

Theory Book

INFORMATION TECHNOLOGY

12



basic education

Department:
Basic Education
REPUBLIC OF SOUTH AFRICA



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Information Technology Theory Book Grade 12

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Dear Learner

Welcome to the *Theory Book for Information Technology Grade 12*. 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 11 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

CHAPTER OVERVIEW	
Unit 1.1	Data collection
Unit 1.2	Data warehousing
Unit 1.3	Data mining
Unit 1.4	Caring for and managing data

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	
At the end of this chapter you should be able to:	
<ul style="list-style-type: none">• provide an overview of data collection• provide examples of data collection• describe data warehousing• compare data warehousing with database• describe data mining and provide examples• describe the processes of data mining• describe how data should be cared for and managed.	

 **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

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.

INTRODUCTION

In this chapter, you will learn about what data collection is and also look at some examples where data collection is used. Several key **warehousing** concepts will be introduced. This will enable you to compare data warehousing with a **database**. You will also learn how to collect and **mine data**. However, before learning any new concepts, let's revise what we know about databases.

New words

These are difficult words that you may not have encountered before. A brief explanation for these words are given.



New words

field – a single bit of information about a person or an item, for example, age

record – a group of related fields about an item or person that is captured in the table

Primary key – a field that holds a unique identifier for each record in the database (Unique means there is only one of its kind)

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 1.3

Data collection

- 1.3.1 Define a web form and provide an example.
- 1.3.2 Provide a brief explanation of what tagging is and give an example of how a tagging system (not mentioned in this book) has been used in South Africa. (You will need to do a bit of research to answer this question.)
- 1.3.3 Choose the answer and write 'true' or 'false' next to the question number. Correct the statement if it is FALSE. (You may not simply use the word 'NOT' to change the statement.)
 - a. RFID stands for radio frequency identifier and refers to tiny chips that can store a few kilobytes of information.
 - b. A basic RFID reader will scan all the information stored on the product with an RFID tag and make them

'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.



Take note

Hardware manufacturers release new components every year, and the relative strength and weaknesses of these components change every year. As such, the table above can, at best, be a starting point. Before purchasing any components, you should do research on them using the internet.

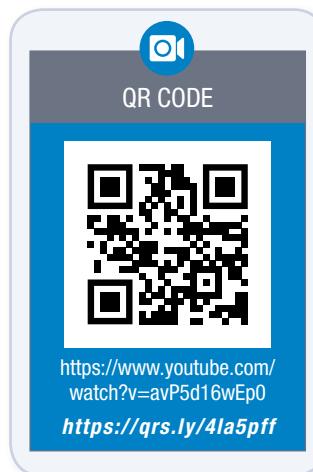


Did you know

Data warehousing is a key tool in business intelligence (BI), which refers to several technologies and applications that are used to improve business decision making.

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: Database Management

1. Choose the correct answer.
 - a. Which of the following scenarios does NOT need a database?
 - A. Storing the credentials of all Gmail accounts.
 - B. Backing up all the information on your personal computer.
 - C. Storing all the webpages of a website.
 - D. Storing all the information about a business's inventory.
 - b. Which of the following techniques is NOT used to protect data in databases?

DATABASE MANAGEMENT

CHAPTER OVERVIEW



- Unit 1.1 Data collection
- Unit 1.2 Data warehousing
- Unit 1.3 Data mining
- Unit 1.4 Caring for and managing data



Learning outcomes

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

- provide an overview of data collection
- provide examples of data collection
- describe data warehousing
- compare data warehousing with database
- describe data mining and provide examples
- describe the processes of data mining
- describe how data should be cared for and managed.

INTRODUCTION

In this chapter, you will learn about what data collection is and also look at some examples where data collection is used. Several key **warehousing** concepts will be introduced. This will enable you to compare data warehousing with a **database**. You will also learn how to collect and **mine data**. However, before learning any new concepts, let's revise what we know about databases.

DATABASES IN A NUTSHELL

Computers store data for a number of reasons. viz. Instructions that a computer uses to function, data required in RAM when an application is being used, data in the form of Images and files that the user's application requires. The structures commonly used to store data are: Files and Databases.

FILES AND DATABASES

Data is saved in the computer's memory while a user is working in an application. The information that the user will need to access later, is stored in a database or file on a more permanent storage devices.



Did you know

Data is unprocessed numbers, facts or signals. In order for humans to use it and for computers to share it, the data needs to be processed and organised into meaningful information. One way in which data is shared amongst people is by using letters and characters.



Databases are a collection of organised data. Databases are the single most important tool used to store data by programmers and web developers. It can, for example, be used to store everything such as, the settings in an application, text on a website, graphics, status updates, personal messages and comments on social networks.

DATABASE MANAGEMENT SOFTWARE (DBMS)

Database management software (DBMS) is the software responsible for managing a database. This includes creating the database and tables and managing data security. Examples of popular database management software include: Microsoft SQL Server, Microsoft Access, MySQL and SQLite.

ACTIVITY 1.1

Revision Activity

- 1.1.1** Define data.
- 1.1.2** What does a computer do with the data?
- 1.1.3** List two reasons why computers store data.
- 1.1.4** Define the term, database.
- 1.1.5** List two instances where a database can be used.
- 1.1.6** Explain DBMS and its advantages.
- 1.1.7** List two examples of DBMS.

1.1 Data collection

In Grade 11, you created a database and manually added some data to your tables. This is a very ineffective way of adding data to a database and is only suitable for small databases. Instead of using manual entries, most databases use different techniques to capture data automatically. In this section, you will learn about a few of these techniques.

FORMS

A web form, is an online interactive page that allows for user input. This page imitates a physical form that users need to complete. To assist with user input and limit errors, a web form usually contains GUI components such as:

- checkboxes
- combo boxes
- spinners
- drop down lists
- text boxes
- buttons, and so on.

Web designers can also create quite sophisticated web forms for most online activities such as banking, shopping and job or enrolment applications by using programmed objects, functions and methods. These Web forms have changed the way that business is done because it limits paperwork and documentation, and favours online documentation.

TAGS

Electronic tags transmit a radio frequency from the tag to a tag reader, or vice versa. It transmits the information to a computer program associated with the tag. Tags can be used to track or identify different items and are often used in merchandising warehouses, for vehicle tracking, pet tracking, and so on.

Let's look at some examples of how tags are used.

RFID

RFID stands for radio frequency identification and refers to tiny chips (like those in a phone SIM card) that can store a few kilobytes of information. When scanned, this information is read and displayed on a computer. By using the correct software, it could also be added to a database directly.



Figure 1.1: An RFID access card

RFID is used by thousands of businesses across the world. For example, RFID can be used to tag:

- **all products stored in a warehouse.** When an item is removed from the warehouse, it is automatically scanned and removed from the database.
- **tools stored in a workshop.** This allows the company to track which tools are being used, which employees are using them, and when the tools are returned.
- **the tickets of people going to conferences, sports events or concerts.** When a registered RFID chip arrives at the gate, the gates open automatically, and the data on the ticket is added to the database.
- **the tickets of people using public transport.** For example, the Gautrain uses RFID cards to allow people to board trains. The trip is recorded on a database, and the cost of the trip is subtracted from the user's balance.
- **all products sold in a shop.** When an item is purchased, the RFID tags are scanned and the details about the product are retrieved and added to the bill. The item can then also be removed from the shop's inventory automatically.

A basic RFID reader will only scan the information stored on RFID chips and make them available to a computer. However, there are many software solutions that will automatically take this information and add it to a database. These applications may also write additional information to the database, like the date and time that the RFID chip was scanned and the location.

E-TOLLS AND RFID

In December 2014, South African National Roads Agency Ltd (SANRAL) opened its electronic toll (or e-toll) system in Gauteng. The goal of the system was to help the government pay for the R20 billion highway improvement project that had been running since 2007.



Figure 1.2: An e-toll gantry

Motorists had to purchase an e-tag (the RFID chip read by the toll gantry). The system used a combination of cameras and RFID readers to automatically record the information of any car driving through the gantry. This information is then stored in a database, which is used to automatically generate an invoice at the end of each month.

DIGITAL SENSORS

A digital sensor is an electronic or electrochemical sensor, where data conversion and data transmission are done digitally, for example, temperature, distance, humidity, light. Sensors sense a wide range of different energy forms like movement, electrical signals, radiant energy, pressure, thermal or magnetic energy. For example, wireless sensor tags connect events in physical world, for example, motion in an area, whether a door/window is opened/closed, temperature or humidity exceeding a certain limit, or smartphones or any Web browsers with internet access.



Activity 1.2

Answer the following questions:

- 1.2.1** Do some research to find out how this e-toll system automatically detects information for:

- a. vehicles with an e-tag, and
- b. vehicles without an e-tags.

Write a short report on how reliable you think this system is.

Discuss ways in which:

- i. the system could work, and
- ii. how this system could work well.

- 1.2.2** Can you think of any other situations where RFID chips can be used to automatically create an invoice?



QR CODE



<https://www.youtube.com/watch?v=cZwLlxM7PdE>
<https://qrs.ly/66a7ke1>

INVISIBLE ONLINE DATA COLLECTION

Databases form the heart (or memory) of the internet because they store most of the information shown on websites today.

Databases are especially important on websites where users create the content (like YouTube, Facebook and Wikipedia), as it would be impossible for a data capturer to add this information manually. Instead, these websites are set up so that any information entered by users are automatically stored in different databases. This includes items like status updates, likes, tweets and any videos or pictures the user uploaded. The databases on computers or mobile phones also store the user's personal information, such as their email address, username and password.

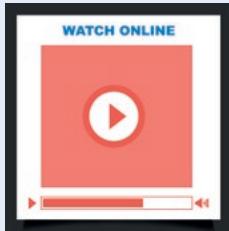


Figure 1.3: Social media usernames and passwords are stored in a database



Animation

Animation showing a banking transaction. Money is subtracted from one account, then transferred from starting bank to another bank over the internet, but before the destination account the connection is broken. This causes all the transactions to be rolled back.



A cookie is a message given to a web browser by a web server. The web browser stores the message in a text file. Each time the browser requests a page from the server the message is sent back to the server. The cookie identifies users and could customise web pages for each person. When a person first enters a website using cookies, they may be asked to fill out a form providing personal information, which is packaged into a cookie and sent to the browser. The next time you go to the same website, your browser will send the cookie to the server.

Since this incredibly detailed information is recorded for billions of internet users, online advertising companies require massive databases with software that can automatically track users and their activity across web pages.

There are hundreds of different systems that have been designed specifically to automatically record information in databases, for example credit card payments, automatic toll gates, cookies and cell phone calls.

In all these examples, software was specifically built to read the information and record it in a database. This software also allows the companies to create automatic reports from the database. For example, you may receive a credit card statement or phone bill at the end of each month. This is a report that your service provider's database generates automatically.



Figure 1.4: Credit card payments make use of database transactions

TRANSACTION TRACKING

Transaction data (type of transaction, store where transaction occurred, employee who performed the transaction, customer information, payment information including signatures if captured) is sent from stores to the corporate database. Data is stored on cards, such as credit cards, store cards (for example, Jet or Edgars) and store loyalty cards (for example, Clicks ClubCard, Pick 'n Pay SmartShopper card). Some transaction tracking benefits include: consumer safety when it comes to purchasing toys, cars, food and medication, enhancing a user's on-site experience by tracking browsing history and demographic profiles, fraud detection, and so on. The main disadvantage of transaction tracking is the unauthorised use of your personal information.

LOCATION BASED DATA

Location based data is data that provides information about different things that can be shown on maps. **Static location-based data** includes data such as maps with roads, street names, shops, offices and other features, but also farming information, government buildings and assets, electric distribution networks with pylons and substations, military information and so on. **Non-static information** obtains the position of aeroplanes, tracking transport or stolen vehicles, personal positioning, satellites, traffic patterns, rhinos and even pets; all of which are based on input from geographic positioning systems (GPS).

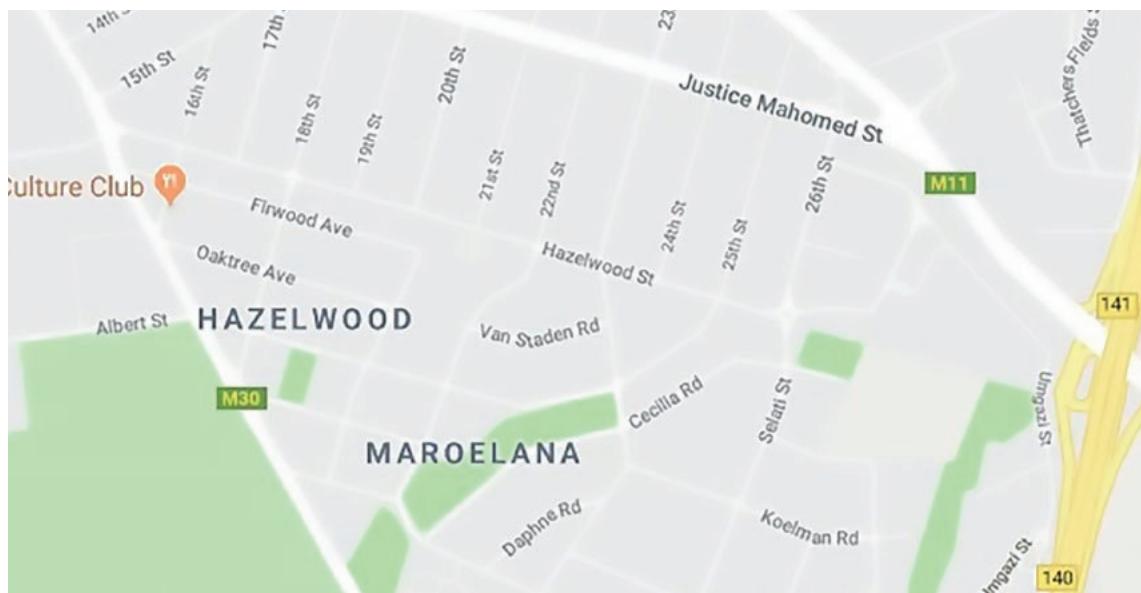


Figure 1.5: A city map based on a GIS database

Location based services (LBS) are services that use software applications together with the location-based databases to deliver a service such as finding the best route to a destination or shop, find the location or movement of a stolen vehicle, a lost pet, find the characters in the Pokémon GO game or the places where photographs were taken during a holiday trip.

Smartphones and tablets are also better at location-based computing, which refers to software based on a user's location. Examples of location-based computing includes:

- Weather applications tell you what the weather in your specific area will be, based on your location.
- Food ordering applications can use your location to deliver food directly to you.
- Car sharing services, such as, Uber use your phone's location to find the nearest Uber driver, who will pick you up and drop you off at the correct location.

The problem with so much data being stored in databases is how to make sense of it and use it. In the next section, you will see how companies mine databases to improve their decision making.



Activity 1.3

Data collection

- 1.3.1** Define a web form and provide an example.
- 1.3.2** Provide a brief explanation of what tagging is and give an example of how a tagging system (not mentioned in this book) has been used in South Africa. (You will need to do a bit of research to answer this question.)
- 1.3.3** Choose the answer and write 'true' or 'false' next to the question number. Correct the statement if it is FALSE. (You may not simply use the word 'NOT' to change the statement.)
 - a. RFID stands for radio frequency identifier and refers to tiny chips that can store a few kilobytes of information.
 - b. A basic RFID reader will scan all the information stored on the product with an RFID tag and make them available to a computer.
 - c. Databases are especially important on websites where users create the content, since it would be impossible for a programmer to add this information manually
 - d. Credit card payments, automatic toll gates and cell phone calls automatically record information in databases.



Activity 1.3

Data collection *continued*

- e. RFIDs automatically identify objects, collect data about them, and enter those data directly into computer systems with little or no human intervention.
- f. Databases are not important on websites where users create the content, since it is possible for a data capturer to add this information manually.
- g. These websites are set up so that any information entered by users are manually stored in different databases.
- h. Invisible data capturing refers to data that is captured online, usually entered by the user.
- i. Online data capturing refers to data that is automatically recorded and captured on a database without requiring user input and usually without informing the user.
- j. Websites help advertisers to create advertisements that are specific to each user. To do this, advertisers create a database recording information from each user on the website that includes information like what the user searches for, what links they click on and how long they stay on different pages.

1.3.4 Whenever an item is purchased from an online shop and the payment is received, several database transactions must occur. Underline what this includes:

- Creating a customer order in the database.
- Removing the purchased items from the company's inventory.
- Subtracting the amount paid from the amount owed on the customer's account.
- Placing an order with a shipping company.

1.3.5 Explain how websites use the data they collect to determine which advertisements to run on the website.

1.3.6 Which other examples do you know of that are commonly used to add information to a database automatically?

1.3.7 On many websites, when an internet transaction is done, the data can be captured without the user's knowledge or consent.

- a. How can this type of data capturing be used in day-to-day life? Give an example of the data that is captured to support your answer.
- b. RFID chips can also be used to automatically capture large amounts of data. What does RFID stand for?
- c. Give four examples of how RFID cards are used in real life to capture data.

1.3.8 What does transaction processing refer to?

1.3.9 Why is it important to group transfers into a single transaction?

1.3.10 What is meant by 'rolled back' in the following sentence:

'If a single task fails, the transaction is rolled-back.'

1.3.11 Why is a complete roll-back important? Explain it in terms of a bank transfer being cancelled during the final step.

1.3.12 Banks and online shops use transaction processing systems. Can you think of any other situations in which transaction processing systems may be used? Make a list.

1.3.13 Answer the following questions in your own words.

- a. What is location-based data and what is its main goal?
- b. Name and shortly describe each of the two types of location-based data.
- c. Which technology is generally used for location-based computing?
- d. How would location-based computing assist the organisers in gathering information about the participants using mobile devices?
- e. What is the name of the system used to determine the position of non-static devices?
- f. What two technologies are combined by location-based computing to deliver a service to customers?
- g. Give three examples of location-based services.
- h. The Computer Olympiad will be managed from a main office and all communications will be sent from this office. On the day of the event the data will be distributed electronically to all institutions that have registered to participate in the Computer Olympiad.

Suggest ONE advantage for the Computer Olympiad if they use location-based computing.

1.2 Data warehousing

A warehouse is a place where you can store a large number of items or products.

WHAT IS DATA WAREHOUSING?

Data warehousing is similar to how factories and distribution companies store their products in a warehouse in real life. It is a technique for storing data from more than one database. Unlike most databases, where the data is normalised and stored in the most efficient manner, data warehousing takes the data from these databases and stores it in a non-normalised way.

Since the data is not normalised, there may be **redundancies** and it can use additional storage space.

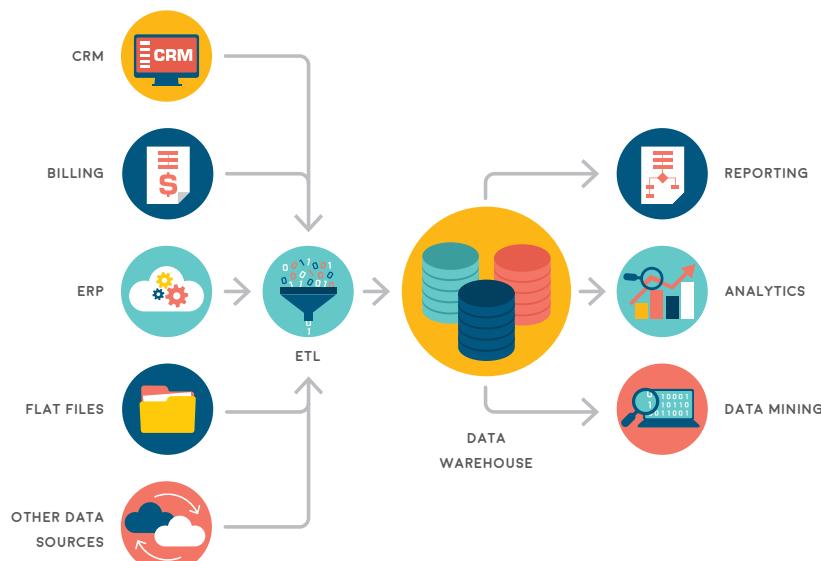


Figure 1.6: Data warehousing is used to make data available for analysis

The goal of a data warehouse is to make the data available and ready for analysis.

It is important to understand that a data warehouse does not contain copies of the original databases, instead, it is a new database that is created to hold structured data from multiple sources. A data warehouse is usually opened to multiple people in different departments of a company. Each of these people can then access the data and use it to create graphs and reports useful to them.

DATA WAREHOUSING VS DATABASE

Data warehouses and databases are similar in that they are both relational data systems. However, they were built to serve different purposes.

- A data warehouse stores a large quantity of historical data and all the data from the various databases are available.
- A database stores current transactions and enables easy access to specific transactions for ongoing business processes.



Did you know

Normalisation is the process of refining the structure of a database to minimise redundancy and improve integrity.



Did you know

Data redundancy occurs within a database when the same piece of data is held in two different places.



Did you know

Data warehousing is a key tool in business intelligence (BI), which refers to several technologies and applications that are used to improve business decision making.

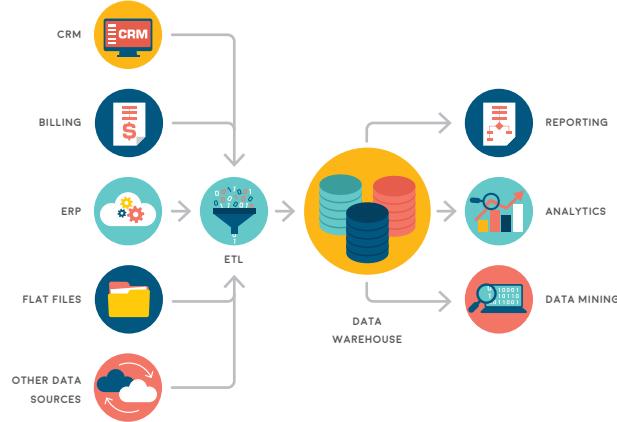


Activity 1.4

Data warehousing

- 1.4.1** In real life, a warehouse is a place where you can store many items or products.
- What is a data warehouse?
 - How does data warehousing store the data? Explain it in your own words.
 - What are two advantages of denormalised databases?
 - What is the goal of a data warehouse?
 - Does the data warehouse replace the original data base? Give a reason for your answer:

- 1.4.2** Explain in one or two sentences what this diagram means.



- 1.4.3** Tabulate two differences between data warehousing and database.

1.3 Data mining

WHAT IS DATA MINING?

Data mining is a process used to identify trends and patterns between different sets of data in large databases. Selecting the right data from such large amounts of data (called **big data**) can help show trends and patterns between data sets, which can improve decision making dramatically. For example:

Marketing: Data mining is used to explore increasingly large databases to improve market segmentation. By extracting data like customer age, gender, tastes etc. and looking for patterns and trends between them, it is possible to guess their behaviour in order to direct personalised loyalty campaigns. Data mining in marketing also predicts which users are likely to unsubscribe from a service, what interests them based on their searches, or what a mailing list should include to achieve a successful response rate.



Activity 1.5

Data mining

You have been given access to three massive data sets containing hundreds of thousands of records. The three data sets are:

- Sales information from Amazon, including sales information per product, per product category and per country.
- Number of viewers per television show, including information on the time of day and the demographics of the people watching.
- List of tweets from the past year, including the content of the tweet, the hashtags used and the location the tweet was sent from.

Based on these datasets, complete the following tasks.

1.5.1 Give three questions that would you be interested in answering using these data sets.

1.5.2 Describe how a business owner could use these datasets to improve their decision making on the following topics:

- a. Women are 50% more likely to purchase your product than men. When should the business advertise their product on TV?
- b. An electronics company is not sure if they should make an affordable electric toothbrush, or a high-quality expensive toothbrush.
- c. A restaurant owner has noticed that people often talk about food on Twitter. How can he use this information to decide which type of restaurant to open in Johannesburg?

To make sense of the massive amounts of information available, people need to follow a basic process. This is called the data mining process.

DATA MINING PROCESS

To mine a database, you will:

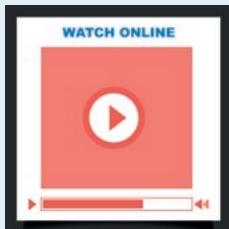
- extract the relevant data
- look for patterns in the data
- discover knowledge from the patterns

This section will look at each of these steps in some detail.



Animation

Animation showing how small pieces from different tables are taken and combined to create a new database.



EXTRACT THE RELEVANT DATA

Once you have access to a database, you need to extract the data that will be useful to you. Many of these databases store incredible amounts of data (such as the UN database, which contains information for most countries in the world), and you may only need a small section of that data to answer your questions. Rather than filtering a massive database the whole time, you use the full database to create a new database containing only the information relevant to you.

In most situations, data will be extracted from the datasets using SQL. This is a programming language that was created specifically to manipulate and extract data from a database. By using SQL queries, users can specify exactly which data they want to extract. This is done by specifying:

- Which fields to extract
- Which data table to use
- What conditions are used

Only data that meets these requirements will then be extracted to be used for analysis.

LOOK FOR PATTERNS IN THE DATA

When working with large amounts of data, it is impossible to look at each data point on its own. Instead, you need to look for patterns in the data that will help you understand the dataset. As you will see in the later steps, these patterns can result in knowledge, which is used to make better decisions and develop strategies.

For example, you may want to determine whether fewer people use the highway between Pretoria and Johannesburg today than before the Gautrain was built. To do this, you may find Gautrain project planning data for 2014 and N1 toll gate data for 2019 and calculate daily and monthly averages that you can then compare. Based on this analysis, you will know if the Gautrain decreased the traffic on the N1 or not, and importantly, by how much. This information can then be used to decide whether or not to build a system similar to the Gautrain system for Durban or Cape Town, who have similar traffic problems.



Figure 1.7: The Gautrain is a high-speed train traveling between Pretoria and Johannesburg

DISCOVER KNOWLEDGE

By identifying these patterns, you have turned an overwhelming amount of disorganised data into a few useful facts. This allows you to understand what happened rather than rely on vague uninformed views of people. Once you have confirmed the situation, informed decisions can be made, or strategies developed.

Example 1.1 Data mining used for Government Social Grants

Social grants are administered by the South African Social Security Agency (SASSA). SASSA is mandated to "ensure the provision of comprehensive social security services against vulnerability and poverty within the constitutional legislative framework". Most social grants are "means tested", this assesses the value of assets and income. Only a certain threshold is eligible for a social grant.

To measure the living circumstances of South African households, the Government conducts an annual General Household Survey (GHS). This is a household survey which collects big data on education, health, social development, housing, access to services and facilities, food security, and agriculture.

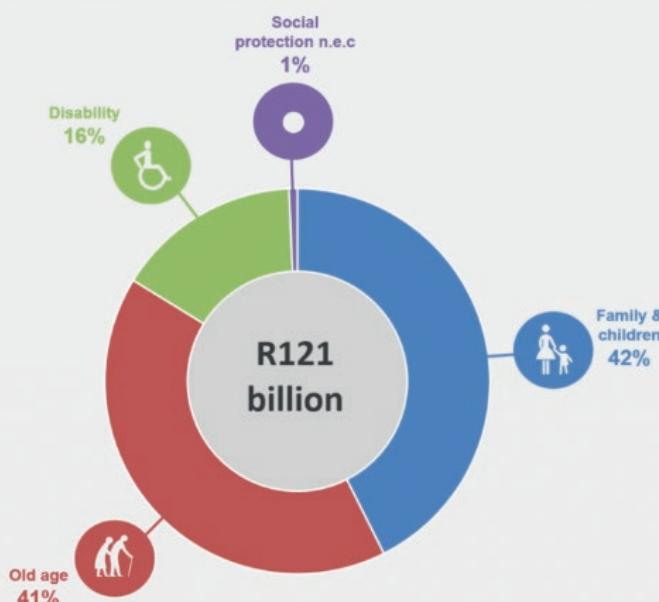
Using data mining techniques the relevant data that will be useful is extracted. This data is then analysed (finding patterns) and used to obtain information/ knowledge.

This knowledge can then be used to provide the necessary budget for social grants and to know what limit to set the threshold or provide reports like:

- The number of households receiving at least one form of social grant rose from 29,9% (of the population) in 2003 to 44,3% in 2010, according to the latest General Household Survey report² from Stats SA. This rose to 45,5% in 2015. Further details and analysis on the issue of the growing social welfare net are available from Stats SA's Poverty Trends in South Africa report³.

Breakdown of the social grant pie

Spending on social grants by national government in the 2014/15 financial year



Family & children includes child support, foster care and care dependency grants.
Social protection n.e.c includes grant-in-aid and social relief-of-distress. Old age includes war veteran's grants
Source: Financial statistics of national government, 2014/2015 (P9119.3) <http://www.statssa.gov.za>

Example 1.2**Data mining used by Facebook**

Facebook (and other Web giants) accumulate all our personal data over time. Increasingly, identifiable data collection is happening in more dimensions than are ever understood by most users. The more data there is in one place, the more data mining can be done. Over time, and in context of other individual data points, it becomes Big Data. Using data integration, it's then mixed with other data sources that, as end-users, we'll never be aware.

Companies, individuals and Facebook itself that have access to this data extract the relevant data that is useful to them and store it in a smaller database.

Apps, that use data analytics, are used to analyze "friends of friends" comments, textual analysis, online behaviour, and so on, to compile data about us.

This *information/knowledge* is then used to: determine our current emotional state, correlate how sad or depressed someone might be, suggest possible friends etc.

**Activity 1.6****Data mining**

- 1.6.1** The tour company requires the use of a database management system to store details of tours and tour guides. A record of the tours and the agent responsible for each tour is stored in a table called 'TBL Tours'. The first five records of the table are shown below.

TBL TOURS				
TOUR DESTINATION	STARTDATE	ENDDATE	TOURGUIDE	GUIDETELNUM
Kruger National Park	2019-07-01	2019-07-10	Senzo Dhladla	0812345678
Drakensberg	2019-07-20	2019-07-24	Meredith Peters	0731112223
Kruger National Park	2019-08-01	2019-08-06	Senzo Dhladla	0812345678
Cape Town	2019-08-14	2019-08-24	Kajal Singh	0619988772
Sun City	2019-08-22	2019-08-30	Senzo Dhladla	0812345678
Mozambique	2019-08-23	2019-09-03	Kajal Singh	0619988772
Kruger National Park	2019-09-15	2019-09-18	Senzo Dhladla	0812345678

This data in the database can be used for data mining.

- a. Give examples of three questions that can be analysed using the database?
- b. Whom will your answers help? I.e. who will get the advantage of the answers obtained from your questions?
- c. What must you do to mine a database?
- d. To gain access to a database, which of the following options can you legally apply?
 - i. You can ask someone that you know to get access for the database.
 - ii. You can buy access to their database from a company.
 - iii. You can give money to an employee of the organisation to get you access to the database.
 - iv. You can hack into a database.
 - v. You could personally request access to the database.
 - vi. You could use a scraper or the website's API to record data directly from the site.
 - vii. You can use a free database from the internet.

- 1.6.2** Which website does not provide data sets for free.

- a. Code for South Africa
- b. Gapminder
- c. University of Pretoria
- d. Reddit comments



Activity 1.6

Data mining *continued*

- 1.6.3** What must you do after you obtained access to the database?
- a. Filter the information
 - b. Read through the information to find what you are looking for.
 - c. Look for patterns in the information you obtained.
 - d. Extract the information, creating a new database that contains only the information relevant to you.
- 1.6.4** The following is an example of a pattern that may emerge from the TBL Tour database.
- a. Senzo does every second trip.
 - b. The starting dates are evenly spaced.
 - c. The lengths of the tours are all the same.
 - d. There is an even distribution between the different destinations.
- 1.6.5** The final step in the data mining process is _____
- a. Extracting data.
 - b. Obtaining knowledge
 - c. Developing a strategy.
 - d. Accessing a data set
- 1.6.6** Which of the following targets are SMART.
- a. By decreasing the price of Gautrain tickets by 70%, you hope to increase the number of passengers by 20% over the next six months.
 - b. By decreasing the price of Gautrain tickets, you hope to increase the number of passengers by 20%.
 - c. By decreasing the price of Gautrain tickets by 10%, you hope to increase the number of passengers by 20% over the next six months.

