example, on the internet, you may only have a



limited amount of data available before your access is blocked. On a home network, the network can be set up in such a way that only certain users can add or remove files from the network. Thus, by thinking carefully about the limitations you would like to implement, you can create a network that is both secure and convenient to use.



## THE CLIENT SERVER MODEL



[https://www.youtube.com/watch?v=L5BlPU\\_muY](https://www.youtube.com/watch?v=L5BlPU_muY)

<https://qrs.ly/zzab20a>



## WHAT IS A PEER-TO-PEER SYSTEM?



[https://www.youtube.com/watch?v=w2u4eN\\_WWvc](https://www.youtube.com/watch?v=w2u4eN_WWvc)

<https://qrs.ly/ayab20b>

## CLIENT-SERVER AND PEER-TO-PEER NETWORKS

A network architecture refers to the differences in the way that the network is built. The two types of network architectures are peer-to-peer and client-server networks.

### CLIENT-SERVER NETWORKS

A server is used to manage a client-server network, where computers (nodes) connect to the server. It ensures that authorised users have access to certain resources when logging on to a network. In a school, one would have the following:

- Many nodes, your PCs, connected via cables to the server.

### PEER-TO-PEER NETWORKS

In a peer-to-peer network, each computer (node) on the network connects directly to the network AND to the other nodes. However, each computer has its own security. This means that the computer's settings determine who is authorised to access the resources. Peers on this network are visible to each other and can share files and resources with each other.

In a peer-to-peer network, data flows between peers and most home networks are organised as peer-to-peer networks. This means that if your computer connects to your home network, it will have the same role and permissions as your mother's notebook and your father's smartphone. None of these devices organise the network nor do they need to be connected for the network to work correctly. Instead, each computer can connect and disconnect from the network automatically.



### Activity 5.3

- 5.3.1** What is a LAN and where is it used?
- 5.3.2** What is a WAN and how is it different from a PAN?
- 5.3.3** Describe a peer-to-peer network.
- 5.3.4** Peer-to-peer networks share \_\_\_\_\_ and \_\_\_\_\_.
- 5.3.5** Describe a client-server network.
- 5.3.6** Name ONE advantage and ONE disadvantage of using a LAN.
- 5.3.7** What is the main difference between a LAN and a WAN?
- 5.3.8** What is one of the major advantages of a WAN?
- 5.3.9** Which type of network is better suited to each of the following?

Choose from a peer-to-peer or client-server network. In each case you must provide an argument to support your choice.

- a. Four friends get together to host a LAN party at one of their houses.
- b. A school that has two computer labs used for both CAT and IT and where the educators and administrative staff all use the same network.
- c. The local dentist office where there is one computer in reception and one in each of the two dentists' offices.
- d. A temporary network that is being set up to run a large craft market for a week. There will be eight different computers set up in the management office to run the inventory and sales.

**CONSOLIDATION ACTIVITY**

## Chapter 5: Networks

1. Describe the concept of a network.
2. List the reasons for using networks in order of importance. Explain your answer.
3. Evaluate the use of networks. Are they really beneficial? Support your answers.
4. For each type of network based on the communication medium used:
  - a. Illustrate and label the network connections and components.
  - b. Define each type of network, in your own words.
5. Complete the table comparing the communication medium in terms of accessibility, coverage and security.

DEFINITION	COST	ACCESSIBILITY	COVERAGE	SECURITY
UTP				
Fibre optic				
Radio waves				
Infrared (IR) technology				

6. Differentiate between client-server and peer-to-peer networks.
7. Explain the reasons for logging into a network and connecting to a server.
8. The IT class has invited interested parties and companies to exhibit business, career and study opportunities in IT and new developments in technology at their school. The exhibition will take place in the school hall over a weekend. A peer-to-peer LAN, which may be used by the exhibitors, will be provided in the school hall. The school has a separate client-server network that is in daily use. The LAN in the hall will be connected to the school's router to provide internet access.
  - a. One advantage of using a network is that one can share hardware, such as printers.
    - i. State TWO **other** advantages of networking computer networks.
    - ii. Explain why a client-server network is more suitable than a peer-to-peer network to host a school's administration system.
    - iii. What risks are there for the exhibitors linking their devices to the peer-to-peer network? Name and describe two.
  - b. The school uses UTP cables as a communication medium in their LAN.
    - i. What limitations are there to using UTP cables?
    - ii. Fibre-optic cables were installed in the area around the school as part of a WAN that the school would be able to use.  
What medium is used to transfer data in fibre-optic cables?
    - iii. Motivate why fibre-optic cables would be advisable to use in a WAN.
  - c. The exhibitors can use laptop computers to connect to the internet, using the school's wireless connection.
    - i. What hardware will a laptop computer require to connect wirelessly to the Internet?
    - ii. What are the advantages and disadvantages of wireless communication compared to wired communication.

# ELECTRONIC COMMUNICATIONS

## CHAPTER OUTCOMES

- Unit 6.1 Electronic communication tools
- Unit 6.2 Email as a form of electronic communication (e-communication)
- Unit 6.3 Social implications

## Learning outcomes

At the end of this chapter, you will be able to:

- describe electronic communication
- describe the applications/tools that facilitate e-communication
- use email as a form of e-communications
- explain the social issues pertaining to ergonomics, green computing issues and health issues
- explain the social issues pertaining to e-communication.

## INTRODUCTION

In the past, communication between people was done either face to face, using the telephone or by writing letters. Now we live in a world where electronic communication (or e-communication) is the preferred way of communication. Electronic communication refers to any data, information, words, photos, emojis and symbols that are sent electronically to one or more people.

There are many ways to communicate, allowing you to:

- make phone calls using your computer
- share the same message with many people at the same time without sending the same message individually
- interact with different platforms on the internet and make comments, update statuses or even send messages
- use video conferencing.

In this chapter, we will look at the different electronic communication tools and the different types of applications used in electronic communications. We will also look at email and how to compose and send basic email messages as well as basic email **netiquette**.



## UNINTENDED CONSEQUENCES OF E-COMMUNICATION



[https://www.youtube.com/watch?v=rH6dMhf\\_P-w](https://www.youtube.com/watch?v=rH6dMhf_P-w)

<https://qrs.ly/xyab20e>

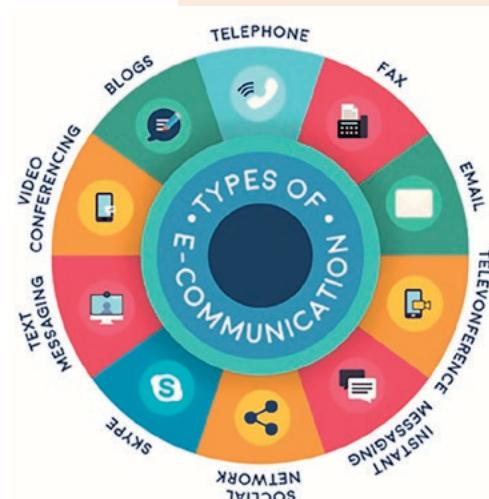


Figure 6.1: Examples of e-communication

## 6.1 Electronic communication tools

### ELECTRONIC COMMUNICATIONS

Electronic communication is any data, information, words, photos or symbols exchanged electronically using a computing device to communicate with one or more people.

Today, thanks to computers and the internet, we now have many different ways of communicating, from sending an email to uploading videos on YouTube.

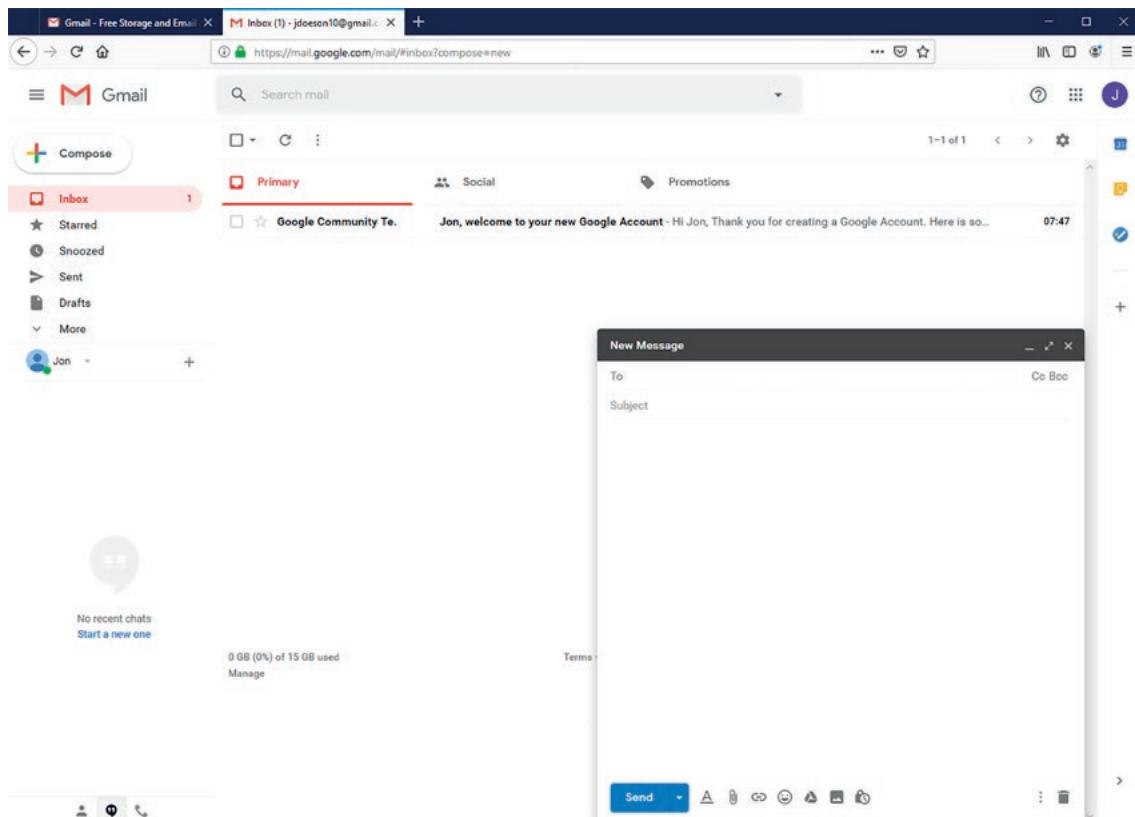
### OVERVIEW OF APPLICATIONS/TOOLS TO FACILITATE E-COMMUNICATION

The following section will briefly look at some of the most popular electronic communication tools.

#### EMAIL

One of the very first forms of internet communication was email (electronic mail). It allowed users to send and receive messages and documents electronically over the internet. Email is still widely used today in various ways. This includes:

- sending out marketing communication to potential clients
- communicating within and / or between businesses
- sending messages to many different people simultaneously.



**Figure 6.2:** Gmail is an example of an email application

Because it is so easy to send an email, users may receive hundreds daily. Email is still the most popular and important communication medium in the business world.

## WEB BROWSER

A web browser is a program that provides a user interface for accessing information on the world wide web. It allows you to browse webpages, search for websites containing information and to do activities.



**Figure 6.3:** Some of the largest websites in the world are social media networks

**Social media networks** are a good way of keeping in touch with family and friends, especially those who are far away. Many companies and organisations also use social media to communicate with their users and fans.

## FILE TRANSFER PROTOCOL (FTP)

File Transfer Protocol (FTP) is a client/server protocol used for transferring large files or folders. It can be secured with user names and passwords.

FTP allows you to access an FTP site. The site looks like a folder on your computer. Once you open the site, you can either upload files to the FTP site or download files from the site. It is still used for uploading new files to a web server.

## INSTANT MESSAGING

Instant messaging is type of online chat that offers real time text transmission over the internet. It is used for real-time communications and is convenient. It mostly uses data, but can be accessed using a network service (such as Wi-Fi). Some of the most popular applications used are WhatsApp and Facebook Messenger.

## CHAT ROOMS

Chat rooms are tools that allow you to join a group online and then exchange messages (or chat) in that group. Group chats have a similar structure to a physical social get-together. Group chats can be diverse, are not restricted, and people are able to have live conversations, often about different topics.



### New words

**social media network** – a network of individuals, like friends, acquaintances, and coworkers who are connected by interpersonal relationships



### Take note

Chat rooms can be dangerous and lead to unsolicited approaches by people who wish to take advantage of a young person. Do not reveal personal details to people you do not know and always consider safety

One of the popular chat applications is WhatsApp group chats. This application gives its users the platform to create and join a group that has a common topic or interest. Today, WhatsApp groups have become the preferred choice of communications among learners, committees and neighbourhood watches. There are also other social networks that allow you to create groups.

### VOICE OVER INTERNET PROTOCOL (VoIP)

VoIP is a standard set of rules allowing you to make voice calls over a network. A popular application used for making VoIP calls is Skype.

The quality of VoIP calls depends on your internet connection. If the connection is weak, users may experience a slight delay when speaking.

VoIP calls can be used for personal voice calls, where users can speak directly to one another, or business and video conferences, when it is necessary to see the person you are speaking to.

### VIDEO CALLS

A video call is mixed media using video and audio for communication.

Hardware required can be:

- webcam/camera
- microphone.

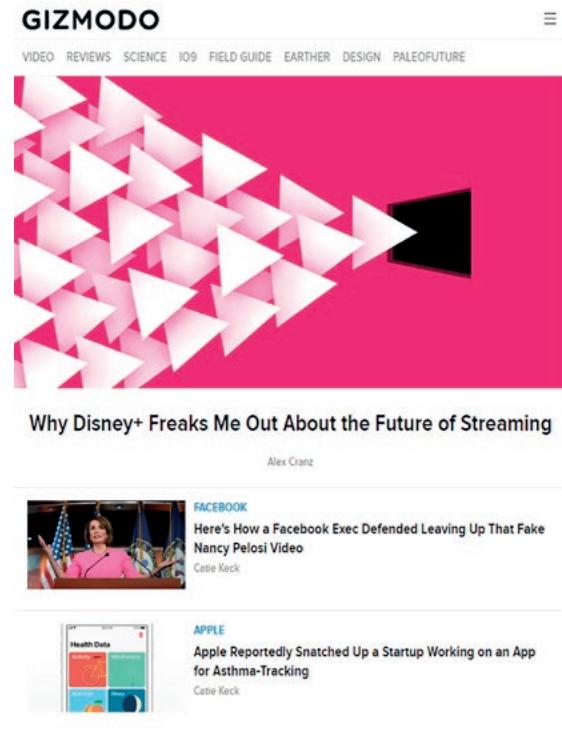
### BLOG

Blogs (short for web logs) is an online platform that allows text and picture content to be created and shared with other people. Blogs can be in the form of an online magazine or a platform that is hosted on a website where a blogger (or a small group of people) post regular articles and photographs about topics they are interested in. The latest articles appear at the top of the blog, allowing website visitors to easily stay up to date with the newest stories. In South Africa there are many popular blog websites, such as WebPress.

Websites such as the Verge, Engadget and Gizmodo are also examples of blogs focused on technology.

### VLOG

Vlogs (short for video blogging) are like blogs, except that the posts are in a video format. Most vloggers do not have their own vlog websites, but rather place videos on popular video sharing websites like YouTube and Facebook TV. Some Vloggers have an audience of millions of viewers, meaning that their video posts have received billions of views.