1.4 Caring for and managing data

In this unit, you will learn more about the value of data and how data can be protected.

VALUE OF DATA AND METADATA

Data can be valuable for many different reasons. For example, online shopping websites can charge owners a fee for placing an advertisement of their house, used car or gym equipment on the website. However, the only way in which owners will be willing to pay this fee is if the database already contains many other products. To gather the data needed to sell these products, the website's creator can ask sellers to enter the important data for their products on the website, from where it is added to the database.

For a database to be useful, it needs to record and store valuable and useful data. To decide if the data is valuable to record, you can ask yourself these questions:

- n Will I ever use the data in this field?
- n Will anyone else use the data in this field?
- n What fields do I need specifically for my application?
- n What fields would I need for my application in the future?

Based on these questions, you can determine whether certain types of data are valuable to record and store in your database. Only data that will potentially be used by you (either now, or in the future) is valuable. Data that will not be used increases the size of your database without adding value to it.

Once you have determined whether the data itself is valuable, you need to ensure that the data is of a high quality. The following five characteristics determine the quality of the data.

CHARACTERISTIC	DESCRIPTION
Accurate	This means that the data needs to be both correct and precise.
Consistent	This means that the data in one part of your database should not contradict or differ from the data in another part of your database.
Current	For the information to be of high-quality, it is important that it is up-to-date. If you fail to keep your information current, you run the risk that it will no longer be relevant or accurate.
Complete	In a database, incomplete data is almost as bad as inaccurate data. Gaps in the data can cause the data to be difficult to use, outdated and misleading.
Relevant	Good quality data is relevant to the people who are using it.

HOW TO PROTECT DATA

Databases need to be protected from several different threats, including incorrect data entry, data corruption, data loss, accidental data deletion, purposeful data deletion and unauthorised access. In the following sections, you will look at eight tools and techniques that can be used to protect databases from these threats:

- Data validation
- Data verification
- Data integrity checks
- Logging changes
- Data warehousing
- Access control
- Parallel data sets

Since no single tool offers perfect protection against all threats, most large databases use most or all these tools.

DATA VALIDATION

Data validation refers to the process in which you check whether the data is accurate, in the correct format or of the correct type before allowing your database to record it. This ensures that the data in your database is consistent and accurate. It can also be used to prevent certain types of unauthorised access (such as [SQL injections](#)).

For example, if you are recording data for a government survey, you can use a digit validation to ensure all people's ID numbers are exactly 13 digits long. This prevents you from accidentally adding incorrect ID numbers to the database.

DATA VERIFICATION

Data verification is a manual technique that can be used to make sure that the data on a database is correct and accurate. There are two main ways to do this:

- **Full verification** which requires that each piece of data that is entered into a database is read and checked by someone. This, however, can be very time consuming.
- **Sample verification**, in which a randomly selected sample of data is checked to ensure there are not systematic errors. This can help you to notice errors that occur in all data, but with this method it is possible to miss small mistakes (like typing errors).

DATA INTEGRITY

When we speak about data integrity, we are referring to the reliability, accuracy and how trustworthy data is over its entire lifecycle. This ties in with [data security](#) because uncorrupted data (integrity) is considered to be 'clean data' that stays unchanged throughout its lifecycle.

Many DBMSs have built-in [integrity controls](#) that help to maintain the data integrity. This includes features such as data validation and access control, but also refers to several automatic maintenance processes to prevent data corruption and errors from occurring in a database.

LOGGING CHANGES

Logging is the process of recording any changes made by users to a database. While logging does not directly protect a database from any possible threats, it can discourage people from sabotaging a database and make it easier to solve any problems once they occur.

This is called creating an [audit trail](#). The audit trail records exactly:

- who made the changes
- what the user changed
- when they made the changes.

DATA WAREHOUSING

Data warehousing is a technique used for storing data from more than one database, it is usually stored in a way that is secure, reliable and easy to retrieve. While data warehousing is generally not considered as a security tool, it can help improve data integrity in several ways:

- Data warehouses make incorrect data entries or data corruption more visible by allowing data analysis.
- Data warehouses can make data loss more visible, allowing the problem to be fixed.
- Data warehouses can be used to recover critical data if it is deleted or corrupted.

Data warehouses are also a potential security weakness for databases. Your database could have all the best security features in the world, and it would not matter if hackers could simply access your data warehouse.

ACCESS CONTROL

Access control refers to managing and controlling the parts of a database that users have access to. By limiting the number of people who can change a database, and by limiting what changes each user can make, you can reduce the damage that any single user can do to a database. This becomes especially important when many users have access to your database.

There are three important ways to control access to your data:

- Passwords ensure that only the owner of a username can log in with that username.
- User rights determine which tables and fields every username can access, and what changes (if any) the user can make to these tables. This prevents others from gaining access to certain data or making changes they are not authorised to do.
- Good database security ensures that the data is secure and that outside people cannot find other ways to access the database.

For example, by using access control on a large news website, regular guests may be able to read stories but not change the data. Writers may be able to add new stories to the website but not add new users or delete stories. Finally, one or two administrators may be able to add new users or delete stories.

PARALLEL DATA SETS

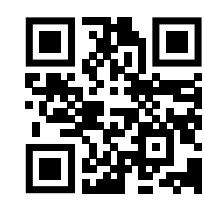
Backups are the most important tool to protect databases from data loss and data corruption. To ensure that data has not been corrupted or deleted, the database is checked at intervals against a perfect copy of it, called a parallel data set. If there are differences, it means that data was either corrupted or deleted.

A company, like YouTube, would break the database into smaller pieces and have multiple backups of each piece. In this way you never risk losing the entire database at once, and even if a database crash occurs, the system can automatically load an existing backup while creating new backups.

Database backups should be protected as securely as the database itself. There have been many instances of websites where the database backup, rather than the can protect data from data corruption, data loss, accidental deletion and purposeful deletion.



QR CODE



<https://www.youtube.com/watch?v=avP5d16wEp0>

<https://qrs.ly/4la5pff>



Activity 1.7

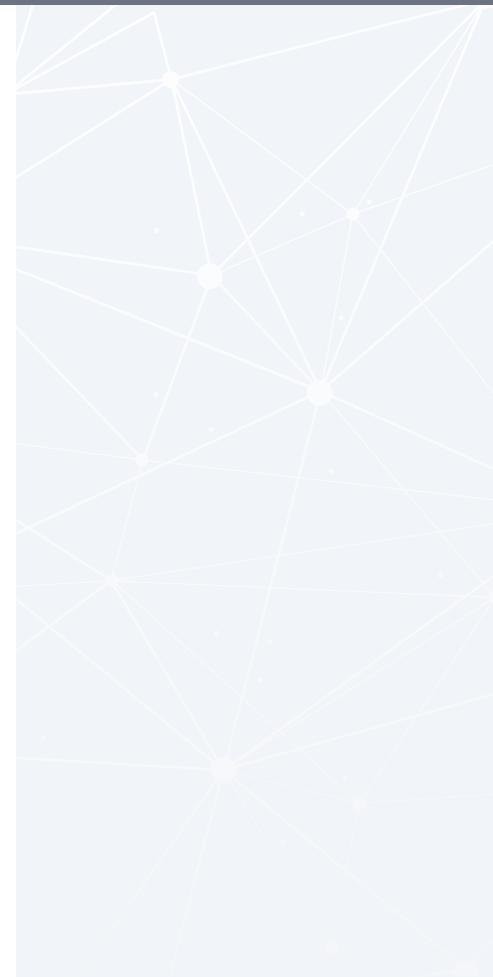
Caring for and managing data

1.7.1 Choose the correct answer.

- a. Data validation refers to _____?
 - A. Built-in integrity controls that help to maintain the data integrity.
 - B. A technique used for storing data from more than one database in a way that is secure, reliable and easy to retrieve.
 - C. The process in which you check whether the data is accurate.
 - D. A manual technique that can be used to make sure that the data on a database is correct and accurate.
- b. Verification refers to _____?
 - A. Built-in integrity controls that help to maintain the data integrity.
 - B. A technique used for storing data from more than one database in a way that is secure, reliable and easy to retrieve.
 - C. The process in which you check whether the data is accurate.
 - D. A manual technique that can be used to make sure that the data on a database is correct and accurate.
- c. Warehousing refers to _____?
 - A. Built-in integrity controls that help to maintain the data integrity.
 - B. A technique used for storing data from more than one database in a way that is secure, reliable and easy to retrieve.
 - C. The process in which you check whether the data is accurate.
 - D. A manual technique that can be used to make sure that the data on a database is correct and accurate.
- d. Databases need to be protected from several different threats, including:

A. Data mining	B. Unauthorised access
C. Data redundancy	D. Audit trails
- e. What does an audit trail record? [Hint: This question has more than one correct answer.]
 - A. Who made the changes?
 - B. Why were the changes made?
 - C. What did the user change?
 - D. When did they make the changes?
- f. Explain what data corruption is.
 - A. When a hacker steals money from someone else using personalised data.
 - B. When someone says something that is not true about someone else on the internet.
 - C. A criminal action by someone in a position of power using private data.
 - D. Errors in computer data that occur during writing, reading, storage, transmission, or processing, which introduce unintended changes to the original data.
- g. Which of the following threats are prevented by the validation of data?

A. Incorrect data entry	B. Data corruption
C. Accidental deletion	D. Data loss





Activity 1.7

Caring for and managing data *continued*

- 1.7.2** Explain in your own words why data is valuable.
- 1.7.3** List three tools and techniques that can prevent accidental and purposeful data deletion.
- 1.7.4** Explain how parallel data is used to detect and correct data corruption or loss
- 1.7.5** Today, the entire world's financial system is stored on databases that are connected to the internet. Whether you are an individual with R10 in your bank account or a massive company with billions of Rand in your account, your money is stored on a database connected to the internet. As you can imagine, this data is not only incredibly valuable, but also incredibly important to protect.

Answer the following questions.

- a.** List six techniques that can be used to protect data.
- b.** Criminal hackers around the world are trying to break into banks' databases. List two techniques that can be used to protect data from unauthorised access.
- c.** What is data integrity and why is data integrity critical for a bank's database?
- d.** Do you think banks make backups of their databases? Give reasons for your answer.

CONSOLIDATION ACTIVITY**Chapter 1: Database Management**

1. Choose the correct answer.
 - a. Which of the following scenarios does NOT need a database?
 - A. Storing the credentials of all Gmail accounts.
 - B. Backing up all the information on your personal computer.
 - C. Storing all the webpages of a website.
 - D. Storing all the information about a business's inventory.
 - b. Which of the following techniques is NOT used to protect data in databases?
 - A. Data encryption
 - B. Data validation
 - C. Data verification
 - D. Access control
 - c. Integrity control is used to check _____.
 - A. Unauthorised access, Data loss and Data corruption.
 - B. Data corruption, Incorrect data entry and Data loss.
 - C. Incorrect data entry, Data corruption and Purposeful deletion.
 - D. Purposeful deletion, Accidental deletion and Unauthorised access.
 - d. Which of the following techniques can be used to recover lost data?
 - A. Access control
 - B. Data verification
 - C. Data validation
 - D. Data warehousing
 - e. Which of the following people would financially benefit from data mining?
 - A. Online advertisers
 - B. Programmers
 - C. Database administrators
 - D. Security personnel
 - f. When you create a data warehouse you need to _____ the data.
 - A. Access, Analyse and Use
 - B. Find, Extract and Store
 - C. Access, Extract and Load
 - D. Extract, Transform and Load
 - g. In location-based data, which of the following is an example of non-static information?
 - A. The most popular Gautrain routes.
 - B. The current flight route of an aeroplane.
 - C. The location of a car.
 - D. The location of a hotel.

CONSOLIDATION ACTIVITY**Chapter 1: Database Management *continued***

2. 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. (You may not simply use the word 'NOT' to change the statement.)
- Full verification is when someone randomly selects a sample of data and manually checks it for systematic errors.
 - Gapminder provides free access to databases of South African matric results.
 - SMART strategies are Specific, Measurable, Achievable, Relevant and Time-bound.
3. 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).
4. Explain TWO ways RFIDS can be used to improve each of the following industries:
- Retail stores
 - Train transportation systems.
 - Universities and colleges
 - Medical hospitals
5. Below are THREE development strategies based on different databases. State which of them are SMART strategies. Give a reason for your answer.

STRATEGY	IS IT A SMART STRATEGY?	EXPLANATION FOR ANSWER
Show car adverts on TV between 10 P.M and 12 P.M.		
Sell airtime in clothing stores like Edgars and Woolworths for the next three months to see if it increases clothing sales.		
Use flyers to advertise a new store opening in a mall, so that people will go and shop at the mall more and increase mall sales by 30% before the store opens.		

6. Other than banking, name ONE other industry that can make use of database transaction tracking. Also provide an example of a scenario in which they would use it.
7. Cherry wants to expand her small bakery business, by creating a website so that she can sell her goods online. Cherry will need to make use of a DBMS and she will need to find ways to secure her business's data.
- Who would Cherry need to hire to help her keep her create, maintain and secure her database.
 - Mention ONE way location-based technology can help Cherry expand her business.
 - Mention ONE way Cherry can use data mining to improve and expand her business.

DATABASE DESIGN CONCEPTS

CHAPTER OVERVIEW

- Unit 2.1** Characteristics of a good database
- Unit 2.2** Problems with databases
- Unit 2.3** How to get rid of anomalies

Learning outcomes

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

- provide the characteristics of a good database
- describe the problems with databases
- explain normalisation and the process.

INTRODUCTION

Data is stored in tables in a database. It can be stored in a single table (called a **flat database** – as shown in Figure 2.1) or in multiple connected tables (called a **relational database** – as shown in Figure 2.2).

Title	Artist	Song information				Title	Artist	Album information				Name	Albums	Songs	Artist information		
		Duration	Album	Track number	Music file			Date	Duration	Cover art	Biography				Artist picture		
Broken Whiskey Glass	Post Malone	0:35:32	Stoney	1		Stoney	Post Malone	09/12/2016	0:50:40		Post Malone	Stoney; Beerbongs & Bentleys;	Broken Whiskey Glass; Big Lie; Déjà Vu; No Option; Cold; White Heroin; Fall Apart; Patienc; Go Flex; Feat; Too Young; Congratulations feat; Quavo; Up There; Yours Truly; Austin Post; Farinold feat; Swae Lee; Spoil My Night; Rich & Sedi; Zack and Codine; Takin' Shots; Rockstar; Feat; 21 Savage; Over Now; Psycho Feat; Ty Dolla \$ign; Better Now; Ball; For Me; Feat; Nicki Minaj; Othesense; Stay; Blame It on Me; Same; Birthes; Jonestown; 2 Explorers; Candy Party; Sugar Waifit;	Austin Richard Post (born July 4, 1995), known professionally as Post Malone, is an American rapper, singer, songwriter and record producer. Born in Syracuse, New York and raised in Grapevine, Texas, Malone began his musical career following the release of his debut single "White Iverson" in 2015. The song, which peaked at number fourteen on the Billboard Hot 100 and later certified quadruple platinum, allowed Malone to secure a recording contract with Republic Records later that year.			
Big Lie	Post Malone	0:32:27	Stoney	2		Stoney	Post Malone	09/12/2016	0:50:40		Post Malone	Stoney; Beerbongs & Bentleys;	broken Whiskey Glass; Big Lie; Déjà Vu; No Option; Cold; White Heroin; Fall Apart; Patienc; Go Flex; Feat; Too Young; Congratulations feat; Quavo; Up There; Yours Truly; Austin Post; Farinold feat; Swae Lee; Spoil My Night; Rich & Sedi; Zack and Codine; Takin' Shots; Rockstar; Feat; 21 Savage; Over Now; Psycho Feat; Ty Dolla \$ign; Better Now; Ball; For Me; Feat; Nicki Minaj; Othesense; Stay; Blame It on Me; Same; Birthes; Jonestown; 2 Explorers; Candy Party; Sugar Waifit;	Austin Richard Post (born July 4, 1995), known professionally as Post Malone, is an American rapper, singer, songwriter and record producer. Born in Syracuse, New York and raised in Grapevine, Texas, Malone began his musical career following the release of his debut single "White Iverson" in 2015. The song, which peaked at number fourteen on the Billboard Hot 100 and later certified quadruple platinum, allowed Malone to secure a recording contract with Republic Records later that year.			
Déjà Vu	Post Malone	0:35:34	Stoney	3		Stoney	Post Malone	09/12/2016	0:50:40		Post Malone	Stoney; Beerbongs & Bentleys;	Broken Whiskey Glass; Big Lie; Déjà Vu; No Option; Cold; White Heroin; Fall Apart; Patienc; Go Flex; Feat; Too Young; Congratulations feat; Quavo; Up There; Yours Truly; Austin Post; Farinold feat; Swae Lee; Spoil My Night; Rich & Sedi; Zack and Codine; Takin' Shots; Rockstar; Feat; 21 Savage; Over Now; Psycho Feat; Ty Dolla \$ign; Better Now; Ball; For Me; Feat; Nicki Minaj; Othesense; Stay; Blame It on Me; Same; Birthes; Jonestown; 2 Explorers; Candy Party; Sugar Waifit;	Austin Richard Post (born July 4, 1995), known professionally as Post Malone, is an American rapper, singer, songwriter and record producer. Born in Syracuse, New York and raised in Grapevine, Texas, Malone began his musical career following the release of his debut single "White Iverson" in 2015. The song, which peaked at number fourteen on the Billboard Hot 100 and later certified quadruple platinum, allowed Malone to secure a recording contract with Republic Records later that year.			
No Option	Post Malone	0:29:59	Stoney	4		Stoney	Post Malone	09/12/2016	0:50:40		Post Malone	Stoney; Beerbongs & Bentleys;	Broken Whiskey Glass; Big Lie; Déjà Vu; No Option; Cold; White Heroin; Fall Apart; Patienc; Go Flex; Feat; Too Young; Congratulations feat; Quavo; Up There;	Austin Richard Post (born July 4, 1995), known professionally as Post Malone, is an American rapper, singer, songwriter and record producer. Born in Syracuse, New York and raised in Grapevine, Texas, Malone began his musical career following the release of his debut single "White Iverson" in 2015. The song, which peaked at number fourteen on the Billboard Hot 100 and later certified quadruple platinum, allowed Malone to secure a recording contract with Republic Records later that year.			

Figure 2.1: Data stored in a single table in a flat database

The screenshot displays three tables in a relational database:

- Song Table:** Contains columns: Title, Artist, Duration, Album, Track number, and File size. It lists various songs by Post Malone.
- Artist Table:** Contains columns: Name, Alias, and Description. It lists Post Malone's names and descriptions.
- Biography Table:** Contains columns: Name, Alias, Songs, and Biography. It provides detailed information about Post Malone's career and achievements.

Figure 2.2: Data stored in multiple tables in a relational database

New words	
field – a single bit of information about a person or an item, for example, age	
record – a group of related fields about an item or person that is captured in the table	
Primary key – a field that holds a unique identifier for each record in the database (Unique means there is only one of its kind)	

Each table consists of **fields** and **records**. Fields are the categories that you want to record data for. For example, the music table shown above, contains fields like Title, Artist, Duration and Album. Records refer to the actual data being captured, with each record containing the data of a single item. For example, in the Song table, each record represents a single song, with all the information (like artist and duration) related to that song.

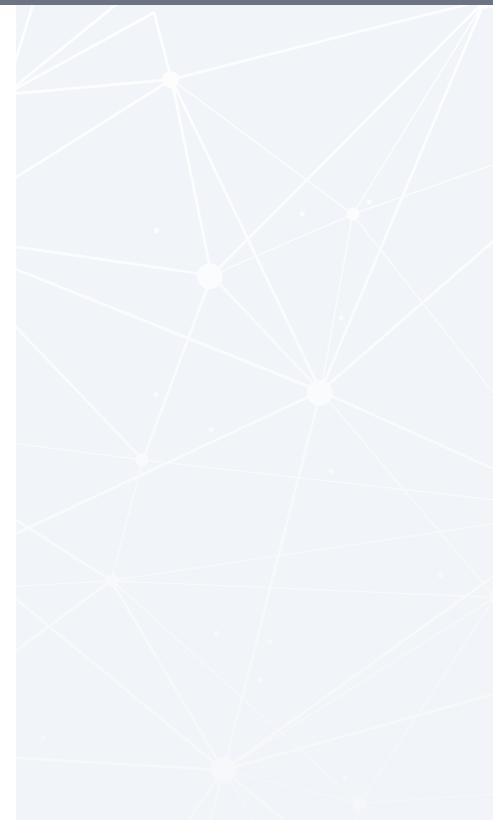
Each table may have one **compulsory field**, called a primary key, which contains a **unique identifier** for each record in the database. This allows you to refer to a specific record on a table in such a way that it could only refer to one entry. While it is possible to make an existing field of a table a key field, database creators usually create a new field specifically for this purpose. This allows them to make sure that there are no duplicates.

Sometimes there are anomalies with databases, you will learn how to get rid of these anomalies.

In this chapter, you will design and create a relational database. Sometimes there are anomalies with databases, you will learn how to get rid of these and reach normalisation.

DATABASES IN A NUTSHELL

Data, in principal, is stored in 1s and 0s. The computer still needs to know how these 1s and 0s are organised and how they should be interpreted. In order to do this, 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.



We know that each letter in the alphabet represents a character. When you add enough characters together, they form a word (like ‘orange’ or ‘love’) that represents a concept. Therefore, allowing communication of useful information between two or more people – even across distances.

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

ACTIVITY 2.1

Revision Activity

- 2.1.1** In your own words, explain what a database is and what it can be used for. Provide an example to support your answer.
- 2.1.2** True or False: A data warehouse uses transaction data from various sources and makes analytical use of the data.
- 2.1.3** Fill in the blanks by choosing the correct term from the list below:
[warehouse, tables, current, record, relational, primary, field]
 - a. Data is stored in _____ in a database.
 - b. A single bit of information about an item or person is a _____.
 - c. When many related fields about an item are put together they form a _____.
 - d. A _____ key contains unique identifiers for each record in a database.
 - e. A database is designed to store _____ transactions whilst a data _____ stores a large quantity of historical data.
 - f. A _____ database stores data in multiple tables.

2.1 Characteristics of a good database

All good databases should begin with valuable metadata and data. In Chapter 1 we looked at the characteristics of valuable data and how to manage that data. These are illustrated in Figure 2.3 below:

The Infoneering Model

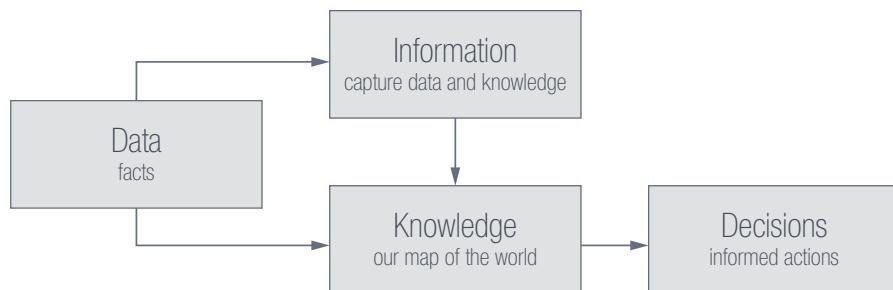


Figure 2.3: How to manage valuable database

Let's now look at the characteristics of a good database:

- The database should be strong enough to store all the relevant data and requirements.
- Should be able to relate the tables in the database by means of a relation, for example, an employee works for a department so that employee is related to a particular department. We should be able to define such a relationship between any two entities in the database.
- Multiple users should be able to access the same database, without affecting the other user. For example, several teachers can work on a database to update learners' marks at the same time. Teachers should also be allowed to update the marks for their subjects, without modifying other subject marks.
- A single database provides different views to different users, it supports multiple views to the user, depending on his role. In a school database, for example, teachers can see the breakdown of learners' marks; however, parents are only able to see only their child's report – thus the parents' access would be read only. At the same time, teachers will have access to all the learners' information and assessment details with modification rights. All this is able to happen in the same database.
- **Data integrity** refers to how accurate and consistent the data in a database is. Databases with lots of missing information and incorrect information is said to have low data integrity.
- **Data independence** refers to the separation between data and the application (or applications) in which it is being used. This allows you to update the data in your application (such as fixing a spelling mistake) without having to recompile the entire application.
- **Data Redundancy** refers to having the exact same data at different places in the database. Data redundancy increases the size of the database, creates Integrity problems, decreases efficiency and leads to anomalies. Data should be stored so that it is not repeated in multiple tables.
- **Data security** refers to how well the data in the database is protected from crashes, hacks and accidental deletion.
- **Data maintenance** refers to monthly, daily or hourly tasks that are run to fix errors within a database and prevent anomalies from occurring. Database maintenance not only fixes errors, but it also detects potential errors and prevents future errors from occurring.

There are also many people involved with organising a well-run database. These are:

- the **developers**, who design and develop the database to suite the needs of an enterprise
- the **administrator**, who:
 - checks the database for its usages
 - who is checking it
 - provides access to other uses
 - provides any other maintenance work required to keep the database up to date
- the **end user**, who uses the database, for example, teachers or parents.

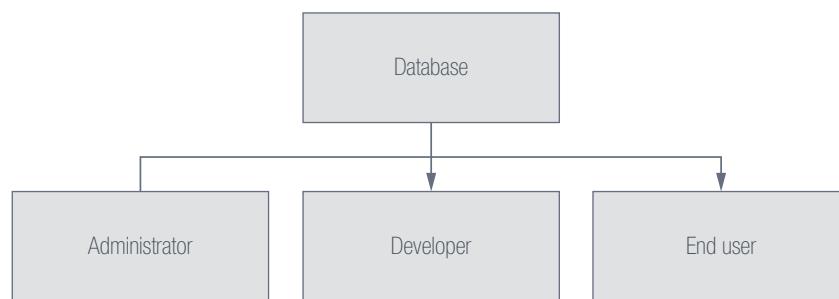


Figure 2.4: People involved with organising a well-run database



Activity 2.1

- 2.1.1** 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. 5–F).

COLUMN A	COLUMN B
1. Data maintenance	A. It refers to how well the data in the database is protected from crashes, hacks and accidental deletion.
2. Data integrity	B. It refers to how accurate and consistent the data in a database is.
3. Data redundancy	C. It refers to the separation between data and the application (or applications) in which it is being used.
4. Data security	D. It refers to monthly, daily or hourly tasks that are run to fix errors within a database and prevent anomalies from occurring.
5. Data independence	E. It refers to storing the exact same data at different places in a database.

- 2.1.2** Describe the three types of people who are involved with a database.

- 2.1.3** List the five characteristics of quality data.

- 2.1.4** A school would like to create a database that can:

- keep the parents informed about their child's academics, assessments and school activities
- help the teachers record work and assessments
- store details of each child and their families.
 - a. Work in small groups of four or five learners. Discuss each characteristic of a good database and explain these referring to the scenario above.
 - b. Use a mindmap to present your discussion.

2.2 Problems with Databases

If a flat-file database is poorly planned, denormalised and inconsistent, it will create problems when trying to insert, delete or modify the records (tables) in the database. This causes **anomalies**, which make handling the data increasingly difficult as the database grows. It also makes the data integrity harder to maintain. Trying to make the data consistent once an anomaly occurs can become quite difficult.

There are three types of problems that can occur in databases:

- **Insertion anomaly:** The database has been created in such a way that required data cannot be added unless another piece of unavailable data is also added. For example, a hospital database that cannot store the details of a new member until that member has been seen by a doctor.
- **Deletion anomaly:** The legitimate deletion of a record of data can cause the deletion of some required data. For example, deleting some of the patient's details can remove all the details of the patient from the hospital database.
- **Modification anomaly:** Incorrect data may have to be changed, which could involve many records having to be changed, leading to the possibility of some changes being made incorrectly.

Example 2.1

Problems that occur in a database

For example, look at the below schema that represents information related to a school:

AccountInfo

ACCOUNTNO	ACCOUNTNAME	ACCOUNTADDRESS	CHILD	BALANCE
335684	Agatha Jones	Cape Town	Keene	R451
335684	Bob Jones	Cape Town	Keene	R451
335684	Agatha Jones	Cape Town	Joshua	R451
335684	Bob Jones	Cape Town	Joshua	R451

Problems:

- **Data redundancy:** Data redundancy refers to storing the exact same data at different places in a database. Data redundancy increases the size of your database, creates integrity problems, decreases the efficiency of the database and can lead to database anomalies. Data should be stored in such a way that it should not be repeated in multiple tables. The family can be represented as one unit.
- **Update anomaly:** Data will be inconsistent if one entity is updated, for example, if the family address changes, the data capturer will need to change all four entities.
- **Unable to represent some information:** the school cannot keep information about learners who are on the waiting list as they do not have an account with the school.
- **Deletion anomaly:** closure of the account for one child will remove all data of the second child from the database.



Activity 2.2

2.2.1 List the three types of anomalies and provide an example for each one.

2.2.2 Look at the below schema that represents information related to a hospital:

AccountInfo

ACCOUNTNO	ACCOUNTNAME	ACCOUNTADDRESS	DOCTOR	BALANCE
45873	J Jones	Cape Town	Dr Pretorius	R12 342
45874	P Jones	Cape Town	Dr Pretorius	R762
45875	R Jones	Cape Town	Dr Pretorius	R980
45875	R Jones	Durban	Dr James	R2 633

List and explain at least four anomalies with this database.

2.3 How to get rid of Anomalies

To prevent anomalies you need to normalise the database by efficiently organising the data in a database.

According to Edgar F Codd, the inventor of relational databases, the goals of normalisation include:

- removing all redundant (or repeated) data from the database
- removing undesirable insertions, updates and deletion dependencies
- reducing the need to restructure the entire database every time new fields are added to it
- making the relationships between tables more useful and understandable.

Normalisation is a systematic approach of decomposing tables to eliminate data redundancy and Insertion, Modification and Deletion Anomalies. The database designer structures the data in a way that eliminates unnecessary duplication(s) and provides a rapid search path to all necessary information. It is a multi-step process that puts data into tabular form, removing duplicated data from the relation tables. This process of specifying and defining tables, keys, columns, and relationships in order to create an efficient database is called **normalisation**.

Normalisation will reduce the amount of space a database uses and ensure that data is efficiently stored. Without normalisation, database systems can be inaccurate, slow, and inefficient. They might not produce the data that you expect.

In practice this means changing your database so that the following requirements are met:

- each table must have a **primary key**
- each record should have single valued attributes/columns (atomic)
- there should be no repeating groups of information.

Keys are used to establish and identify relationships between tables and also to uniquely identify any record or row of data inside a table. A key can be a single attribute or a group of attributes (composite-primary key), where the combination may act as a key. Keys help us to identify any row of data.

When designing a database, the four types of key fields are:

- **Primary key:** the field selected by the database creator to uniquely identify each record on a table. For example, each song in your music database might have a primary key field called “song_id”.
- **Alternative key:** a field containing unique values that could be used as the primary key but is not currently set as the primary key, for example, artist_id.
- **Foreign key:** a field containing values from a different table’s primary key field. Foreign keys are used to show the relationship between different tables. For example, each song in your music database might have a foreign key field called “artist_id” that links the song to a specific artist on an “artists” table.
- **Composite key:** a combination of more than one field that uniquely identifies each record on a table, for example, song_id and artist_id.

Let’s use this example to understand the four main types of keys:

SONG_ID	ARTIST_ID	TYPE OF MUSIC	YEAR
Twinkle twinkle	Mary	Lullaby	1893
Humpty dumpty	Percy	Nursery rhyme	1872
Snowflake	King	Lullaby	1978
Wheels on the bus	Dwayne	Nursery rhyme	1956

Normalisation rules are divided into the following normal forms:

FIRST NORMAL FORM (1NF)

For a table to be in the **First Normal Form**, it should follow the following four rules:

- **Each column must have a separate field/attribute.** Each column of your table should not contain multiple values. For example, imagine the database for Facebook status updates, specifically the table related to likes. For the records to be indivisible, each like should be stored in a separate record. In this way, each record would either have occurred or not occurred. There is no way to say that only a small part of the like occurred, while a different part did not. However, if all the likes for a status update are stored in a single record, then the record would be divisible, since it would be possible for some of the likes to have occurred while others did not occur.
- **Values stored in a column should be of the same kind or type (domain).** In each column the values stored must be of the same kind or type.
- **All the columns in a table should have unique names.** Each column in a table should have a unique name to avoid confusion at the time of retrieving data or performing any other operation on the stored data. For example, specify Child's name and parent's name, don't use 'Name'.
- **The order in which data is stored, does not matter.** For example

ACCOUNTNO	NAME	SUBJECT
542	Tafadzwa	Eng, Maths
543	Sipho	Science, ICT
544	Gift	ICT, Maths
545	Naledi	English, Science

- The table complies to three rules out of the four rules: the column names are unique, the data stored is in the correct order and there are no inter-mixed different types of data in the columns. However, the learners in the table have opted for more than one subject. This data has been stored in the subject names in a single column. As per the 1NF, each column must contain a single value.