**Figure 6.4:** Gizmodo is a popular technology blog

## WEBINARS

A webinar is similar to a seminar, but it is hosted online. Webinars are usually used to deliver lectures, presentations or workshops to a group of people over the internet. They are mostly scheduled for a specific time.

Webinars are now commonly used in an online learning platform by many educational institutions. These webinars enable students to attend classes without physically going to a classroom.



### Activity 6.1

Individual activity

- 6.1.1** Match column A with column B. Only write the question number and the alphabet letter, e.g. 1–M.

	Column B
1.	A. Social network
2.	B. Webinar
3.	C. Web browser
4.	D. Electronic communication
5.	E. Vlog
6.	F. VoIP
7.	G. Dropbox
	H. Email
	I. Skype
	J. Internet Relay Chat
	K. Hard drive

- 6.1.2** Your grandparents have decided to join the online world! Their motivation: close family members recently moved overseas, and they want to keep in touch. They got a pamphlet that says the following and then gives some options for three Internet plans, option 1, 2 and 3.

*VoIP (e.g. Skype or FaceTime) helps users stay in touch with family and friends by giving video messaging at little to no cost. Users can make high-quality audio and video calls to people anywhere in the world.*

*Need broadband?*

Option 1 (Fibre)	Option 2 (Fibre)	Option 3 (ADSL)
100 GB Capped data	Uncapped data	100 GB Capped data
Up to 20 Mbps Fibre Line	Up to 10 Mbps Fibre Line	Up to 10 Mbps ADSL
20 Mbps download	1 Email account (with 3 GB of online storage and 5 aliases)	Line rental included
Upload = 25% of download	Free Night Surfer Data (00:00 – 06:00)	1 Email account (with 3 GB of online storage and 5 aliases)
1 Email account (with 3 GB of online storage and 5 aliases)	Fibre Router included	Free Night Surfer Data (00:00 – 06:00)
Free Night Surfer Data (00:00 – 06:00)	<b>Cost: R1230.00</b>	Free Wi-Fi enabled modem included
Fibre Router included		
<b>Cost: R850.00</b>		<b>Cost R700.00</b>



## Activity 6.1

*continued*

Now, your grandfather wants to understand the terminology to make an informed decision. He gave you a list of questions that he needs explained before making a decision.

- a. Explain why one would need an internet plan to be able to communicate with family over the internet?
- b. Expand on the acronym VoIP.
- c. Give one or two disadvantages of having VoIP.
- d. List three ways that email can be used.
- e. If a friend wants to upload some books for you to read, how would they do it?
- f. Your grandfather wants to know what the free night-surfer data is all about. Explain what it meant by this concept, why it is used as a selling point and whether your grandfather is likely to benefit from this aspect.
- g. Would all three these options automatically be available in the neighbourhood where your grandfather lives? Explain your answer.

## 6.2 Email as a form of e-communication

In this unit, you will learn how to use email to communicate online. In addition, you will also learn about the following:

- the different uses of emails
- email accounts (internet service provider (ISP) and web-based)
- email addresses
- how to use email (best practices).

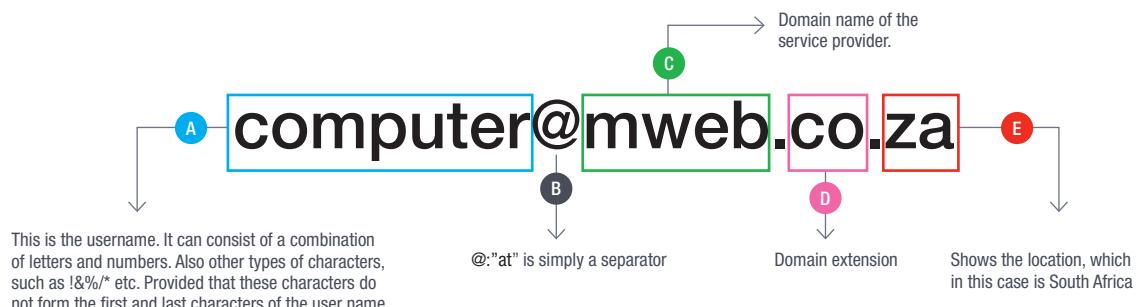
### COMPONENTS OF AN EMAIL ADDRESS

In order to receive emails, you need an email account and address, which will enable you to send and receive emails. Whomever you wish to communicate with, will also need their own email address.

An email address is a unique identifier of who owns an email account. It is important to understand how to type an email address correctly because, if entered incorrectly, the email will not be delivered to the intended recipient and might end up being sent to the incorrect person!

Email addresses are always written in a standard format. This standard format consists of two parts: a local-part (or user name) and a domain-part. These two parts are separated by the symbol, @. The local part of an email address is used by the receiving mail server to determine where the email must go and what must be done with it after it arrived at its destination.

The email address computer@mweb.co.za is explained below.



**Figure 6.5: Components of an email address**

### EMAIL ACCOUNTS: ISP AND WEB-BASED

When looking for an email service provider, you will first need to consider whether you want to use a web-based or an Internet Service Provider (ISP) to manage your emails. Because both have their advantages and limitations, which one you choose will depend on how much money you are willing to spend and how important it is for you to maintain your email account.

Table 6.1 compares the advantages and disadvantages of each type of email account.

**Table 6.1: ISP vs. web-based**

Service provider	Advantages	Disadvantages
ISP	<ul style="list-style-type: none"><li>The main advantage of having an ISP email account is the support that you get when something goes wrong.</li></ul>	<ul style="list-style-type: none"><li>An ISP provides a mailbox to end-users as part of their paid services. When using an ISP, your emails will be on the ISP's servers. This means that you will have to connect to the ISP mail server to download your emails. If anything happens to these servers, there is no way that you can get your emails until the problem is fixed.</li><li>If you have the wrong incoming or outgoing password, you will not be able to receive or send emails.</li><li>ISPs charge for their services.</li><li>Should you move or change your ISP, you will most probably have to get a new email address.</li><li>It may also have a limited amount of storage space for your emails and attachments.</li></ul>
Web-based	<ul style="list-style-type: none"><li>Does not charge for their services.</li><li>Webmail refers to any email service that you can reach through a web browser. It also means that you can check for email messages on any computer with a web browser installed, whether you are at home, at work or on holiday.</li><li>You can also keep the same email address, even if you change your ISP.</li></ul>	<ul style="list-style-type: none"><li>One of their main disadvantages is that it will send advertisements to your inbox to help cover their costs. Some services such as Gmail will look for keywords in your email messages and show you relevant advertisements.</li></ul>



#### Did you know

The top current webmail providers are Google's Gmail, Yahoo and Microsoft's Outlook. These are most commonly used because they allow you to access your email account from anywhere in the world, provided that you have an internet connection. You can also access webmail from a mobile device!

# EMAIL ADDRESSES

## PARTS OF AN EMAIL

**To:** The recipient's address

**Cc (carbon copy):** Lets all recipients see the email addresses of everyone the message was sent to.

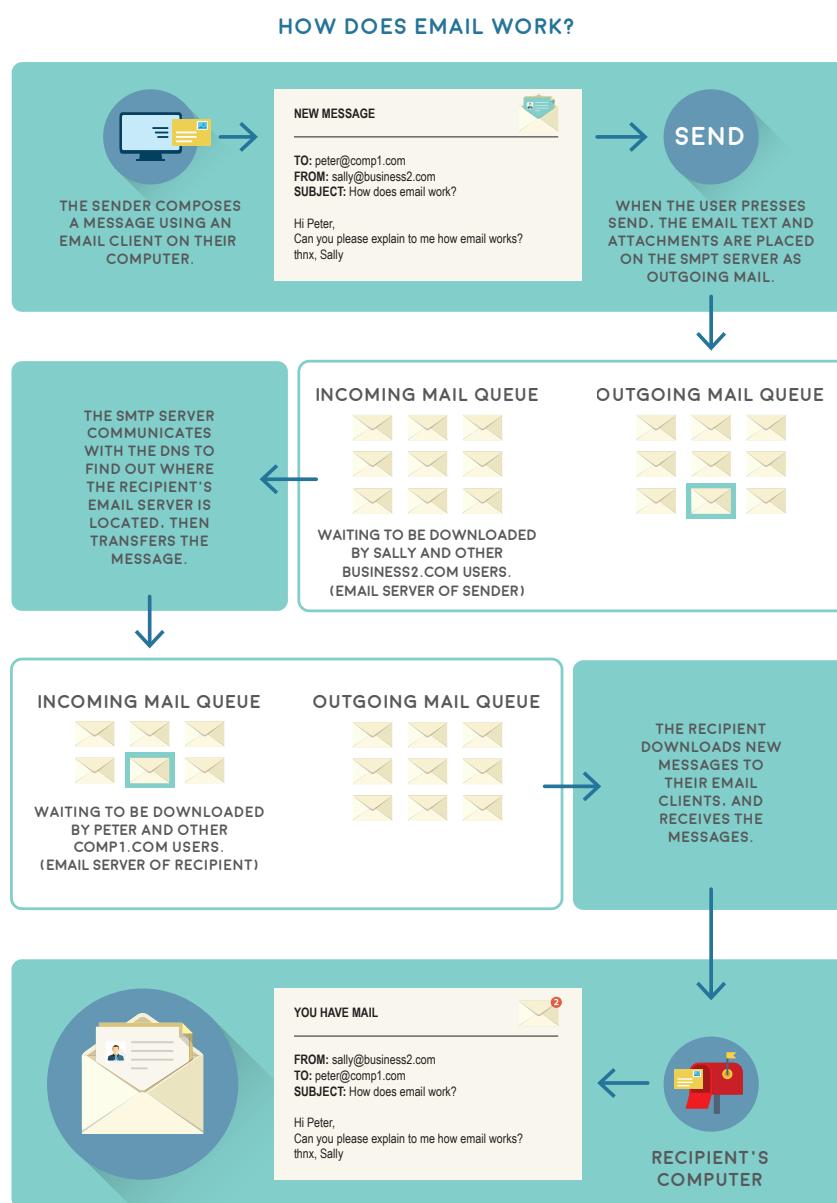
**Bcc (blind carbon copy):** The identities of the other recipients will not be shown.

**Subject:** The title of the email, used to gain the attention of the recipients.

**Attachment:** Files that you want to share with the recipient.

## HOW EMAIL WORKS

The following happens when an email is sent:



**Figure 6.6:** This is how email works



## HOW EMAIL WORKS



<https://www.youtube.com/watch?v=YBzLPmx3xTU>

<https://qrs.ly/wjab20g>

The QR code alongside will explain in detail how email works.

## HOW TO USE EMAIL (BEST PRACTICES)

Whenever you communicate on the internet – whether it is via email, instant messaging or by posting a blog – it is important that you follow proper netiquette. This will not only make the internet a more pleasant place for everyone, it will also save you from potential embarrassment in the future!

The following are some guidelines you can follow when communicating on the internet:

- Show people on the internet the same respect you would show to them in real life.
- Do not say things to people you would not say to them in real life.
- Do not post things on the internet that you would not want your mother or future boss to see.
- Things posted on the internet often last forever. This means that things you post as a teenager or young adult can negatively affect the rest of your life.
- Make sure your messages are clearly written and easy to understand.
- When joining an existing conversation, speak about subjects relevant to the topic.
- Try to make useful contributions and help people out on the internet.
- If you need help from the internet, do not expect other people to do all the work for you. Do as much work as you can before asking your question.
- See if there are existing conversations about your topic before starting new conversations.
- Do not spam people! Do not post the same advertisement repeatedly.

While the tips covered in this section are generally good guidelines, it is important to note that netiquette differs from site to site and changes rapidly without notice. When joining a new website, spend some time figuring out what is acceptable behaviour on that website before sending out your messages.

## ADVANTAGES AND DISADVANTAGES OF E-COMMUNICATION

**E-communications** has many advantages over traditional modes of communication as well as disadvantages. We will look at these in terms of accuracy, time, distance, communication costs and speed.

### ADVANTAGES OF EMAIL

- Provides a written record of a communication, which is available for a long time.
- Is inexpensive to send and receive email messages.
- Can be sent from anywhere in the world and at any time provided you have an internet connection.
- It is an environmentally friendly alternative to sending regular mail.
- Can be typed and temporarily stored and sent at a later stage.

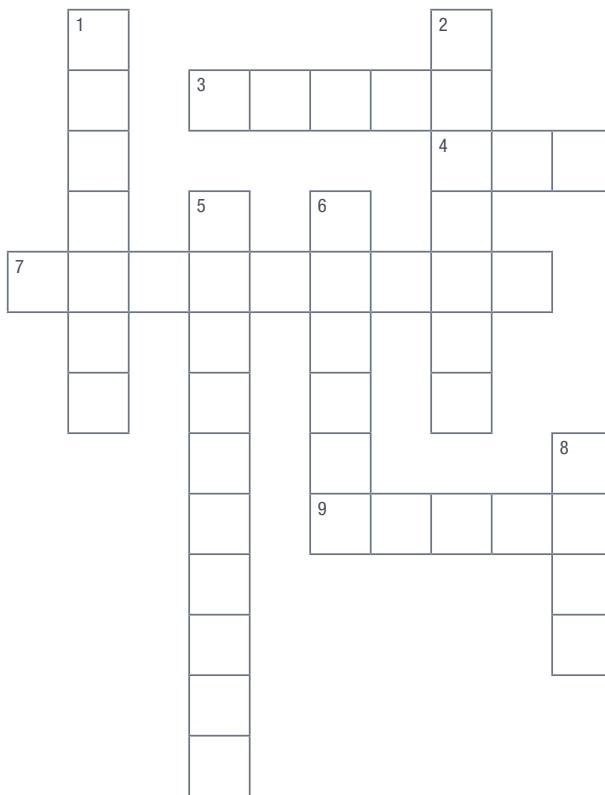
### DISADVANTAGES OF EMAIL

- Email attachments can be used to spread viruses.
- Spam (electronic junk mail i.e. advertising) is a big problem. Over time many institutions will acquire your email address and start sending advertisements to you via email.



## Activity 6.2

**6.2.1** Fill in the missing words in the crossword puzzle below.



DOWN	ACROSS
<ol style="list-style-type: none"><li>1. Where you enter the topic of your email</li><li>2. Online seminar</li><li>5. Good manners when communicating on the internet</li><li>6. A popular web browser</li><li>8. Short form for web-log</li></ol>	<ol style="list-style-type: none"><li>3. A type of VoIP service</li><li>4. Email address of somebody you would like to include in the email, without the knowledge of the other person</li><li>7. This is a communication tool used to speak</li><li>9. One of the first forms of internet communication</li></ol>

**6.2.2** Your friend has bought a new computer; he has a modem-router combination. He wants to connect to the internet to chat to his friends. Answer the following questions:

- a. The priority is being able to receive and send email. List any additional hardware that he might need to accomplish this and briefly explain the function or purpose of the hardware.
- b. Compare the advantages and disadvantages of the two types of e-mail accounts (web-based or ISP-based).
- c. Your friend has never actually sent email his entire life, but he has heard of people referring to something called Netiquette. Give the owner THREE practical rules of netiquette when it comes to sending out emails.