SECOND NORMAL FORM (2NF)

For a table to be in the **Second Normal Form**:

- it should be in the First Normal Form.
- and it should not have Partial Dependency.

This is where an attribute in a table depends on only a part of the primary key and not on the whole key. For example, a table records the primary keys as student_id and the subject_id of each learner. Only the teacher's name depends on subject. So, the subject_id, and has nothing to do with student_id.

THIRD NORMAL FORM (3NF)

A table is said to be in the **Third Normal Form** when:

- it is in the Second Normal Form.
- it does not have Transitive Dependency. Transitive Dependency occurs when an attribute/field depends on other attributes/fields rather than depending on the primary key.

This is an indirect relationship between values in the same table.



Activity 2.3

- 2.3.1** Explain why normalisation is important for a database.
- 2.3.2** How can normalisation be reached?
- 2.3.3** List and describe the four types of key fields that can be used in a database.
- 2.3.4** How would you fix the below table to reach 1N?

ACCOUNTNO	NAME	SUBJECT
542	Tafadzwa	Eng, Maths
543	Sipho	Science, ICT
544	Gift	ICT, Maths
545	Naledi	English, Science

- 2.3.5** Give examples, not mentioned above, of the different key fields.
- 2.3.6** Using the information in the table below, give examples of any two keys.

STUDENT_NAME	STUDENT_PHONE	SUBJECT	TEACHER	TEACHER_PHONE	TEST_1	TEST_2	EXAM
John Smith	082 000 0000	Mathematics	Siyabonga Molefe	083 123 4567	67%	72%	81%
John Smith	082 000 0000	Science	Pieter Botha	083 986 5432	41%	65%	62%
Junior Ndlovu	082 111 1111	IT	Mpho Dlamini	082 333 3333	81%	84%	88%
Junior Ndlovu	082 111 1111	Science	Pieter Botha	083 986 5432	71%	73%	73%
Junior Ndlovu	082 111 1111	Mathematics	Siyabonga Molefe	083 123 4567	79%	65%	81%

CONSOLIDATION ACTIVITY**Chapter 2: Database design concepts**

- 1.** Choose the correct answer.
 - a.** Which of the following scenarios does NOT need a database?
 - A. Storing the credentials of all Gmail accounts.
 - B. Backing up all the information on your personal computer.
 - C. Storing all the webpages of a website.
 - D. Storing all the information about a business's inventory.
 - b.** Which of the following is a characteristic of a good database?
 - A. Making copies of data in a database for backup.
 - B. Keeping the data and application connected and dependant on each other.
 - C. Preventing errors from occurring in the database.
 - D. Storing data in different formats.
 - c.** Which of the following is needed to make each record in a database table different?
 - A. Secondary key
 - B. Foreign key
 - C. Primary key
 - D. Alternative key
- 2.** List the four types of keys used to design a database. Design a table to use as an example.
- 3.** In database design what are the requirements for 1NF, 2NF and 3NF?

HARDWARE

CHAPTER OUTCOMES



- Unit 3.1 Mobile technologies
- Unit 3.2 Factors influencing performance of a computer
- Unit 3.3 Motivate a typical computer system in respect of user requirements



Learning outcomes

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

- list the advantages and disadvantages of mobile technologies
- discuss the factors influencing the performance of a computer
- make better hardware buying decisions and make recommendations for specific scenarios.

INTRODUCTION

A large reason for this trend towards mobile computing is that mobile computers provide you with most of the advantages of computers wherever you go. Computer users no longer need to sit in one place to use a computer or a fixed internet line to connect to the internet. Instead, any question you have, message you need to send, video you want to watch or song you want to listen to, is now available to you wherever you go – if you have a smartphone.

Most of the tasks smartphones are not suited to do (sending long emails, creating documents etc.), notebooks can do exceptionally well. It is only in specialist areas like programming, video editing and gaming that desktop computers are preferred. As a result, many desktop computers are sold to power users and gamers, while average computer users prefer mobile computers.

In this chapter you will learn about the advantages and disadvantages of mobile computing and how to troubleshoot hardware problems. You will also learn more about choosing hardware components and designing an appropriate computer for different situations.

HARDWARE IN A NUTSHELL

You have learnt about the different hardware devices, their functions and capabilities. Here is a recap of these:

- An input device allows the user to interact directly with a computer. An input device allows the user to interact directly with a computer. Common input devices include the following: keyboards, pointing devices (mouse), touch-sensitive pads, pen input, video input, scanners, capturing devices, data collection devices, biometric input, and card readers.
- 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). Common input/output devices include: touch screens, game controllers, digital cameras, smart phones, smartboards, toy/electronic device interfaces.
- 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), and printers (inkjet, ink tank, laser, 3-D).
- 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. Types of storage devices: hard disk drive (HDD), external (portable) hard drives, solid-state drive, hybrid storage device, flash drives (disks), SD/memory cards, cd, dvd and blu-ray drives.
- Processing devices are the computer devices responsible for carrying out instructions and performing calculations. Processing devices include: central processing unit (CPU) and the graphics processing unit (GPU).

ACTIVITY 3.1

Revision Activity

- 3.1.1** List five examples of hardware.
- 3.1.2** List five of your own examples of input devices.
- 3.1.3** Explain how computers have changed (in what way, advantages and disadvantages).

3.1 Mobile technologies

In ICT, mobile technologies refer to computing devices like smartphones, laptops and tablets. These are small, but powerful, devices that are easy to carry around. This unit will look briefly at the advantages of mobile computers, before looking at the constraints faced by mobile computer creators.

UNDERSTANDING SMARTPHONES

Small, mobile computers and smartphones have most of the same hardware as desktop computers. As such, it is important to understand how smartphone components compare with those of desktop computers. In general:

- A smartphone features an onscreen-touch keyboard that is much smaller than that of a standard computer. The keyboard and mouse of a standard computer is preferred because of the comfortable sizing.
- Smartphones screens are touch screens that are smaller than desktop screens.
- Standard computers generally can be fitted with more RAM and faster processors, making them better suited to tasks that require significant processing power.
- Smartphones come standard with communication devices like bluetooth and wifi, making them better at connecting to the internet via the numerous hotspots anywhere in the world.

This means that desktop computers are more powerful and are better suited for serious computing tasks, whether it is a processor intensive task such as encoding videos or inputting large amounts of data. However, high-end smartphones are small, easy to carry around and better suited than computers at many tasks requiring a very mobile computer. This includes tasks like reading messages and emails, setting reminders, checking the weather, updating social media accounts, making bank payments, doing Google searches and making voice and video calls.

Smartphones and tablets are also better at location-based computing, which refers to software that changes the application based on a user's location. As you have learned in Chapter 1, examples of location-based computing include weather applications, food ordering applications, car sharing services, dating applications and **augmented reality (AR)** applications.

All these technologies use a combination of GPS and mobile internet connections to improve the service they offer you. Many of these location-based services are unique to mobile computers.

ADVANTAGES OF MOBILITY

When compared to desktop computers, mobile computers have several significant advantages. Amongst these advantages is:

- **size and weight:** due to these devices being small and light weight, they are easy to carry around, easy to keep on hand, can be used in any location and are comfortable to use without a desk.

As smartphones, tablets and notebooks have become more powerful, the number of uses that desktop computers are significantly better at (like gaming and video editing) have decreased, while the number of tasks that mobile computers are significantly better at continues to increase.

MOBILE CONSTRAINTS

Mobile computing constraints refers to the disadvantages of smart phones, laptops and tablets caused through battery life and computing power versus power consumption.

Let's work through each constraint in order to understand how these constraints affect mobile computers.

BATTERY LIFE

The processing power of a CPU is closely linked to the amount of electricity available to it. The more power your CPU uses; the more instructions it can complete. The problem for smartphones and tablets is that they have a limited amount of power stored in the battery, and this power generally needs to last the whole day.

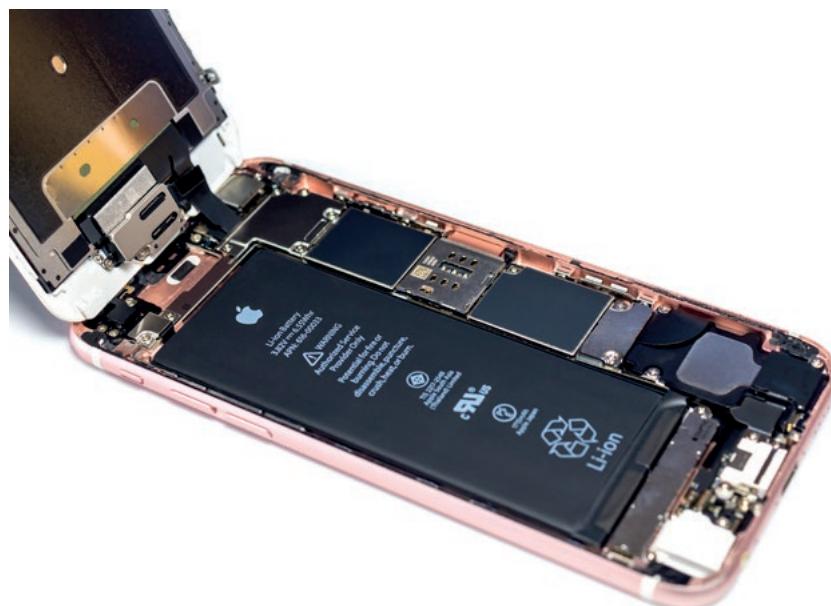


Figure 3.1: Smartphone batteries are designed to last at least one day on a single charge

COMPUTING POWER VS POWER CONSUMPTION

Because of the small size of mobile devices (especially smartphones and tablets), all smartphone components need to be miniaturised. The physical size of a smartphone or tablet CPU is almost the same as the physical size of a desktop CPU. However, unlike desktop CPUs, these chips contain many components, including a CPU, GPU, LTE modem, Wi-Fi connector, RAM, Bluetooth connector and GPS tracker. In a desktop, each of these components are separate – this means that each item can be more powerful.

Even the biggest smartphone monitor is tiny compared to a desktop monitor and can only display a limited amount of information. This makes it unsuitable to use applications that require a large amount of information to be shown (such as spreadsheets or word processing).

- While this works well when it is in a user's hands, it makes it difficult to use with a physical mouse and keyboard.

	A	B	C
1	Timestamp	Name	Date
2	01/03/2018 00:00:00	Azhar Patel	01/03/2018
3	01/03/2018 00:00:00	Caryn O'mahony	01/03/2018
4	01/03/2018 11:49:41	Annamarie Maritz	01/03/2018
5	01/03/2018 15:27:59	Britt Els	01/03/2018
6	02/03/2018 00:00:00	Azhar Patel	02/03/2018
7	02/03/2018 00:00:00	Azhar Patel	02/03/2018
8	02/03/2018 00:00:00	Caryn O'mahony	02/03/2018
9	02/03/2018 10:10:18	Fahd Lajabu	01/03/2018
10	02/03/2018 11:47:51	Annamarie Maritz	02/03/2018
11	04/03/2018 23:53:38	Praise Magidi	01/03/2018
12	04/03/2018 23:55:17	Praise Magidi	02/03/2018
13	04/03/2018 23:57:46	Praise Magidi	03/03/2018
14	04/03/2018 23:59:32	Praise Magidi	04/03/2018
15	05/03/2018 00:00:00	Azhar Patel	05/03/2018
16	05/03/2018 00:00:00	Kassie Kasselman	05/03/2018
17	05/03/2018 00:00:57	Praise Magidi	04/03/2018
18	05/03/2018 10:32:20	Marc Pellencin	02/03/2018
19	05/03/2018 11:56:16	Annamarie Maritz	05/03/2018
20	05/03/2018 13:27:24	Lauwinda Hartley	05/03/2018
21	05/03/2018 13:33:43	Marc Pellencin	05/03/2018
22	05/03/2018 13:34:51	Marc Pellencin	05/03/2018
23	05/03/2018 14:53:59	Ivy Asamoa-awuh	01/03/2018

Figure 3.2: Smartphone do not show large amounts of data well

The last element we will explore is the size of the keyboard. While a smartphone or tablet keyboard is well suited to sending quick messages or occasionally typing an email, they are not well suited to entering large amounts of text.

Taken together, these functions make smartphones and tablets less suitable for tasks requiring a lot of processing power or user input.

Because of this, smartphones simply cannot run the same CPU-intensive programs as computers. Even if they could somehow get rid of all the heat this would generate, their battery would go flat in a few minutes.



Did you know

A high-end gaming PC uses more power in one day than a high-end smartphone uses in a year!



Case Study

Samsung Galaxy Note 7 heat problems

In 2016, the Samsung Galaxy Note 7 was one of the fastest and most expensive smartphones of the year. However, a few weeks after the phone launched, Samsung received thousands of complaints that the phone was heating up to dangerous levels and were forced to recall and refund the owners of more than 2 000 000 Galaxy Note 7s.



Figure 3.3: Many organisations banned people from travelling with Galaxy Note 7's

Two months after being released, Samsung issued a full recall on all Samsung Galaxy Note 7s and stopped all production of the phone. After testing more than 200 000 phones, Samsung announced that the problem was with the lack of space between the CPU and the battery. As a result, the connectors inside the battery warped from the heat, which caused some of them to short circuit and catch fire.



Activity 3.2

Mobile technologies

- 3.2.1** 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. (You may not simply use the word 'NOT' to change the statement.)

- a. In ICT, mobile technologies refer to computing devices that are small, but powerful, devices that are easy to carry around.
- b. The current trend shows that more desktops are sold than mobile devices.
- c. Notebooks are not suited to do tasks such as sending long emails or creating documents.
- d. Mobile computing constraints do not refer to the disadvantages of mobile computers.
- e. The more power a CPU uses the less heat it generates.



Activity 3.2

Mobile technologies *continued*

- 3.2.2** Compare mobile devices with desktop computers and give at least THREE reasons why mobile devices are becoming more popular than their larger counterparts?
- 3.2.3** What are the limitations of smartphone monitors as compared to desktop monitors?
- 3.2.4** You bought yourself a good middle-of-the-range smartphone so that you can play your games wherever you are. However, you soon realise that most of the time you are playing a game, your phone becomes very hot.
- a.** Why does this happen? Explain.
 - b.** Why does this not happen when you play the same games on your desktop computer? Explain in your own words.
 - c.** What other problems may you experience when playing games on your smartphone and why does it happen?
 - d.** Choose whether you would prefer using a desktop computer or a laptop/mobile device. List all the pros and cons of the device you choose. Your list should convince someone else to switch from their current device.

3.2 Factors influencing performance of a computer

Having looked at some of the differences between mobile technologies and traditional desktop computers, it is useful to see exactly how the different computer components influence the performance of a computer or smartphone.

There are two factors that have a direct effect on your CPU's (and therefore, your computer's) performance: **The speed of the CPU** and the **ability of the CPU to run multiple processes**.

The speed of the CPU is a direct measurement of how many instructions it can complete per second. The more instructions it can complete, the faster the CPU and your applications run. This is closely linked to the CPU's clock speed (given in MHz or GHz), which indicates how frequently it will complete an instruction per second.

The second factor is the ability of the CPU to do multiprocessing. Multiprocessing allows a computer to complete tasks from multiple applications at the same time. A CPU that is good at multiprocessing might be able to complete the instructions from hundreds of processes at the same time. A CPU that is not as good at multiprocessing might start stuttering if it tries to run too many processes at once.

A slow GPU will not affect your computer's performance on normal applications (like creating a document or browsing the web), but it will have a big effect on the performance of graphic-intensive tasks, such as playing games or creating videos.

The two main factors that affect the GPU's performance are:

- GPU clock speed (MHz) – the higher the clock speed, the more instructions the GPU can process
- the type of GPU.

MEMORY CAPACITY

RAM

When the RAM capacity is too small, using the computer will become much slower as information needs to constantly be added to and removed from RAM. This will be especially noticeable when switching between two open applications since the computer would need to remove all the previously open application's data from memory and replace it with the new application's data. When this problem becomes serious enough, your computer might automatically close some applications to free up memory.



Not enough memory to open this page

Try closing other tabs or programs to free up memory.

[Learn more](#)

Figure 3.4: A computer might close applications or web pages if it runs out of RAM

CPU CACHE

Another form of memory is caching. Caching refers to a small, temporary form of storage that is created so that the data stored in the cache can be accessed more quickly. There are three important forms of caching:

- **CPU cache:** Due to the growing difference in speed between a computer's CPU and RAM, many CPUs now have a small, high-speed cache built into the CPU where it can temporarily store the data it needs. The speed and size of the CPU cache can have a significant impact on a CPU's performance.
- **Disk cache:** The disk cache is a small amount of RAM that is built into a hard disk drive. It stores data being sent or received by the hard disk plates for a short period of time.
- **Web cache:** The web cache is a small area on a computer's hard drive where images and pages from the **world wide web** are stored for a short period of time. This allows users to quickly load those images from their computers, rather than over a slow internet connection, when they open a page that they have previously viewed.

STORAGE

Secondary Storage (also called external memory or auxilliary storage) is not directly accessible to the CPU. The computer uses its Input/output channels to access secondary storage and transfer the desired data to primary storage. **Hard Disk Drives (HDDs)** and **Solid State Drives (SSDs)** are used as secondary storage. Other examples of secondary storage technologies include USB flash drives, Compact Disks(CDs), Digital Video disks(DVDs) external hard disk drives.



New words

seek time – the time taken for a disk drive to locate the area on the disk where the data to be read is stored.

rotational latency – also called rotational delay, is the amount of time it takes for the desired sector of a disk (i.e., the sector from which data is to be read or written) to rotate under the read-write heads of the disk drive)

SPEED

The access time per byte for HDDs or SSDs is typically measured in milliseconds (one thousandth seconds), while the access time per byte for primary storage is measured in nanoseconds (one billionth seconds). Thus, secondary storage is significantly slower than primary storage. Rotating optical storage devices, such as CD and DVD drives, have even longer access times. Once the disk read/write head on HDDs reaches the proper placement and the data, subsequent data on the track are very fast to access. To reduce the seek time and rotational latency, data are transferred to and from disks in large contiguous blocks.

DISK CACHING

The disk cache is a small amount of RAM that is built into a hard disk drive. It stores data being sent or received by the hard disk plates for a short period of time and if the same data is required then it is taken from the disk cache improving the time it takes to read from or write to a hard disk. It is usually included as part of the hard disk or a specified portion of random access memory (RAM).

NETWORK INTERFACE CARD (NIC)

The NIC provides the hardware interface between a computer and a network and enables a device to network with other devices. It can either be in the form of an add-in card that fits in an expansion slot on a computer's motherboard to expand the functionality of the system or is usually built-in and is a part of the circuit board. The standard wired NIC is measured by its speed in Mbps (Megabits per second): 10 Mbps is too slow, 100 Mbps is faster, and 1000 Mbps (1 gigabit) is the fastest.

The speed of the NIC can affect performance when it comes to:

- loading webpages or web applications
- downloading applications or games from the internet
- downloading program updates from the internet
- copying large amounts of data over the network
- watching multimedia over the network.



Activity 3.3

3.3.1 Choose the correct answer.

- a. What is the purpose of the CPU?
 - A. Completes the graphics processing tasks of the computer.
 - B. Completes the general processing tasks of the computer
 - C. Slow, long-term storage of data used on the computer
 - D. Fast, long-term storage of data used on the computer
- b. What is the purpose of the GPU?
 - A. Completes the general processing tasks of the computer
 - B. Slow, long-term storage of data used on the computer
 - C. Connects all the components of the computer.
 - D. Completes the graphics processing tasks of the computer
- c. What is the purpose of the ROM?
 - A. It stores the BIOS, the motherboard's operating software
 - B. Connects computers to a network and the internet.
 - C. Fast, long-term storage of data used on the computer.
 - D. Very high-speed storage which temporarily stores data the CPU is using.
- d. What is the purpose of the HDD?
 - A. Very high-speed storage which temporarily stores data the CPU is using
 - B. Very high-speed storage which temporarily stores data the CPU is using
 - C. It stores the BIOS, the motherboard's operating software
 - D. Slow, long-term storage of data used on the computer.
- e. What is the purpose of a NIC?
 - A. Displays the images generated by the computer.
 - B. Connects all the components of the computer.
 - C. Connects computers to a network and the internet.
 - D. Completes the general processing tasks of the computer



Activity 3.3 *continued*

3.3.2 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–A).

COLUMN A	COLUMN B
1. CPU cache	A. It is a small area on a computer's hard drive where images and pages from the world wide web are stored for a short period of time.
2. Disk cache	B. It is a small amount of RAM that is built into a hard disk drive which stores data being sent or received by the hard disk plates for a short period of time.
3. Computers	C. _____ have more and better communication devices, making them better at connecting to the internet from anywhere in the world.
4. Smartphone	D. It is a small, high-speed cache built into the CPU where it can temporarily store the data it needs.
5. Web cache	E. _____ have more RAM and faster processing devices, making them better suited to tasks that require significant processing power.

3.3.3 Choose the correct answer.

- a. What causes a computer program to stutter, stall, or take a long time to complete a task?
 - A. The speed of the storage device.
 - B. Slow CPU.
 - C. A RAM capacity that is too small.
 - D. All three
- b. What is the speed of the CPU a direct measurement of?
 - A. The CPU's clock speed.
 - B. Network speed
 - C. How many instructions it can complete per second.
 - D. The computer's cache and RAM.
- c. When does low NIC speed affect a computer's performance?
 - A. When switching between two open applications.
 - B. When storing large amounts of data on a storage device.
 - C. When loading your operating system.
 - D. When watching multimedia over the network.

3.3.4 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. (You may not simply use the word 'NOT' to change the statement.)

- a. When programs stutter, stall or take a long time to complete a task, the CPU is too slow.
- b. The speed of the CPU and its ability to run multiple processes have a direct effect on the CPU's performance.
- c. The speed of the CPU is a direct measurement of how many instructions it can complete per minute.
- d. The CPU's clock speed indicates how frequently it will complete an instruction per second.
- e. The CPUs ability to do a single task determines how good it is.
- f. Data that the computer is using, is permanently stored by the cache and RAM.
- g. Since the cache and RAM are both much faster than the computer's hard drive, this ensures that the CPU has access to the data it needs.
- h. If a computer's RAM capacity is too small, using the computer will become much slower as information needs to constantly be added to and removed from the CPU.



Activity 3.3 *continued*

- i. Your computer (or CPU's) cache is a slower form of memory, used to send and store all the information the CPU needs.
- j. Storage speed is unimportant when opening a program or a large data file.
- k. Storage speed is important when loading your operating system.
- l. Network speed also affects the computer's performance. If the time to download a video is shorter than the video time, the video will stutter if you try to play it on YouTube.
- m. The network speed will negatively affect a computer's performance when downloading applications or games from the internet.
- n. Buses are the electrical circuit as well as the whole communication system between two devices, including the hardware components, the electrical requirements, the communication format and the software.
- o. A faster GPU will allow you to browse the web much more quickly.

3.3.5 Answer the following questions in your own words:

- a. Which Three computer components can have a significant impact on a computer's performance?
- b. How does a CPU's clock speed affect the computer's performance?
- c. Why does the speed of a storage device determine how quickly a new program opens?
- d. Why does the computer become slower if the RAM's capacity is too small?

3.3.6 After owning the same computer for many years, you decide to upgrade your computer by purchasing a new CPU. Fortunately, the CPU still uses the same socket as your motherboard, so you can install the CPU without replacing the motherboard. However, after using your new CPU for a few days, you are disappointed that it has not improved your computer's speed as much as you hoped it would, especially in games.

With this scenario in mind, answer the following questions.

- a. Although your computer has a brand-new CPU, you only have 2GB of RAM that is more than 10 years old. How can RAM affect the performance of your computer?
- b. Thinking back, your HDD might be even older than your RAM and runs at only 5 400 RPM. How will this affect your computer's performance?
- c. Give three situations in which the speed of a hard disk drive is important.
- d. Poor performance in games is often associated with a slow graphics card (or GPU). Why is this?

3.3.7 Sandy has been experiencing the following problems whenever she is on the network. The webpages and web applications take a long time to open. She cannot download certain applications or games from the Internet. Whenever her computer starts downloading updates from the Internet, she knows it is going to take forever.

- a. What causes this to happen?
- b. List at least THREE other problems that she is most probably experiencing.
- c. What can she do to fix her problems?

By using top-of-the-line hardware components, you could build a computer able to play the latest games with ultra-quality graphics and 4K resolution, encode videos in a fraction of the time of normal computers, and complete any daily computing task while only using a small percentage of the power available!

In this unit, you will learn more about different hardware configurations. You will learn what range of hardware to select for a specific type of user, how to compare and select between two different types of hardware, and finally, how to identify the hardware configuration already installed in a computer.

SELECTING AN APPROPRIATE CONFIGURATION

This section will look at typical computer setups for the following types of users:

- Home user
- Small office user
- Gamer
- Power user

For each user, you will learn to identify what they are most likely to use the computer for, what components are important for their use and why certain components should be selected.

HOME USER

The average home user mostly uses a computer for:

- browsing the internet
- posting on social networks
- sending email
- doing word processing
- watching online and local videos
- listening to music.

However, categorising someone as an 'average' home user has become a lot harder than it used to be.

SMALL OFFICE USER

The average business user uses a computer for:

- online research
- sending emails and business communication
- using word processing and spreadsheet applications
- note taking.

None of these tasks require a very powerful computer. However, there are four factors that are particularly important to business users:

- **Mobility**, which allows them to take their computers to meetings or home.
- **Battery life**, which allows them to use their computers for extended periods of time without access to a power source.
- **Screen resolution**, which allows them to view more information on a screen at a time.
- **Speed**, since business users are usually paid for the work they deliver, the computer should never decrease their productivity.

GAMER

Modern games are designed to take advantage of the incredible processing power of CPUs and GPUs. As a result, they are one of the most processing-intensive tasks completed on personal computers.

Gaming is such a good measure of a computer's processing power, that games are often used to **benchmark** computer hardware and see how well certain types of hardware perform.

This does not, however, mean that all gaming computers must be expensive. There are three options for gaming PCs:

- entry level
- mid-range
- high-end

The biggest difference between an entry-level gaming computer and a mid-range gaming computer is the graphics card. High-end gaming computers will be able to play all games at high or very high quality, while the most expensive of these computers will be able to play games at ultra-high quality at very high resolutions.

With gaming computers, it is incredibly important that you build a balanced setup where all the components are roughly the same speed. Having a CPU that is much faster than your GPU will not help your computer, since the quality of your game will be limited by the speed of your GPU. The same is true if you have too little or too slow RAM.

POWER USERS

The term *power user* is a general term that refers to people who use their computers to do advanced tasks. Examples of power users include computer programmers, web developers, video editors and graphic designers.

In general, these tasks do not require computers more powerful than those of gaming computers, although processing speed and RAM are especially important for power users, as it allows these users to run more applications at the same time and complete processing-intensive tasks (such as video encoding or compiling a program) more quickly. Power users may also require more storage space on their computers and usually use at least two monitors for their work.

SELECTING THE HARDWARE

Now that you have a basic idea of the types of computers to purchase for different users, you can look at specific components to use for different configurations. The table below suggests hardware configuration for different types of computers.

Table 3.1: Hardware configuration for different types of computers

	HOME	SMALL OFFICE	GAMING	POWER USER
CPU	Entry	Mid	High end	High end
GPU	No Specification/ Entry	No Specification	High end	High end
RAM	Entry	Mid	High end	High end
STORAGE	Entry/Mid	Entry/ Mid	High End	High end
MONITOR	Entry	Entry	High End	High End



Take note

Hardware manufacturers release new components every year, and the relative strength and weaknesses of these components change every year. As such, the table above can, at best, be a starting point. Before purchasing any components, you should do research on them using the internet.



Activity 3.4

Analysing pre-built computers

Look at the following computer advertisements, then answer the questions below.



Based on these advertisements, answer the following questions.

- 3.4.1 Which computer would you recommend for a high-end gamer?
- 3.4.2 Which notebook would you recommend for a power user?
- 3.4.3 Which computer would you select for a family and why would you select it? Are there any extra accessories you would purchase for this computer?



Activity 3.5

Hardware configurations

- 3.5.1 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).

COLUMN A	COLUMN B
1. Someone who uses a computer or network service for own personal use.	A. Gamer
5. This refers to the small or home office environment and the business culture that surrounds it.	B. Home user
6. A hobbyist or individual that enjoys playing various types of digital or online game.	C. Power user
7. This is a person that uses their computer to do advanced tasks.	D. Small office user
8. Mobility, battery life, screen resolution and speed in a computer is important for this type of user.	
9. The computers used by this type of user require powerful computers with very good processing speed and RAM. They also require more storage space on their computers and usually use at least two monitors for their work.	
10. This type of user can start with a desktop computer with a mid-range CPU and mid-range graphics card (for gaming).	
11. An Ultrabook or mid-range notebook is a good choice for this type of user.	
12. This user uses a computer with word processing and spreadsheet applications mostly for online research, sending emails and business communication, note taking	
13. This user uses a computer mostly to browse the Internet, post on social media, send emails, watch online and local videos and listen to music.	



Activity 3.5

Hardware configurations *continued*

- 3.5.2 If you have a computer at home, what do you do on the computer as a home user?
- 3.5.3 Let's say you choose to do home-schooling where you learn and study at home, will your uses of the computer change? How?
- 3.5.4 What are the four factors that are particularly important to business users when they are selecting a computer to do their work on?
- 3.5.5 What are the main characteristics of a gaming PC?
- 3.5.6 What is a power user? Give two examples of power users.
- 3.5.7 Explain the term, "hardware configuration" in your own words.
- 3.5.8 Give two reasons why you should know your computer hardware configuration.
- 3.5.9 Look at the following advertisements of four computers.

ACER AXC-780 i3 DESKTOP	AMD RYZEN 7 2700	INTEL 8TH GEN	HP 15-SERIES INTEL CORE i5 LAPTOP
Intel® CoreTM i3-7100 processor 4GB RAM & 1 TB hard drive Wireless mouse and keyboard Windows 10 Home 1-year warranty R4 800 (Price includes VAT) Featuring Intel 7th generation CPU Competent multi-tasker Smooth computing Great HD visuals Enjoy added functionality	AMD RYZEN 7 2700 (3.2 GHz; 20 MB cache; 8 x cores, 16x threads, turbo 4.1 GHz) CPU MSI B350 PC mate gaming AM4 DDR4 USB3.1 RYZRN motherboard 500W 80+ high performance power supply 4.1 GHz GeForce GTX 1070 Ti Pro-gaming PC 8GB DDR4 2666MHz high performance gaming RAM 480GB SSD up to 500MB/s + speed ultra-fast SSD (OS drive) 6 x 120mm RGB fans + dual tempered glass Integrated 8 CH high definition sound card LCD and OS optional 24 months warranty	INTEL 8th generation core i7-8700 (3.2GHz; 12MB cache; 12 x cores; Turbo 4.6GHz) CPU MSI H310 PRO VD DDR4 LGA 1151 USB 3.1INTEL 8th Gen motherboard Default CPU integrated 3D graphics video INTEL 8th generation UHD 630 DX12 integrated graphics core 8GB DDR4 high performance gaming RAM 1TB HDD 7200rpm 64MB cache high performance hard drive Standard black case with 400W PSU 24 x dual layer DVD +/- writer Integrated 7.1 CH HD sound card Gigabit LAN card + broadband ready LCD and OS optional 24 months warranty	Intel core i5 – 7200U (up to 3.10 GHz) Integrated 3D graphics 8GB RAM 1 TB HHD 8 hour battery life Ethernet/Wi-Fi/ Bluetooth Windows 10 Home Includes backpack and mouse 2 year collect-an-repair warranty

Based on these advertisements, answer the following questions:

- a. Identify the CPU used for each of the four computers.
- b. Write down the name of one of the motherboards included in these computers.
- c. Which computer is sold with a solid-state drive?