**6.2.3** Mpho sent Vusi a document via email. What can Vusi do to make sure that he gets the document without viruses?

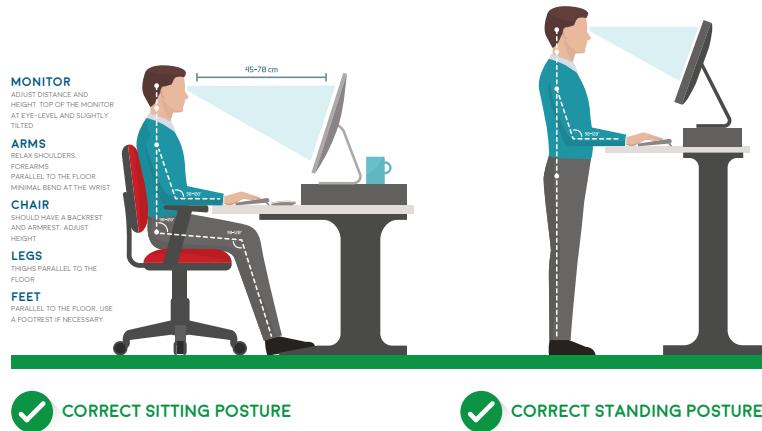
## 6.3 Social implications

### ERGONOMICS, GREEN COMPUTING AND HEALTH ISSUES

Using computers every day may result in several long-term health problems. This unit will look at the most significant health problems associated with computer use, before providing you with some tips on how to reduce the health risks associated with the daily use of computers. Regular computer use is not just bad for your own health, but also for the health of the environment. The last part of this unit will therefore look at **green computing**, and its importance to the environment.

#### ERGONOMICS

Ergonomics is the study or science of how humans interact with man-made objects and then creating products to increase productivity, reduce discomfort and reduce injuries. In our modern environment these products include, keyboards, a mouse, computer desks and chairs.



**Figure 6.7:** Good ergonomic positions

Key ergonomic guidelines for safe computer usage include:

- Sit up straight with your back perpendicular to the ground.
- Your forearms should be at the same height as your mouse and keyboard.
- Your feet should be placed firmly on the ground or on a footrest.
- The back of your chair, height of your chair and height of your armrest should be adjusted to support your body in this position.
- Your monitor should be positioned at eye level and roughly 50 cm away from you. You may need to place something under your monitor to increase its height.
- Your monitor should be tilted to reduce glare.
- You should stand-up and take regular breaks while using the computer.

#### GREEN COMPUTING

Green computing aims to reduce the environmental impact of the daily use of computers. Below are some examples of green computing:

- Using bio-degradable materials
- Using low-power devices (LED backlit screen, Solid State Drives (SSD))
- Using a power management function on your computing device.



#### New words

**green computing** – the environmentally responsible and eco-friendly use of computers and their resources



#### COMPUTER DESK SETUP ERGONOMICS



<https://www.youtube.com/watch?v=Ree1CWifQTg>

<https://qrs.ly/a5ab20h>



#### Did you know

Energy Star is a U.S. Environmental Protection Agency voluntary program that helps businesses and individuals save money and protect our climate through superior energy efficiency. Energy Star provides simple, credible, and unbiased information that consumers and businesses rely on to make well-informed decisions to save money and reduce emissions. <https://www.energystar.gov/>

## HEALTH ISSUES

While it is probably not bad for your health to use a computer for a few minutes every day, spending hours in front of the computer every day can be bad for your health. The most common health problems associated with regular computer use include:

- **Back and neck pain:** sitting hunched forward or lying back in your chair can cause both back pain and neck pain.
- **Hand or arm pain:** this is caused by the overuse of a mouse and keyboard.
- **Eyestrain:** by focusing your eyes for hours on the screen.
- **Obesity:** inactivity sitting behind the computer for extended periods of time.
- **Computer stress:** being anxious or nervous when a computer malfunctions or does not perform optimally as expected.

Frequent use of a computer keyboard can increase the risk of:

- **Repetitive strain injury (RSI):** a general term used to describe the pain felt in muscles, nerves and tendons caused by repetitive movement and overuse.
- **Carpal tunnel syndrome (CTS):** a condition that causes numbness, tingling and other symptoms in the hand and arm.



**Figure 6.8:** Poor sitting posture



### Activity 6.3

- 6.3.1** Choose a term/concept from COLUMN B that matches a description in COLUMN A. Write only the letter next to the question number (e.g. 1–A). Some of the questions (column A) may have more than one correct answer (column B)

COLUMN A	COLUMN B
1. This refers to the environmentally responsible and eco-friendly use of computers and their resources.	A. Obesity B. Eyestrain C. Ergonomics D. Computers going to “sleep” after they have been inactive for a certain amount of time E. Repetitive strain injury F. Green computing G. Carpal tunnel syndrome H. Data stored on SSDs I. Back and neck pain J. Greenhouse gases
2. A science which tries to increase our well-being.	
3. One of the most common health problems associated with regular computer use.	
4. You must take frequent short walks to prevent _____.	
5. Making sure that your mouse is positioned close to the keyboard, you can prevent _____.	
6. Glare on your monitor, may cause the following.	
7. Since most electricity is created by burning coal, computers are a large contributor to the _____ emitted by humans.	
8. This is an example of green computing.	

- 6.3.2** Which rules of ergonomics do you normally follow, and which rules do you break?



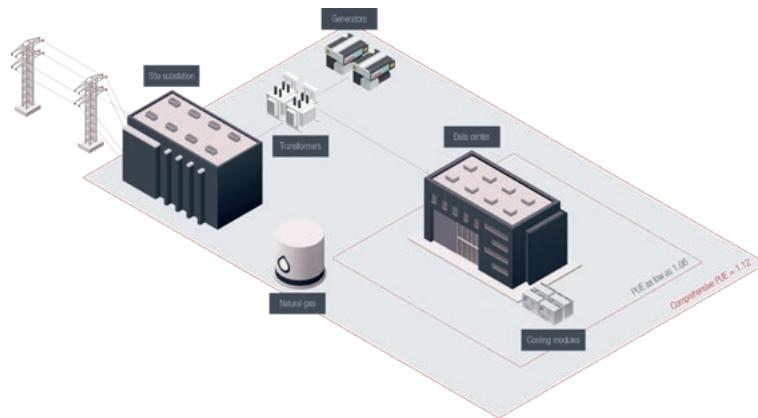
### Activity 6.3

*continued*

**6.3.3** Your mother has recently started working in an office environment. After the first month, she started complaining about regular headaches and back pain that you believe may be the result of poor ergonomics. Based on this information answer the following questions:

- a. What is ergonomics?
- b. How can poor ergonomics cause back pain?
- c. How can headaches be caused by poor ergonomics?
- d. Which five tips would you give your mother to help reduce her pain?
- e. What are the advantages of using a standing desk? Could a standing desk help your mother?

**6.3.4** The image below shows the general structure for Google's data centres.



To reduce their impact on the environment as well as their cost, Google has invested millions of Rand to improve the power use effectiveness (or PUE) of their data centres. As a result, Google's data centres are 50% more energy efficient than the average data centre. Based on this information, answer the following questions.

- a. Why is it important that data centres are energy efficient?
- b. How does computer-use result in more greenhouse gasses being emitted?
- c. Name four things that you, as a normal computer user, can do to conserve energy?

**6.3.5** Computing devices, including mobile phones, are mostly made of non-biodegradable substances such as plastic. Think of two green computing practices that you could follow when buying a new mobile phone when your old one is still in good working order. Explain them.

1. Choose the correct answer.
  - a. Which one of the following is a use of video calling.
    - i. Allows you to see the person you are speaking to
    - ii. Allows you to give a presentation to a group of people over the internet
    - iii. Allows you to share media to people who couldn't attend a function
    - iv. All of the above
  - b. This is an article posted in video format.
    - i. Blog
    - ii. Vlog
    - iii. Webinar
    - iv. None of the above.
  - c. What does FTP stand for?
    - i. File transfer process
    - ii. File transfer progress
    - iii. File transfer protocol
    - iv. File transfer practice
  - d. Which one of the following is untrue of emails.
    - i. Emails are usually short and to the point
    - ii. Email is more formal than messages
    - iii. Used for communicating within a business
    - iv. The recipient receives an email within seconds after it is sent
2. Choose the answer and write 'true' or 'false' next to the question number. Correct the statement if it is FALSE. Change the word(s) in bold to make the statement TRUE where necessary.
  - a. A **web browser** like Chrome or Firefox is designed to open and view websites.
  - b. **Etiquette** is having good manners when communicating on the internet.
  - c. **VoIP** is also used when lessons are presented over the internet.
  - d. A **vlog** is a website where one person (or a small group of people) write regular articles about topics they are interested in.
  - e. The first step to communicating electronically is to make sure you have an account with the **online service provider** you would like to use.
3. Answer the following questions in your own words.
  - a. VoIP will be used for video calls over the Internet. Briefly discuss TWO possible problems that could be experienced when using VoIP.
  - b. List any TWO advantages of instant messaging.
  - c. Give a brief description of a chatroom and how it is an e-communication tool.
  - d. List any TWO uses of websites.
  - e. One of the world's most popular types of websites are social network websites (or social networks).
    - i. Describe what a social network is and how it is used.
    - ii. Give ONE advantage of a social network.

- f. Answer the questions based on the figure below:



- i. What is the difference between Cc and Bcc in an email?
- ii. List ANY three netiquette rules that have been violated.
- g. Briefly explain what a blog is.
- h. Briefly explain how a webinar is an example of an e-communication tool.
- i. Email is a e-communication tool that allows you to send text messages. Give other THREE uses email has.
4. Mr Knowitall's family's Internet service provider is Bluedot. As part of their contract, the Knowitall family receives one free email address. Should they need more email addresses, they need to pay an additional fee per month for each additional email address. Mr Knowitall has a business organising weddings and outdoor events and the business name is Rain! Events
  - a. Suggest a suitable domain and thus an email address for Mr Knowitall's business.
  - b. Mr Knowitall needs to make a few calls to a potential client in Brazil. Briefly explain to Mr Knowitall how he can make these calls without wasting a lot of money. State ONE disadvantage of this type of tool.
  - c. How would Mr Knowitall avoid viruses getting on to his computer via attachments to his emails?
  - d. Mr Knowitall finds that he is getting a lot of junk mail. Explain what junk mail is.
  - e. Explain how do the senders of the junk email know Mr Knowitall's email address.
5. Jonathan has recently been employed by ABC Corporation. He has just read some of the rules around the use of email at the company.
  - a. Jonathan is rather upset when he reads that the company reserves the right to monitor all employee emails. Comment on whether you think this is an ethical practice.
  - b. The company has placed a limit on the size of the attachments that can be sent via email. Explain why this restriction has been put in place.
  - c. What could the company do so that it would no longer really matter what the size of the email attachments are?

# COMPUTER MANAGEMENT

## CHAPTER OVERVIEW



### Unit 7.1 Computer management tasks



## Learning outcomes

At the end of this chapter you should be able to:

- describe computer management and its maintenance
- list and describe different computer management tasks and the utilities used.

## INTRODUCTION

When you get something new, everything is clean, it looks fantastic, it works well, and it even smells good! You want to show all your friends because you are excited.



**Figure 7.1:** When you get something new, you are very excited about it!

This feeling usually lasts for about a few months and then you might start noticing a few problems ...

The same can be true when you get a new computer. The first day you use your computer you will think it's the fastest computer ever. After a few years of installing and uninstalling programs, adding and deleting files on it, getting and removing viruses from it, and generally using the computer, it is simply not as fast as it used to be. This chapter will focus on helping you understand the challenges of maintaining a computer throughout its life span.

## 7.1 Computer management tasks

In this unit you will learn about several different computer management tasks. These tasks include clearing up storage space, updating software, and increasing the capability of your computer by installing new software and hardware. You will also learn how to change the key settings of your computer.

### COMPUTER MANAGEMENT

Computer management is a process of managing, monitoring and optimising your computer's functionality to best serve your needs. This process could include improving and maintaining the security features, performance, and reliability of your computer.

### THE PURPOSE OF COMPUTER MANAGEMENT TASKS

So, how can you keep your computer running smoothly? Let's quickly look at key tasks that you can do to ensure your computer remains fast, reliable and secure:

- Managing your desktop
- Managing files and folders
  - freeing storage space
  - compressing files and folders
  - updating your software
  - backing-up your files
  - scanning for viruses and malware
  - checking your hard disks.

To keep your computer running effectively, you need to ensure that you have enough free storage space available. If not, you might not be able to create new files or install new programs.

The majority of programs also automatically create temporary files and folders when you run them. Without enough free space, these programs cannot create the temporary files they need, and this will cause the files to crash or have error messages. The operating system uses some of your hard drive space as virtual memory. This will allow the operating system to operate more smoothly – therefore without any free space, your computer will slow down noticeably.

We will look at two ways of identifying files that can be deleted or moved to a different device to free space by:

- automatically identifying files and folders to delete
- manually identifying files and folders to delete.

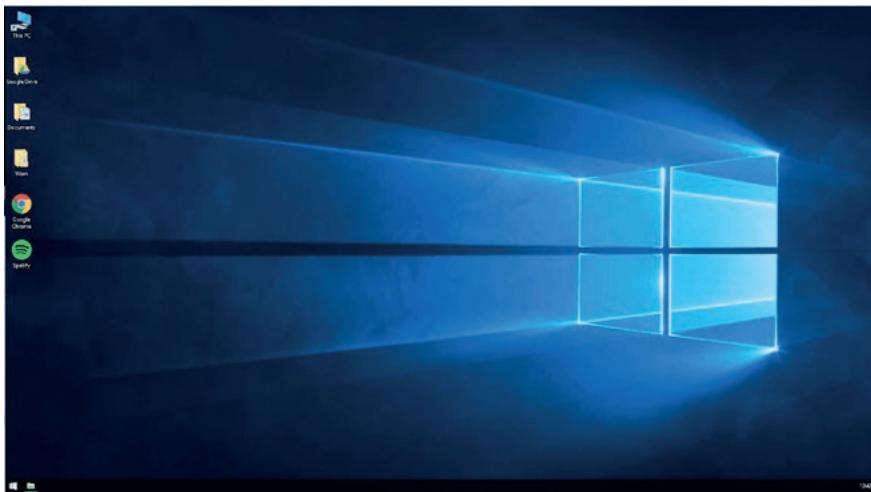
All the tasks discussed form part of good computer management practices.

### MANAGING A DESKTOP

The desktop refers to the most basic element of a personal computer's GUI (Graphical User Interface) and is what you see on your screen after the computer boots up.

It is a special folder in the file system that is shown when no other windows are open and can consist of a wallpaper as background, icons, and your most frequently used files.

When you copy items to your desktop, or delete them from your desktop, you are simply deleting them from this folder.



**Figure 7.2:** A computer desktop with a few important shortcuts

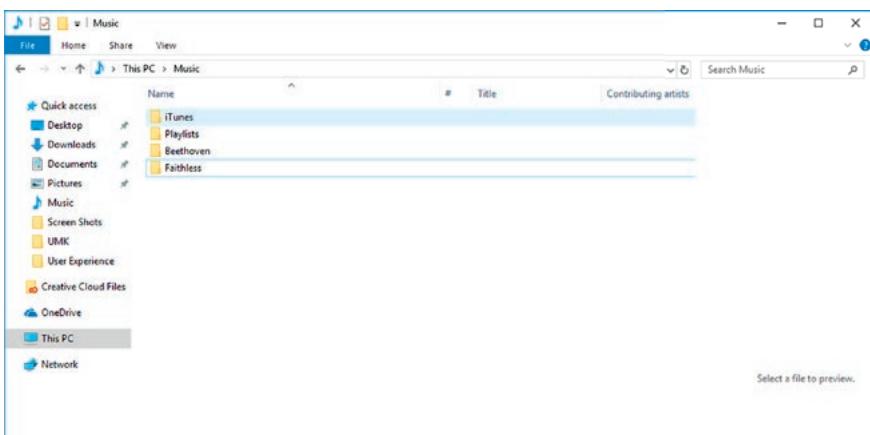
If you need to keep your desktop well organised, you can use the following guidelines:

- good practice is to use the desktop as a temporary storage area and do not copy, move or store files here for a long time.
- create shortcuts on your desktop to your applications and folders.
- delete application shortcuts that are not used.

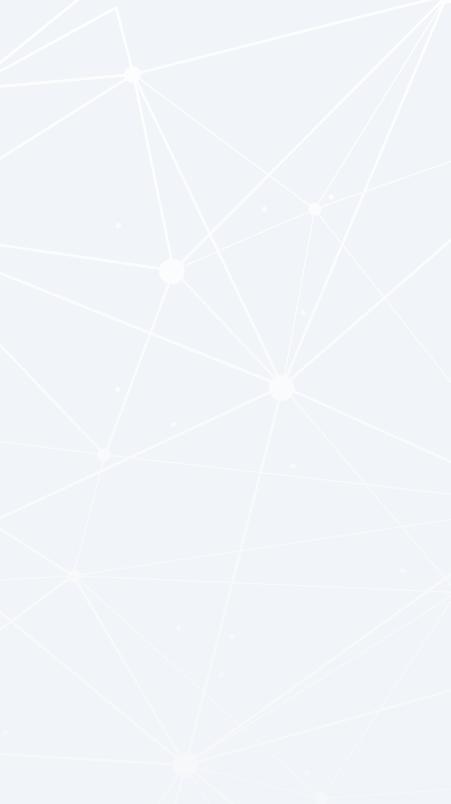
## MANAGING FILES AND FOLDERS

File management on a computer is similar to filing documents in a filing cabinet. A filing cabinet is used to store paper files in cardboard folders. In the same way, we can store files and folders on a computer electronically.

The figure below shows the ‘This PC’ folder with the sub-folders ‘Music’ and ‘Playlists’. These folders contain files that are organised according to the name of the folder. This is to give you an idea of how file management looks on a computer. In a Windows program, folders are used to organise files.



**Figure 7.3:** Folders used for file management



### EXPLAINING COMPUTER FILES AND FOLDERS



<https://www.youtube.com/watch?v=hUW5MEKDtmM>

<https://qrs.ly/wnab20p>

Folders are stored on a drive in a computer. A **disk drive** is an important component that helps you store and retrieve data from the computer. Each drive will indicate the type of storage, this was discussed in Chapter 2, as well as directory trees and some aspects of file management.

## GENERAL HOUSEKEEPING TASKS

### 1. DISK-CLEAN-UP

- Disk clean-up is a computer maintenance utility designed to free-up storage space on a computing device. It safely identifies and removes temporary files that are no longer needed in order to free up storage.

### 2. SCHEDULING AND UPDATING

- You can use a task scheduler to create and manage common tasks that your computer will carry out automatically at a time you specify, for example, you can schedule your computer to run a software update or make a backup at a specific time.

### 3. ARCHIVE AND BACKING-UP

- Archiving is the process of moving data that is no longer actively used to a separate storage device for long-term retention, however, this data is not duplicated. Archived data consists of old data that remains important and is retained for future reference.
- Creating a back-up is the process of making copies/duplicates of data, then storing it on a different device in a different geographical location. You are then able to retrieve the data in the event of the data on your PC being lost or destroyed.

### 4. COMPRESSION AND DECOMPRESSION

- File compression is a process that makes use of advanced algorithms and mathematical formulae to decrease the amount of disc space used by big files.
- Decompressing a file is a method used to extract the compressed file back to its original form and size using the same algorithms or mathematical formulae.

### 5. SECURITY FEATURES

- A firewall is a network utility that prevents unauthorised network connections to and from your computer. This means that only the applications you allow on your computing device can send or receive data from and to the internet.
- Antivirus is a software programme that is designed to prevent, search, detect and remove malicious software (Malware) from your computing device.
- Control of Spyware – Spyware is a piece of code that hides on your computer and tracks all your activity without your knowledge. You can control Spyware by activating the pop-up blocker on your browser settings or by installing an anti-spyware software application.
- Adware is a type of Malware that presents unwanted advertisements to the user in the form of pop-up or an ‘unclosable window’.



### DATA COMPRESSION AS FAST AS POSSIBLE



<https://www.youtube.com/watch?v=guo8if4Yxhw>

<https://qrs.ly/wwab20k>

## 6. INSTALLING AND UNINSTALLING SOFTWARE

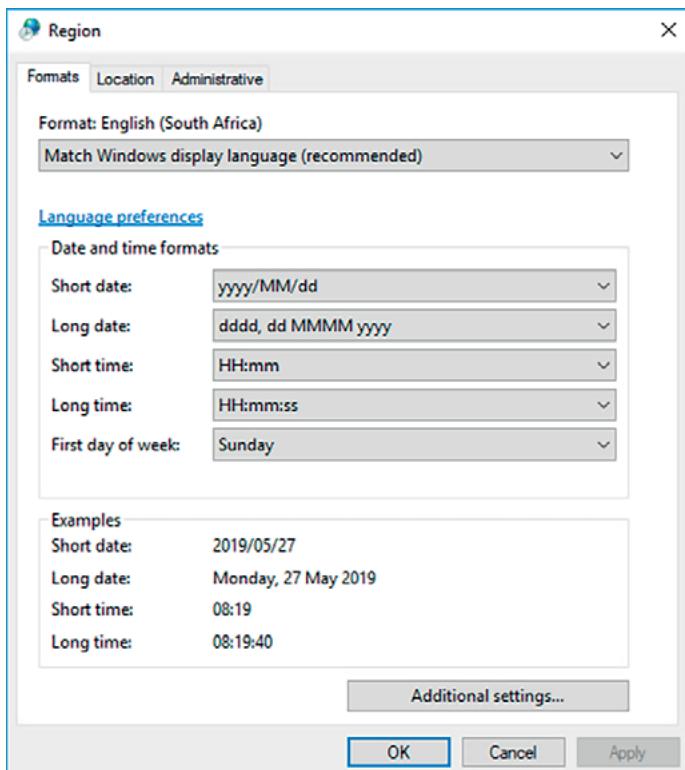
- All installed applications used on your computing device are managed by the operating system. These applications may be used to view images, play videos or run tasks on your computing device. There are different ways of installing software: custom and default installations.
  - A custom installation will allow you to see and select parts of the software you want to install.
  - A full installation (default) will select all parts of the software and install it on your computing device.
- Some applications may give you a unique product key or activation code once you purchase the application. The installer will then request this product key before allowing you to install the application.

## 7. DEFRAAGMENTATION

The disk defragmenter is a built-in utility in Microsoft Windows. When you have been installing and uninstalling applications over time, as well as creating and deleting files, the files on your computer can become fragmented. Files are not stored in one piece, but are broken up into segments of a specific size. When the disk starts running out of space, the parts of a file can not be stored next to each other on the hard disk. Instead they are stored wherever there is a space available. When you want to open the file it will take time to read the bits of the file from the fragmented locations on the hard disk.

## SYSTEMS SETTINGS AND PROPERTIES

- **Regional settings:** Your Microsoft Windows regional settings will influence how your date/time, numeric, and currency data types appear when you apply formatting options. Click on the *Formats* tab under Current format.

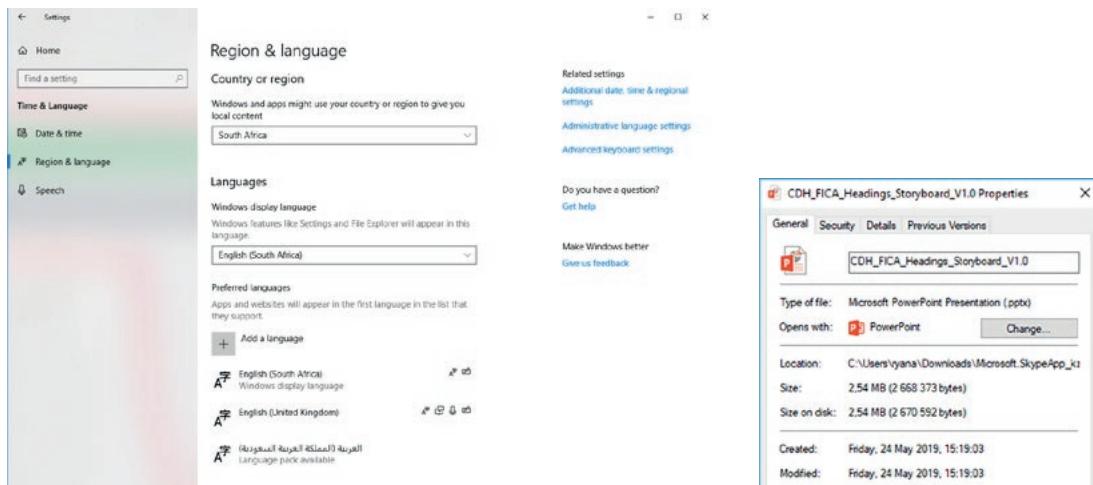


### HOW TO UNINSTALL PROGRAMS



<https://qrs.ly/8aab20q>

- **Language settings:** To access your language settings, click Language, then Region. Then click Regional and Language Options. The Regional and Language Options dialog box will appear.



- In general, **properties** are the settings of an object on a **computer**. For example, you could right-click highlighted text and view the **properties** of that text. The **properties** of a font or text could be the font size, font type, and colour of the text.

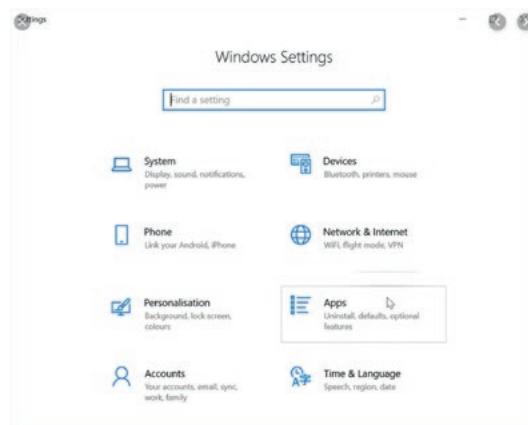


## Activity 7.1

- 7.1.1 The directory system of a computer is an inverted tree. Explain what this means.
- 7.1.2 Draw an example of a hierarchical tree using the file and folder structure on your own computer. Show how you would address a particular file in the structure you have drawn.
- 7.1.3 Explain how this hierarchical structure makes it easier to store a file on the computer so that it does not get lost.
- 7.1.4 Sometimes we forget the 'obvious' folder that we stored a file in. What tool is provided in order that we may find it?
- 7.1.5 Looking at the picture answer the following questions.

**Note:** Do not use the 'Find a setting' search option.

- a. What does the image show?
- b. If you want to change your password, where would you go?
- c. Where would you go to increase the text size of applications on your computer?
- d. Where would you go to change the time on your computer?
- e. Where would you go to uninstall a program?
- f. If you wanted to change your firewall's setting where you would go.
- g. Where would you go to change the brightness of your screen?



- 7.1.6 Work on your own to answer the following questions.

- a. Name three locations where you can change your system settings in Microsoft Windows 10.
- b. What is the difference between these locations?
- c. Which method will you use to change your system settings? Why?

- 7.1.7 There are four housekeeping activities that are necessary to keep your computer working efficiently. Answer the following for each housekeeping activity:

- a. Name the process.
- b. Describe how to invoke the process.
- c. Describe what it does.
- d. Why is this necessary?

**CONSOLIDATION ACTIVITY****Chapter 7: Computer management**

1. Which of the following is NOT a system you can use to change your computer's settings:
  - a. Control panel
  - b. Properties
  - c. Search
  - d. Windows settings
2. Which of the following is NOT a good reason to delete a file:
  - a. It is large
  - b. It is redundant
  - c. It is not needed
  - d. It is infected with a virus
3. Which of the following programs can be uninstalled if your computer's hard drive is full:
  - a. The operating system
  - b. Pre-installed software
  - c. Antiviruses
  - d. Applications you installed
4. If software on your computer stops working properly, which of the following could fix it:
  - a. Uninstalling the program
  - b. Updating the program
  - c. Defragmenting the hard drive
  - d. Installing a driver
5. Which of the following is NOT a technique that can be used to backup data:
  - a. Using Windows Backup
  - b. Copying files to a memory card
  - c. Using Cloud storage
  - d. Moving files to an external hard drive
6. When Philip connected his new keyboard to his laptop, it did not want to work. What do you think the problem is?
  - a. He needs to install its drivers manually.
  - b. He needs to free up space on his computer.
  - c. He needs to change his system settings.
  - d. He needs to scan it with his antivirus.
7. When copying and pasting files from a computer to create a backup, which of the following can be done:
  - a. Delete the original files.
  - b. Copy the files on the computer's hard drive.
  - c. Organise the files on the external storage.
  - d. Move the files to external storage.

8. Indicate if the following statements are 'True' or 'False'. Choose the answer and write 'true' or 'false' next to the question number. Correct the statement if it is FALSE. Change the underlined word(s) to make the statement TRUE where necessary.
- The Disk clean-up tool can be used to delete files **manually**.
  - Defragmentation** is when the parts of a program are not stored next to each other.
  - Archiving** can be used to reduce the size of a file.
  - Adware is usually installed on your computer when you do a **custom installation**.
  - Uninstalling** an application removes it and its files from your computer.
9. Choose a term/concept from COLUMN B that matches a description in COLUMN A. Write only the letter next to the question number (e.g. 1–A)

COLUMN A	COLUMN B
1. A set of instructions that tells your operating system how to communicate with a specific piece of hardware.	A. Compression
2. Utility software that can be used to prevent unauthorised network connections to your computer.	B. Automatic installation
3. Software that gets installed as part of a different program's installation.	C. Defragmentation
4. Extracting the files from a .7z file.	D. Firewall
5. Grouping many files and folders together into a single file so that you can save space on your hard drive.	E. Decompression
6. When your computer automatically installs the software needed to operate a connected piece of hardware.	F. Disk Clean-up
7. When your computer shuffles the files on your hard disk so that your computer can perform faster.	G. Manual installation
8. A program that automatically identifies files that are good to delete.	H. Fragmentation
9. Using the store compression method to group multiple files together.	I. Archiving
10. An application used to change your system's settings.	J. Adware
	K. Control Panel
	L. Optimise Drives
	M. Device Manager
	N. Driver

- Give an example of a tool that can remove adware.
- Explain how you activate your firewall.
- List THREE types of hardware you can create backups on.
- Waldo is a graphic designer and has recently bought a new Desktop PC. Since he creates content for many important clients, Waldo must make sure that he creates a management system that allows him to manage, protect, and control his computer and its files.
  - Mention TWO things Waldo can do to make sure he can locate files on his computer easily.
  - Waldo does not have much space on his hard drive as he does not do any housekeeping tasks. List and describe four ways he solve this problem.
  - Suggest THREE things Waldo can do to protect his clients' work from cybercriminals.
  - How regularly do you think Waldo should make backups? Give TWO reasons for your answer.
  - Waldo tells his friend that he is going to defragment his hard drive to gain disk space. Criticise this statement.
  - Waldo employs a new assistant that has problems reading text clearly. Where can he go to adjust the settings on the computer to assist the new employee?
  - Waldo only has a little bit of money left over from his computer budget. What should he rather spend money on – a good anti-virus system or a firewall? Substantiate your choice.