Activity 3.5

Hardware configurations *continued*

- d. Why do you think each of these advertisements start by listing the computer's CPU?
- e. The third advertisement states that an OS is optional. What do you think this means?
- f. Which computer would you suggest for the following users? Give reasons for your answers.
 - i. A family that will use the computer for browsing the internet and playing some games.
 - ii. A gamer and power-user.
 - iii. An office worker who often travels.

3.5.10 This is an optional activity.

Read through the following table showing hardware configurations for different types of computers.

	HOME	SMALL OFFICE	GAMING	POWER USER
CPU	Intel Core i3; AMD Ryzen 3	Notebook Intel Core i5	Intel Core i5; AMD Ryzen 5	Intel Core i7; AMD Ryzen 7
GPU	None; GeForce x50-series	None	GeForce x60 or x70 series; Radeon x70 or x80 series	GeForce x60 or x70 series; Radeon x70 or x80 series
RAM	8 GB, 2 400 MHz	8 GB	8 GB, 2 666 MHz	16 GB, 2 666 MHz
Storage	1 TB, 7200 RPM	500 GB	256 GB SSD and 2 TB, 7200 RPM	256 GB SSD and 4 TB, 7200 RPM
Monitor	23" FHD	14" – 15" built-in	23" FHD	2 × 23" FHD
Additional	Speakers, Printer	23" FHD Monitor, Printer, Wireless mouse and keyboard	Gaming mouse, Gaming headset	Speakers

Based on internet research, answer the following questions:

- a. What is the best price you can find for the home computer's components?
- b. How much would the gaming computer cost?
- c. Which components have the largest impact on the price?
- d. How much would a similar small office notebook cost?
- e. How much does a gaming notebook cost?

3.5.11 Building your own computer: Imagine you had a job that paid R100 per hour and wanted to save for a new computer. Based on the money you can save and the prices of components, complete the activity below:

- a. Make a list of all the components you would purchase for your computer. Make sure to include at least the following components: CPU, motherboard, RAM, case, power supply, monitor, keyboard and mouse.
- b. Give reasons why you selected each of your components.
- c. Using the internet, search for a benchmark for the CPU you selected. How does it compare to other CPUs on the list?
- d. Did you include a GPU in your computer? Why or why not?
- e. How much would your computer cost to build?
- f. How many hours would you need to work to save up for this computer?
- g. Realistically, how many hours could you work per week?
- h. Based on this information, would you change any of your components?

CONSOLIDATION ACTIVITY**Chapter 3: Hardware**

1. Choose the correct answer.
 - a. Which of the following affects the performance of the CPU?
 - A. Memory clock speed
 - B. Number of cores
 - C. Amount of RAM
 - D. Amount of space
 - b. Which of the following would permanently store the operating system?
 - A. CPU
 - B. ROM
 - C. RAM
 - D. Hard disk
 - c. Which of the following devices is best suited for location-based technology?
 - A. Smartphone
 - B. Laptop
 - C. Server
 - D. Desktop PC
 - d. Which of the following devices is best suited for creating PowerPoint presentations?
 - A. Server
 - B. Smartphone
 - C. Notebook
 - D. Mainframe computer
 - e. Which of the following devices is the best device for a web developer?
 - A. Entry-level notebook
 - B. Mid-range tablet
 - C. High-end Smartphone
 - D. Mid-range desktop PC
 - f. Which of the following does not affect a computer's performance?
 - A. Storage capacity
 - B. Control processing unit
 - C. Central processing unit
 - D. Memory speed
 - g. If you want to install a large program on your computer, which of the following would affect your RAM's performance?
 - A. Storage space
 - B. Storage speed
 - C. Cache
 - D. Network speed

CONSOLIDATION ACTIVITY

Chapter 3: Hardware *continued*

COLUMN A	COLUMN B
1. A constraint of mobile computing devices that is caused by a lack of heat sinks and fans.	A. Network speed
2. Memory that stores data being sent and received by the hard disk.	B. Power and heat
3. This a factor that affects the download speed of online content.	C. CPU
4. A computing component that processes instructions sent from the computer's internal and external components.	D. Small office user
5. Memory that stores instructions being sent and received by the central processing unit.	E. CPU cache
6. A person who requires a lot of processing power, storage capacity, and memory to run multiple resource-intensive applications at the same time.	F. Power user
7. The measure of how many instructions the CPU can process each second.	G. GHz
8. A factor that affects the visual quality of images displayed on your monitor.	H. Graphics processing ability
9. The capability for a mobile computing device to supply power without a power source.	I. Battery life
10. A person who requires a computing device that can be used for multiple purposes and by multiple users.	J. kW
	K. Gamer
	L. Home user
	M. GB
	N. Disk cache
	O. Motherboard

CONSOLIDATION ACTIVITY**Chapter 3: Hardware *continued***

4. Determine which of the following factors should be considered for the following performance issues:

CPU	Memory capacity	Storage speed
Network speed	Graphics processing ability	Bus performance

PERFORMANCE ISSUE	FACTOR
a. Clarissa recently built a top of the range desktop computer, with all the best and most expensive components. But for some reason her computer's performance is very slow.	
b. Every time Jung Min opens an application his computer automatically closes any other open applications.	
c. Kiva is a teacher and usually creates PowerPoint presentations from digital textbooks that are in a PDF format. Whenever she switches between the presentation and textbook to compare the two, her computer starts to lag and freeze.	
d. Yves is a gamer who loves playing first-person shooter games. Whenever he plays online games, they load slowly and have reduced graphic quality.	
e. All the applications on Mpano's computer slow down each time he opens a new application in the background.	
f. Whenever Nicolas copies files from his flash disk onto his computer's hard drive, his computer takes a long time to complete the copying process.	
g. Tsholofelo bought a brand new notebook but noticed that whenever she tries to run Adobe products like Adobe Premiere her computer takes a long time to open it and it takes a long time to compile video files.	
h. Imogen likes to play the latest racing games for titles like Dirt, Forza and Need for Speed. Her computer has an overclocked Intel i5 core processor, but her games perform very slowly when she tries to use high resolution settings, so she must use the lower game graphic settings.	
i. Every time Martinique tries to install a new program on her computer, her computer starts to slow down significantly.	
j. Before Sean buys an album from a musician, he prefers to download the songs so that he can listen to them because it takes too long to stream them online.	

5. Consider the following 3 users:

- Ahmed is a freelance graphic designer that travels a lot for business.
- Belinda is a banker that must regularly check and edit accounting spreadsheets.
- Nkosi is a professional gamer that plays at international gaming tournaments.

5.1 Which type of computer would be best suited for each user? Give ONE reason for each answer.

5.2 What type of user do you think Ahmed is? Give a reason for your answer.

5.3 Based on Belinda's computing requirements, would she benefit from using a smartphone or a mobile computer. Give TWO reasons for your answer.

- 5.4 a. Name ONE piece of computing hardware Nkosi should financially invest in upgrading. Mention TWO benefits of upgrading this piece of hardware.
b. Other than being potentially expensive, mention ONE other disadvantage or problem that could occur because of Nkosi upgrading this piece of hardware.

CONSOLIDATION ACTIVITY**Chapter 3: Hardware *continued***

6. Tokozile is a young entrepreneur who wants to open a computer centre for tourists in Cape Town. Her goal is to have 16 computers with high-speed internet that can be used by tourists to browse the internet or send messages home. However, she would also like the computers to be able to play modern multiplayer games so that youths from the area will visit her centre.

She has obtained the following two quotations for her centre.

COMPUTER A	COMPUTER B
3.2 GHz Quad Core CPU with 4 MB cache	3.6 GHz Dual Core CPU with 1 MB cache
8 GB DDR3 RAM	2 GB DDR3 RAM
2 TB HDD	256 GB SSD
Gigabit (1 Gbps) network card	802.11 g (50 Mbps) wireless adapter
NVidia GeForce graphics card (4 GB VRAM)	Integrated graphics (32 MB VRAM)
15" LCD monitor	17" LCD monitor
Windows Home 10	Ubuntu Linux
Microsoft Office	OpenOffice
Skype (VoIP Software)	Skype (VoIP Software)
R10 795	R7 995

She starts her comparison by looking at the CPUs of the two computers.

- a. Name TWO manufacturers of CPUs.
- b. One CPU is a “dual core” CPU, while the other is a “quad core” CPU. What do these terms mean?
- c. Which CPU will be faster for multitasking? Give reasons for your answer
- d. The two CPUs have different amounts of cache memory. Define the term cache memory?
- e. Tokozile expects that some of her customers will want to play games on the computers. Advise her on which computer (according to the quotations) would be best for games and why.
- f. The computers not only have different hardware, but also different software. List the operating systems installed on each computer.
- g. Which computer’s software will be the most expensive. Give reasons for your answer.
- h. The operating systems of both computers support multitasking and multithreading. Define these concepts and explain how they differ.

SOCIAL IMPLICATIONS

CHAPTER OVERVIEW



Unit 4.1 Impact of Mobile technology on privacy – (personal and business)

Unit 4.2 IoT – Technologies enabling the IoT and their impact on society



Learning outcomes

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

- Discuss the advantages and disadvantages of mobile technology and how it impacts on Privacy (Personal and Business)
- Internet of Things (IoT) and their Impact on society

INTRODUCTION

Mobile Technology has radically changed our personal and social lives and how the business world works. Although these changes have mostly been positive (social networking, navigation, and so on), the security of our personal information is at great risk.

4.1 Mobile technology

In Chapter 3 we learned that a mobile device is any type of handheld computer, for example, tablets, e-readers, global positioning system (GPS) devices, wireless debit/credit card payment terminals and smartphones. These devices are portable, fit in your hand and are powerful enough to do many of the same things you can do with a desktop or laptop computer.

Internet privacy (also called online privacy) is the right of personal privacy in regards to the rearranging, storing, provision to third parties, and display of information relating to you via the internet. In general, the right to be free from secret surveillance and to determine whether, when, how, and to whom, one's personal or organizational information is to be revealed.

IMPACT OF MOBILE TECHNOLOGY

ADVANTAGES

INSTANT COMMUNICATION

Family and friends have easy access to SMS, text messaging, call, video chat, and apps that allow them to instantly communicate with everyone across the globe. Smartphone cameras allow this 'selfie' generation to constantly post pictures of themselves, business related pictures, holiday videos and business related videos etc. via social media.

ACCESS TO INFORMATION

These devices are integrated with mobile browsers that enable them to access websites anytime and anywhere. A large amount of the total time spent by people on smartphones is used in opening browsers to surf the internet. With easy access to helpful content, learners can have interactive learning through watching education videos, playing education applications and researching topics.

ENTERTAINMENT

Mobile technology (especially smartphones) provides a source of entertainment. Users can listen to their favorite music, play games, gamble on-line, watch movies and read e-books among other things.

SAVING TIME – INCREASED PRODUCTIVITY

Smartphones can do almost everything with the help of apps. Both individuals and businesses benefit from the use of apps like: photo and video editor, ticket booking, online store, payment system, data analysis, personal assistant, and so on. These services are not restricted to business hours. With Global Positioning System (GPS), people can locate certain addresses and areas all around the world which has helped both individuals and business with communication and especially transportation.

PRIVACY

You can do whatever you want without anyone knowing it via a smartphone. You can snap photos of yourself and secure your photo library with a password. You can also send messages to your loved ones without the fear of anyone knowing it. Online transactions can also be done through smartphones.

DISADVANTAGES

COST

Smartphones can be expensive, especially high-end phones with great specs and features. This added cost has a negative impact on a family's and businesses financial budget.

POOR SOCIAL INTERACTION

'Real' social interaction degrades. People no longer interact with people outside since they spend more time with their smartphones.

DISTRACTION

Smartphones can be distracting. Applications notify you when there are messages, updates, latest offerings, etc. These interrupt the momentum and can affect your productivity.

HEALTH

Mobile devices (like smartphones) emit radiofrequency energy which can be absorbed by the tissues in the body. Sleep deprivation, damage to your eyes etc. are some of the health issues associated with the use of smartphones. Addiction to games, social media, and so on, also impacts negatively on your health.

EXTRA WORK

Smartphones are widely used in business. Various apps allow you to work on extra workloads which were not even existent before. Your boss can instantly call you even in the middle of the night.

UNCENSORED CONTENT

With easy access to information and the internet, people, especially children can see uncensored content including violence, pornographic content, fake news, and so on.

IMPACT ON PRIVACY

Your smartphone interrupts you with texts, WhatsApp messages, tweets, e-mails, Facebook alerts, and so on. You are being overloaded by social networking Information on a daily basis. This flood of messages and alerts, distracts you to an extent that productivity and efficiency suffers. All networking tools, sites and apps encourage you to share information, but you are not told of the possible negative consequences. You are also unaware of how your information and uploads will be shared. Search engines are built into various social networking tools and apps and privacy settings are defaulted to 'maximum sharing and visibility'. These settings allow search engines to access data that you have not restricted. Even if you keep your data private, a search engine can still access your networking profile. Anything you say or do in a group environment is immediately public and vulnerable in terms of being shared. Some social engineers can be con artists who pretend to be what they are not in order to benefit themselves (gain access to information, money, and so on). The availability of personal information on social networking sites makes the jobs of social engineers much easier and hence identity theft (stealing and using another persons identity to fraudulently open accounts) is becoming increasingly prevalent.

Although smartphones are made private, there is still security risks and threats everywhere. Hackers are always present and virtual viruses are potent. Smartphones are vulnerable to these threats when you access the internet.

Several other institutions give internet users cause to worry about their personal or corporate privacy online. Government and law enforcement agencies, Internet Service Providers (ISPs), public search engines, and social media gain access to our private data as we interact with them online – and many of them gain from gathering and distributing this information more widely. This might be for political, investigative purposes, as leverage in facilitating criminal activities or as a profit-making tool in sales to third parties.

Mobite technology users often aren't even aware that by making an online transaction, they may in effect be selling data about themselves to not only the parent company or website they're dealing with, but their affiliates and supply chain partners, as well. The ease of connecting mobile devices to public free wifi hotspots and always-on networks has compromised personal and corporate privacy online.



Activity 4.1

Privacy

4.1.1 Give ONE word/term for each of the following descriptions. Write only the word/term next to the question number in your homework book.

- a. A person's ability to control how information about them is shared with other people or institutions is referred to as _____
- b. _____ are used to store data about a user and a user's preferences in a local file on the user's hard drive. The website can then read this data and update the website according to the user's preferences.
- c. The goal of the _____ is to make users aware of the way in which websites use cookies.

4.1.2 On 21 January 2019, Google was fined R800 000 000 for breaking the rules of the General Data Protection Regulation (or GDPR). Specifically, a French court found Google guilty of not informing users well enough how their personal data will be processed and not asking for legal consent before showing users targeted advertising. Similar lawsuits filed against Instagram, Facebook and WhatsApp are still being fought in court.

Based on this scenario, answer the following questions.

- a. Do you think it is important to protect your privacy online?
- b. Do you think targeted advertisement is a bad or a good thing?
- c. Do you think it is a good idea to stop targeted advertisements, even if it significantly decreases the amount of money websites can earn from these advertisements?
- d. Do you think the GDPR will help people understand how their data is used?
- e. Do you think people should be informed about how their data will be used? Is there a good way to inform people?
- f. Do you think the fine against Google was too much or too little. Give reasons to support your answer.

The Internet of Things (IoT) consists of all the web-enabled devices that collect, send and act on data they acquire from their surrounding environments using embedded sensors, processors and communication hardware. IoT refers to the billions of devices around the world that are connected to the internet through sensors or Wi-Fi.

TECHNOLOGIES THAT ENABLE IOT

The recent convergence of three technological trends has made the IoT possible:

- **Increasing processing power of embedded platforms:** due to the smaller sizes, reduce in cost and reduce in power consumption, general purpose CPU's have gradually replaced microcontrollers in devices. The transition to CPUs is critical because CPUs can run operating systems that support networking and popular programming languages.
- **Development of smaller OSs and protocol:** as the performance of embedded platforms rose, lightweight versions of mainstream operating systems like Windows and Linux displaced embedded operating systems and brought their massive software ecosystems, and large pool of developers, with them.
- **Development of wireless communications:** Wi-Fi has gotten faster with each new addition to the 802.11 class of protocols. The connectivity options for low-power devices have also been expanding in the industrial and consumer electronics markets.

There are many ways that IoT will affect and benefit society, below are a few examples:

- **Waste management:** sensors in a fridge will record anything that is not used so that you can examine the trends and patterns. The less waste the less pollution. Sensors in bins can record the trends and patterns of what can be recycled.
- **Daily commute:** Sensors will let you know the shortest route to your work or home; which routes would be the most economical on petrol and if you can rather take public transport. Taxi services for business meetings can be planned according to your calendar and synced with your smartphone.
- **Smart cities:** These can include fast and convenient transportation systems, street lighting that switches on or off depending on the amount of natural light and energy-efficient buildings. For example, Barcelona has a citywide WiFi and information network linked to sensors, software and a data analytics platform. This provides the city with smart water technology, automated street lighting, remote-controlled irrigation for parks and fountains, “on-demand” waste pickups, digital bus routes and smart parking meters. This has reduced traffic jams and pollution, as well as water, light and energy usage.
- **Agriculture:** Sensors can track microclimates across farms, to monitor temperature changes and humidity levels as perishable goods move from field to warehouse to store. This can extend their shelf life and eliminate waste.
- **Businesses:** IoT is used to detect and troubleshoot remote issues, predict maintenance needs, track production line efficiency, monitor devices etc. These directly impact a company's revenue.
- **Smart water sensors:** These sensors monitor the water quality, temperature, pressure, and usage. This data is used by the water company to analyse how customers are using water and to help them be more efficient. Water leak detectors are used to find tiny leaks that can lead to huge water waste.



Activity 4.2

- 4.2.1** In small groups discuss at least three ways IoT impacts society, you can research your answers. Each group presents their findings to the class.
- 4.2.2** Read the following article on the top five predictions of IoT in 2019.

5 Internet Of Things Trends Everyone Should Know About

By **BERNARD MARR**

Johannesburg, 15 Feb 2018

2019 will see the Internet of Things (IoT) becoming more deeply embedded in our day-to-day lives at home and at work. We may begin to hear the term itself used less frequently – but that's because it's moving out of the hype phase and quickly becoming a part of everyday life.

Soon, it will be taken for granted that pretty much any device we own – cars, TVs, watches, kitchen appliances can go online and communicate with each other. In industry too, tools and machinery are increasingly intelligent and connected, generating data that drives efficiency and enables new paradigms such as predictive maintenance to become a reality, rather than a pipe-dream. In fact, it is predicted that by the end of 2019 there will be 26 billion connected devices around the world.

Here are five predictions about how this is likely to play out over the next 12 months as we become increasingly used to the fact that the internet isn't just something we connect to using computers and smartphones, but virtually anything we can think of:

Businesses will get serious about IoT: According to research by Forrester, businesses will lead the surge in IoT adoption in 2019, with 85% of companies implementing or planning IoT deployments this year.

IoT clearly offers huge benefits to businesses: Some examples we have seen in recent years include mannequins that can communicate with customers' smartphones in retail environments, beaming information about products on display.

Manufacturing, however, is the clear leader when it comes to IoT deployment. Here, throughout 2019, businesses will increasingly see the value in connected machinery that is capable of reporting every detail of its operating parameters and efficiency to other smart, connected devices.

Predictive maintenance is something that has been promised for a while by tech evangelists but is currently only achieved by the biggest players who have invested heavily in IoT for several years now.

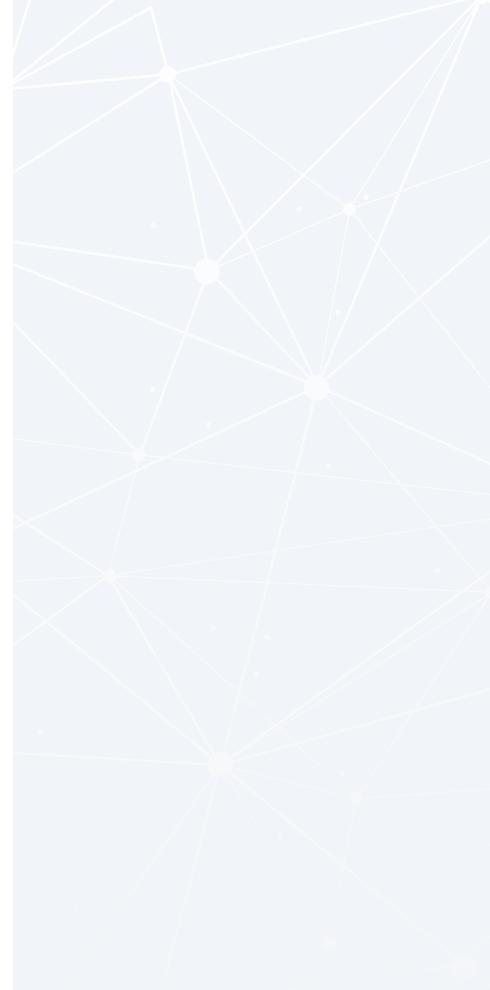
With a growing **understanding of when these solutions are (or aren't) useful, these solutions will start to trickle down** to smaller organizations, that can be confident that their investments will pay off.

[Source: <https://www.forbes.com/sites/bernardmarr/2019/02/04/5-internet-of-things-trends-everyone-should-know-about/#5a1e747f4b1f>, accessed 10 June 2019]



Activity 4.2 *continued*

- a. Do you agree with each prediction?
 - b. Explain why you say so.
- 4.2.3** What are your top five predictions for IoT for 2020? For each prediction provide an explanation of its use for society or businesses.
- 4.2.4** Watch the following video on The Ultimate Smart Device: An Intelligent Diaper (or Nappy) <https://www.youtube.com/watch?v=sUynHP7D8Uc>.
- a. Discuss the benefits of this IoT device.
 - b. Do you think it is necessary? Explain.



CONSOLIDATION ACTIVITY**Chapter 4: Social implications**

1. Mention any THREE mobile technologies that make life easier, how they have improved your life, and the danger of using this technology.

TECHNOLOGY	BENEFIT	RISK

2. Mention any THREE mobile technologies that make life easier, how they can improve a business, and the danger of using this technology.

TECHNOLOGY	BENEFIT	RISK

3. Research the following companies and complete the table. Sometimes an app might not have any disadvantages.

APP	HOW CAN IT HELP SOCIETY?	HOW CAN THE APP HINDER SOCIETY?
Whats App		
Moodle		
FaceBook		
LinkedIn		
Shopify		

4. What is your ultimate smart device, either real or invented. Explain its benefits. Design an advertisement and present your smart device to the class.

COMPUTER MANAGEMENT

CHAPTER OVERVIEW



Unit 5.1 Factors influencing computer management



Learning outcomes

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

- discuss computer management issues.
- recommend management tasks for general housekeeping, maintaining data integrity and protecting the system

INTRODUCTION

In this chapter 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 IN A NUTSHELL

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 key tasks that you can do to ensure your computer remains fast, reliable and secure include the following:

- managing your desktop
- managing files and folders by:
 - freeing up storage space
 - compressing files and folders
 - updating your software
 - backing up your files
 - scanning for viruses and malware
 - checking your hard disks.

Remember that 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 display 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 – so without any free space, your computer will slow down noticeably.

ACTIVITY 5.1

Revision Activity

- 5.1.1** Define backup and explain its importance.
- 5.1.2** What two methods can you use to create a backup?
- 5.1.3** List the eight steps to perform a backup.
- 5.1.4** Define malware and explain how it harms your computer.
- 5.1.5** List the four steps to scan for viruses or malware.
- 5.1.6** Why should you update your software?

5.1 Factors influencing computer management

A computer's speed, ease of use and security are influenced by various factors.

The five most important factors are:

- software
- security
- housekeeping
- amount of unused space on the hard drive
- errors and corrupt files

SOFTWARE

Software refers to computer instructions in the form of operating systems, utilities, programs, and applications that enable computers to work.

Software affects a computer's performance in different ways:

- installing too many applications may use up a computer's resources and cause the computer to slow down,
- out-of-date software may contain bugs or security problems
- viruses are also a form of software and are often installed with other software applications.

The most important software task you should complete is to regularly update your software. (An update is new, improved, or fixed software, which replaces older versions of the same software.)

Most applications follow one of three update strategies. They:

- Ask you to allow them to update automatically: Whenever your computer asks to update a program, allow it to update as soon as possible. If it is not possible to install the update immediately, schedule a suitable time to install the update.
- The application informs you that an update is available and links you to the update location.
- This will update the program to the newest version without changing your settings.
- The application can reates patches but does not inform you. If this occurs, then search the internet once or twice a year to see if a new version has been released. If it has, download this version and install it to update your software.



Figure 5.1: Microsoft Windows automatically installs updates

Today, most computer programmers continue to release patches and updates to their software after the software is released. Software patches and updates generally repair security holes, fix or remove computer bugs and add new features and improve existing ones.

SECURITY

Computer security is the protection of computer systems and information from harm, theft, and unauthorized use. Closely linked to a computer's software is the security of the computer. As you learned in Grade 10 and 11, weak security can result in files being accessed illegally, and viruses being installed leading to reduced computer performance. As such, a computer's security must be managed.

When it comes to computer security, there are two main goals: Prevent any malicious software from affecting your computer by using antivirus software, and backup your files so that they are safe, even if your computer is damaged in some way.

In this section, you will look at these tasks:

Firewall: 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: An Antivirus is a software programme that is designed to prevent, search, detect and remove malicious software (Malware) from your computing device.
Spyware: Spyware is a piece of code that hides on your computer and tracks all your activity without your knowledge. You can control the Spyware, by activating the pop-up blocker on your browser settings or by installing an anti-spyware software application.

Adware: Adware is a type of malware that presents unwanted advertisements to the user of a computer in the form of pop-up or an 'unclosable window'.

BACK UP DATA

Data backup is a process of duplicating data and storing it in an alternative location to allow retrieval of the duplicate set after a data loss event (natural disaster, theft situation, accidental deletion).

Data loss can occur due to:

- hardware failure
- many potential threats to your data (like viruses and Trojans don't just steal your data. In some cases, they erase it)
- the threat of ransomware (when a hacker puts a virus on your computer that encrypts your data, making it useless).

Backing your data up is the single best way to protect your data. With an up to date backup, any data that you lose can be recovered easily.

To make sure your backup is effective, you should use the following guidelines when creating a backup system. The backup:

- must include all important files and folders.
- should be run regularly, preferably every day, but at least once a week.
- must be saved on a different storage device from the data it is backing up.
- should be saved on a storage device that is not permanently connected to your computer.
- should be kept in a safe place to protect it from physical damage.
- data should be verified occasionally to make sure the backup system is still working.

There are three main techniques you can use to create a backup:

- *Copy and paste* (select files and folders you would like to backup, copy them using the copy command and paste in a folder on an external hard drive),
- *Backup and Restore Software*: (This utility can be used to automatically backup your data to an external hard drive by simply updating changes to the relevant files that were backed-up previously).
- *Online backup* (back files up online using a service like Google Drive).

HOUSEKEEPING

This refers to the way in which a computer and its files and folders are organised so that they are quick and easy to find. General housekeeping tasks include:

DISK CLEAN-UP

Disk clean-up is a computer maintenance utility designed to free-up storage space on a computing device. It identifies and removes temporary files that are no longer needed and cleans out old files, programs and settings that cause your computer to slow down. Defragmentation of the hard disk also improves the speed at which the files are accessed.

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.

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. These files are, however, not duplicated. Archived data consists of old data that remains important and is retained for future reference.

A back-up is the process of making copies/duplicates of data and storing it on a different device in a different geographical location in the event of the original data being lost or destroyed.

COMPRESSION AND DECOMPRESSION

File compression refers to the process that makes use of advanced algorithms and mathematical formulas to decrease the amount of disc space used by big files. Decompressing a file is the method of extracting the compressed file back to its original form using the same algorithms or mathematical formulas.

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. Examples include 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 will select all parts of the software and install it on your computing device.
- Product keys and activation codes: 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.

ORGANISING YOUR FILES

Organising your files refers to the planned system that you use when you save your files on your computer (stand alone computer or network drive). Well organised saving of files will allow you quick and easy access to them, avoid duplication and ensure that your data can be backed up.

To organise your files:

1. Decide on a logical folder structure that can be used to organise your files and a naming convention.
2. Move existing files to the appropriate location within this folder structure.
3. Save any new files in the appropriate location within this folder structure.
4. Occasionally, check your hard drive to ensure that your new files have not become disorganised.

AMOUNT OF UNUSED SPACE ON THE HARD DRIVE

Computers need sufficient unused space on the hard drive in order to operate smoothly. Free space on your drive is required because certain programs/applications create temporary files whilst in use and the computer system requires hard disk space to supplement RAM (virtual memory). To free up space on a drive, there are a few things you can do:

- use the disk clean-up tool
- uninstall unused software.
- empty the recycle bin
- compress data not frequently used.

ERRORS AND CORRUPT FILES

Errors and corrupted computer files are files have been damaged or saved incorrectly and can't be opened in the normal way.

Files with errors and corrupt files are difficult to detect and they can cause everything from videos not loading to applications crashing, or even your operating system not opening.

Regularly scanning for files with errors or corrupt files using an appropriate utility (e.g. SMART scan or Disk Check) will warn you before errors become a problem.



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 (column B) to a question (column A).

COLUMN A	COLUMN B
1. A computer's speed, ease of use and security are influenced by various factors. The FIVE most important factors are:	A. Housekeeping B. Free space on drive C. Computer management tasks D. Errors or corrupt files E. Security F. Software
2. When this is weak, it can result in files being accessed illegally, viruses being installed leading to reduced computer performance.	
3. This refers to the way in which a computer and its files and folders are organised so that they are quick and easy to find.	
4. Too many applications can cause the computer to slow down, while out-of-date applications may contain bugs or security problems	
5. This is often difficult to detect, since it can cause everything from videos not loading to applications crashing and even your operating system not opening.	
6. Without this, some programs will stop functioning and the computer may slow down dramatically.	
7. This refers to the tasks used to maintain the computer.	

- 5.1.8** List the management tasks for general housekeeping. Which tasks do you use on your computer or school computer? Which task do you think is the most important? Explain.
- 5.1.9** List steps that can be followed to guide a friend on how to go about creating a well organised filing system.

CONSOLIDATION ACTIVITY

Chapter 5: Computer management

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. 1.1–A). There can be more than one answer (column B) to a question (column A).

COLUMN A	COLUMN B
1. The most important software task that you must do.	A. They become infected with viruses and malware.
2. Prevent any malicious software from affecting your computer by using antivirus software, and backup your files so that they are safe, even if your computer is damaged in some way. This refers to _____.	B. Backing up the data
3. This can be done to prevent your computer to overheat and either crash your computer or limit the speed of your computer.	C. Free disk space
4. This is the single best way to protect your data.	D. Regularly update your software
5. This should be used to set the location where your documents, images and media files are saved.	E. Disk Clean-up tool
6. This is one of the biggest reasons why computers slow down as they get older.	F. SMART scan
7. This space can be used as the page file, to save new files or to create temporary files required by the application.	G. Disk check
8. To ensure that your hard drive does not fail, it is important that you regularly check the health of your hard drives by running a _____ and disk check on it.	H. Computer security
9. Together, these two tests should inform you if your hard drives have any issues.	I. File organisation
10. To clean-up a disk, you can use this technique.	J. Physically clean the computer

2. 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. (You may not simply use the word 'NOT' to change the statement.)
- a. To make sure that your computer is protected against viruses, you should install more than one virus scanner.
 - b. The two biggest ways to pick-up malware is by installing applications without reading all the instructions carefully and by inserting other people's flash disks into your computer.
 - c. You should clean your computer more regularly during the rainy season as they become especially dirty during this period.
 - d. Manually backing up your data is the best and easiest way to make sure that your data is safe.
 - e. The best file organisation strategy is to make sure that files are always saved in the correct location the first time.
 - f. It is important that you also organise files within an application's folder.
 - g. You can always recover a file that has been permanently deleted.
 - h. To regularly uninstall used applications will free up disk space as well as memory and decrease Internet use.
 - i. While you can uninstall applications to free some disk space, you should not wait until you run out of storage space to uninstall applications.
 - j. It is very important to run a Disk Clean-up and SMART scan if you are struggling to open files, if your hard drives take a long time to load, or if your hard drives are making clicking noises.

CONSOLIDATION ACTIVITY**Chapter 5: Computer management *continued***

3. Do the following on a computer under instruction and supervision of your teacher.
 - a. Update software
 - b. Scan for viruses
 - c. Physically clean the computer
 - d. Back up the data on the computer using copy and paste.
 - e. Back up the data using Backup and Restore
 - f. Manually back up files on Google Drive
 - g. Automatically back up files to Google Drive
 - h. Organise your files
 - i. Free disk space by using the Disk Clean-up tool
 - j. Manually delete files
 - k. Uninstall unused programs
 - l. Run a SMART scan
 - m. Run a disk check
4. What is the difference between installing software and uninstalling software?
5. Give FOUR reasons for uninstalling a program.
6. Name THREE programs you have installed on one of your computing devices and give a reason for each of your answers.
7. Mention ONE negative experience you have had because of installing a piece of software. In addition, mention why you think this happened.
8. Do the following tasks on your computer (Ask your teacher for a suitable application to practice with):
Install new software onto your computer.
Uninstall software from your computer.
9. 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.
10. 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
11. 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

CONSOLIDATION ACTIVITYChapter 5: Computer management *continued*

12. 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
13. 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.

SOFTWARE

CHAPTER OVERVIEW



- Unit 6.1 Cloud computing
- Unit 6.2 Virtual Reality (VR)
- Unit 6.3 Augmented Reality (AR)
- Unit 6.4 Virtualisation



Learning outcomes

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

- describe cloud computing and its effects on hardware needs, explain software as a Service (advantages and ownership of data).
- describe virtual reality, hardware and software requirements and advantages and limitations
- describe augmented reality, hardware and software requirements and advantages and limitations
- describe virtualisation, its uses and benefits

INTRODUCTION

Software means computer Instructions or data in the form of operating systems, utilities, programs, and applications that enable computers to work.

Software can be categorized as **systems software** or **applications** software.

System software is a specific type of software that manages a computing device and comprises of:

- the operating system that manages hardware, software and other applications on a computing device. Functions of the operating system is grouped into: hardware management, I/O management, process management, file management and memory management.
- utility programs that adds functionality to your computer and helps your computer perform better. These include antivirus, backup, disk repair, file management, security, and networking programs.
- device drivers (software program) that controls a particular type of hardware device that is attached to a computer.



Application software is a program or group of programs designed for end-users. Applications software include database programs, word processors, web browsers, spreadsheets, and so on.

Software is becoming smarter, easier to use and better at helping humans than ever before. Due to rapid improvements and various developments in computer software (**cloud computing**, **virtual reality**, **augmented reality** and **virtualisation**), software is able to do many of the tasks previously left to humans more reliably and at higher quality, and this include complex tasks like driving a car, diagnosing cancer or creating legal briefs etc.

6.1 Cloud computing

Cloud computing refers to the process in which computers on the Internet (rather than local computers) are used to store, manage and process data.

Cloud computing can also be used to run applications (or services) on the Internet like Google Docs and Microsoft's Office 365. Cloud computing has made it easier and cheaper to host a website with 100% uptime.

Cloud computing offers several significant advantages to users:

- **Scalable:** Cloud computing is perfectly scalable, which means that the capacity of your virtual machine will grow automatically as your requirements increase.
- **Affordable:** A single virtual machine is affordable, and it only becomes expensive once you need to rent large numbers of virtual machines.
- **Reliable:** Many cloud computing companies guarantee that the machine will be available to users always.
- **Fast:** Cloud computers and the Internet connection to these computers can be incredibly fast.
- **Maintained:** The servers used for cloud computing are maintained by an expert team who ensure they continue running efficiently.

Thanks to these advantages, most websites and web applications make use of cloud computers to host their websites.

Each client only pays for the small part of the server they need.

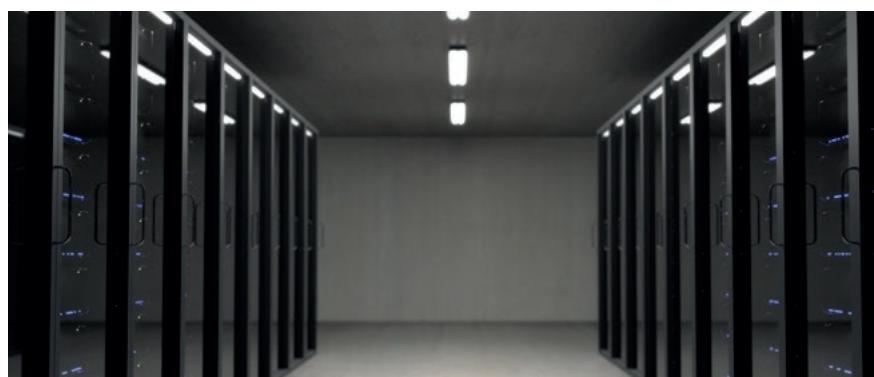
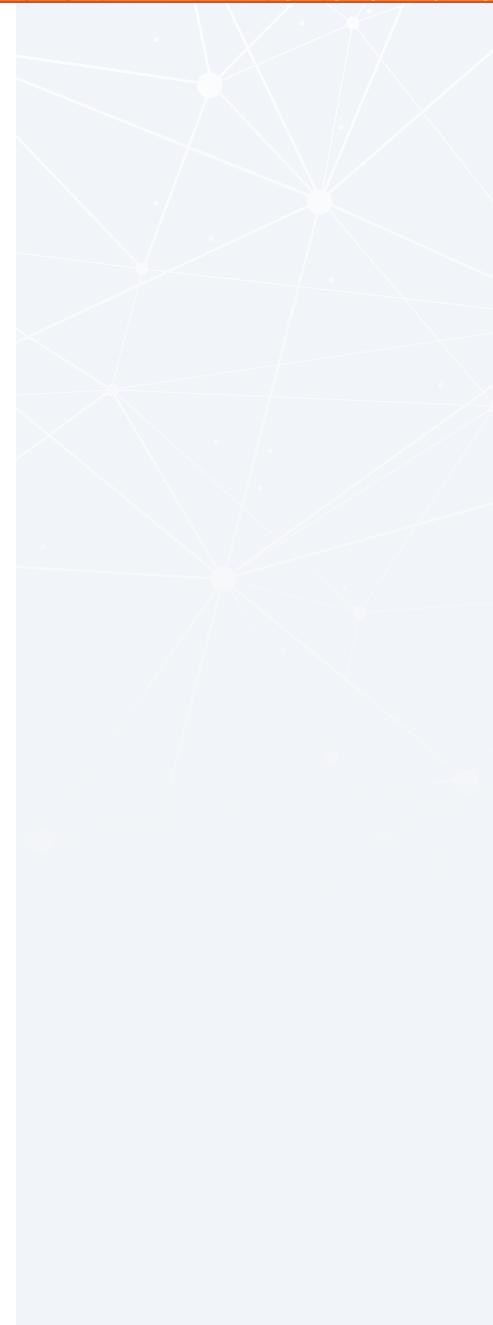


Figure 6.1: Data centres can contain hundreds of powerful servers

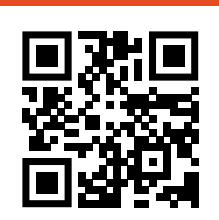
EFFECT ON HARDWARE NEEDS

Cloud computing infrastructure includes server hardware and software, storage, networking, adequate cooling and security for access control. This can be quite expensive to set up and maintain. Nowadays most businesses are moving the support and administration of servers to the cloud as cloud servers are available anywhere there is an Internet connection.

The virtual servers are built on large hardware platforms so that they can scale up or down quickly. This is helpful for businesses whose computing infrastructures changes frequently.



QR CODE



<https://www.youtube.com/watch?v=XZmGGAbHqa0>

<https://qrs.ly/8qa5pii>

Businesses are becoming more reliant on cloud-based resources and less dependent on traditional IT hardware and software assets. Businesses employ a hosting provider to manage the hardware and they can focus on the software.

In the past companies ran multiple operating systems on virtual machines and the servers were often used at 20% to 30% of capacity. Recently with cloud computing, on-premise hardware will share computing power with a cloud computing service provider for a monthly subscription fee. This results in companies doubling the amount of capacity they get with their hardware. Therefore, there is less need for the purchasing of new servers and hardware.

One negative effect is downtime. For example, when businesses maintain their servers, it causes the system to be out of action or unavailable for use.

SOFTWARE AS A SERVICE (SAAS)

SaaS (or Software as a Service) refers to applications that are hosted on the cloud and that users pay a monthly subscription to access. As the name suggests, SaaS is based on the idea that many software applications present a service to users. This service might be to provide entertainment, increase productivity or improve communication.

With SaaS, applications are run on cloud computers and users access these applications through their web browsers, without any of the applications being installed on their local computer. This works by a cloud computer in the background performing all the tasks and simply showing the user interface in the web browser.

Advantages of SAAS

- minimal setup required.
- minimal initial cost.
- software is updated automatically on the cloud computers.
- new features are regularly added.
- can be used from any computer with an Internet connection.
- easier to collaborate or share information with other users.



Case Study

Microsoft Office 2019 vs Microsoft Office 365

Microsoft Office 365 is a service that users subscribe to. Every month or year, users pay a small subscription fee (between 3% and 5% of Microsoft Office price). Once subscribed, users can download and install all the same Microsoft Office applications on their computer and between 2 and 5 other devices, use the online versions of the applications through their web browser, and store up to 1 TB of files on Microsoft OneDrive.

The screenshot shows the Microsoft Word Online interface with a document titled "Document1 - Saved". The ribbon menu is visible at the top, showing tabs like File, Home, Insert, Page Layout, References, Review, and View. The Home tab is selected. The main content area contains several paragraphs of text:

Software as a service (SaaS)
SaaS is just one of three categories that define cloud computing along with Infrastructure as a Service (IaaS) and Platform as a Service (PaaS). SaaS is where a third party provides an application, which is hosted on its own servers and delivered via the internet, typically through your web browser.

SaaS is the top of the stack, meaning it's what most users like you and me see and use over the internet daily, while IaaS and PaaS are the underlying infrastructure that all SaaS applications are built upon.

We are only talking about SaaS, as this is what's relevant for most online business owners in running their business (unless, of course, you are planning on developing your own SaaS business).

What Makes SaaS Different from Regular Software Licenses?
Typically, software is sold on a perpetual license basis. This means you pay for a single license to access the software and use it, essentially, forever – with most enterprise software vendors charging a yearly support or maintenance fee.

At the bottom of the screen, there are status indicators: "Page 1 of 1", "188 words", "English (U.S.)", "100%", and "Give Feedback to Microsoft".

Figure 6.2: Word 365 can be used as a web application

Users who are subscribed to Office 365 are given access to the newest version of Microsoft Office.

The online versions of Office 365 make use of cloud computers to run the software applications, and these computers are paid for using a part of the users' monthly subscription fees.

It is important to note that, with SaaS, the subscriber does not own the software, he or she is simply renting it. As a result, once the SaaS subscriber stops paying their subscription fee, they lose access to the software. The subscriber does, however, own any work created using the software even if this information is stored on a cloud service.



Activity 6.1

Cloud computing

- 6.1.1** List the advantages cloud computing has for its users.
- 6.1.2** Create a debate for and against cloud computing. Include the effects on hardware and advantages or disadvantages on businesses
- 6.1.3** Itumeleng is a young writer who recently started working for a large newspaper. On the first day of work, he received a work laptop that he could use to write articles for the newspaper. According to his supervisor, the company has recently started using cloud applications for most of their work, especially for the work of writers and editors.
Based on this information, answer the following questions.
 - a. Explain in your own words what SaaS is.
 - b. Besides Office 365, research and give two examples of SaaS (software as a service).
 - c. What software do you need to have installed to use SaaS?
 - d. What are three advantages for a company to use SaaS over a normal software application?

6.2 Virtual Reality (VR)

Virtual reality is an artificial environment that is created with software. It is computer-generated simulation of a three-dimensional image or environment. This is presented to the user in such a way that the user believes and accepts it as a real environment and becomes completely immersed in that world and shuts out the physical world. It is primarily experienced through two of the five senses: sight and sound.

PURPOSES

- **Gaming:** use of virtual reality application and virtual worlds.
- **Military:** used for training simulation so soldiers can train for combat situations.
- **Education:** so that large groups of students can interact in a virtual classroom with supporting data.
- **Healthcare:** used for doctors and nurses to learn new skills e.g. surgery simulation, phobia treatment, robotic surgery and skills training.
- **Entertainment:** for example, interactive theme parks, virtual museums and theatre.
- **Fashion:** for example, avatars are used to help with clothing design and virtual stores can be created.
- **Heritage:** for example, visitor centres like the Terracotta Army are being created in a virtual world so that the site can be protected from tourism.
- **Business:** to train new employers and provide virtual tours of the business environment.
- **Engineering:** engineers can view their project virtually to understand how it works, to spot any flaws or potential risks before implementation.
- **Sport:** to measure and analyse athletic performance.
- **Media:** virtual reality is used in producing more realistic films.
- **Scientific Visualisation:** uses computer graphics to show abstract or complex ideas to show scientific concepts, like molecular models.
- **Telecommunications:** especially with smartphones.

HARDWARE AND SOFTWARE REQUIREMENTS

The hardware needed for virtual reality includes:

- Personal Computer (PC)/Console/Smartphone are used to process and power the inputs and outputs sequentially.
- Input devices lets users navigate and interact within a VR environment e.g. joysticks, force Balls/Tracking balls, controller wands, data gloves, trackpads, On-device control buttons, motion trackers, bodysuits, treadmills and motion platforms (virtual omni).
- Output devices present the VR content or environment to the users and includes visual, auditory or haptic displays.

Software manages the I/O devices, analyses incoming data and generates proper feedback. Virtual reality is time-critical and software must manage it. Input data and the system response that is sent to the output displays must be prompt in order not to destroy the feeling of immersion.

ADVANTAGES

There are many advantages to using virtual reality mainly that it can be used as a training tool in many areas of life and can provide remote access e.g. surgery can be performed in remote locations using robotic technology and virtual reality. It provides learning experiences that one cannot get from reading books as it immerses you in that world. This makes learning fun and can eliminate the language barrier and certain dangers associated with scientific experiments. This makes virtual reality a very convenient tool to connect people around the world.

LIMITATIONS OF TECHNOLOGIES

The software for virtual reality is limited and in some cases inflexible as it cannot go out of that scope,
It cannot simulate a real classroom where learning fluctuates,
Virtual reality can be addictive and detrimental to social connections as it is not real-life, only an imaginary world.



Activity 6.2

- 6.2.1** Complete the table on Virtual Reality.

DEFINITION:	
Benefits:	Limitations:

- 6.2.2** Read the following article on VR headsets <https://www.pcmag.com/article/342537/the-best-virtual-reality-vr-headsets>. Discuss the different types of headsets. Which headset do you prefer? Explain.

- 6.2.3** Explore this site, the best VR YouTube videos <https://www.youtube.com/channel/UCzuqhhs6NWbgTzMuM09WKDQ>. What impressed you the most about VR? Which was your favourite video and why? Explain how the VR videos could benefit society.

6.3 Augmented Reality (AR)

Augmented reality technology superimposes a computer-generated image onto a user's view of the real world. It provides a composite 3D view that provides full immersion. AR can be experienced through headsets that people wear and through displays on mobile devices.

USES

AR apps, headsets, and smart glasses add value to virtually every industry - from retail to industrial manufacturing. AR has the potential to solve some of the biggest problems.

Initially PC, smartphone and tablet applications for augmented reality focused on games, but the uses of AR has extended far and wide. Listed below are a few uses of AR technology:

- **Product view** – Allows customers to view and interact with products or services before purchasing.
- **Enhance content** – Allows users to embed various types of data onto content. People can point their device at a real-life object to learn whatever kind of information is necessary, instead of needing to search for it elsewhere.
- **Training** – AR enables users to train employees more thoroughly than they can through documentation and meetings. This software allows for trainees to learn job responsibilities by fully visualizing them, instead of just reading about job duties.
- **Productivity** – This software enables users to improve workflow and processes at their business. Factory line workers can spot potential dangers quicker.
- **Engage your audience** – People are inundated with print and television advertisements to the point where they don't pay much attention to them. Inserting augmented reality into advertisements will catch the eye of your target demographic.

HARDWARE AND SOFTWARE REQUIREMENTS

Hardware requirements for augmented reality include:

- battery life
- bluetooth connectivity/Wi-Fi
- field of view in 3D view
- on board storage capacity
- on board OS/Web Browser
- inputs/outputs (button, eye tracking, accelerometer)
- microphone
- sound capacity
- display capacity
- visual tracking

Software requirements for augmented reality include:

- AR software works in conjunction with devices such as tablets, phones, headsets, and more. These integrating devices contain sensors, digital projectors, and hence require:
 - appropriate software that enables computer-generated objects to be projected into the real world.
 - on-board operating system and user interface to support the software
 - web Browser
 - authoring to allow the user to use API links to other databases and websites to display information.

ADVANTAGES

Some of the advantages to augmented reality are:

- to get or enhance creativity
- provide a new product experience
- able to preview the product visually
- build real-time data experiences
- enjoy experiential experiences
- functional uses demo

LIMITATIONS OF AUGMENTED REALITY

Some of Augmented Reality's limitations include:

- rendering digital data into meaningful graphics
- scaling digital data to be suitable with the perspective of the visual field
- in smartphones, AR must work with limited storage, small processing power and small amount of memory.



Activity 6.3

6.3.1 Explain the difference between virtual reality and augmented reality.

6.3.2 Complete the table on Augmented Reality.

DEFINITION:	
Benefits:	Limitations:

6.3.3 How can Augmented Reality help a business with marketing?

6.3.4 How will Augmented Reality change in the future?

6.3.5 Research and explain what a business will need to set up augmented reality for their advertising?

6.4 Virtualisation



Did you know

Even though they are often mentioned together, virtualisation is different from cloud computing. Virtualisation is the software that allows you to create hundreds of virtual machines on a single virtual server, while cloud computing is the service that uses virtualisation to rent out small parts of a server. Virtualisation is therefore the software, while cloud computing is the product sold to consumers.

Virtualisation refers to running multiple computing environments (called virtual machines) on a single set of hardware.

On very old operating systems, you could only load and run one program into the computer's memory at a time! However, modern processing techniques allow you to use your CPU more effectively. These processing techniques are:

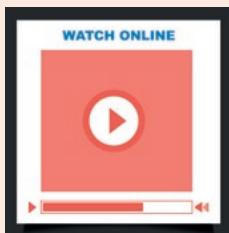
- **Multitasking:** With multitasking, a single processor splits its time between different processes.
- **Multithreading:** Multithreading completes the instructions for multiple different tasks inside the same program (called threads) by quickly switching between them.
- **Multiprocessing:** Multiprocessing uses many processors to complete tasks.

These techniques are heavily used in virtualisation, where a single computer can be broken into many 'virtual machines'. Each virtual machine is allocated its own CPU, RAM and storage space and are treated in the same way as a real computer. This means that each virtual machine must have its own operating system and its own applications installed, and that the different virtual machines do not have access to the main computer or any of the other virtual machines.



Animation

Animation showing how a single data centre server is broken into small pieces, with each of these pieces connecting to a different user on the Internet. The goal is to show how cloud computing works by breaking servers into hundreds of smaller virtual machines.



USES OF VIRTUALISATION

Virtualisation has many different uses, including testing different operating systems and software, cloning computers, hosting cloud applications and allow multiple people to use the same computer at the same time.

BENEFITS

- **Less expenditure:** servers, storage and desktops, virtualisation can release assets, saving in capital and operational expenditure. It can reduce the number of software licences that are needed.
- **Save assets:** server virtualisation supports multiple applications to operate on a single physical server, enabling the same assets to be better utilised.
- **Disaster recovery:** options include building in high availability and disaster recovery processes without replicating everything. The automation embedded in virtualisation tools supports management processes. It does not replace them. After all, if systems fail, administrators rely on management tools to identify where the problems are.
- **Green IT:** with fewer server and storage resources, the demand for power and cooling can be reduced and there will be fewer units to dispose of.
- **Long-term benefits:** virtualisation starts to change the basic infrastructure, saving money and establishing a new foundation for on-going developments. The IT team can show it has answers to help reduce operating costs and show how every employee can make a contribution to reducing greenhouse gases.



Activity 6.4

6.4.1 Choose the correct answer.

- a. The following techniques are used in virtualisation:
 - A. Multithreading
 - B. Multiprocessing
 - C. Multitasking
 - D. All of the above
- b. This completes the instructions for multiple different tasks inside the same program (called threads) by quickly switching between them.
 - A. Multithreading
 - B. Multiprocessing
 - C. Multitasking
 - D. None of the above
- c. It uses multiple processors to complete tasks.
 - A. Multithreading
 - B. Multiprocessing
 - C. Multitasking
 - D. None of the above
- d. The difference between virtualisation and cloud computing is:
 - A. Cloud computing is the software, while virtualisation is the product sold to consumers
 - B. Virtualisation is the software, while cloud computing is the product sold to consumers
 - C. Virtualisation is the software, while cloud computing is based on the idea that many software applications present a service to users.
 - D. None of the above.
- e. Virtualisation is one of the core technologies used in _____.

6.4.2 List at least THREE uses of virtualisation.

CONSOLIDATION ACTIVITY**Chapter 6: Software**

- 1.** Create two groups to debate which is better Virtual Reality or Augmented Reality.
- 2. a.** Complete the table by giving an example for each field.

	VIRTUAL REALITY	AUGMENTED REALITY	DIFFERENCES
Medical			
Military			
Education			
Entertainment			
Fashion			

- b.** Compare the uses of Virtual and Augmented Reality.

SOCIAL IMPLICATIONS

CHAPTER OVERVIEW



- Unit 7.1 Computer criminals: hackers, crackers, cyber gangs, virus authors
- Unit 7.2 Types of cyber crimes
- Unit 7.3 Effects of cyber crimes
- Unit 7.4 Computer crimes: hardware, software, Information, Identity theft, bandwidth theft, theft of time and services
- Unit 7.5 Safeguards against computer crimes, threats and criminals



Learning outcomes

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

- discuss different types of computer criminals and cyber crimes.
- protect yourself from online threats

INTRODUCTION

With the increased use of computers and technology, it is important to be aware of safety and security when online. This chapter will discuss computer criminals and cybercrimes and safeguards against computer crimes, threats and criminals.

7.1 Computer criminals

You have already learned how to keep your computer safe from malicious software. You have also seen the techniques websites use to help keep you safe. So, in this final section on computer security, you will look at the different types of computer criminals and the targets of their attacks in greater detail.

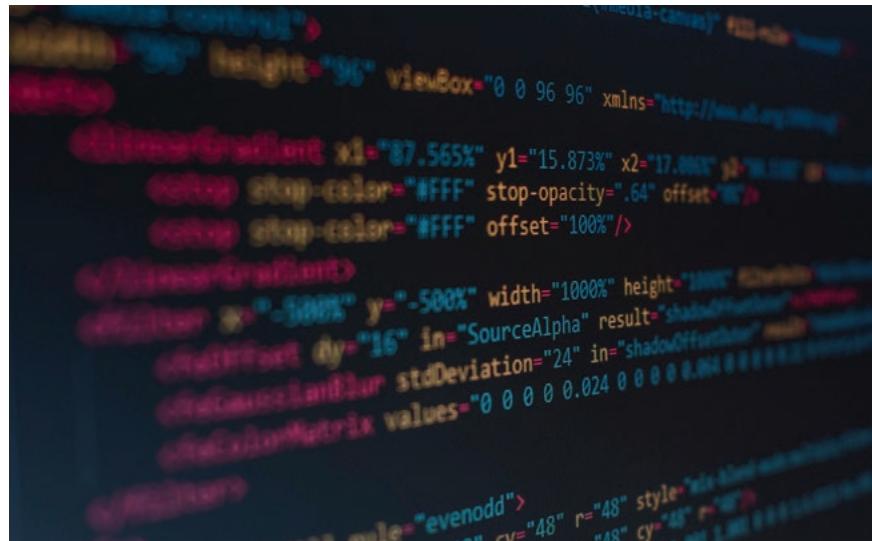


Figure 7.1: Cyber-criminals use their computer skills to gain access to data

HACKERS

A hacker is anyone who uses their computer skills to gain unauthorised access to computer systems or data. They can do this through a combination of exploits, scripts and social engineering.

TYPES OF HACKERS

White hat hackers help companies improve their security by trying to hack into their computers.

Black hat hackers illegally break into computer systems.

CRACKERS

Cracker refers to individuals who use their skills illegally. They may break into computer systems for a variety of reasons, from stealing data to testing their skills to making political statements.

The word cracker can also be used to refer to people who write software cracks (tools that allow software to be pirated and used illegally).

CYBER GANGS

A cyber gang, much like a gang in real life, is a group of people who work together to commit computer crimes. Just like in real life gangs, these gangs can be made up of many loosely organised members.

VIRUS AUTHOR

A virus author is any person who writes a computer virus. Virus authors create viruses for several reasons, including causing damage, showing off their skills, gaining information or money or taking over computers and using them to send spam emails.

Many security experts will argue that calling a hacker a criminal is also incorrect since many hackers do not use their computer skills for illegal purposes but are instead paid by companies to test their security systems.

7.2 Types of cyber crimes

In Grade 10 and 11 you learned about different types of computer viruses and malware attacks. The table below describes five new types of attacks that you should be aware of:

TYPE	DESCRIPTION
Backdoors	A backdoor refers to any method by which authorized and unauthorized users are able to get around normal security measures and gain high level user access on a computer system, network or software application. (Programmers build backdoors into their programs to help solve software problems with the program)
Remote access virus/trojan	A remote access virus (or remote access trojan) allows the virus author to control the computer it has infected from anywhere in the world. This can be used to spy on users, record usernames and passwords and infect their computers with additional viruses.
Botnets	A botnet refers to several computers infected by the same virus who can work together to perform attacks. These attacks include sending spam emails, mining bitcoins, or performing a distributed denial-of-service (DDoS) attack. (many computers attempt to use up all the bandwidth of a website, making it inaccessible). Each individual computer in a botnet is known as a zombie
Internet fraud	Internet fraud refers to a wide variety of scams used to steal money from people on the internet. As mentioned in the previous section, popular scams include sending fake emails and catfishing (someone who pretends to be someone else online). Other scams include creating fake charitable organisations after a natural disaster, selling fake tickets to large sporting or music events, and creating fake gambling sites with rigged odds.



Activity 7.1

- 7.1.1** In small groups discuss the types of crimes, the criminals' reasons for committing the crimes and the consequences.
- 7.1.2** Choose one type of cybercrime and research a case study on the crime. Ask your peers questions on the case study in order to gain further knowledge.

7.3 Effects of cyber crime

Cybercrimes can have long lasting effects on the people targeted by it.



Figure 7.2: Cybercrimes have many negative effects on people

Cyber crime is being committed every day. Thieves commit cyber crimes to steal people's money and their identity. With your identity, the cyber criminal:

can take out loans, incur credit, accumulate debt and, then flee without a trace. It can take years to rehabilitate your identity. A virus can destroy someone's files and a lost database can result in receiving unwanted sales calls.

The list below includes some of the most immediate effects:

- lost money due to online theft
- expenses incurred to fix problems and prevent future cybercrimes
- loss of reputation due to personal information that is revealed
- corrupted files due to viruses
- long-term debt created resulting in poor credit rating due to online identity theft



Activity 7.2

Revisit the case study and questions that you discussed in your small group about a type of cybercrime. After reading this information, revise your answers and share them with the class.

7.4 Computer crimes

Just like you have different types of cyber criminals, you also have different targets with different goals. In the following section, you will learn about the following types of targets:

- Hardware hacking
- Software hacking
- Information and website hacking
- Bandwidth theft
- Service theft

HARDWARE HACKING

Hardware hacking refers to attacks aimed at specific pieces of hardware. The goal of these attacks is to unlock the hardware in order to give the owner access to features that are normally locked.

SOFTWARE HACKING

Software hacking is achieved by finding software exploits and breaking software protection

When finding software exploits, hackers look for weaknesses in an application's security. These exploits are used to gain unauthorised access to the software itself, or gain remote access to the computer.

When breaking software protection, the goal of hackers is to remove the protection which ensures that the software was purchased and is used legally. This allows people to play pirated games or use pirated software.

WEBSITE AND INFORMATION HACKING

Hacking a website is illegally getting the password to add, edit, delete data stored in that website. After hacking, the hacker will insert harmful programs by inserting malicious codes into the website.

Website and information hacking is used for several different reasons:

- Steal users' personal (email addresses, passwords, credit card information, information) for identity theft
- Build a database of common usernames and passwords
- Deface the website or place political messages on the website
- Reroute traffic from the website to a phishing website

IDENTITY THEFT

Identity theft happens when a criminal gains access to your personal information and uses that information to gain some benefit. This can include taking out loans in your name, taking control of your existing bank or service accounts, creating a phone number in your name, or using your name to commit other illegal activities.

BANDWIDTH THEFT

Bandwidth theft, occurs when someone links to a file on your website or server from their website. This video will use your bandwidth for all users viewing the video.

SERVICE THEFT

Service theft occurs on the Internet whenever someone illegally uses a username and password to access an online service.

INTERNET RELATED FRAUD SCHEMES

Internet fraud is the use of Internet services or software to defraud victims or to otherwise take advantage of them. Some examples of Internet related fraud schemes are: business fraud, credit card fraud, fraudulent investment schemes, non-delivery of merchandise etc.

INTERNET ATTACKS (WORMS, MALWARE, DENIAL OF SERVICE, BACK DOORS)

An attack targeting an enterprise's use of cyberspace for the purpose of disrupting or maliciously controlling a computing environment or destroying the integrity of the data or stealing controlled information. Some types of Internet attacks are: worms, malware, denial-of-service (DoS) attacks, Phishing, back doors, drive by attacks, SQL injection attacks, and so on.

PHISHING

Phishing is an attempt by cybercriminals to obtain sensitive information (usernames, passwords and credit card details) by posing as legitimate institutions, usually via an electronic communication.

UNAUTHORISED REMOTE CONTROL AND ADMINISTRATION, FOR EXAMPLE, BOTNETS, ZOMBIES

Remote administration refers to any method of controlling a computer from a remote location. Bot programs allow attackers to remotely control vulnerable computers and form virtual networks of zombies – botnets.

RIGHT TO ACCESS VS RIGHT TO PRIVACY, MISUSE OF PERSONAL INFORMATION

Individuals and corporations have the right to know where the data originated, the right to have inaccurate data rectified, a right of recourse in the event of unlawful processing and the right to withhold permission to use data in some circumstances. For example, individuals will have the right to opt-out free of charge from being sent direct marketing material, without providing any specific reason.

Online services require users to provide personal information in order to use their service. Personal information may include your full name, address, phone numbers, date of birth, email address, username and password and banking details. Although personal information is used responsibly online by many businesses for legitimate communication, it is not always the case and some personal information can be misused by criminals (used to commit fraud and identity theft).