# THE INTERNET AND WORLD-WIDE WEB

## CHAPTER OVERVIEW



- Unit 8.1 The internet and World-Wide Web
- Unit 8.2 Browsing and searching
- Unit 8.3 Social issues



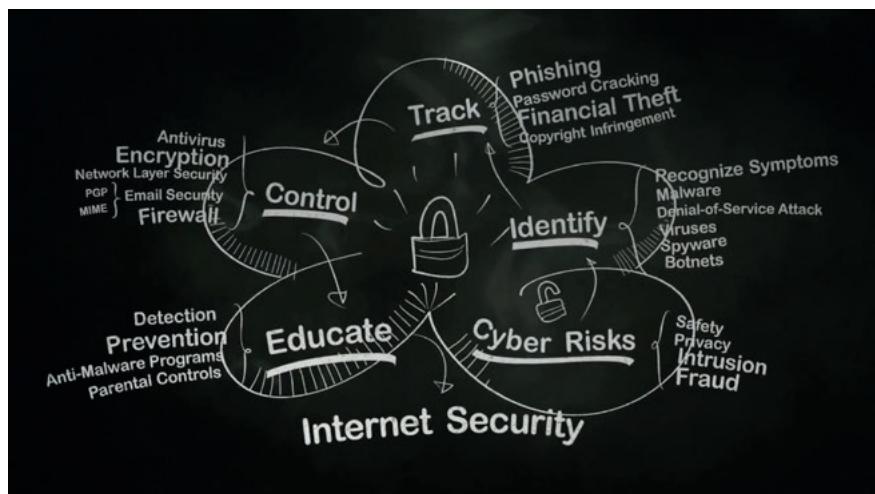
## Learning outcomes

At the end of this chapter you should be able to:

- describe and give an overview of the internet
- explain what is needed to connect to the internet
- describe and give an overview of the World Wide Web
- describe and explain social issues with the internet
- understand the functions of browsing and searching.

## INTRODUCTION

In the previous chapters you have learnt a lot about the internet and the different types of networks, the networking equipment and some of the electronic communications that uses the internet.



## 8.1 The internet and world-wide web

The internet is the world's largest WAN and is made up of various nodes that connects via communication media all over the world. This allows all nodes to connect and communicate with one another. It also allows for various services, such as the world wide web and email to be hosted over or work on the internet.

### INTERNET ADDRESSES

Each day there are over a billion emails and search requests sent over the internet. But how does the data know where to go? How do we make sure that the data goes to the intended receiver and the correct destination?

Every computing device that is connected to the internet receives a unique address, much like your street address. This address is called, an internet protocol address or IP address. Whenever a message is sent over the network, it is sent to a device's IP address. The most common type of IP address is known as an IPv4 (internet Protocol Version 4) in which each number can range between 0 and 255, and is represented by 1 byte (or 8 bits) of information. The IP address is made up of four sets of these numbers, separated by dots. This is shown in Figure 8.1 alongside:



#### IP ADDRESSES EXPLAINED



[https://www.youtube.com/watch?v=7\\_-qWlvQQtY](https://www.youtube.com/watch?v=7_-qWlvQQtY)  
<https://qrs.ly/5jab20r>

My IP Address Is:  
**IPv4: 197.98.0.86**  
 IPv6: Not detected



Figure 8.1: An IP address graphic

IP addresses are difficult to remember. For example, an IP address for Facebook could be 185.60.219.35, while an IP address for Google could be 216.58.223.3. To make it easier to find a specific website or, websites make use of domains.

A domain is a unique name that may be linked to an IP address. A domain name is the part of a network that identifies itself as belonging to a particular person or company, for example, the SABC, SARS, and so on.

### INTERNET CONNECTION

In order to connect to the internet, you need to have an internet service provider (ISP). The ISP will charge you a fee and in return, permit your device to use their network to connect to the internet. Most ISPs may also offer to help clients set-up internet services connections as part of their service offering.

## INTERNET SERVICE PROVIDERS (ISPS): WIRED AND WIRELESS CONNECTIONS

ISPs can provide you with either a wired or a wireless connection to the internet. In most cases, your ISP will provide you with the hardware you need to connect to the internet. However, if this is not part of their service offering, you will need to ensure you have the following hardware equipment:

- a computing device
- the internet connection channel
- an internet communication device.

The table below summarises the hardware needed for the different types of internet.

**Table 8.1:** Equipment needed for the different types of internet

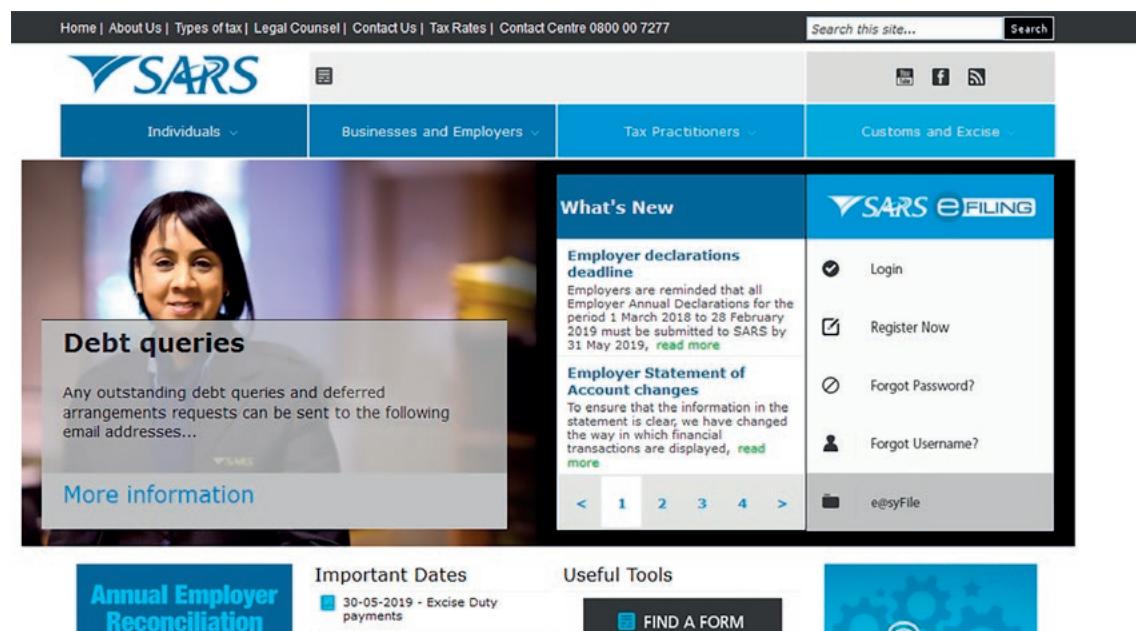
	DSL/FIBRE	3G, 4G & LTE / WI-MAX, WI-FI
Computer	Any node	Any node
Channel	Active telephone line Active DSL enabled on the telephone line/ Active fibre connection	Wireless, so no physical channel is needed
Communication device	Router plus an ONT (optical network terminal) for a fibre connection	A mobile router

## THE WORLD WIDE WEB

The world wide web (WWW) is a collection of websites that you can browse or access through the internet using a web browser. If you think about the IP address as a company's physical address, a website on the WWW will be that part of the company that customers can see.

### WEB ADDRESSES AND THE ADDRESS BAR

Each webpage on the internet has its very own address called a uniform resource locator (URL), which indicates to the internet exactly what page you want to see on a website. When you type a URL in the address bar of the web browser and press ENTER, the browser will take you to that specific page. For example, in the figure below, we typed [www.sars.gov.za](http://www.sars.gov.za) in the address bar, which then loaded the South African Revenue Services (SARS) webpage.



**Figure 8.2:** Typing in a URL in the address bar

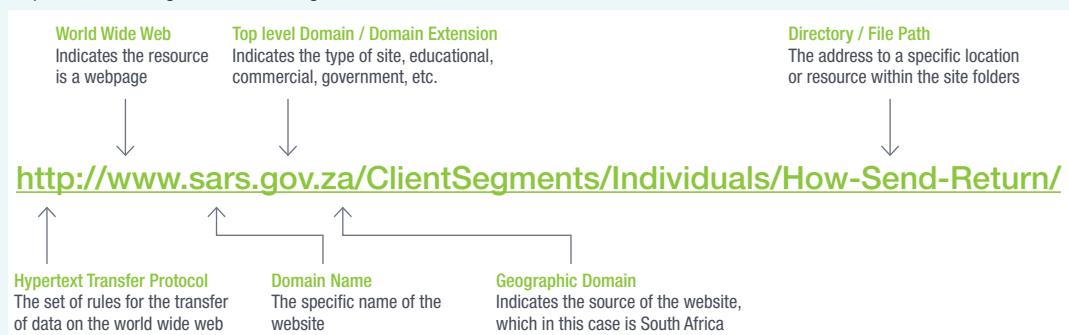
In the following example, you will learn more about URLs.

### Example 8.1

Each segment in an URL is a part that makes up the web address.

The **domain name** is the most important part of an internet address. This could be a word or a phrase that an internet site has identified as the name of the website. People use it to find information on the internet, for example businesses use it to get people to visit their websites.

<http://www.sars.gov.za/ClientSegments/Individuals/How-Send-Return/>



**Figure 8.3:** The different parts of a URL

A webpage is a single page of a website. Hypertext mark-up language (HTML) is a type of coding language used on a webpage that enables the display of text, multi-media and other interactive content. The web browser is a piece of software that can interpret the HTML code and display the content as we see it on a webpage. A website consists of a collection of many of these HTML-coded webpages that are connected together. When you have accessed a secure website you will see that the http prefix has changed to https. You should check for this before making any electronic payments online.



### Activity 8.1

- 8.1.1** In your own words, define the internet.
- 8.1.2** What have you personally used the internet for?
- 8.1.3** What is an IP address?
- 8.1.4** Is the IP address the same on all devices? Give a reason for your answer.
- 8.1.5** Why do computers have IP addresses?
- 8.1.6** Explain the use of a domain name.
- 8.1.7** Tabulate and compare the equipment you need to access the internet for fibre and 3G.
- 8.1.8** The URL for New York Public Library is: <https://www.nypl.org/events/programs/2019/08/03/create-website-html-and-css>
  - a.** Identify the three key elements of a URL.
  - b.** Using the information in the URL, explain what information could be displayed on the webpage.
  - c.** Is this a secure site? Explain.
- 8.1.9** What does the following URL tell you? <http://publicdomaintorrents.info/nshowcat.html?category=animation>

## 8.2 Browsing and searching

In this unit, you will learn about browsing and searching the internet.

A browser is an application designed specifically to access and display webpages, including the webpage's content such as text, images and videos.

### EXAMPLES OF WEB BROWSERS

The five most popular web browsers are:

- Google Chrome
- Mozilla Firefox
- Microsoft Internet Explorer
- Microsoft Edge
- Apple Safari.

### ACCESSING A WEB BROWSER

In order to open your web browser, select your web browser icon (Any of the listed browsers). Once your browser is open, you need to decide which website you would like to visit. This is done by either:

- **browsing** to the correct website
- searching for the correct website.

The next section will show how the different methods of browsing can achieve the same results – they may just be easier or more difficult to use.

#### BROWSING

When you browse a website, you need to know its unique web address (such as <https://en.wikipedia.org> for the Wikipedia website). Once you know the address, you can visit the website as follows:

**Step 1:** Open your web browser.

**Step 2:** Enter the website's address or URL in the address bar at the top of your browser.



**Figure 8.4:** Enter the web address in your browser's address bar

● HOW DO WEB  
BROWSERS WORK?



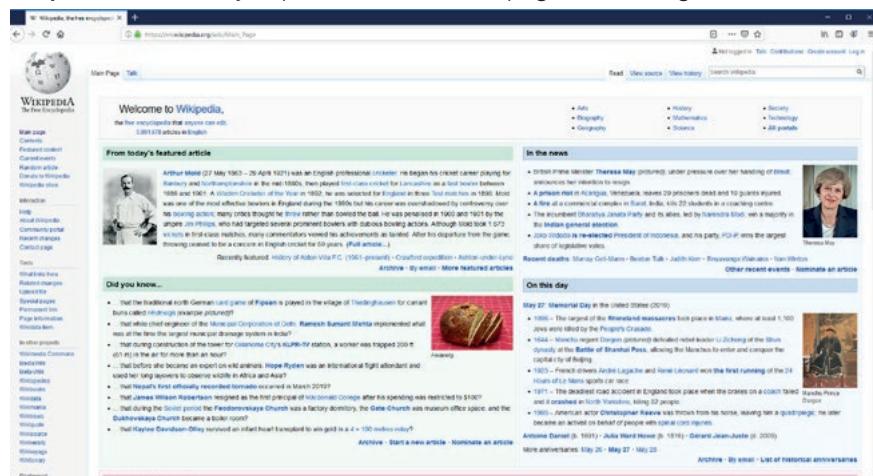
<https://www.youtube.com/watch?v=WjDrMKZWct0>  
<https://qrs.ly/8jab20s>



### Did you know

Anything on a website can be a link. Whenever your cursor moves over a link, the cursor will change from an arrow to a small hand.

**Step 3:** As soon as you press *Enter*, the webpage should begin to load.



**Figure 8.5:** The Wikipedia home page

**Step 4:** Once loaded, you can browse the website by clicking on buttons, links or following the instructions on the page.



### THE INTERNET: HOW SEARCH WORKS

[https://www.youtube.com/watch?v=LVV\\_93mBfSU](https://www.youtube.com/watch?v=LVV_93mBfSU)

<https://qrs.ly/d2ab20u>

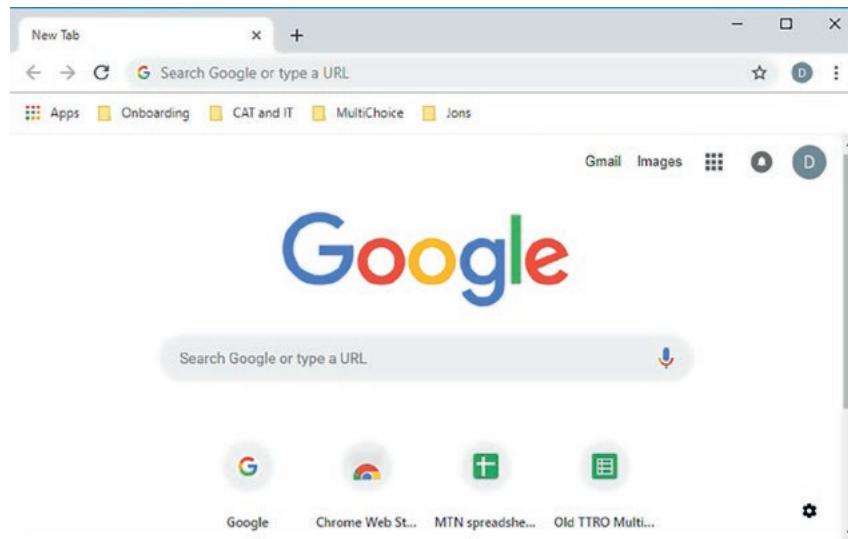
## SEARCH ENGINES

**Searching:** you may want to search the internet for specific answers or try to find new, interesting websites to explore. To do this, you can use a search engine to find the information you are looking for.