Activity 7.3

Cybercrime targets

7.3.1 Choose the correct answer.

- a. Any person who writes a computer virus is called a _____
 - A. Hacker
 - B. Cracker
 - C. Virus author
 - D. Cyber gang or hacker group
- b. Anyone who uses their computer skills to gain unauthorised access to computer systems or data.
 - A. Hacker
 - B. Cracker
 - C. Virus author
 - D. Cyber gang or hacker group
- c. They may break into computer systems for a variety of reasons, from stealing data to testing their skills to making political statements.
 - A. Hacker
 - B. Cracker
 - C. Virus author
 - D. Cyber gang or hacker group
- d. A group of people who work together to commit crimes
 - A. Hacker
 - B. Cracker
 - C. Virus author
 - D. Cyber gang or hacker group
- e. This virus allows the virus author to control the computer it has infected from anywhere in the world.
 - A. Backdoors
 - B. Remote control
 - C. Botnets
 - D. Internet fraud
- f. It refers to a wide variety of scams used to steal money from people on the Internet.
 - A. Backdoors
 - B. Remote control
 - C. Botnets
 - D. Internet fraud
- g. It refers to several computers infected by the same virus who can work together to perform attacks.
 - A. Backdoors
 - B. Remote control
 - C. Botnets
 - D. Internet fraud
- h. A secret entrance that computer programmers build into their programs
 - A. Backdoors
 - B. Remote control
 - C. Botnets
 - D. Internet fraud
- i. This type of hacking is used to steal users' personal information for identity fraud.
 - A. Hardware hacking
 - B. Software hacking
 - C. Information and website hacking
 - D. Bandwidth theft
 - E. Service theft
- j. When one website uses the images stored on and hosted by another website.
 - A. Hardware hacking
 - B. Software hacking
 - C. Information and website hacking
 - D. Bandwidth theft
 - E. Service theft
- k. This occurs when employees spend their time not doing work but instead browse Facebook or watch videos on YouTube.
 - A. Hardware hacking
 - B. Software hacking
 - C. Information and website hacking
 - D. Bandwidth theft
 - E. Service theft



Activity 7.3

Cybercrime targets *continued*

- I. When someone illegally uses a username and password to access an online service.
 - A. Hardware hacking
 - B. Software hacking
 - C. Information and website hacking
 - D. Bandwidth theft
 - E. Service theft
 - m. When finding software exploits, hackers look for weaknesses in an application's security.
 - A. Hardware hacking
 - B. Software hacking
 - C. Information and website hacking
 - D. Bandwidth theft
 - E. Service theft
- 7.3.2** One of the most famous hacking groups in the world is Anonymous. According to Anonymous, they are a hacktivist group which means that they hack websites and organisations for political reasons. Since the start of 2010, their attacks have included:
- Organisations responsible for stopping online piracy like the RIAA, the MPAA and the Copyright Alliance.
 - Government websites in countries where they disagree with the government (such as Tunisia and Thailand).
 - Organisations and churches accused of homophobia.
 - The website and Twitter account of the racist organisation the Ku Klux Klan.
 - South African websites owned by the Gupta family (including the websites of ANN7, The New Age and Sahara).
- With this information in mind, answer the following questions.
- a. List and describe four different types of computer criminals.
 - b. Which type of criminal is anonymous?
 - c. Anonymous often uses botnets and remote control in their attacks. Describe what these terms mean.
 - d. According to the scenario, what is the target of Anonymous' attacks. Give examples to support your answer.
 - e. While Anonymous usually targets large organisations that they disagree with, it is most often individuals who are hurt by cybercrime. What are the most immediate effects of cybercrime?
- 7.3.3** Has your online security improved since the start of Grade 10? Are you using a secure password?
- 7.3.4** How many people, on average, do you think use a secure password?
- 7.3.5** Do you think the average Internet user should worry about online security?
- 7.3.6** Do you think South Africans are likely to be the victims of online scams?

Cyber/Computer crime cannot be stopped completely. But sometimes it can be prevented with practicing good online safety habits. Several methods can be used to safeguard against computer crimes, threats and criminals.

- Make sure your security software is current – and update it regularly for protection from malware, viruses and other online threats.
- Lock or log off your computer when you step away to ensure that no one else will have access to all your information.
- Go offline when you don't need an internet connection to reduce the chances of hackers and virus scans invading your computer.
- Take advantage of security settings by using PINs or passcodes to protect someone from easily accessing all your information.
- Consider sharing less online. Your birthdate and the city where you live on your social media profiles can give criminals a more complete picture and make it easier for them to steal your identity.
- Think twice about using public Wi-Fi. Avoid entering private information and using apps that have passwords when you are on public Wi-Fi.
- Delete tweets, posts and online advertising, in addition to emails, if it looks suspicious.

CONSOLIDATION ACTIVITY

Chapter 7: Social implications

1. Without looking at your notes, complete the sentences on the different type of computer criminals.

TYPE	DESCRIPTION
Hacker	A hacker is anyone who uses their computer skills to gain _____ access to computer systems or _____. They can do this through a combination of exploits, scripts and social engineering. _____ help companies improve their security by trying to hack into their computers, while _____ (or _____) illegally break into computer systems.
_____	This refers to hackers who use their skills _____. They may break into computer systems for a variety of reasons, from _____ to _____ to _____. This term can also be used to refer to people who write _____ cracks (tools that allow software to be pirated and used illegally).
Virus author	A virus author is any person who writes a _____. Virus authors create viruses for several reasons, including _____, _____, _____ or _____.
_____	This is a group of people who work together to commit crimes. They can be made up of many loosely organised members (like the group Anonymous) or they can be a small team of specialists.

2. Complete the table on the types of cybercrimes.

TYPE OF CRIME	DEFINITION	EFFECT ON SOCIETY
Hardware hacking		
Software hacking		
Information and website hacking		
Bandwidth theft		
Service theft		

Which type of crime do you think is the worst and why?

3. Explain three safeguards you can put in place to protect your device. Do you follow these safeguards? Explain.

INTERNET SERVICES TECHNOLOGIES

CHAPTER OVERVIEW



Unit 8.1 Improve searching

Unit 8.2 Online applications



Learning outcomes

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

- discuss Semantic, Mediated and Search Engine Optimisation
- explain how online applications work with regards to data storage, running instructions and formatting output.

INTRODUCTION

INTERNET TECHNOLOGIES IN A NUTSHELL

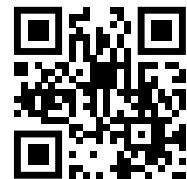
In the previous years, you learned that the Internet can be grouped into three generations:

- **Web 1.0**, websites were **static** with all the information programmed directly onto the web page. (these web pages stayed the same until a web developer changed the web page's code).
- **Web 2.0**: websites became more interactive and dynamic. Instead of simply providing information, websites became applications that allowed users to search, send messages, post updates and watch videos. Users also play a role in the development of content,
- **Web 3.0**: like Web 2.0, but smarter! To cope with the large amounts of information on the Internet, Internet services created increasingly smarter web applications to help find and recommend relevant information to visitors. To do this, Web 3.0 website are much more likely to make use of the user's location, preferences etc. to improve the information it provides.

One way in which Web 3.0 aims to improve the Internet is by creating a **semantic web**. The word semantic refers to the meaning of words and sentences, so the semantic web will be a web of meanings. Where most of the web is built out of a collection of web pages connected to each other through hyperlinks, the semantic web is a proposed development of the World Wide Web in which data in web pages is structured and tagged in such a way that it can be read directly by computers.

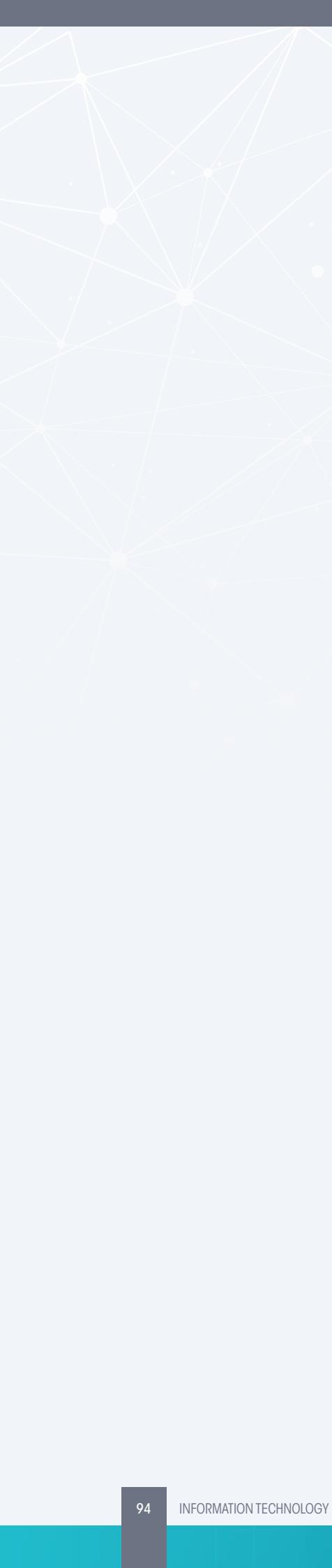


QR CODE



<https://tech.co/news/internet-history-websites-wrote-2015-09>

<https://qrs.ly/j9a5pj1>



ACTIVITY 8.1

Revision Activity

- 8.1.1** The Internet can be grouped into three generations. Give ONE word/term for each of the following descriptions. Write only the word/term next to the question number in your homework book.
- a. Web pages were static with all the information programmed directly onto the web page.
 - b. Websites became more interactive and dynamic. Instead of simply providing information, websites became applications that allowed users to search, send messages, post updates and watch videos.
 - c. To cope with the large amounts of information on the Internet, Internet services must create increasingly smarter web applications to help find and recommend relevant information to visitors.
 - d. These are websites that, rather than providing information, provide a service like desktop applications, with Web 2.0 and 3.0 being closely linked to it.
 - e. This consists of a massive database containing the data from the WWW in a logically connected way with the aim to be a collection of data connected directly to other data, thereby ignoring web pages.

8.1 Improve searching

The smart internet search engines have changed from simply searching for keywords to answering natural language questions, often before they are even asked!

Search engines used to work by searching for specific words (or keywords) in the text of web pages. This type of search is known as keyword search and is a reasonably good way to search for information. Combined with an effective ranking system, keyword search will show you the most useful websites containing your keywords.

However, keyword searches struggle to answer questions. Since the keyword search does not know what the individual words mean, all it can do is to look for pages where those keywords are found on the page. As a result, the search results often include pages containing the keywords that are unrelated to the question being asked. Searches may also fail to find web pages that do answer the question but use different keywords.

In the following sections, you will see how improvements to semantic search and **mediated search** hopes to improve your search results.

SEMANTIC SEARCH

Semantic refers to the meaning of words and sentences, a semantic search engine is a search engine that searches for answers based on the meaning of the search, rather than on the keywords (i.e. improve **search** accuracy by understanding a searcher's intent through contextual meaning)

If you search for: 'What is the semantic web?' then a semantic search engine will attempt to answer this question (and show definitions, articles and advantages, advantages of the semantic web), while a keyword search engine will show you web pages containing the words 'What', 'is', 'the', 'semantic' and 'web'

MEDIATED SEARCH

Disagreements are mediated, that means a neutral person has stepped in to help. Most websites provide a search facility within the site. Rather than each website creating their own, basic search engine, mediated search allows websites to make use of an advanced search engine like Google to power search their website. When a user enters a search query, it runs the query through a search engine like Google or Bing but limits the results to the specific website. These results can then be shown directly inside the web page, like any other search query would be. This allows small website creators to use the most powerful search engines in the world on their website.

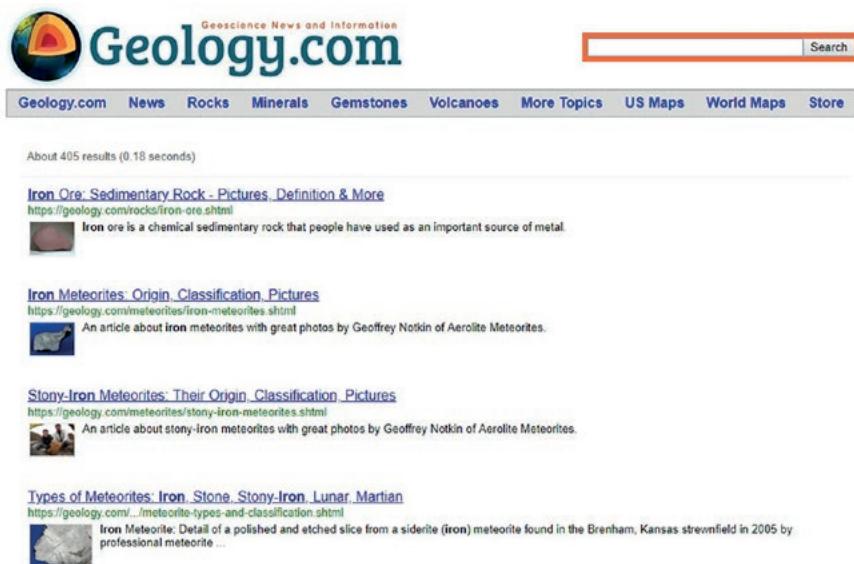


Figure 8.1: Geology.com makes use of mediated search

SEO (SEARCH ENGINE OPTIMIZATION)

SEO is the practice of increasing the quantity and quality of traffic to your website through search engine results. A search engine has a crawler (systematically browses the WWW) that gathers information available on the Internet. The crawlers bring that data back to the search engine in order to build an index. When you type in a query or phrase in the search engine, it tries to match all that data using an algorithm. The index is then fed through that algorithm and a long list of links to webpages that could potentially answer your question is provided.



Activity 8.2

Using search engines

8.2.1 Choose the correct answer.

The following are different methods of searching information on the Internet.

- a. Combined with an effective ranking system, this type of search engine will show you the most useful websites containing your keywords. It can however not answer questions.
 - A. Semantic search
 - B. Mediated search
 - C. Keyword search
 - D. None of the above
- b. This type of search engine searches for answers based on the meaning of the search, rather than on the keywords.
 - A. Semantic search
 - B. Mediated search
 - C. Keyword search
- c. This type of search engine allows websites to make use of an advanced search engine like Google to power searches on their website.
 - A. Semantic search
 - B. Mediated search
 - C. Keyword search

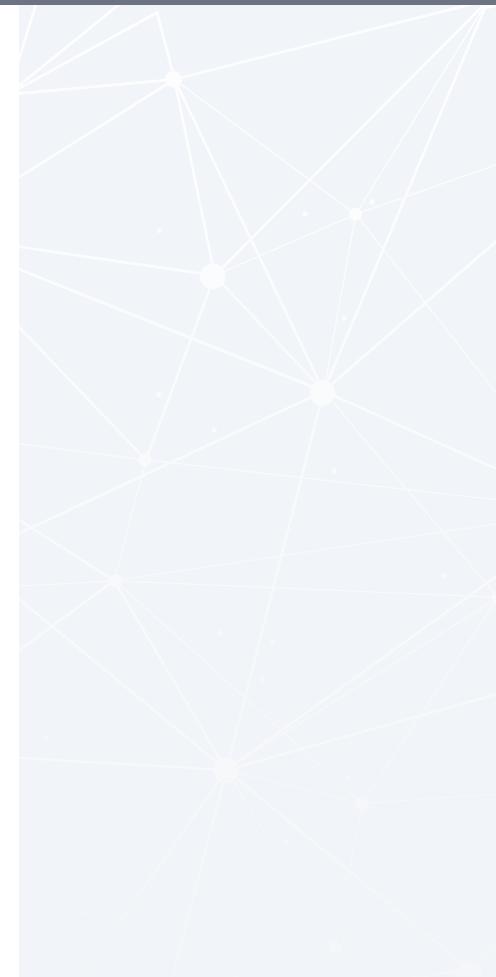


Activity 8.2

Using search engines *continued*

- d. The following improvements have been made by Google to become closer to search engines, namely automatically correcting spelling mistakes, using natural language and learning from other people's searches.
- A. Semantic search
 - B. Mediated search
 - C. Keyword search
- e. When a user enters a search query, it runs the query through a search engine like Google or Bing but limits the results to the specific website. These results can then be shown directly inside the web page, like any other search query would be. This is how _____ works.
- A. Semantic search
 - B. Mediated search
 - C. Keyword search
- 8.2.2** Individually or in pairs, use a web search to find answers to the following questions:
- a. What is the name and height of the tallest mountain in South Africa?
 - b. On which day was Nelson Mandela born?
 - c. Who is the current world chess champion?
 - d. What is the best-selling album of all time?
 - e. Which movie did the best of the box office this year?
- 8.2.3** Individually or in your pairs, do online research to find answers to the questions below. You will need to look at more than one website.
- a. What is the best price for a GeForce RX 2080 8GB? At which shop did you find this price?
 - b. Which South African musician or band has sold the most albums?
 - c. Which celebrity popularised the Adidas Ultra Boost sneakers?
 - d. Which YouTuber has the most subscribers?
- 8.2.4** Individually or in your pairs, do online research to answer the following questions. For each of the questions, give reasons for your answer.
- a. What is the best smartphone of the year? How much does it cost in South Africa?
 - b. What is the best budget smartphone currently available? Is it available in South Africa? What is the best price you can find for this smartphone?
 - c. Does the Xiaomi M8 smartphone work on South African mobile networks?
- 8.2.5** Individually or in your pairs, create a presentation or report containing your answers to the questions from the three practical activities (2 to 4). For each question, state the following:
- a. The answer to each question
 - b. The website where you found the answer
 - c. How difficult it was to find an answer.

Once prepared, present your answers to the rest of the class or submit your report to your teacher.



8.2 Online applications

Online (web) applications work using the IPO model of input, processing, storage and output. In this section, you will learn about three of these steps, namely:

- how data is stored,
- how instructions are run (or processed) and
- how the output is formatted.

STORING DATA

Deciding where to store the data usually depends on the number of users who need to access the data and the size of the data. As with processing, web applications can choose to store data either locally or online.

LOCALLY

Web application creators also store data about the user locally in a cookie. While cookies were initially used to store a user's preferences (such as their language preference) for a website, they have recently been used to store all kinds of different information about the user. This includes information on the times a user visits the website, how long the user stays on the website, the links the user clicked on and the physical location of the user while browsing the website.

ONLINE

Data that needs to be accessible to more than one user, or to the same user on more than one computer, will usually be stored online. As a result, information like status updates and tweets are stored online since this data should be accessible to any user searching for it. In contrast, WhatsApp messages are stored directly on the smartphones that received them. Unless these messages are backed up, they will not appear on a new phone.

Once the data has been stored in an appropriate location, it needs to be used on the website once the website has been loaded. To do this, website creators make use of several different tools, including:

- **SQL:** (short for Structured Query Language) is a standard language for working with databases. SQL is incredibly important for websites where the data is stored in a database, since SQL queries can then be used to search for and display this data.
- **Scripting languages (like PHP or JavaScript):** a programming language that work inside very specific situations (such as web pages) to automatically complete tasks.
- **XML:** (Extensible Mark-up Language) is a language used to describe, store and transport data.

RUNNING INSTRUCTIONS

During processing, applications run a set of predetermined instructions. These instructions might be as simple as HTML code that tells the web page what information to display, or it may be millions of lines of complicated search code running in the background. These instructions can either be run on a local computer or they could be run on a virtual machine somewhere on the cloud.

LOCAL COMPUTER

With local (or client-side) scripts, all the code that will be run must be stored in the code of the web page. This is usually done in the form of a **JavaScript** or **PHP script**. One common use of local scripts on websites is to show a pop-up message about **cookies** or **ad blockers**. When users accept the terms and conditions or click on the Close button, a small local script runs which removes the pop-up message from the page.

Another popular use of local scripts is known as **AJAX** (or *Asynchronous JavaScript and XML*), which allows you to update or refresh a small part of a web page without reloading the entire page. AJAX is used on thousands of websites to display new information that is requested from a web server without updating the entire page. Examples include Facebook showing new status updates or Twitter informing you of new tweets without refreshing the page.

While local scripts can be quick to run and remove a lot of processing from the web servers, they have several problems:

- They can cause the user's computer or the website to slow down.
- They may require the user to download the entire script each time the website is opened.
- The scripts are visible, allowing anyone to see and copy the script for their own programs.

ONLINE

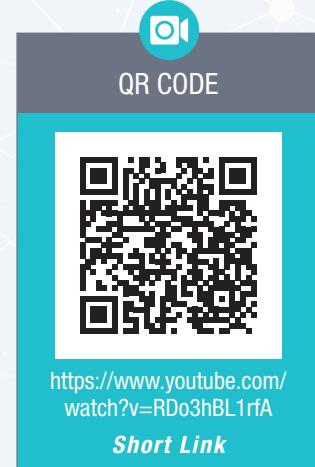
For these reasons, many web applications run their instructions online, on a web server. With server-side processing, the instructions are not downloaded as part of the web page. Instead, the web page simply displays data that is generated and sent to it by instructions running on the server. For example, many websites use SQL scripts to collect information from a database and display it on a page.

FORMATTING OUTPUT

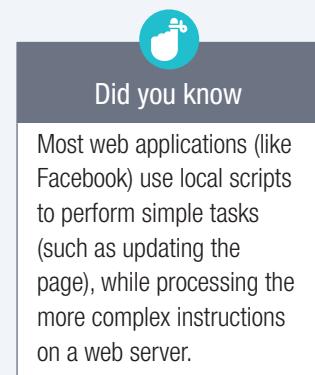
Online applications are evaluated on the way they look and feel, so website creators spend a lot of time formatting their output.

CSS stands for Cascading Style Sheets. HTML is used to structure a web document (defining things like headlines and paragraphs, and allowing you to embed images, video, and other media). CSS specifies your document's style—page layouts, colors, and fonts. Think of HTML as the foundation (every house has one), and CSS as the aesthetic.

One way to change the output of a web application is to change the website's **CSS** (or cascading style sheets). CSS determines how a website will look by creating a style sheet. This style sheet contains information on all the styles used throughout the website. Rather than manually changing the style of each paragraph of text, each heading and each image, CSS allows web application creators to create a style for these items.



QR CODE
<https://www.youtube.com/watch?v=RDo3hBL1rfA>
Short Link



Did you know
Most web applications (like Facebook) use local scripts to perform simple tasks (such as updating the page), while processing the more complex instructions on a web server.



Case Study 8.2.1

Cascading style sheets

The two images below show the same webpage with and without CSS.

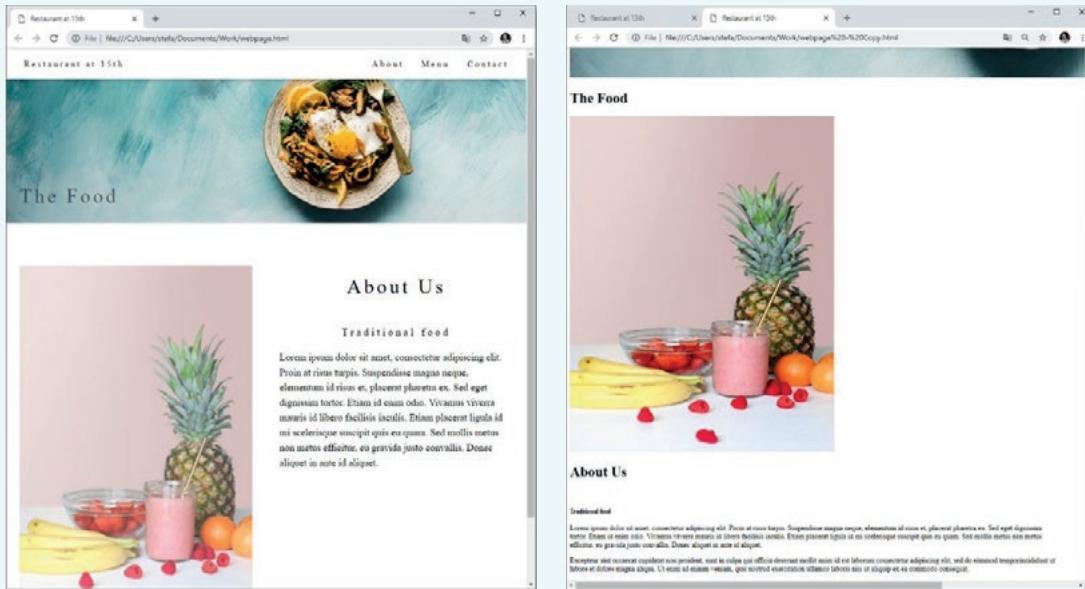


Figure 8.2: Website with and without CSS

Study the two images carefully, then answer the following questions.

1. Which of the two websites is more attractive and easier to use?
2. Can you identify at least eight style changes between the two pages?
3. Can you identify an example of CSS being used to determine the position of items on the page.



Activity 8.3

Online applications

8.3.1 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). There can be more than one answer (column B) to a question (column A).

COLUMN A	COLUMN B
1. According to which model do online (web) applications work?	A. Number of users
2. With local (or client-side) scripts, all the code that will be run must be stored in the code of the web page. This is usually done in the form of _____ or _____.	B. IPO
3. One common use of local scripts on websites is to show a pop-up message about _____ or ad blockers.	C. Cookies
4. _____ is used on thousands of websites to display new information that is requested from a web server without updating the entire page.	D. SQL
5. Deciding where to store the data (locally or online) usually depends on the _____ who need to access the data and the size of the data.	E. JavaScript
6. Information like status updates and tweets are stored _____ since this data should be accessible to any user searching for it.	F. PHP script
7. _____ have recently been used to store all kinds of different information about the user, for example information on the times a user visits the website, how long the user stays on the website, the links the user clicked on and the physical location of the user while browsing the website.	G. Online
	H. XML
	I. AJAX



Activity 8.3

Online applications *continued*

COLUMN A	COLUMN B
8. This is a standard language for working with databases.	
9. This is a programming language that works inside very specific situations (such as web pages) to automatically complete tasks.	
10. This is a language used to describe, store and transport data.	

8.3.2 Explain what a 'local script' is.

8.3.3 What is the importance of AJAX?

CONSOLIDATION ACTIVITY

Chapter 8: Internet services technologies

1. Choose the correct word.

a. Look at the following website, what type of search engine does it use?



- A. Sematic search
 - B. Mediated search
 - C. Keyword search
 - D. Theme search
- b. Which of the following internet generations only makes use of keyword searches?
- A. Web 1.0
 - B. Web 3.0
 - C. Web 2.0
 - D. Web 3.1
- c. Which of the following internet generations makes use of the AJAX scripting language to create targeted adverts?
- A. Web 3.0
 - B. Web 4.0
 - C. Web 2.0
 - D. Web 1.0

- d. What is the web address of W3C?
 - A. www.w3.com
 - B. www.w3.org
 - C. www.w3c.org
 - D. www.w3schools.com
- e. Which of the following is a web application for spreadsheets?
 - A. Google Slides
 - B. Instagram
 - C. Google sheets
 - D. YouTube
- f. SSL stands for _____.
 - A. Secure Server Layer
 - B. Secure Sockets Layer
 - C. Socket Secure Layer
 - D. Standalone Sockets Layer
- g. Which of the following is an example of a programming language that can be used to run server-side instructions on a web page?
 - A. PHP
 - B. HTML
 - C. CSS
 - D. AJAX
- h. Which of the following data should be processed server-side?
 - A. User comments
 - B. User preferences
 - C. User searches
 - D. User passwords
- i. Which of the following apps would store your messages locally?
 - A. WhatsApp
 - B. Google Mail
 - C. Instagram
 - D. Facebook
- j. Which of the following should NOT be stored by a cookie?
 - A. Recently visited websites
 - B. Time spent on a website
 - C. Your bank details
 - D. Your username

CONSOLIDATION ACTIVITY**Chapter 8: Internet services technologies *continued***

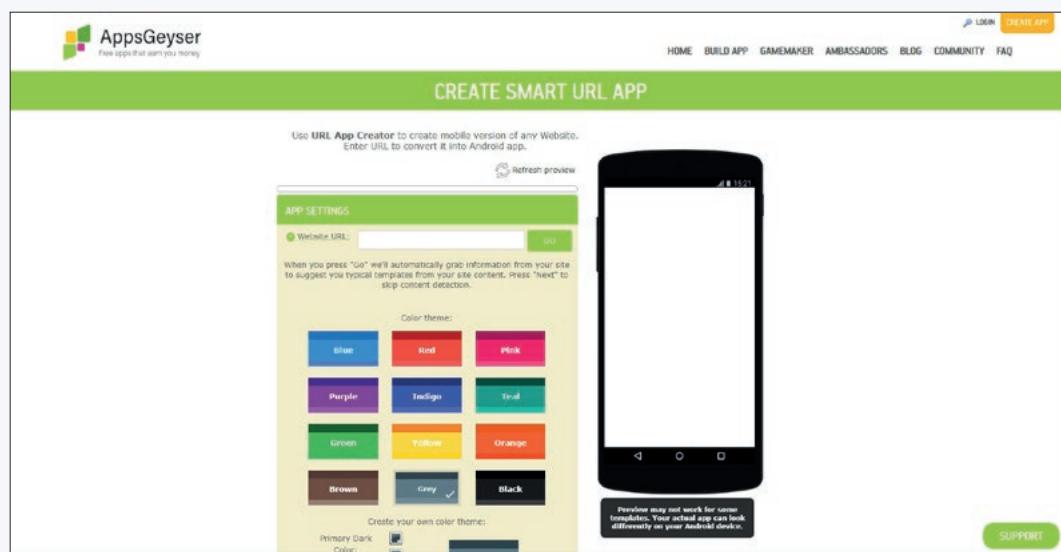
2. Indicate if the following statements are 'True' or 'False'. Choose the answer and write 'true' or 'false' next to the question number. Correct the statement if it is FALSE. Change the underlined word(s) to make the statement TRUE. (You may not simply use the word 'NOT' to change the statement.)
- PHP script allows you to update or refresh a small part of a web page without reloading the entire page.
 - In order to do client-side processing, you can use local scripts like AJAX.
 - CSS can be used to change the look and feel of a website.
 - Any sensitive information like credit card details or passwords must be decrypted when sent over a private network.
3. 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). (10)

COLUMN A	COLUMN B
1. A scripting language that concentrates on processing data stored on a website's server.	A. AJAX
2. An internet that would make use of programming languages like JavaScript and AJAX; and semantics to make web pages more dynamic.	B. HTML
3. A search engine that makes use of other more powerful engines to improve its search results.	C. Semantic search
4. A scripting language that can be used in client-side processing to update the content of a page without reloading it.	D. PHP
5. A basic scripting language that can integrate other scripting languages into its coding to improve the way a website displays content and processes information provided and sent to users of the website.	E. Web 3.0
6. A search engine that returns search results that concentrate more on answering the user's search query rather than the query itself.	F. CSS
7. A scripting language that is used to enhance the formatting and layout of a website.	G. Encryption
8. A search engine that looks for websites that contain the user's search query.	H. SSL certificate
9. An Internet where users do not have the ability to contribute to the development of a website's content.	I. Web 1.0
10. A process that secures data by making use of public keys and private keys.	J. Mediated search
	K. Keyword search
	L. Web 2.0

CONSOLIDATION ACTIVITY

Chapter 8: Internet services technologies *continued*

4. Analyse the following website and answer the questions that follow.



- a. Mention ONE thing you like about the website's layout and design.
 - b. Mention ONE thing you dislike about the website's layout and design. Also mention what scripting language you would use to improve or fix this problem.
 - c. Mention ONE thing on this website that would NOT be processed locally.
5. Yelena has decided to setup a website where she can sell her uniquely hand-made teddy bears to possible clients. Mention TWO tools she can integrate into her website, to either enhance a user's experience or allow a user to contribute to her website. Also mention what technology(s) she can use to implement each of these things.

NETWORKS

CHAPTER OVERVIEW



- Unit 9.1 Essential parts to link nodes
- Unit 9.2 Connecting to the internet
- Unit 9.3 Sharing concepts
- Unit 9.4 Remote access



Learning outcomes

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

- essential parts to link nodes (Switch, cables, wireless base station)
- connecting to the internet (Router/modem, ADSL/WiMAX/4G/5G)
- all-in-one solution ('router' is modem, router, switch and base station – all in one)
- sharing concepts:
 - sharing files and folders, user rights, BitTorrent (Risks and benefits)
 - online services (Drop box/Mobile Me/GSuite/Office 365)
- remote access: (On local network, through Internet, VPN).

INTRODUCTION

In Grade 10 and Grade 11, you learned that networks are incredibly powerful tools that most modern people and businesses depend on daily. Networks have thousands of different uses, including:

- communication
- sharing resources
- centralisation of data
- transfer of files
- increased productivity
- leisure.

These uses help to make life easier, more enjoyable, makes people more productive, saves time and money, increases social opportunities and can improve knowledge.

NETWORKS IN A NUTSHELL

Networks can be categorised based on their size. A local area network (or LAN) is a computer network that covers a small area like a home, office or building. LANs usually have a limited number of computers connected to them (between 2 and 25), and these computers can be connected to the network using either ethernet or Wi-Fi. Once connected, the computers on the network can share resources, transfer files and communicate.