Two popular search engines are:

- Google ([www.google.com](http://www.google.com))
- Microsoft Bing ([www.bing.com](http://www.bing.com))

Google is the most popular, powerful and easy-to-use search engine of the two. In fact, Google's search engine has become so well known that 'to Google something' has become a verb that means to search for something. In future, if someone asks you a question that you do not know the answer to, you can tell them to just 'Google it'.



**Figure 8.6:** Google is the most popular search engine in the world

Microsoft's Bing search engine is also a very popular English search engine and this is all thanks to its integration with Microsoft Windows.

In order to search for information on the internet, enter the search engine's address in your address bar. Once the search engine loads, there will be a space on the page for you to enter your search criteria. For example, if you want to find a website to teach you how to play the guitar, you may search for the phrase 'learn to play guitar' and press *Enter*.



#### Did you know

Your web browser will search for any information you enter the address bar that is not a web address. For example, if you type 'Learn to play guitar' into the Google Chrome or Bing address bar, the search-engine will search for websites that teach you how to play guitar. These pages will be ranked with 'most popular' first.

**Figure 8.7:** Search results for the phrase 'learn to play guitar'

As the figure above shows, the search engine found 280 000 000 webpages that can teach you how to play the guitar! By clicking on one of these links, the search engine will take you to the specific website you selected. The search results displayed to you will include images, videos, maps, shopping, books, music and so forth. The results all depends on the type of information and format that is available on the search engine.

### SEARCH TECHNIQUES

Search engines search through billions of webpages stored on hundreds of millions of websites to find information matching your search. Most search engines try to place the best options near the top of the search results, with the results becoming worse as you move to the second and third pages.

Since the first search results are usually the best, if you do not find what you are looking for on the first page or two of the results, you should try a different search phrase or try to use an advanced search technique.



#### Did you know

While the first result is usually the best result, companies can pay search engines to have their website advertised above the first search result. While these advertisements can look like a normal search result, they will always be marked as an advertisement or promoted search result.

The table below highlights a few of the most useful search techniques.

**Table 8.2: Search techniques**

PURPOSE	METHOD	EXAMPLE
Search for a specific type of webpage	Once you have made a Google Search, click on the <i>Images</i> , <i>News</i> , <i>Videos</i> or <i>Maps</i> button to search for those items.	Search: <i>Leonardo DiCaprio</i> Click on <i>News</i>
Search for webpages updated at a specific time	Once you have made a Google Search, click on the <i>Tools</i> button. Click on <i>Any time</i> then select the period you are looking for.	Search: <i>Leonardo DiCaprio</i> Click on <i>News</i> Click on <i>Tools</i> Click on <i>Any time</i> Select <i>Past 24 hours</i>
Search for results that exactly match your query	Place quotation marks around the keywords you would like to match exactly.	Search: 'fastest animal'
Exclude certain words from your search results	Add a minus symbol before any words you specifically do not want to see in the search results.	Search: 'fastest animal' -cheetah
Search for results from a specific website	Add the phrase 'site:' followed by the website to your search query.	Search: 'fastest animal' site: youtube.com
Search on social media	Add the name of the social media website after the @ symbol in your search query.	Search: 'fastest animal' @twitter

These techniques can be very useful. However, thanks to improvements in search engines, you should generally find the information you are looking for without requiring any additional techniques. When you find a website that you would like to use again in the future, you can bookmark the URL. This will place it on a favourites list in the web browser for easy access in the future. In Google Chrome and Edge you simply click on the star shape to the right of the URL in the address bar to create a bookmark.

## THE WORLD WIDE WEB CONSORTIUM

The World Wide Web Consortium (shortened to W3C) is the organisation that is responsible for setting standards for the world wide web. By following the W3C standards, web designers can ensure that their webpages display correctly on any browser. This also helps computers to do more useful work over the world wide web.



### Activity 8.2

**8.2.1** Which of the following is an example of a web browser?

- a. Mozilla Firefox
- b. Google
- c. Linux
- d. Microsoft Outlook

**8.2.2** When you are looking for interesting websites to explore, you use a \_\_\_\_\_ to find the answer.

- a. browser
- b. bookmark
- c. search engine



## Activity 8.2 *continued*

- 8.2.3** Which of the following is NOT an example of a search engine?
- Google
  - Google Chrome
  - Microsoft Bing
- 8.2.4** The first result found is always the best result.
- True
  - False
- 8.2.5** What is a web browser?
- 8.2.6** If you are looking for something specific on the WWW, how do you decide which website you would like to visit?
- 8.2.7** How do you know that something on the webpage is a link to another website/page?
- 8.2.8** What do you do if you want to search for webpages that were updated within a certain time?
- 8.2.9** What do you do if you want to search for results that exactly match your query? Give an example.
- 8.2.10** What do you do if you want to search on social media?
- 8.2.11** For this activity, you will need a computer with access to the internet.
- Use the following URLs to browse the internet. Give at least two examples of what you found on each website.
    - <https://www.conservationinstitute.org/10-fastest-animals-on-earth/>
    - <https://www.pcgamer.com/new-games-2019/>
    - <https://www.livescience.com/33316-top-10-deadliest-natural-disasters.html>
  - Using any search engine, find at least two websites per topic and write down their URLs:
    - the biggest spider
    - the best rapper in South Africa
    - artificial intelligence.
- 8.2.12** For this activity, you will need a computer with access to the internet. Using web searches, find answers to the following questions:
- What is the second fastest mammal in the world?
  - On what day was the first telephone call made?
  - Who is the richest person in the world and what is his or her job?
  - Which film made the most money of all time?
  - How old would Nelson Mandela have been today (in years)?
  - Which YouTube channel has the most subscribers?
  - Which YouTube video has the most views?
  - How tall is Mount Fuji?
  - How many people live in South Africa's largest city?
  - Which artist has sold the most albums?
- Once you have found the answers, your teacher will share the correct answers with the class.  
Did you get them all right?
- 8.2.13** Based on the previous activity, discuss the following topics:
- Why did different people get different answers?
  - Were the websites with inaccurate answers incorrect, outdated, or did they answer a different question?
  - Were any of the teacher's answers incorrect or outdated?
  - How do you think people kept up to date with information before the internet?

## 8.3 Social issues

In this unit you will learn a bit more about the different types of security threats. You will also learn how you can protect yourself from these threats when browsing the internet and opening emails.

We use computers and smartphones to do just about anything. This ranges from transferring money through online banking to getting ID documents and passports. As a result, if someone can gain access to a person's computer and password, they can gain access to their bank account, identity and their photos. They can also use their computer to send spam emails and add unwanted advertisements. Because of this, computer users need to understand the basics of computer malware (malicious software) and know how to use computers and the internet safely.



**Figure 8.8:** Hackers can steal your money

### FAKE NEWS

Never react to any news until you have checked it against at least one other reputable news site, and remember to never share fake news, not even as a joke! False news stories, which are often of a sensational nature, are created to be widely shared online for the purpose of generating ad revenue via web traffic or discrediting a public figure, a political movement, a company, a fringe organisation and so forth. In order to spot fake news, you need to understand what real news looks and sounds like. Getting into the habit of visiting trustworthy news sites is one way to become familiar with real news.

### TYPES OF THREATS

Not all types of computer threats work in the same way or have the same goals. The table below lists some of the most common threats in the world today, as well as the best way to avoid them.

**Table 8.1:** The most common threats

TYPE	DESCRIPTION	PROTECTION
Virus	A computer virus is any program that infects a user's computer and acts in a way that will harm the user without the user's knowledge.	Keep your software up to date, especially your antivirus software. Do not install or run any programs you do not know or trust. Do not download executable (.exe) email attachments. Run a virus scan on any flash disk that you do not know, before using it.
Spam	Spam is probably the most common problem on the internet. Spam refers to irrelevant, unsolicited emails sent over the internet, typically to many users. Spam emails are often used for advertising, phishing and spreading malware.	Use an email provider with a strong spam detection tool. Do not open emails from suspicious email addresses or with suspicious messages.

Type	Description	Protection
Hoaxes	Hoaxes are false reports deliberately changed to look like they are true. One example of a hoax could be an email claiming that you have won a million rand in a competition, even when you never entered any competition. The email asks you to enter your banking details with your secure pin and login details.	Be aware of any social events, such as, April Fool's Day so that you are able to identify a hoax. Make sure any communication you receive is true by looking at legitimate news sites or by validating any communication that sounds too good to be true.
Email spoofing	With email spoofing, the attacker forges the address from which the email is sent to pretend that the email is sent from a different person. For example, the attacker might send emails to your friends and family with an urgent request for money while providing their own banking details. By forging the email address, this email will look as if you sent it.	Never send sensitive information such as usernames and passwords over email, even to email addresses you know. Be cautious when receiving suspicious emails from friends or family members. If you receive a suspicious email from a friend, speak to them about the email in person (or telephonically) before acting on the email.
Phishing	Phishing attacks try to obtain sensitive information (such as usernames, passwords and banking details) by sending emails to users that look like official emails. This is often used with email spoofing to convince victims that the email is from a legitimate source.	Never send sensitive information such as usernames and passwords over email. No company will ever ask for this information via email or phone. Make sure the email address and domain name are correct for any email that looks suspicious.
Pharming	Pharming attacks create an official-looking website that requests sensitive information. A very common pharming attack allows users to 'change' their passwords. Instead of changing their passwords, the user's username and password is recorded and their account is taken over.	Do not follow any links to change your password, unless you requested the password change. Verify the domain name and web address of any website that requests sensitive information.
Ransomware	Ransomware is a particular kind of malware that encrypts the data on your computer. You then receive an instruction to pay a certain amount in order for your data to be unlocked. The ransomware is usually activated by clicking on an email attachment.	Never open attachments that you are not expecting even if it appears to come from someone you know. Make regular backups of your data. The backups must not be on your computer, but in a remote location such as an external drive or cloud drive.
Adware	Adware is mostly in the form of annoying pop-ups that appear randomly when using your web browser. The pop-ups contain advertisements. The advertisements relate to your online behaviour. Adware may be used to track your online habits to target you with adverts. Adware may be used to track your online habits to target you with adverts and usually installs without your knowledge.	Take care which websites you visit and beware of tempting links that appear on less reputable websites.

## SAFE EMAIL AND INTERNET USE

In order to avoid threats, computer experts suggest following these guidelines:

- use a secure password
- pay careful attention to the websites and links you open
- do not share your sensitive information unnecessarily
- do not open suspicious emails.

## ETIQUETTE FOR E-MAILS

Netiquette is short for network and e-mail etiquette. Netiquette refers to the use of good manners when communicating electronically or when using the internet, whether it is in the workplace or on a personal level. This includes respecting other people's privacy.

Look at the following guidelines to practice good netiquette:

- **Messages:** Do not spam people at work, your friends or family with unwanted e-mail messages or chain e-mails. Spam is unwanted or irrelevant messages that are sent over the internet or through e-mails.
- **Concise:** Make sure that when writing e-mails, it is clear and to the point. Also make sure that it does not contain spelling and grammatical errors.
- **Subject line:** Make sure the subject line is clear so that the recipient knows what the e-mail is about.
- **Identify yourself:** Always say who and what you are at the beginning of the e-mail and add your signature at the end of the mail.
- **Action required:** Let the recipient know right away if any action is required from their side. You can do that by marking e-mails that do not require any action with FYI in the subject line.
- **Capital letters:** Do not type e-mails in capital letters as it gives the recipient the idea that you are shouting.
- **Exclamation marks:** Avoid using exclamation marks or use them sparingly. The use of exclamation marks sends a message to the recipient that you are demanding.
- **Large attachments:** Compress large files before sending them. This helps the recipient to save time instead of waiting for a long time to download files. You can always ZIP or compress files (as learnt in Chapter 5) to make it easier to send.
- **Gossip, inflammatory remarks and criticism:** Avoid gossiping about others through e-mail, especially at the workplace. Also, do not send insulting, abusive or threatening e-mails. You cannot withdraw such an e-mail and it can easily be forwarded to unintended recipients. This could lead to unnecessary disputes and grudges in the workplace and in your personal environment.
- **Focus on what is in the e-mail:** Make sure that you read the e-mail properly and address the sender's questions.
- **Proofread the text:** Before sending the e-mail, read through it again to make sure that it is saying what you want it to say and that there are no spelling and grammar mistakes.



## 10 TIPS TO PROTECT YOURSELF ON THE INTERNET



<https://www.youtube.com/watch?v=X6mkV9F6ak>  
<https://qrs.ly/3oab20v>



## EMAIL ETIQUETTE



<https://www.youtube.com/watch?v=dxAuQHMtX5c>  
<https://qrs.ly/m2ab20x>



### Activity 8.3

- 8.3.1** Indicate whether the following statements are TRUE or FALSE. Write 'true' or 'false' next to the question number. Correct the statement if it is FALSE. Change the word(s) in bold text to make the statement TRUE. You may not simply use the word 'NOT' to change the statement. NO mark will be awarded if only FALSE is written down.
- A **virus** is any program that infects a user's computer and acts in a way that will harm the user without the user's knowledge.
  - Phishing** attacks create an official-looking website that requests sensitive information.
  - With **adware**, the attacker forges the address from which the email is sent to pretend that the email is sent from a different person.
  - Ransomware** is a particularly malicious virus that locks all a user's files and encrypts data on the computer.
  - Freeware** is a type of virus that creates unwanted advertisements all over a user's computer.
  - Email spoofing** refers to irrelevant, unsolicited emails sent over the internet, typically to many users.
- 8.3.2** Choose a term/concept from COLUMN B that matches a description in COLUMN A. Write only the letter next to the question number (e.g. 1.1–A). There can be more than one answer to a question. To prevent threats, you must do the following:

COLUMN A	COLUMN B
1. Keep your software up to date, especially your antivirus software.	A. Ransom ware
2. Pay careful attention when installing new applications and make sure you read the instructions carefully.	B. Phishing
3. Never send sensitive information such as usernames and passwords over email, even to email addresses you know.	C. Virus
4. Do not follow any links to change your password, unless you requested the password.	D. Spam
5. Do not open emails from suspicious email addresses or with suspicious messages.	E. E-mail spoofing
6. Make sure the email address and domain name are correct for any email that looks suspicious.	F. Adware
7. Do not install or run any programs you do not know or trust.	G. Pharming

- 8.3.8** List the steps you can take to keep your internet usage safe in order of importance, according to your opinion. Support your answer.

- 8.3.9** In 2014, photos were obtained by a hacker who created an email account called 'Apple Privacy Security' and sent emails to hundreds of celebrities asking to verify their security information. While many celebrities did not respond, those who did provided sensitive security information that could then be used to crack their passwords or change their passwords. Once the hacker had access to the celebrities' Apple accounts, he looked through their personal photos and shared them on the internet.

Based on this case study, answer the following questions.

- List and describe the two hacking techniques the hacker used to gain access to the celebrities' photos.
- How could the celebrities have prevented these attacks?
- The accounts of celebrities who did not provide any sensitive information were still hacked after the hacker successfully guessed the correct password.
  - How could these celebrities have created a better password?
  - Give an example of a more secure password. Note: Do not give your own password!
  - How likely do you think a hacker, who knows everything about you, would be to guess this password?
- How would two-factor authentication have prevented this hack?

**CONSOLIDATION ACTIVITY****Chapter 8: The internet and world-wide web**

Choose the correct answer.

- 1. What is the internet**
  - a. The world's largest wide area network.
  - b. The same as the World Wide Web.
  - c. Both A and B
- 2. What is the URL?**
  - a. It is a domain name.
  - b. It is the unique web address of a webpage.
  - c. It is an internet protocol.
- 3. What is an ISP?**
  - a. An ISP is used to identify the webpage that you would like to connect to when browsing the internet
  - b. An ISP primarily provides a connection to the internet as its main service.
  - c. An ISP is used to allow devices to connect to the internet without using an IP address
- 4. You will need the following equipment to connect via a fibre line to the internet.**
  - a. A computer, router, USB dongle, ONT device
  - b. A computer connected to a router, active telephone line, ONT device
  - c. A computer, an active fibre connection and an ONT device and a router
- 5. Which are the five most popular web browsers.**
  - a. Apple Safari, Google Chrome, Microsoft Edge, Microsoft internet Explorer, Mozilla Firefox
  - b. Mozilla Firefox, Google Chrome, Google, Microsoft Edge, Microsoft internet Explorer
  - c. Microsoft Edge, Microsoft internet Explorer, Microsoft Bing, Google Chrome, Google
- 6. When you place quotation marks around the keywords you would like to match exactly, you are \_\_\_\_\_ ?**
  - a. Searching on social media.
  - b. Searching for results from a specific website.
  - c. Searching for results that exactly match your query.
- 7. The attacker sends emails using your email address to your friends and family with an urgent request for money while providing their own banking details. This is called \_\_\_\_\_ ?**
  - a. Phishing
  - b. Email spoofing
  - c. Spam
- 8. What must you do to avoid safety and security threats.**
  - a. Use a password that is easy to remember but difficult to hack.
  - b. Use two-factor authentication whenever possible.
  - c. Do not download an attachment if you do not know who the sender of the email is.
  - d. All three of the above

**CONSOLIDATION ACTIVITY****Chapter 8: The internet and world-wide web *continued***

9. Choose a term/concept from COLUMN B that matches a description in COLUMN A.

Write only the letter next to the question number (e.g. 1–A). There can be more than one answer to a question.

COLUMN A	COLUMN B
1. This prevents anyone from logging into your accounts using just your username and password.	A. Anti-virus
2. Emails that are often used for advertising, phishing and spreading malware.	B. Ransomware
3. For which specific threat should you run a virus scan on any flash disk that you do not know, before using it.	C. Bookmarks
4. Shortcuts saved in your browser that take you directly to a specific website.	D. Two-factor authentication
5. Your last line of defence against viruses.	E. Bing
6. A particularly malicious virus that locks all a user's files and encrypts data on the computer.	F. W3C
7. Add a minus symbol in the search words	G. Words you do not want to see in the search results
8. This search engine is the second most popular English search engine and is popular thanks to its integration with Microsoft Windows.	H. Spam
9. The organisation that is responsible for setting standards for the world-wide web.	I. Bookmarks
	J. Virus

11. Using your understanding of URLs, see if you can figure out which webpages the following URLs are accessing:

- i. <https://www.google.com/>
- ii. <https://images.google.com/>
- iii. <https://www.google.com/mail>
- iv. <https://www.facebook.com/messages/>
- v. <https://www.google.co.za/search?q=computers>

12. List and describe two search techniques.

13. What are bookmarks?

14. According to the World Wide Web Consortium (W3C), websites should be evaluated according to four criteria.

- a. Who is the W3C and what is their purpose?
- b. Today, most restaurants understand the importance of having a business website that provides users with information on the restaurant, its menu, its specials and any opening or closing times. For example, the website of the popular South African restaurant, Mugg & Bean, can be found at <https://themugg.com/>. Based on this information, answer the following questions.
  - c. A website's address is made up of three key elements. What are they?
  - d. Mugg & Bean's website uses the HTTPS protocol. What is the difference between HTTP and HTTPS?
  - e. Online shops mostly use the HTTPS protocol. Why do you think this is?
  - f. Hackers often try to hack into online shopping accounts.
    - i. Which hacking techniques can they use to hack your account? List and describe how each technique can be used.
    - ii. How can you create a password that is not easily cracked?
    - iii. Can Adware be used to hack into your online shopping account? Give reasons for your answer.

**CONSOLIDATION ACTIVITY****Chapter 8: The internet and world-wide web *continued***

- 15.** Thanks to a new infrastructure in your area, your parents can upgrade your internet from 4Mb DSL to a 100Mb fibre line. However, before they can do that you need to give them some advice first. To do this, answer the following questions:
- Will your parents need to find a new ISP for their fibre internet? Give a reason for your answer.
  - What additional hardware will your parents need for the fibre?
  - What hardware or connections will your parents no longer need for DSL?
  - How will the new fibre internet be connected?
- 16.** After Tsekiso has struggled with a slow mobile internet for a few months, he decides to change his mobile internet service provider. Answer the following questions on internet service providers.
- What is the purpose of an ISP?
  - How can an ISP help you to set up an internet connection?
- 17.** Enrichment activity – this activity is optional.
- Working together with at least one but preferably two classmates, you need to do research on internet options available to you, before presenting your findings to the class. To do this, decide what speed internet and how much data you would need if you shared the internet with each other.
- Do research on different internet packages that can satisfy your requirements. Each group member should analyse at least one internet package.
  - For each package, you should answer the following questions:
    - What is the internet speed?
    - What is the data cap?
    - Are there any terms and conditions you should be aware of?
    - Is the required hardware included in the package?
    - Is the package a long-term contract or a month-to-month deal?
    - What is the cost of the package?
    - Are there any additional costs you will also need to pay (such as a telephone line rental)?
  - Once you have two to three viable options, decide what the best internet package will be.
  - Present the packages you investigated, your selected package and the reasons for your choice to the rest of the class.

# INTERNET SERVICES

## CHAPTER OUTCOMES



Unit 9.1 Overview of internet plug-in applications and internet services technologies



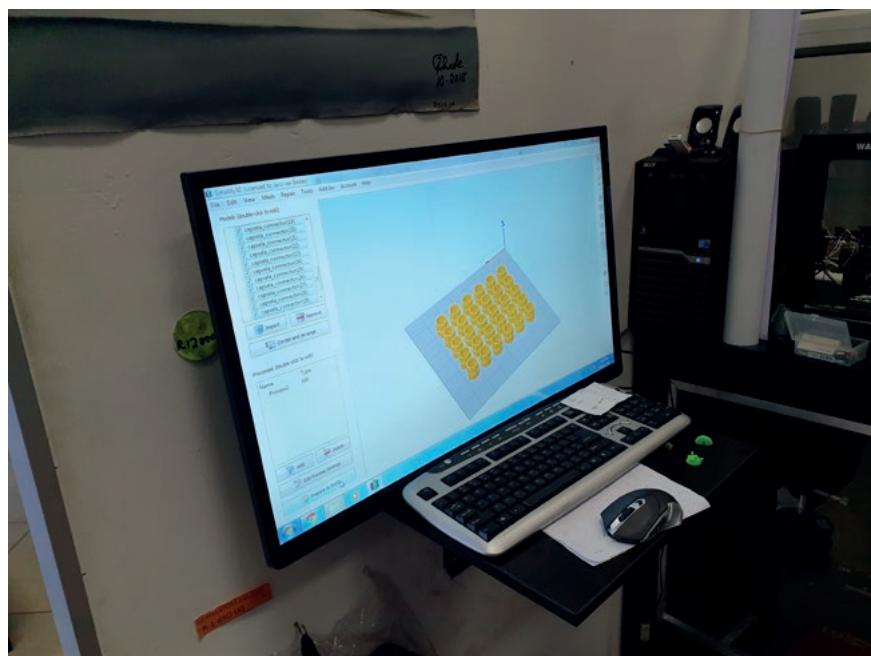
## Learning outcomes

At the end of this chapter, you will be able to:

- describe the different types of internet plug-ins
- explain the purpose of internet plug-ins
- describe the different internet services technologies.

## INTRODUCTION

Internet services technologies refers to the technologies and programming languages used to develop software and applications for the internet. This can refer specifically to website development and languages like HTML, C++ and JavaScript, but also more generally to any technology used on the internet, from networking technologies to e-commerce and communication technologies.



## 9.1 Overview of internet plug-in applications

In this unit, you will learn about internet services technologies and their purpose. You will also learn more about web plug-ins and their importance for website development.

### PLUG-INS

A plug-in is an additional functionality that you can install onto an existing application. For example, web browsers allow you to install a plug-in that adds new functions to your web browser.

One of the most popular plug-in was Flash Player. It allowed web browsers to understand interactive web pages and display videos and animations. Flash Player was the default method app used for watching videos.

Other popular plug-in examples include:

- **PDF converters and tools:** allows the conversion of web pages to PDF formats in a web browser.
- **Java:** allows Java programs to run on the website in a web browser.
- **QuickTime player:** allows the streaming of videos watched directly from the web in a web browser, it is developed by Apple Inc.
- **Real-player:** allows the streaming of videos watched directly from the web in a web browser.
- **Silverlight:** allows for a more interactive experience with web pages and when watching videos in a web browser.

Applications support plug-ins for many reasons, including:

- being able to reduce the size of an application
- being able to separate source code from an application because of incompatible software licenses.

The release of a new version of HTML (called HTML5) and improvements in web browsers include some of these functions and may not require some plug-ins. The increase in technology allows plug-ins to serve a different purpose today. They change the behaviour of websites or web browsers to improve user-experience.



#### WHAT IS A PLUG-IN



<https://www.youtube.com/watch?v=cgL002vvGuQ>

<https://qrs.ly/dhab20y>

## INTERNET SERVICES TECHNOLOGIES

Internet services technologies cover a very broad range of technologies that is used for web development, web production, web-design, networking, and e-commerce. These technologies are also part of website maintenance, database management, and graphic design.

These technologies are all used either separately or together to enable a better user web experience or functionality, whether it is for personal or business applications using a web browser as the interface.



### Activity 9.1

- 9.1.1** List three areas that Internet Service Technologies incorporates.
- 9.1.2** Work on your own to answer the following questions.
  - a. In your own words, explain what a plug-in is.
  - b. Why were plug-ins previously used?

This activity will require you to do some of your own research. You can use the internet, speak to your teacher or any other expert you may have access to.

## How your computer can be infected

By CHRIS HOFFMAN

In a perfect world, there would be no way for your computer to be infected via your browser. Browsers are supposed to run web pages in an untrusted sandbox, isolating them from the rest of your computer. Unfortunately, this doesn't always happen.

Most people that are compromised through browsers are compromised through their browsers' plugins. Apple and Facebook recently had internal computers compromised because they accessed websites containing malicious Java applets. Their Java plugins could have been completely up-to-date – it wouldn't matter, because the latest versions of Java still contain unpatched security vulnerabilities.

Other browser plugins, particularly Adobe's Flash player and PDF reader plugins, also regularly have to patch security vulnerabilities. Adobe has become better than Oracle at responding to these issues and patching their plugins, but it's still common to hear about a new Flash vulnerability being exploited.

Plugins are juicy targets. Vulnerabilities in plugins can be exploited across all different browsers with the plugin across all different operating systems – whether you are running Chrome, Firefox, or Internet Explorer on Windows, Linux, or Mac.

*[Adapted from Source: <https://www.howtogeek.com/138667/how-you-can-be-infected-via-your-browser-and-how-to-protect-yourself/>, accessed 30 April 2019]*

1. In your opinion, is using plug-ins worth it? Consider the risks that these have for your computer.
2. What can you do to protect your computer from plug-in vulnerabilities?
3. Do you think hackers can use plug-ins to gain access to your computer and data? Explain.

# Annexure A

## PROGRAMMING AND VISIBLE CHARACTERS (ASCII Values)

The programming characters

DECIMAL NUMBER	CHARACTER	NAME
0	NUL	Null
1	SOH	Start of Heading
2	STX	Start of Text
3	ETX	End of Text
4	EOT	End of Transmission
5	ENQ	Enquiry
6	ACK	Acknowledgement
7	BEL	Bell
8	BS	Backspace
9	HT	Horizontal Tab
10	LF	Line Feed
11	VT	Vertical Tab
12	FF	Form Feed
13	CR	Carriage Return
14	SO	Shift Out
15	SI	Shift In
16	DLE	Data Link Escape
17	DC1	Device Control 1
18	DC2	Device Control 2
19	DC3	Device Control 3
20	DC4	Device Control 4
21	NAK	Negative Acknowledgement
22	SYN	Synchronous Idle
23	ETB	End of Transmission Block
24	CAN	Cancel
25	EM	End of Medium
26	SUB	Substitute
27	ESC	Escape
28	FS	File Separator
29	GS	Group Separator
30	RS	Record Separator
31	US	Unit Separator

The next 95 characters are all visible characters that you can see on the screen.

## VISIBLE CHARACTERS

Decimal	Character	Decimal	Character	Decimal	Character
32	SPACE	38	&	45	-
33	!	39	'	46	.
34	"	40	(	47	/
35	#	41	)	48	0
36	\$	42	*	49	1
37	%	43	+	50	2
51	3	74	J	97	a
52	4	75	K	98	b
53	5	76	L	99	c
54	6	77	M	100	d
55	7	78	N	101	e
56	8	79	O	102	f
57	9	80	P	103	g
58	:	81	Q	104	h
59	;	82	R	105	i
60	<	83	S	106	j
61	=	84	T	107	k
62	>	85	U	108	l
63	?	86	V	109	m
64	@	87	W	110	n
65	A	88	X	111	o
66	B	89	Y	112	p
67	C	90	Z	113	q
68	D	91	[	114	r
69	E	92	\	115	s
70	F	93	]	116	t
71	G	94	^	117	u
72	H	95	_	118	v
73	I	96	@	119	w
120	x				

Decimal	Character	Decimal	Character	Decimal	Character
121	y				
122	z				
123	{				
124					
125					
126	~				

The 127th character is the *DELETE* character, which is used when something needs to be removed or deleted.

To write the word ‘English’, a computer would thus receive the following values:

E	n	g	l	i	s	h
69	110	103	108	105	115	104

However, the computer would receive these characters as bytes. Can you calculate the 8-digit binary numbers for each of these characters?