A WAN is a network that covers a large area – which 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. Unlike LANs, many WANs are not private but are instead organised by communities or businesses. To join a WAN (like the internet) you need to seek permission from a company that manages the service.

Another way to categorise networks is based on the way computers on the network are connected to each other. **Client-server networks** are managed by one or more servers. These servers make sure that everyone can access the network, that people only have access to the correct resources and that problems on the network are resolved. Many client's computers can then connect to these servers and make use of the resources they provide. However, client computers on a client-server network can often not see each other.

In contrast, in a **peer-to-peer (p2p) network** there is no central computer, server or person that manages the network. Instead, each computer on the network connects directly to the network and the other computers on the network. Peers on this network are visible to each other and can share files and resources with each other. You will learn more about peer-to-peer networks and filesharing in this chapter.

ACTIVITY 9.1

Revision Activity

- 9.1.1** Match the COLUMN A with the correct answer in COLUMN B. Write down only the question number and the matching letter in COLUMN B in your answer book.

Networks have many uses. Try to identify SIX of the uses by matching the descriptions in column A to the words in column B.

COLUMN A	COLUMN B
1. Data and information, printers and scanners, software, labour and money are examples of _____ that can be shared over a network.	A. Communicate
2. Computer networks also help people to work together to organise information. This is called the _____ of data.	B. Productivity
3. Networks allow computers to _____ and share data – little 1s and 0s – between two or more computers	C. Centralisation
4. By _____ files, you allow users connected to the same network to gain access to specific files	D. Sharing
5. Allowing people to collaborate more easily, share resources and information and centralise useful information, networks allow people to increase their _____	E. Resources
6. Networks help people to _____ easily and efficiently with each other using email, chat, video conferencing and more	F. Entertainment
7. Networks give people access to _____ so that they can watch movies, listen to music and play computer games.	
8. Networks allow people and computers to share _____ with other people and computers connected on the same network.	

9.1 Essential parts to link nodes

A link node connects processing locations or nodes, like a computer or a printer. Networks are grouped into two types of networks: wired networks and wireless networks. To create a wired network, you need the following networking equipment:

- Switch
- Network cable
- Wireless base station

SWITCH

A **switch** or **router** are devices that allow multiple computers to connect to the same network. They can also be used to connect two networks to each other. A switch serves as a controller, enabling networked devices to talk to each other efficiently.

A router connects multiple networks together. They also connect computers on those networks to the internet. Routers enable all networked computers to share a single internet connection.



Figure 9.1: Switches allow multiple computers to connect to the same network

NETWORK CABLES

Network cables are used to connect a computer to a local area network or one network to another network. If you are connecting directly to the internet, you may require a specific cable based on the type of internet you are using such as a **DSL enabled phone cable** or a **fibre optic cable**.

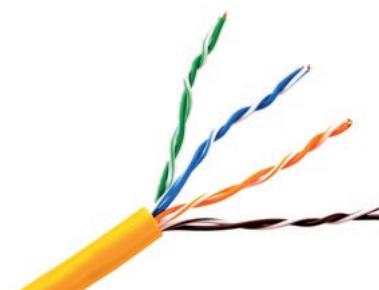


Figure 9.2: An ethernet cable is made up of four twisted pairs of wires

WIRELESS BASE STATION

A wireless base station is a radio receiver/transmitter that serves as the hub of a local wireless network. It may also be used to link a wired network and the wireless network. It consists of a low-power transmitter and wireless router. It is basically a router that communicates with devices based on the Wi-Fi standard. The router creates a connection between two or more networks, usually a local network and the internet. This allows all computers on the local network to connect to the internet. Since most routers have multiple ethernet ports, routers can often be used as an 'all-in-one' solution, instead of using switches in small home and office networks.



Did you know

Switch and router can be used interchangeably since modern routers come with a switch.



Activity 9.2

Setting up a network

9.2.1 Choose the correct answer.

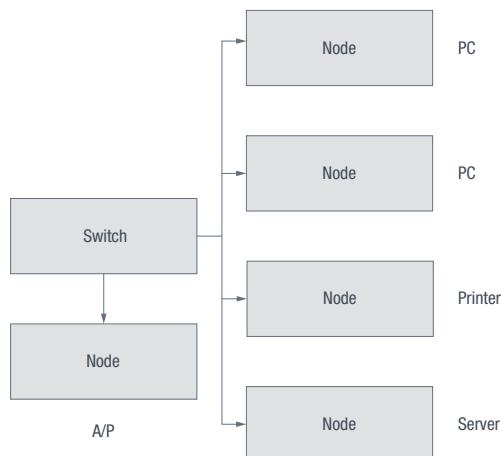
- a. You want to connect your computer to a wired network. What equipment do you need?
 - A. Network cable and switch, router or wireless base station
 - B. Adapter, cable, WAP, network card
 - C. Wireless adapter, switch, ethernet cable, wireless access point
 - D. Router, switch, wireless access point, network card
- b. This device connects a computer or network to the internet.
 - A. Switch
 - B. Router
 - C. LAN
 - D. Modem

9.2.2 Give ONE word/term for each of the following descriptions. Write only the word/term next to the question number in your homework book.

- a. If you are connecting directly to the internet, you may require a specific cable based on the type of internet you are using such as a _____ cable or _____ cable.
- b. This piece of hardware allows a computer to connect to a network and is built into most computer's and laptop's motherboards.

9.2.3 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. (You may not simply use the word 'NOT' to change the statement.)

- a. The speed at which you can send and receive data over the network will depend on the type of network and network card you use.
- b. The image below shows a basic WAN setup.



9.2 Connecting to the internet

By the end of this section, you should feel comfortable not only installing the hardware, but also choosing an appropriate internet connection for your household.

ROUTER OR MODEM

Routers and modems look similar but they each serve a different purpose.

ROUTER

A router is a small box that allows multiple computers to join the same network. Early routers only had Ethernet ports for wired connections, but now modern routers also provide wireless connectivity. They allow multiple computers and other devices, like smartphones and tablets, to join the same network. Most routers have a specific Ethernet port that is designed to connect to the Ethernet port of a cable or DSL modem.

MODEM

A modem is a device that provides access to the internet. It connects to your ISP, which typically provides either cable or ADSL internet service. Cable modems connects to a cable port on the wall like a telephone socket.

ACCESSING THE INTERNET

An ISP (Internet Service Provider) can provide you with either a wired or a wireless connection to the internet. In most situations, your ISP will provide you with the hardware you need to connect to the internet. However, if they do not you will need to ensure you have the following three pieces of hardware:

- computer
- internet connection channel
- internet communication device.

The table below summarises the needed for the different types of internet.

Table 9.1: Equipment needed for the different types of internet

	ADSL	WIMAX	4G & 5G
Computer	Any computer or smartphone. Needs to connect to a router.	Any computer or smartphone. Needs to connect to a router.	Any computer connected to a router, or any smartphone.
Channel	Active telephone line. Active ADSL enabled on the telephone line.	Wireless, so no physical channel is needed.	Wireless, so no physical channel is needed.
Communication device	Router.	A mobile router with an external satellite or antenna.	A USB dongle, a mobile router or a smartphone.

When you have connected the router to the internet, you need to create a connection between the router and your local area network and computers.

One way to do this is by connecting computers directly to the router using Wi-Fi or ethernet cables, as shown in Figure 9.3. In this figure, a router connects to the internet using LTE, and multiple devices (including a smartphone and a PC) connect to the router using Wi-Fi

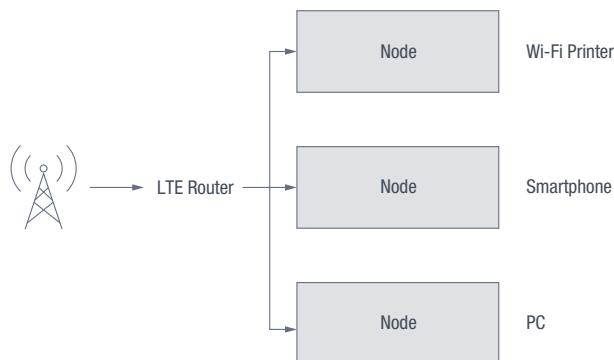


Figure 9.3: Connecting directly to the router

A second way is to connect the router to the local network using an ethernet cable. In Figure 9.4, a router is connected to the internet as well as to a local area network's switch. This allows all the computers on the local area network to connect to the internet.

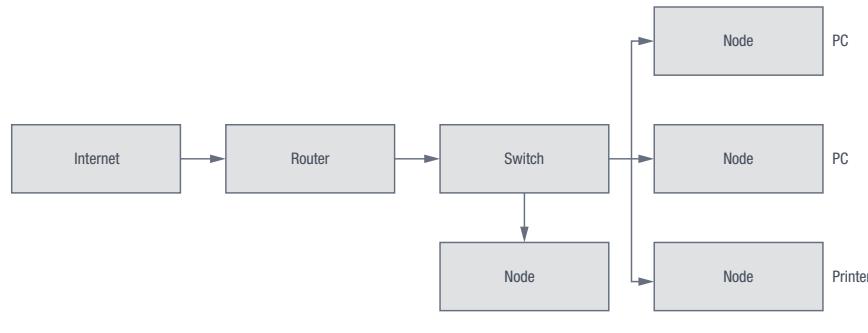


Figure 9.4: Connecting a router to a LAN

ALL-IN-ONE SOLUTION

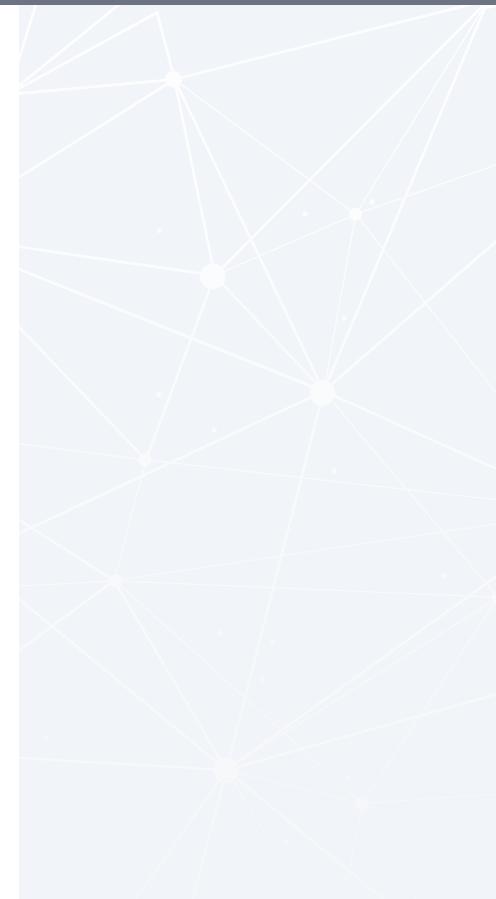
All-in-one solution is to have a contract with an internet service provider (ISP). The ISP will charge you a monthly fee and, in return, allow you to use their network to connect to the internet. Most ISPs will also help you to set up your internet connection, from making sure you have the correct hardware to installing the telephone lines and setting up you the internet account.



Activity 9.3

Connecting to the internet

- 9.3.1** Choose the correct answer.
- What is an ISP?
 - Internet silent partner
 - Internet service provider
 - Internet service partition
 - Internet shared partition
 - What equipment do you need to install a fibre network at home?
 - Any computer or smartphone, router, active fibre connection, ONT device
 - Any computer or smartphone, router, active telephone line, active DLS enabled on telephone line
 - Any computer or smartphone, mobile router with an external satellite or antenna,
 - Any computer or smartphone, mobile router, USB dongle
 - What equipment do you need to install a 4G and 5G network at home?
 - Any computer or smartphone, router, active fibre connection, ONT device
 - Any computer or smartphone, router, active telephone line, active DLS enabled on telephone line
 - Any computer or smartphone, mobile router with an external satellite or antenna,
 - Any computer or smartphone, mobile router, USB dongle
- 9.3.2** When you have connected the router to the internet, you need to create a connection between the router and your local area network and computers. One way to do this is by connecting computers directly to the router using Wi-Fi or ethernet cables. Draw a diagram to show this type of connection and explain it in your own words.
- 9.3.3** A second way is to connect the router to the local network using an ethernet cable. Draw a diagram to show this type of connection and explain it in your own words.
- 9.3.4** Explain the all-in-one-solution; its advantages and disadvantages.



9.3 Sharing concepts

FILES AND FOLDERS

One of the biggest advantages of networks, , is the ability to share files and folders on one computer with other computers on the network. Once shared, people on the network can open and view the files or folders or they can copy the files to their own computers. Depending on the setup, these users might also be allowed to modify the files or delete the files.

USER RIGHTS

User rights allow you to set permissions for your shared files, giving different users access to use your files in different ways (such as reading, writing or modifying the files). In this way, it is possible to allow most users to simply read the files, while specific users can modify or update the files.

Example: on a school network, students are often able to write files to personal folders stored on a network but blocked from writing or changing files from other students' folders. However, the network administrator can see or change files from any student's folder.

The advantages of using user rights are:

- It allows you to specify, in detail, which users have access to your files.
- It allows only specific users to change your files. This decreases the risk of viruses infecting your computer and users deleting your files.

The disadvantages of using user rights are:

- It is more time consuming and difficult to set up.
- It may require you to make changes to the user rights as new users are added.
- It may require you to make changes as user's needs change.
- Some programs on a shared folder will not function if a user does not have full user rights.

BITTORRENT

BitTorrent (or torrents) is a peer-to-peer technology that can be used to share files. What makes torrent files unique is that they do not rely on a single peer sharing a file with lots of peers. Instead, anyone who downloads a torrent file automatically starts sharing it with other people. This means that if you have downloaded 10% of a shared file using torrents, you also share that 10% with new people who start to download the file.

Torrents facilitate the sharing of bandwidth allowing users to download files more quickly than they would from a single source.

BENEFITS

Torrents have many benefits, especially for people or organisations who need to share files with many people:

- The data used to upload the file is shared between all the users downloading the file.
- The bandwidth is also shared, allowing users to download the file more quickly.
- Since the file is not uploaded to a single website or hosted by a single user, people may continue to share it for years after it was first shared.
- For websites using torrents to share pirated material, the website itself is not sharing the illegal materials nor the files linking to the illegal materials. This makes it a lot harder to prosecute the website owners for copyright infringement.

DISADVANTAGES

Torrent files also carry several risks:

- Since the files are shared peer-to-peer, you can never be sure that the file you are downloading is what you are looking for. Many users have used torrent files to share viruses.
- Many ISPs **throttle** or shape torrent downloads, preventing you from downloading them at high speed.
- Torrents are often used to pirate videos and music. When you use torrents to download pirated material, you are also personally sharing pirated material with other people. Distributing pirated material is punished much more severely by the law than receiving pirated material.

Due to these advantages and disadvantages, the primary use of torrents is for downloading and sharing pirated television shows, movies, music and software. However, there are a few companies who share large applications (such as Linux installations) using torrents. The distributed nature of the sharing also makes it a good way to share massive files.

BitTorrent

BitTorrent is a peer-to-peer download network that sometimes enables higher download speeds and more reliable downloads of large files. You will need to install a BitTorrent client on your computer in order to enable this download method.

Ubuntu 18.10	Ubuntu 18.04.1 LTS	Ubuntu 16.04.5 LTS	Ubuntu 14.04.5 LTS
Ubuntu 18.10 Desktop (64-bit)	Ubuntu 18.04.1 Desktop (64-bit)	Ubuntu 16.04.5 Desktop (64-bit)	Ubuntu 14.04.5 Desktop (64-bit)
Ubuntu 18.10 Server (64-bit)	Ubuntu 18.04.1 Server (64-bit)	Ubuntu 16.04.5 Desktop (32-bit) Ubuntu 16.04.5 Server (64-bit) Ubuntu 16.04.5 Server (32-bit)	Ubuntu 14.04.5 Desktop (32-bit) Ubuntu 14.04.5 Server (64-bit) Ubuntu 14.04.5 Server (32-bit)

Figure 9.5: BitTorrent can be used to legally download applications like Ubuntu

ONLINE SERVICES

Sharing files on a local network makes those files only available to the people able who are already connected to your network. If you want to share files with people on the internet (for example, share a group work project with friends), then you need to use an online service.

Online Services are organizations that provides an information service over the Internet. Examples are search engines, cloud storage services and application service providers.

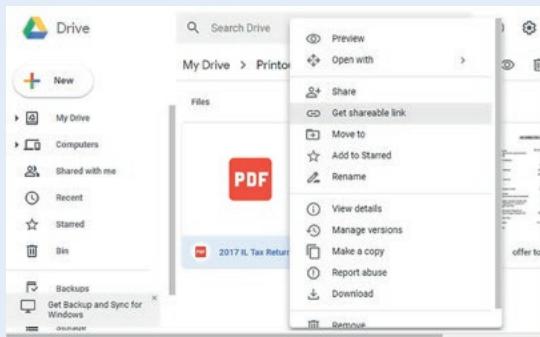
Four popular online services are:

- Drop box: A popular cloud storage service from Dropbox, Inc. that is used to transfer and synchronize files between desktop and mobile devices.
- MobileMe: A service that ensures your iPhone and computer are always in sync. It updates calendars, contacts and emails wirelessly. This online service is being discontinued.
- GSuite: (formerly Google Apps) for Work is a suite of web applications created by Google for businesses. Includes Gmail, Docs, Drive, Calendar, Meet and more.
- Office 365 online: Lets you view and edit Office documents for free in your web browser (like Google Docs, but from Microsoft). All the same apps – Word, Excel, PowerPoint, and OneNote – are available.

Example 9.1

Using online file storage applications

1. Open <https://drive.google.com> and sign in using your Gmail username and password.
2. If you are using Google Chrome, drag and drop files on the folder to upload them. If you are using a different browser, click on the *New* button, select *File Upload*, select the files you would like to upload, then click on the *Open* button.
3. To share these files, right click on a file or folder and select *Share*.



4. In the window that opens, enter the email address of the person you would like to share the file with.
5. Click on the pencil arrow next to the *People* textbox and select if the user can edit, view or comment on the shared files.
6. Click on the *Send* button. If you shared it with a Gmail address, then the user will receive an email and the file will appear in the *Shared* folder of Google Drive for them. If you shared it with a non-Gmail address, you will need to click on the *Send* button again.



Activity 9.4

Sharing files and folders

9.4.1 You want to convince your headmaster to install a network at the school.

- a. Explain to him/her at least FIVE uses of such a network.
- b. Your headmaster is quite positive about the possibilities but asks you to tell him/her what the risks of sharing files and folders over such a network could be. Describe at least FOUR of these risks to him. One way to minimise these risks is by assigning the correct user rights to your shared files and folders.
- c. Explain to your headmaster what user rights means.
- d. What are the advantages as well as disadvantages of using user rights? List TWO of each.

9.4.2 The network worked so well, that your headmaster decided to collaborate with a school in the UK so that the learners can learn new things by sharing certain assignments with the British learners.

- a. How can this be done?
- b. Give TWO examples of online file storage applications.

9.4.3 What are the benefits of being able to share files on a network?

- 9.4.4**
- a. What is BitTorrent?
 - b. What makes it different from other file sharing applications?
 - c. How can you use this application? Name at least TWO things you will be able to do.

- 9.4.5**
- a. Why do you think piracy websites do not host the copyrighted materials themselves?
 - b. How do BitTorrents solve these problems?

9.4.6 Do you think there is a legal difference between hosting the pirated files, and hosting files that link to the pirated files (like torrents)?

9.4.7 What do you think a reasonable punishment would be for downloading a pirated movie?

9.4.8 Do you think downloading a torrent is the same as distributing pirated content?

9.4.9 Why do you think so few legal websites make use of torrents?

9.4 Remote access

Remote access refers to several technologies or applications that allow you to connect to a computer over the network. Once connected with remote access, you will see the remote computer's display on your monitor, and you can use this computer as if it is your own computer. Generally remote access is used for: opening applications, sending emails and fixing problems.

LOCAL NETWORK

Local network is remote access that allows you to connect to a computer on your local network and use it as if it was your own computer. However, you cannot simply use remote access to take over other people's computers! For you to use it, the following requirements must be met:

- The remote computer must have remote access enabled.
- You must be on the same local network as the remote computer.
- You must know the IP address of the remote computer.
- You must know the username and password for the remote computer.

Once these requirements have been met, you can use the Windows Remote Desktop Connection application to connect to the remote computer.



Figure 9.6: Remote Desktop Connection

ONLINE REMOTE ACCESS

While accessing a computer on the local network is useful, doing this over the internet is much more useful. This allows you to manage your home computer from school, or your work computer from home. It also allows you to connect to your friends' or family's computers from anywhere in the world, if both of you have internet connections.

To use online remote access, you need to install specialised software (such as TeamViewer) on both computers. Once installed, you can use the remote computer's ID and password to access it online.

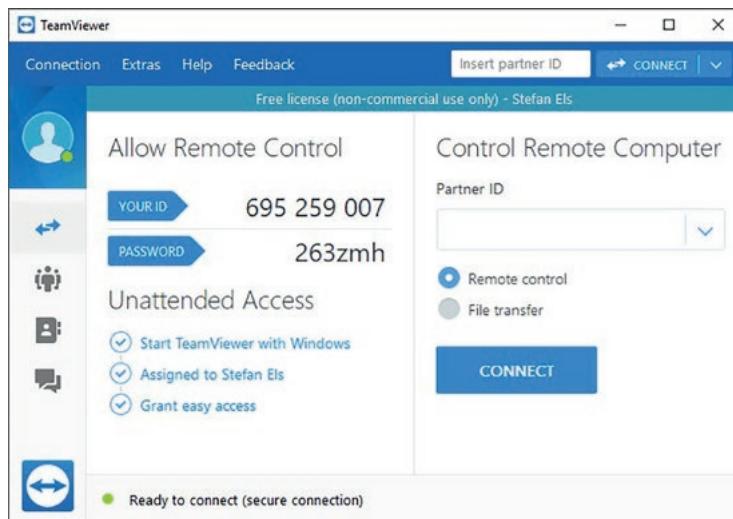


Figure 9.7: TeamViewer allows you to use remote access over the internet

REMOTE ACCESS USING A VPN

A VPN (or virtual private network) is a private network that you can connect to over the internet. It is a service that encrypts your online traffic, enabling you to access the internet with complete privacy and security. Once you are connected to the VPN, you can access all the private network resources (such as shared files, printers and computers) as if you were physically connected to the private network.

Once connected to the virtual network, you can use remote access to connect to a computer on the VPN like you would connect to any local computer.

While accessing a computer on the local network is useful, doing this over the internet is much more useful.



Activity 9.5

Remote access

- 9.5.1** Match COLUMN A with the correct answer in COLUMN B. Write down only the question number and the matching letter in COLUMN B in your answer book. There can be more than one answer (column B) to a question (column A).

COLUMN A	COLUMN B
1.1 This allows you to connect to a computer on your local network and use it as if it was your own computer.	A. Remote access
1.2 In order to use this type of technology, you need to install specialised software on both computers.	B. Local remote access
1.3 It refers to several technologies or applications that allow you to connect to a computer over the network.	C. Remote desktop connection
1.4 This is a private network that you can connect to over the internet.	D. Online remote access
1.5 This technology helps businesses to set up and manage servers	E. VPN
1.6 In order for you to use this technology, you must know the IP address of the remote computer.	
1.7 This technology allows you to quickly jump between computers, running and managing different applications on different computers	
1.8 Once all the requirements have been met, you can use the Windows _____ application to connect to the remote computer	
1.9 Once you are connected to the _____, you can access all the private network resources as if you were physically connected to the private network.	
1.10 While accessing a computer on the local network is useful, doing this over the internet is much more useful. What is this technology called?	

- 9.5.2** What are the benefits of remote access in a home setup? Give examples to support your answer.
- 9.5.3** What are the benefits of remote access in a work environment? Give examples to support your answer.
- 9.5.4** An example of remote access is being able to access your home security system while away from home – like being able to open your gate to your home when you're away. List the advantages and disadvantages of this.

CONSOLIDATION ACTIVITY

Chapter 9: Networks

1. Choose the correct answer.
 - a. Which of these devices does NOT usually have a built-in network adapter?

A. Desktop PC	B. Laptop
C. Smartphone	D. Tablet
 - b. Which of the following has the fastest mobile internet speeds?

A. 4G	B. 3G
C. Ethernet	D. Wi-Fi
 - c. Which of the following makes use of a SIM card?

A. Modem	B. Switch
C. DSL cable	D. Ethernet cable
 - d. Which of the following CANNOT be used in a wired network?

A. WAP	B. Switch
C. Router	D. Ethernet cable
2. 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. (You may not simply use the word 'NOT' to change the statement.)
 - a. A fibre optic cable makes use of telephone lines.
 - b. A Wireless Access Point can be used to create and facilitate an intranet.
 - c. 4G has the slowest internet speeds.
 - d. A notebook uses a switch to connect to the DSL cable that connects it to the router that connects it to the internet.
3. 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 peer-to-peer technology that can be used to share files.	A. Network adapter
2. It is used to connect a LAN to the internet.	B. Router
3. It connects many computers on the same, wired internal network.	C. DSL
4. It is used to connect a desktop PC to a Wi-Fi network.	D. Switch
5. It allows wireless devices to connect to each other in a local network but does not connect the local network to the internet.	E. Vodacom
6. A network that is setup using Ethernet cables to connect computers in a wired network.	F. WAP
7. A network setup that does not have a physical channel.	G. Fibre
8. A way of uniquely identifying a computer connected to a network.	H. Cell C
9. An example of an internet service provider.	I. Remote access
10. Advanced permissions for your shared files, giving different users access to use your files in different ways.	J. User rights
	K. BitTorrent
	L. 4G
	M. IP address
	N. Neotel

CONSOLIDATION ACTIVITY**Chapter 9: Networks *continued***

- 4.** Give ONE word/term for each of the following descriptions. Write only the word/term next to the question number in your homework book.
 - a.** Networks can generally be categorised based on their size.
 - i.** This computer network covers a small area like a home, office or building, has a limited number of computers connected to it using either ethernet or Wi-Fi.
 - ii.** This network covers a large area and is most often used to refer to the internet. This type of network is not private but is usually organised by communities or businesses.
 - b.** Another way to categorise networks is based on the way computers on the network are connected to each other.
 - i.** These networks have no central computer, server or person that manages the network. Instead, each computer on the network connects directly to the network and the other computers on the network. Computers on these networks are visible to each other and can share files and resources with each other.
 - ii.** These networks are managed by one or more servers to make sure that everyone can access the network, that people only have access to the correct resources and that problems on the network are resolved. In many cases, computers connected via these networks cannot see each other.
- 5.** List FOUR advantages of a local network.
- 6.** List TWO advantages of using BitTorrents.
- 7.** Thuli and a group of her university colleagues have decided to start up a small graphics design company. They have decided to call the company United Designz and have a rented a whole floor of a business building.
 - a.** Being one of the lead graphic designers in the company, mention what type of computer Thuli will need to do her work.
 - b.** What type of network should her company use? Give a reason for your answer.
 - c.** Do you think United Designz should make use of a wired or wireless network? Give TWO reasons for your answer.
 - d.** What type of downloading speed would be ideal for a company like United Designz? Also give a reason for your answer.
 - e.** Based on your previous answers and what is required to create an internet-enabled network, identify THREE specific networking equipment United Designz should use?
 - f.** To make file sharing easier amongst the company's employees. Thuli has decided to set up a local network for the company. List THREE user rights she should set up.
 - g.** Some of the employees of United Designz travel a lot, so to access the company's files and documents. What type of remote access should these employees use? Give a reason for your answer.

E-COMMUNICATIONS

CHAPTER OVERVIEW



Unit 10.1 Overview of security concepts



Learning outcomes

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

- Explain the purpose and use of:
- encryption
- SSL
- certificates and security
- and firewalls.

INTRODUCTION

E-communication, or electronic communication, is a type of communication between people in the form of texting, signals, data, sounds, images, signs or intelligence sent via an electronic device. Some examples of e-communication include email, text messages, social media messaging and image sharing. Security measures that can be taken to protect e-communication from cyber criminals is discussed in this Chapter.



Case Study

Cyber-attacks on government websites

There are concerns about the lack of security measures on government websites after a cyber-attack on the official Presidency website. According to Independent Online, the Presidency's website was hacked on Saturday by an unknown group who posted: "Hacked by Black Team. Sahara is Moroccan. And Morocco is ur Lord!".

Information technology security specialists say that if it was so easy to attack a website like that of the Presidency, what other computer systems and websites with sensitive information will be hacked. There have been previous hacks of government websites such as, the departments of Education and Home Affairs which exposed the data of more than 30 million South Africans and SAPS where sensitive information, including that of whistle-blowers, had been compromised.

Cybercriminals are getting more advanced and find ways to hack websites where there are vulnerabilities in software. This cyber-attack caused South Africans to think twice before they shared any personal information with government entities online.

Professor Basie Von Solms, director of the Centre for Cyber Security at the University of Johannesburg said, 'What could help was the implementation of the Protection of Personal Information Act which required organisations to put in measures that would ensure people's data is kept safe and follow international best practices.'

10.1 Overview of security concepts

Since e-communication is online there is a chance of cyber criminals getting hold of the information. Security measures that can be taken are discussed in this Chapter.

ENCRYPTION

Encryption is the process of encoding a message or information in such a way that only authorised parties can access it. With encryption, any data sent between two computers is changed from something that is useful to encrypted data that is meaningless and extremely difficult for unauthorised parties to decrypt. The only way to turn the encrypted data back into useful data is to know the encryption key, which is only known by the receiving computer. The encrypted message, data or information can only be decoded by another entity if they have access to a decryption key.

PURPOSE OF ENCRYPTION

By encrypting personal data such as usernames and passwords, websites provide an extra layer of protection for users. With encryption, even if the website is hacked and its database stolen, the hackers cannot see the usernames and passwords without the encryption key. Since the encryption key is stored separately, the encrypted data remains safe.

HOW DOES ENCRYPTION WORK?

Imagine entering your password on your online banking website. A clever hacker might place himself in-between you and your bank. Any messages you send to your bank (such as your password), therefore first passes through the hacker's computer before going to your bank. If your data is not encrypted, the hacker can easily read your password before sending it to your bank. Neither you, nor your bank, might know that the password is stolen, and the hacker can use the password to steal your money!

Websites that have HTTPS (Hypertext Transfer Protocol Secure) in their URL are using encryption. Most online services today also encrypt personal user information in their databases, which means that, even if a hacker gets access to the database, they cannot just read all the user's usernames and passwords. Instead, they will only see encrypted usernames and password, which is useless to them.

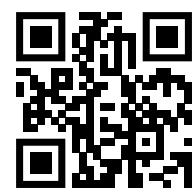
SSL (PRIVATE AND PUBLIC)

When you enter data on a normal HTTP website, the data is sent to the website as plain, unencrypted text. Hackers can use several different techniques to intercept this message and gain access to your username and password. This is especially problematic when you are doing online shopping, since anyone intercepting your purchase message can steal your credit card information!

To stop this from happening, websites can use HTTPS to encrypt any traffic sent from the user to the website, and from the website to the user. HTTPS does this by using SSL (or Secure Sockets Layer).



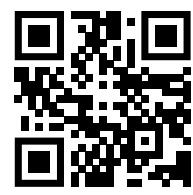
QR CODE



<https://informationisbeautiful.net/visualizations/worlds-biggest-data-breaches-hacks/>
<https://qrs.ly/mja5pit>



QR CODE



<https://www.youtube.com/watch?v=rR0gWTfA5qE>
<https://qrs.ly/4wa5pk3>

PURPOSE OF SSL (SECURE SOCKET LAYER)

SSL adds a security layer to any web page. Any message that is sent to the website first passes through the security layer (which encrypts the message) before travelling to the website. When the website returns information, this information is once again sent through the secure layer and encrypted before being sent to the user. Because of SSL, anyone who intercepts information sent or received on an HTTPS page will simply receive a scrambled, encrypted message that is useless to them.

To see if a website is secure, you can look at the protocol it uses as well as the small lock icon next to its URL.