# Glossary

## A

**access control** any system designed to prevent and restrict access to users

**ad blocker** a program that will remove different kinds of advertising from a web user's experience online

**adware** a type of virus that creates unwanted advertisements all over a user's computer

**aggregator** a website that provides you with the headlines and links to stories you might be interested in

**algorithm** a solution to a problem that meets the specific criteria

**archive** a term used to describe a file that contains multiple files that are usually compressed files

**artificial intelligence (AI)** the ability of a computer to act like a human being

**ascii** American Standard Code for Information Interchange provides a standard way to represent characters using numeric codes

**asynchronous communication** a transmission technique commonly used by personal computers to connect to modems, printers, fax machines, modems, etc

**automation** refers to the use of automatic equipment to complete a job in a manufacturing business

## B

**benchmark** a test that measures the performance of hardware, software or the computer

**binary** describes a numbering scheme in which there are only two possible values for each digit: 0 and 1

**bit** a small piece, part, or quantity of something. With regards to ICT, it refers to a single switch that can only chose (or be told) to turn on or off

**browse** refers to reading and scanning through data

**byte** a group of binary digits or bits (usually eight) operated on as a unit

## C

**cascading style sheets (CSS)** a specification that allows web developers to change the layout and appearance of their web pages

**central processing unit (CPU)** the part of a computer responsible for processing general instructions

**client-server network** a network setup that uses both clients and servers

**clipboard** a space designed specifically to store items that have been copied for a short time

**coding** the process of assigning a code to something for classification or identification

**communication device** any device that allows a computer to connect to a network and communicate with other computers on the network

**compression** data compression is a method used to reduce the size of one or more files

**convert** the process of changing or causing one data format into another

**copyright** the legal right of someone to make copies of something

**crowdfunding** the practice of funding a project or venture by raising money from a large number of people who each contribute a relatively small amount, typically via the internet

## D

**data cap** a term used to describe the data limit

**digit** a single character in a numeric system

**digital divide** a term which refers to inequality between one or more groups in terms of access to, use of, or knowledge about information and communication technologies

**directories** a directory is another name for a folder. File systems use directories to organise files within a storage device

**domain** the location of a website

**domain name system (DNS)** an internet or network server that helps to point domain names or hostnames to their associated IP address

**drive letter** indicates on which storage device the file is saved

**driver** a set of instructions that tells your operating system how to communicate with a specific piece of hardware

## E

**eBooks** short for electronic book, which is a digital publication that can be read on a computer, e-reader, or other electronic device  
**embedded devices** a device that contains a special-purpose computing system

**embedded operating system** a term used to describe an object, software or hardware that is independent and does not need an external program or device to run it

**encoder** a hardware device or software program used to convert or encode data from one format into another

**encrypt** to conceal data in (something) by converting it into a code

**entry-level** suitable for a beginner or first-time user

**ergonomics** the study of people's efficiency in their working environment

**ethernet cables** cables that are used to connect a computer to a local area network or one network to another network

**ethernet hub** a device with more than one ethernet port which allows you to connect multiple computers to the same network

**ethical (question)** means relating to beliefs about right and wrong

**executable file** a file that is used to perform various functions or operations on a computer

**execute** a term that describes the process of running a computer software program or command

**extension** the suffix at the end of a filename that indicates what type of file it is

## F

**fair-usage policy (FUP)** a data limit placed on uncapped internet accounts. According to this policy, an internet account will not be capped or limited unless the user uses too much data, in which case their internet access may be slowed to the point where it is unusable

**feedback** the process of a user (hardware) commenting about a product or service

**file path** the location that a file or folder is saved in a computer's file system

**file transfer protocol (FTP)** a file transfer protocol used to send and receive files

**folder** a digital folder stores and organises data within the file system of a storage device

**freeware** software that is completely free to use for as long as you want to use it

## G

**gigabyte (GB)** a gigabyte is 1 000 000 000 bytes

**graphics processing unit (GPU)** the part of a computer responsible for processing the instructions that create a picture on the screen

**green computing** the environmentally responsible and eco-friendly use of computers and their resources

**greenhouse gases** a gas that contributes to the greenhouse effect by absorbing infrared radiation

## H

**hacker** a person who uses computers to gain unauthorised access to data

**hardware** the collection of physical parts of a computer system

**hexadecimal system** a numbering system that has 16 unique numbers

**hierarchy** refers to the organisation of data and program files in a top-to-bottom structure wherein access to the data starts at the top and proceeds downward throughout the levels of the hierarchy

**HTTP attribute** hypertext reference sets the target location for a link

**hypertext transfer protocol secure**

**(HTTPS)** adds a layer of security on the data in transit and enables encrypted communication and secure connection between a remote user and the primary web server

**I**

**ICQ** ICQ (“I Seek You”) is a program you can download that will let you know when friends and contacts are also online on the Internet. ICQ allows you to page them, chat with them, and initiate and participate in PC-to-PC calls, PC-to-phone and phone-to-phone calling cards calls

**immersive (websites)** a version of the online world that incorporates advanced technologies to enhance user engagement and blur the line between the user’s physical reality and the digital environment

**information and communication technology (ICT)** a wide range of technological tools and resources used to communicate and create, spread, store and manage information

**infringe** the violation of a law or a right

**input device** any hardware or peripheral device that allows you to enter data into a computer or interact with a computer

**intellectual property (IP)** a term that describes the application of the mind to develop something new or original

**internet protocol (IP)** the fundamental protocol for communications on the internet

**internet relay chat (IRC)** a system for chatting that involves a set of rules and conventions and client/server software

**internet service provider (ISP)** a company that provides internet access to users or subscribers of its service

**iris and retina scanners** scanners that rely on unique physiological characteristics of the eye to identify an individual

**K**

**keylogger** a software program or hardware device that is used to monitor and log each of the keys a user types into a computer keyboard

**kilobyte (KB)** the smallest unit of measurement greater than a byte. One kilobyte is technically 1 000 bytes

**L**

**LAN party** describes a get together of individuals and their computers. These parties are held to play network games with other individuals and to share files

**LED** light-emitting diode is a semiconductor that illuminates when an electrical charge passes through it

**link** on the internet, a link is more appropriately referred to as a hyperlink and is what connects web pages to other web pages

**local area network (LAN)** a computer network that covers a small area like a home, office or building. The network usually has a limited number of computers on it (between 2 and 25), although there is no absolute limit

**M**

**malicious (application)/malware** any application/software that is designed to change your settings, delete software, cause errors, watch browsing habits, or open the computer to attacks

**megabyte (MB)** One megabyte is equal to 1 000 000 bytes, 1 000 kilobytes and precedes the gigabyte unit of measurement. It is often used to measure the size of large files

**Microsoft WordPad** a basic word processor that is included with almost all versions of Microsoft Windows from Windows 95 onwards

**mobile network provider (MNP)** a provider of wireless communications services that owns or controls all the elements necessary to deliver services to end-users

**mobility** the ability to move or be moved freely and easily

**msn messenger** the instant messaging (IM) service that was part of Microsoft’s online offerings launched in the mid-1990s

**multimedia** the integration of multiple forms of media such as text, graphics, audio, video, etc.

**N**

**nanometre** a unit of length in the metric system, equal to one billionth of a metre

<b>navigation bar</b>	a graphical bar located at the top of a page that links users to other main portions of the page	<b>peripheral</b>	hardware input device or output device that gives a computer additional functionality
<b>netiquette</b>	a term used to describe the unwritten rules of internet courtesy and good manners	<b>piracy</b>	the unauthorised use or reproduction of another's work
<b>network adapter/dongle</b>	a piece of hardware that can be added to a computer which allows it to connect to a network	<b>pixel</b>	short for picture element. These small little dots are what make up the images on computer displays
<b>network administrator</b>	a person responsible for keeping an organisation's computer network up-to-date and operating as intended	<b>plug-in applications</b>	extra applications that can be installed inside software to increase its functionality
<b>network architecture</b>	the overall structure of how a network is laid out	<b>privacy</b>	refers to information shared with visiting sites, how that information is used, who that information is shared with, or if that information is used to track users
<b>network cable</b>	see ethernet cables	<b>processing device</b>	any device that receives the data, performs a set of instructions, and then returns information to the user
<b>network or server operating system</b>	an operating system that is designed to help other computers on a network	<b>programmer</b>	a person who writes computer programs
<b>niche field</b>	a specialised field or area	<b>proprietary (connection)</b>	a term used to describe a connection that is only compatible with specific hardware, software, computer or manufacturer
<b>nonverbal communication</b>	communication without the use of spoken language including gestures, facial expressions and body positions	<b>proprietary software</b>	copyrighted software that prohibits the redistribution or modification of its program
<b>notepad application</b>	a word processing program, which allows changing of text in a computer file		

## O

<b>obesity</b>	being significantly overweight
<b>OCR</b>	optical character recognition software converts the text on a picture to text that can be used in a word processing application
<b>ONT device</b>	optical network termination device refers to the consumer end equipment in an optical fibre to the home (FTTH) link
<b>open-source software</b>	software that is not only free to use, but the source code is also free, which means anyone can download the code, use it and change it
<b>operating system</b>	the low-level software that supports a computer's basic operations

<b>output device</b>	any device used to send data from a computer to another device or user
----------------------	--

## P

<b>peer-to-peer network</b>	a network that does not have a central computer or dedicated server; i.e., all computers are independent
-----------------------------	--

<b>peripheral</b>	hardware input device or output device that gives a computer additional functionality
-------------------	---

<b>piracy</b>	the unauthorised use or reproduction of another's work
---------------	--

<b>pixel</b>	short for picture element. These small little dots are what make up the images on computer displays
--------------	---

<b>plug-in applications</b>	extra applications that can be installed inside software to increase its functionality
-----------------------------	--

<b>privacy</b>	refers to information shared with visiting sites, how that information is used, who that information is shared with, or if that information is used to track users
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<b>processing device</b>	any device that receives the data, performs a set of instructions, and then returns information to the user
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<b>programmer</b>	a person who writes computer programs
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<b>proprietary (connection)</b>	a term used to describe a connection that is only compatible with specific hardware, software, computer or manufacturer
---------------------------------	---

<b>proprietary software</b>	copyrighted software that prohibits the redistribution or modification of its program
-----------------------------	---

## Q

<b>QR (quick response code)</b>	a two-dimensional barcode installed on a smartphone, allowing the user to scan the QR Code and view the data stored in it
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<b>query</b>	a field or option used to locate information within a database or other location
--------------	--

## R

<b>random access memory (RAM)</b>	a very fast storage device that can only store a small amount of information at a time
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<b>refresh rate</b>	determines how quickly the image on the monitor can be updated with the newest information
---------------------	--

<b>rendering</b>	the process of taking a computer image or file and convert it into another format or apply a modification such as shading or shadows
------------------	--

**S**

- search engine** a program that uses a database to search for keywords or key terms specified by the user
- server** computers that provide (or serve) information to other computers (like webpages)
- shape (the connection)** when an ISP gives preference to certain types of internet use over others
- shared library files** files that contain several very useful instructions that programs may wish to use
- shareware** software that you get to use for free at the beginning, but after a while you must pay to continue using the software
- simulation** a way to model random events, such that simulated outcomes closely match real-world outcomes
- snopes** one of the first online fact-checking websites
- social network** a website (or other application) dedicated to allowing users to communicate and interact with each other using messages, comments, images, etc.
- software** the set of instructions a computer uses to complete any task
- software engineer** a person who designs and creates system level software like operating systems and database management systems
- solid-state drives (or SSDs)** a type of internal hard drive that, unlike normal hard drives, does not have any moving parts. This makes them many times faster
- source code** a term used to describe text that is written using the protocol of a particular language
- source code files** files containing instructions that are created when a computer program is created
- spam** refers to the use of electronic messaging systems to send out unrequested or unwanted messages in bulk
- stand-alone operating systems** a complete operating system that works directly on a computer (or smartphone) to make sure that the tasks of the operating system are completed

**storage device** any computing hardware that is used for storing, porting and extracting data files and objects

**stream(-ing)** data streaming is when a multimedia file can be played back without being completely downloaded first

**subjective** based on or influenced by personal feelings, tastes or opinions

**subwoofer** a complete loudspeaker or loudspeaker component designed to reproduce low-pitched audio frequencies known as bass

**surround sound** a technique for enriching the quality of the sound from an audio source with additional audio channels from speakers that surround the listener

**switch** works in the same way as an ethernet hub with one difference, it is more intelligent. Rather than sending information to all ports, it sends the information only to the correct computer

**synchronous communication** a transmission technique referring to events and processes that occur simultaneously or have dependencies relating to time or another event that relies on time

**T**

**tags** elements that tell the web browser how to interpret the information inside these elements, determining what it displays in any section

**telecommunications** the technology involved in sending information over long distances using electronic equipment like radios and telephones

**tendonitis** a painful inflammation of the tendons that often results from overuse. A tendon is tissue that attaches muscle to the bone

**terabyte (TB)** a terabyte is a unit of information equal to one million million ( $10^{12}$ ) bytes

**throttle** throttling refers to limiting the speed of an internet connection, usually for a short period of time, under specific circumstances

**transmit** the process of sending digital or analogue data over a communication medium to one or more computing, network, communication or electronic devices

**troubleshoot** the process of solving a problem or determining a problem to an issue  
**typography** the style and appearance of printed matter

## U

**unbiased** showing no prejudice for or against something  
**uniform resource locator (URL)** a standardised naming convention for addressing documents accessible over the internet  
**user interface** the way in which people interact with computer program or a website  
**utilities** small programs which help users to maintain their computers

## V

**virtual memory** a method of using the computer hard drive to provide extra memory for the computer  
**virus** a program, script or macro designed to cause damage, steal personal information, modify data, send e-mail, display messages or any combination of these

**voice over internet protocol (VOIP)** the set of rules that makes it possible to use the internet for telephone or videophone communication

## W

**wallpaper** the picture or pattern you see on the main screen after the computer has booted up  
**white space** any section of a document that is unused or spaced around an object  
**wide area network (wans)** a network that covers a large area. This could include all the people in a suburb or city, but it is most often used to refer to the internet, the world's largest WAN  
**wireless access point (WAP)** a wireless receiver which enables a user to connect wirelessly to a network or the internet  
**world wide web** refers to the millions of websites that are hosted on the internet

# Resources

<https://www.youtube.com/watch?v=7cXEOWAStq4>  
<https://www.bls.gov/emp/tables/fastest-growing-occupations.htm>  
[https://en.wikipedia.org/wiki/List\\_of\\_public\\_corporations\\_by\\_market\\_capitalization](https://en.wikipedia.org/wiki/List_of_public_corporations_by_market_capitalization)  
<https://www.osapublishing.org/viewmedia.cfm?uri=ETOP-2013-EThB1&seq=0>  
How much data do we create? <https://www.forbes.com/sites/bernardmarr/2018/05/21/how-much-data-do-we-create-every-day-the-mind-blowing-stats-everyone-should-read>  
How much data do we create 2? <https://www.domo.com/learn/data-never-sleeps-5>  
Why do computers use binary? <https://www.youtube.com/watch?v=Xpk67YzOn5w>  
<https://www.youtube.com/watch?v=5o8CwafCxnU> (IP Addresses)  
[https://www.youtube.com/watch?v=OvF\\_pnJ6zrY](https://www.youtube.com/watch?v=OvF_pnJ6zrY) (What is a URL)

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