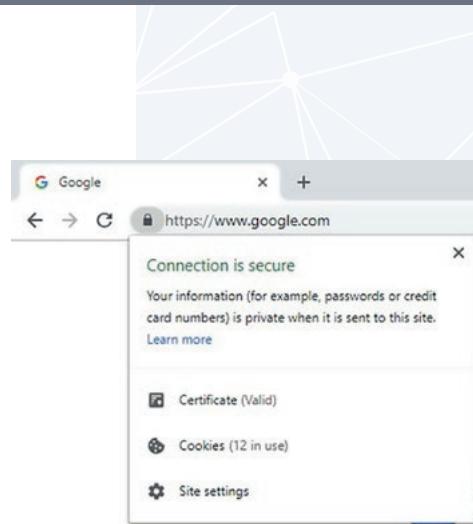


Figure 10.1: Secure websites use the HTTPS protocol and have a lock next to the URL

SSL (PUBLIC AND PRIVATE KEY)

If a user needs a website's encryption key to decrypt any information he or she receives, and the website needs the user's encryption key to decrypt any information they send, then how do they share these keys? Websites use public and private keys to encrypt information.

PUBLIC KEY

The public key is public, which means that all the messages you send and all information you submit on the Internet contains this public key. Even though hackers can easily see this public key, they cannot use it to unlock information encrypted with the public key. To unlock this information, they need your private key. Unlike your public key, your private key is kept a secret by your computer and never shared with anyone.

Whenever your computer visits a new website, you exchange public keys. You send the website your own public key, and the website sends its public key to you. When the website then sends you information, it encrypts it twice: Once with website's private key and once with your public key.

Animation

Animation showing information locked with user's public key and locked with the website's private key. This information is then sent from the website to the user. The animation should show the information having two locks on it at the end.

Since the information has been encrypted twice (with the website's private key and with your public key), you will need two keys: The website's public key (to decrypt its private key)

Animation

Animation showing information locked with a public key then unlocked with a private key, then locked with a private key and unlocked with a public key.



YOUR PRIVATE KEY (TO DECRYPT YOUR PUBLIC KEY)

Since the website's public key is public, you (and any hackers) know the public key and can remove the first set of encryptions using the public key. However, since only you know your own private key, only you can remove the last set of encryptions from the information. This means that only your computer can fully decrypt the information to understand it.

When you return a message to the website, you encrypt it using your own private key and the website's public key before sending it. The website therefore needs your public key (which everyone has), and its own private key (which only it has) to decrypt the information. In this way, you can send information to the website so that only it can decrypt it.

CERTIFICATES AND SECURITY

Before your browser can encrypt and send any data to a website using SSL, it first requests the website's SSL certificate. Websites use this certificate to prove their identity. To obtain an SSL certificate, websites must apply for a certificate with a certification authority.

All SSL certificates should contain the following information:

- The domain name (or subject) the certificate is valid for
- The certificate authority who created (or issued) the certificate
- The dates the certificate is valid for

This is shown in the figure in the margin.

PURPOSE OF SSL CERTIFICATES:

Before you can send any personal or encrypted information to a website, your browser will first compare the certificate it receives with the certificate from the certification authority. If it finds any mistakes, or receives an outdated certificate, it will warn you that the certificate it received is not legitimate and stop you from sending personal information to the website.

SSL therefore not only ensures that any information you send and receive is encrypted, by using certificates, it also ensures that the encrypted information is only sent to the correct websites (and not to malicious or phishing websites).

FIREWALLS

On computers, firewalls prevent malicious users and viruses from sending data to and receiving data from your computer. There are three general types of firewalls:

- Software firewalls that are installed on the user's computer and protects a single computer.
- Software firewalls that are installed on a server or router that protects all the computers on the network.
- Hardware firewalls that are installed between a local network and the internet and protects all the computers on the network.

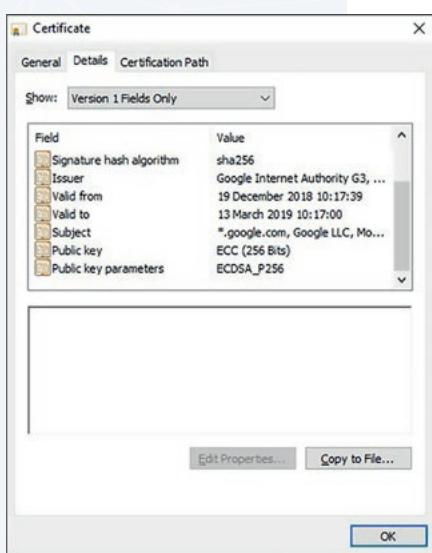


Figure 10.2: Figure 10.2: An SSL certificate

Firewalls work by allowing any data you request or send to go through the firewall, while blocking any unrequested information from passing through the firewall. This allows you to access the internet and use it as normal but stops malicious users on the internet from sending viruses to your computer. Whenever you run a new program that uses the internet on your computer, your firewall will ask you whether to allow this program to send and receive data.

Today, most operating systems have a built-in firewall. This means you do not need to worry about installing a separate firewall. Instead, you should make sure that you only allow programs you to pass data through the firewall.



Activity 10.1

- 10.1.1** Match the COLUMN A with the correct answer in COLUMN B. Write down only the question number and the matching letter in COLUMN B.

COLUMN A	COLUMN B
1. Firewall	A. Wireless LANs connecting computers and devices using radio signals communicating through wireless access.
2. Password	B. These are installed on the user's computer and protects a single computer.
3. Encryption	C. A security feature on most computers and online services.
4. Protocol	D. A set of rules that describe how data is sent between two computers.
5. Wi-Fi	E. This works by allowing any data you request or send to go through while blocking any unrequested information.
6. Software firewall	F. Any data sent between two computers is changed from something that is useful to data that looks like nonsense.
7. HTTPS	G. This protocol ensures that all data sent to and from the website is encrypted.
8. Hardware firewall	H. Connects devices over short distances using radio waves.
	I. This is installed between a local network and the internet and protects all the computers on the network.

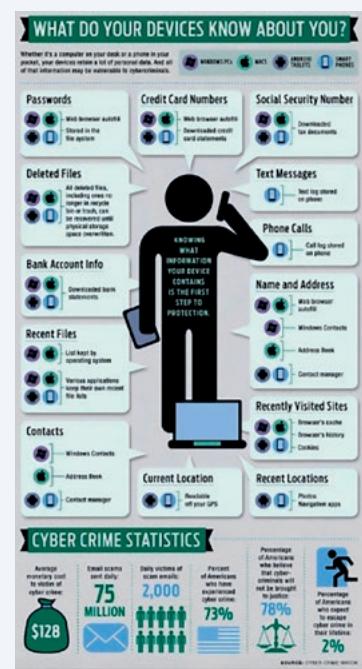
- 10.1.2** Look at the picture below that shows statistics on security and answer the following questions.

- Who would benefit the most from encryption? Why?
- In your opinion, does all data need to be encrypted? Explain.
- Why do you need to install security on your devices?
- What security can be installed on your devices?
- What do you find the most interesting and worrying about the statistics? Explain.

QR CODE

<https://www.youtube.com/watch?v=N2sOPGhva1M>

<https://qrs.ly/tfa5pk9>



CONSOLIDATION ACTIVITY**Chapter 10: E-communications**

- 1.** A password is used to protect your computer from others accessing it. Answer the following questions regarding security of a computer.
 - a.** Explain how using a password for online services can protect you.
 - b.** List THREE ways to make your password secure.
 - c.** Explain how firewalls protect your computer.
 - d.** List THREE types of firewalls.
 - e.** What is encryption?
 - f.** What do most websites use to enable encryption?
- 2.** Give ONE word/term for each of the following descriptions. Write only the word/term next to the question number in your homework book.
 - a.** Before your browser can encrypt and send any data to a website using SSL, it first requests the website's _____
 - b.** To stop hackers from intercepting personal information, websites can use HTTPS to encrypt any traffic sent from the user to the website, and from the website to the user. HTTPS does this by using _____, which adds a security layer to any web page.
 - c.** The process of encoding a message or information in such a way that only authorised parties can access it.
 - d.** The encrypted message, data or information can only be decoded by another entity if they have access to a _____
- 3.** Travel agents must be able to conduct business from their office building or by using their mobile office. As most of the business is conducted online, for example, customers need to book and pay online, they must have access to the Internet.
 - a.** Online transactions are encrypted. Explain the term encryption.
 - b.** How do websites use encryption to secure the site?
 - c.** Online security methods include the use of a public and private key encryption. Briefly explain the difference and purpose of these keys?
- 4.** The AmaNdlovhu Company plans to provide various services to members of the media during the Soccer World Cup. To make sure that no other journalist can steal their data, the media people want to have SSL connections to some websites.
 - a.** What does SSL stand for?
 - b.** What is an SSL certificate and how does it work?
 - c.** Almost all computer security relies on passwords. State THREE rules to follow when creating a password that will be very secure.
- 5.** What is a firewall?
- 6.** Briefly explain how a firewall works.
- 7.** Explain the THREE general types of firewalls you can get.
- 8.** Briefly explain what encryption is.
- 9.** Give an example of how a bank uses encryption.
- 10.** An important part of a network is a firewall. Name TWO ways that a firewall protects your computer.
- 11.** Explain the THREE general types of firewalls you can get.
- 12.** Briefly explain what encryption is.
- 13.** Give an example of how a bank uses encryption.

SOCIAL IMPLICATIONS

CHAPTER OVERVIEW



- Unit 11.1 Computers provide solutions to issues of national and international importance
- Unit 11.2 The evolution of social networking and the effect on society
- Unit 11.3 Privacy and information sharing



Learning outcomes

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

- explain how distributed computing power and decision making provide solutions to issues of national and international importance
- describe the evolution of social networking (information overload and availability of personal information) and the effect on society
- list and discuss issues regarding privacy and information sharing

INTRODUCTION

Social Implications looks at the effect of computers and ICT on the world, your community and yourself. Before continuing with the rest of the chapter, carefully think about the effect of computers and ICT on your privacy and answer the following questions:

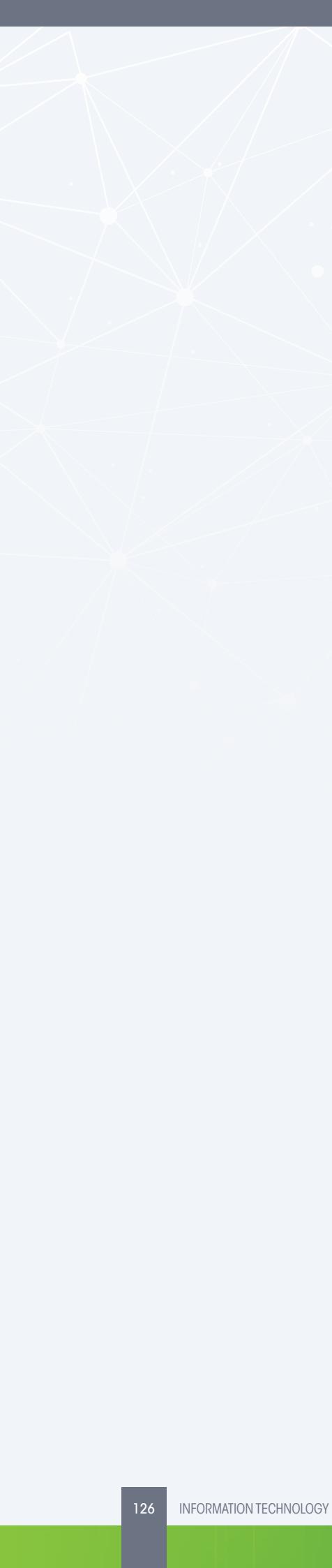
- How can ICT invade your privacy?
- Why do people share their information on Facebook or Instagram, for example?
- What are the benefits of social networking?
- What are the disadvantages to social networking?

SOCIAL IMPLICATIONS IN A NUTSHELL

According to the United Nations, globalisation can be defined as an increase in the rate and ease with which people, companies and governments from different countries interact.

Globalisation has been made possible due to two technologies: transportation and improvements in computers and computer networks.

Globalisation has made the world richer, smarter, more connected and more culturally aware than ever before.



Computers make global communication easy and affordable. This has several advantages, including:

- allowing families to keep in touch, even over large distances.
- helping people to keep and maintain larger social networks.
- increasing people's social and romantic opportunities.
- improving job opportunities, with many young South Africans finding opportunities overseas.
- helping people understand different points of view, with research showing how communicating with different people can increase empathy.

One communication technology that has already had a significant impact and will continue to grow in popularity as internet speeds increase, is video conferencing. Video conferencing allows two or more people to connect to the same video call. This has significant advantages over a typical phone call or teleconference call, including:

- a large part of communication is through facial expressions and body language
- video conferences allow users to visually show what they are talking about.

The benefits of global communication are not just personal. Companies have their own advantages including:

- selling their products to a global (international) audience.
- managing larger, international businesses using video conferences.
- sending critical documents across the world immediately using email.
- quickly transferring and receiving funds between countries and from international customers through online banking.

ACTIVITY 11.1 Revision Activity

11.1.1 List three more advantages of video conferencing.

11.1.2 Debate for or against globalisation.

INTRODUCTION

In Grade 11, you saw how computers can be used to solve real world problems. This included specific case studies on the weather, elections and censuses, but also included a more general discussion of new technologies, including AIs that can diagnose cancer and create legal briefs and self-driving cars.

In this section, you will look at two new techniques that programmers use to solve problems:

- Distributed computing
- Decision making

DISTRIBUTED COMPUTING POWER

Distributed computing refers to computer projects where hundreds, or even thousands, of computers across the world work together to solve a problem, for example, the free, online game called *Phylo*.

In this game, players could use coloured blocks to build DNA and were asked to compare DNA sequences between different species. The closer the match, the higher score players would receive.

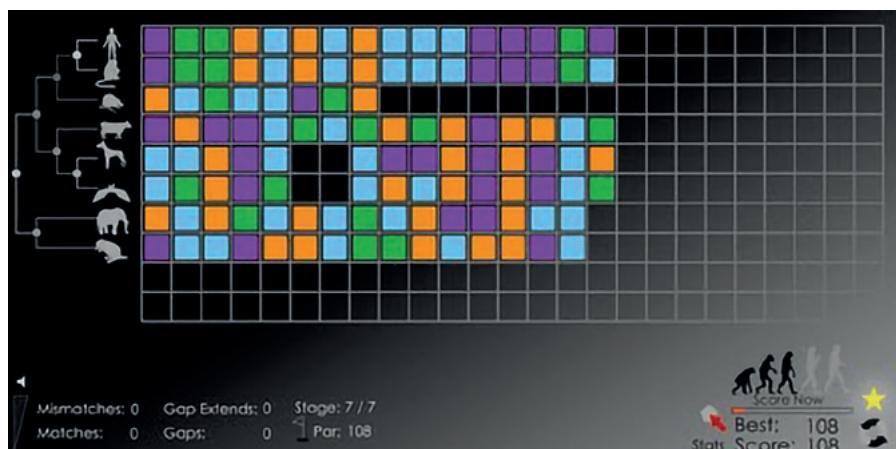


Figure 11.1: *Phylo* asked gamers to compare DNA sequences using coloured blocks

While the game itself was interesting, it was a distributed computing project. The goal of *Phylo* was not just to entertain people, but also to help align DNA sequences correctly and to recognise patterns that computers struggle to recognise. By playing the game, the gamers helped researchers to better understand several different diseases.

Similar distributed computing power has been used to:

- Find a solution for the Ebola virus
- Find a solution for certain strains of childhood cancer
- Find new prime numbers
- Categorise galaxies
- Search for alien life
- Fight AIDS

By allowing people who care about a topic to pool their resources, the creators of these projects gain access to an incredible amount of resources that they might not have had on their own.



Did you know

GIMPS, or the Great internet Mersenne Prime Search, is a distributed computing project to find large prime numbers. Anyone who runs the software and finds a new, undiscovered prime number receives a cash prize of roughly R50 000. Anyone finding a prime with more than 100 million digits will receive a prize of almost R2 400 000! The largest prime number discovered by 2018 has 23,25 million digits.

DECISION MAKING

Computers have changed, and is continuing to change, human decision making. For thousands of years, people have seen human intelligence and the ability of humans to make decisions as the primary difference between humans from animals. Over the last 30 years, and especially the last 10 years, humans are giving up more and more of their decision-making responsibility to computers. This ranges from decisions as simple as when to do exercise or which road to take to work, to potentially life changing decisions such as which romantic partners would suit you and what job occupations would suit you.

As computers become more intelligent and learn more about us, they will undoubtedly play an even bigger role in human decision making.



Activity 11.2

Decision-making

- 11.1.1** Match the COLUMN with the correct answer in COLUMN B. Write down only the question number and the matching letter in COLUMN B in your answer book.

COLUMN A	COLUMN B
1. This has been used to fight AIDS, categorise galaxies and find new prime numbers.	A. Distributed computing B. Automated decision making
2. This is the ability to make decisions without human involvement.	
3. This refers to computer projects where hundreds, or even thousands, of computers across the world work together to solve a problem.	

- 11.1.2** This activity can either be a discussion in class or learners can answer the questions individually in their homework books.

- a. Do your own research and write a paragraph either agreeing or disagreeing with the statements below:
- Humans will always be able to make better complex decisions than computers.
 - Soon, computers will be able to do most jobs, including knowledge jobs such as doctors, lawyers and accountants, better than humans.
 - Soon, your computer and smartphone will be able to analyse all the information it has recorded about you and your friends and provide you with concrete social suggestions such as "You need to spend more time with Mark" or "You and Relebohile would make an excellent couple."
 - The more decisions computers can make; the easier life will be for humans.
 - When you allow computers to make too many decisions, you place too much power in the hands of computer programmers.

INTRODUCTION

Using computers, the internet and social websites have made significant improvements to the world. They have made it easier for people to be more social, made it easier to connect with people who are far away, made communication more affordable, made it easier to find a community of similar people, and allowed people to begin building databases of the world's knowledge. At the same time, it is important to stay aware of the potential risks and problems linked to these improvements.

INFORMATION OVERLOAD

While social networks do allow people to stay connected to their friends, they can also lead to social media information overload. This occurs when there is too much information available, with new messages, photos and notifications demanding your attention every minute of the day. Rather than spend their time productively, people can spend every free minute they have reading social media posts making them less productive, less able to obtain new information, more stressed and can even cause depression!



Figure 11.2: Social media overload can cause depression

If you find yourself spending too much time on social media, you can try the following:

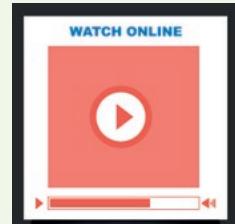
- Limit the time you spend on social networks to five minutes, three times a day
- Do not save your username and password, so that you are forced to enter these each time
- Unfollow or mute people who fill your social media page with useless information
- Disable social media notifications on your phone
- Uninstall or stop using any services that do not improve your life



Animation

Animation showing five techniques to prevent social media overload:

1. Limit time you spend to 5 minutes
2. Do not save username and password
3. Unfollow or mute people
4. Disable notifications on phone
5. Stop using services that do not improve life.



Activity 11.3

Social media overload

This activity can either be a discussion in class or learners can answer the questions individually in their homework books.

11.3.1 How you feel about social media overload.

11.3.2 What is social media overload?

11.3.3 Do you use social networks websites or applications on most days?

11.3.4 Do you enjoy using social networks or do you see it as a chore?

11.3.5 Do you occasionally feel stressed after using social networks?

11.3.6 Do you think, in general, that social networks make people happier?

11.3.7 How easy would it be for you to stop using all social networks?

11.3.8 What can you do if you find yourself spending too much time on social media? List at least THREE things to do.

AVAILABILITY OF PERSONAL INFORMATION

PERSONAL INFORMATION

Social networks like Facebook and Twitter are a great way to keep in touch with friends and acquaintances. They can also be used to meet new people with common interests and talk about the things you have in common. At the same time, unless you specifically change it, most social networks share a lot of the information that you place on their website publicly. This means that anyone on the internet can see this information.

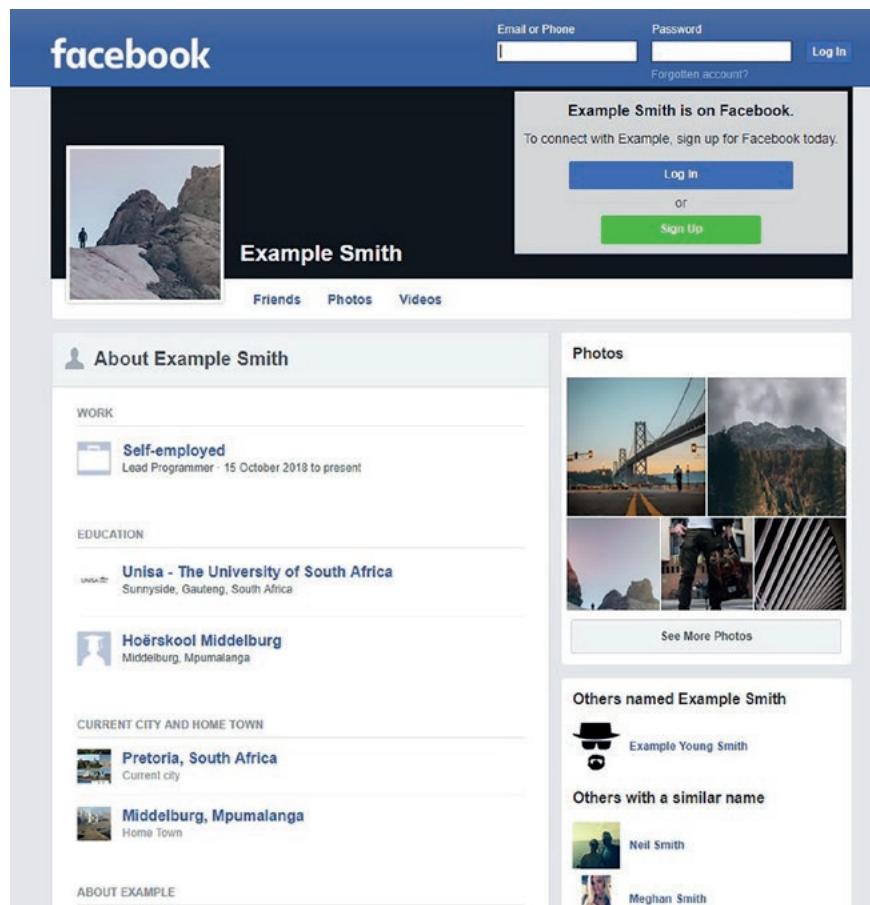


Figure 11.3: Facebook shares a lot of information publicly, unless you specify differently

This can result in uncomfortable family moments when your parents see exactly what you did during the holiday with your friends! It can also have more permanent, long-term consequences, such as costing you a job. In today's competitive job market, there is a growing trend for employers to look at the social media profiles of applicants before making any hiring decisions.

Publicly available online information has also been used to commit crimes. Burglars have used tweets or public photos to see when families are away from home or on vacation. This allowed them to burgle houses at a time they knew the houses would be empty. Stalkers have also used publicly posted information (such as tweets or photos on Instagram) to stalk their victims.



Case Study

Stalking and social media

SEARCH ENGINES AND GROUP COMMUNICATIONS

Consequences of search engines

Every search engine consists of some algorithm that determines how the engine searches the database and shows the results of the search. Web sites hope to make a profit on their business enterprises at some point. If you understand the significant role search engines play in the web surfing behavior of internet users, you can see the value a corporation might place in having its web site be returned as the first and 'most appropriate' result of a search engine's search. 'Ask google': results in people having poor recall of knowledge if they knew where answers to questions were easily found.

Consequences of group communications

Many people go through their lives feeling like they do not fit in. They might have different interests or different beliefs from the people around them, or they may feel awkward in social contexts.

One of the big advantages of social websites is that it allows users to find like-minded people who share their interests and beliefs. For many people, the internet is a place where they can show a part of themselves that they feel the need to hide in real life.

The downside of finding like-minded individuals is that it allows people to create a context in which their ideas are never challenged. Today, you can go online and speak with thousands of people who share your beliefs, reinforcing your (incorrect) beliefs.

As a result, rather than using the internet to expand their horizons and encounter new people with new ideas, people often surround themselves with too many similar people, strengthening their existing (and often bad) ideas. This is particularly problematic with racist social network groups where users can surround themselves with people sharing and speaking about their racism, rather than surrounding themselves with people who will challenge these views.



Case Study

Alt-right

Social, political, environmental

Social

Recent research found that almost a quarter of the world's population is now on Facebook. Social networks grow more powerful with the increase in interactions among people on social platforms. People can find others like them, with their beliefs through social media. People can also create memes (an image, video, piece of text, etc., typically humorous in nature, that is copied and spread rapidly by Internet users), publications, Virtual online worlds, and so on.

Some people believe that social media encourages people to use mobile devices to express their concerns on social issues without engaging actively with real life campaigns. Their support is limited to pressing the 'Like' button or sharing content.

Political

Social networks play an increasingly important role in electoral politics. Social networks are helping to fundamentally rewire human society. Social media lets people freely communicate with one another and they are helping to create influential social organisations among once-marginalised groups.



Case Study

Alt-right *continued*

Environmental

Social media increasingly supports environmental campaigns and connects people on major environmental issues such as climate change. It also provides people with the ability to track the quality of the air and water around them and then share this data with others. Social media has propelled the rise of the independent activist. For example, when Cape Town went through water restrictions, many people shared their personal views and tips on saving water on social media. This brings about an awareness that otherwise might have gone unnoticed.



Activity 11.4

Social websites

This activity can either be a discussion in class or learners can answer the questions individually in their homework books.

- 11.4.1** How do you feel about social, political and environmental communities?
- 11.4.2** Do you belong to any of these communities?
- 11.4.3** Do the people in this community share most of your opinions?
- 11.4.4** How likely are you to encounter people with different opinions?
- 11.4.5** Do you think the internet is making it easier or harder to become an activist?

GLOBAL COMMUNITY – CULTURAL EFFECTS

Globalisation allows people from across the world to form part of a global community where everyone can share and enjoy other people's cultures. For example, most people today watch international movies and listen to international music. There are also many people who are interested in and follow international news.

The risk with the global community is that smaller cultures may disappear. In South Africa, especially among young people who rely on the internet for entertainment, many people rarely watch South African television shows or listen to South African music. Many people are also more interested in international than local affairs, and more interested in international celebrities than local celebrities. This constant focus on international entertainment, news and people can increase the cultural attraction to countries with a large cultural impact (such as the United States) while decreasing the power of smaller cultures.

For many people, culture is an important part of a person's identity, so losing your own culture, or seeing your culture as second to an international culture attacks that identity.

Groups consisting of people with different cultures can improve the groups' performance.

If all small cultures are swallowed by larger, more dominant cultures, some unique ideas and perspectives on the world could disappear.



Activity 11.5

Group communication

This activity can either be a discussion in class or learners can answer the questions individually in their homework books.

- 11.5.1** How you feel about a global community? Give reasons for your answers where applicable.
- 11.5.2** How does a global community differ from an online community?
- 11.5.3** Are you more likely to follow local or international entertainment?
- 11.5.4** Do you see yourself as a South African citizen or as a citizen of the world?
- 11.5.5** Do you think it is important for countries to protect their local cultures?
- 11.5.6** How do you think smaller countries can protect their local cultures?
- 11.5.7** South Africa is a country with a lot of different cultures. Do you think this makes it easier or harder to maintain our culture?

SOCIAL WEBSITES AND SOCIAL ENGINEERING

A few examples ways in which social engineering is practiced include:

- Baiting: This depends on a victim taking the bait, similar to a fish reacting to a worm on a hook. The person dangling the bait wants to entice the target into taking action e.g. unknowingly downloading malware on a server.
- Phishing: This grabs information from an unwitting victim to seek information that might help with a more significant crime.
- Email hacking and contact spamming
- Pretexting: Is a trick to get someone's attention so the fraudster can trick the would-be victim into providing something of value.
- Quid pro quo: This scam involves an exchange, I give you this, and you give me that. Fraudsters make the victim believe it's a fair exchange, but that's far from the case, as the cheat always comes out on top.



New words

Social website – an online platform that allows users to create a public profile and interact with other users on the website

Social engineering – the act of tricking someone into giving information or taking action they usually wouldn't take



Activity 11.6

Social websites and social engineering

This activity can either be a discussion in class or learners can answer the questions individually in their homework books.

- 11.6.1** How you feel about social engineering? Give reasons for your answers where applicable.
- 11.6.2** What type of information is the fraudster looking for and why?
- 11.6.3** How can you not fall for social engineering?

WIKIS

Wikis are encyclopaedias that can be edited by anyone. They can be general encyclopaedias (like Wikipedia) which allows users to create entries for any topic, or they can be very specific, such as the **eSports** Wiki called Liquipedia, which only allows users to add information on the esports-related topics.



Figure 11.4: Wikipedia is an example of a general wiki

Because anyone can contribute information to the wiki, these encyclopaedias can grow incredibly quickly. For example, Wikipedia contributors have written and edited more than 27 billion words across 40 million articles! If the average professional author can write 100 000 words in a year, it would have taken a team of 1 000 professional authors 270 years and hundreds of billions of Rand to create an encyclopaedia as large as Wikipedia. Instead, the information on Wikipedia was written and edited in less than 18 years for free!

Since anyone can update a wiki, they are also easier to maintain and keep up to date. Whenever a large event occurs, hundreds of contributors are ready to update the wiki with the newest information.

This does not, however, suggest that wikis are perfect. Instead wikis are faced with several challenges, including:

- Quality of information: Because anyone can edit the information, many people doubt the quality of information stored on wikis. However, several studies have shown the quality of information on Wikipedia is comparable to that of top encyclopaedias written by experts.
- Bias of editors: Since anyone can edit an article, rather than those with a neutral view of the topic, are most likely to edit the pages. This means that there are often edit wars about controversial topics, with one group of editors writing the article so that the information is positive, and another group so that the information is negative.

While these criticisms have mostly looked at Wikipedia, this is because Wikipedia is by far the largest and best moderated wiki. These issues become even more significant on smaller wikis, where a small number of contributors can have a large impact on the quality of the wiki.



Activity 11.7

Wikis

This activity can either be a discussion in class or learners can answer the questions individually in their homework books.

11.7.1 How do you feel about wikis?

11.7.2 What is a Wiki?

11.7.3 Do you ever use wikis? Have you used wikis outside of Wikipedia?

11.7.4 Do you think people can trust the information they read on Wikipedia?

11.7.5 Do you think Wikipedia should be used as a research tool for school projects?

11.7.6 Do you think it is a problem that most Wikipedia articles are written by men?

11.7.7 Do you think bias on Wikipedia is a significant problem? How can you know if an article is biased?



Did you know

- **Non-diverse editors:** The bias of the information may not always be intentional. A 2013 study found that 90% of Wikipedia's editors were men. As a result, the information on Wikipedia may be biased towards men.
- **Vandalism:** Vandalism occurs when the information on a page is purposely changed to be incorrect or misleading. For example, after South African swimmer Chad Le Clos received a silver medal at the 2016 Olympics, his Wikipedia page was edited to state that he "died at the hands of Michael Phelps, being literally blown out of the water by the greatest American since Abraham Lincoln."
- **Privacy:** Privacy concerns have been raised when relatively unknown people receive Wikipedia pages containing personal information about them against their wishes.

11.3 Privacy and Information sharing

INTRODUCTION

Privacy is defined as a person's ability to control how information about them is shared with other people or institutions.

In South Africa, the privacy of all individuals is protected in Section 14 of the constitution. Furthermore, the *Protection of Personal Information Act* (or POPI Act) ensures that citizens' personal information (such as ID numbers, addresses and telephone numbers) may only be used in very specific circumstances.



Did you know

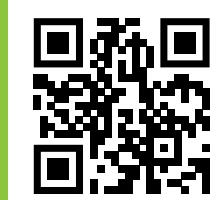
If you have ever received a telemarketing call, then you know that one of the companies you pay (like your bank, cellphone provider or satellite television subscription) sold your contact information to a telemarketing company.

Privacy becomes a very complicated issue on the internet. Companies who provide services to you for free (like Facebook and Google) often collect information about you when you use these services and sell that information to advertisers.

These companies do not break the law, but rather make sure they follow the letter of the law exactly. They may include a section on how your personal information will be used in the 30-page terms and conditions agreement you sign when you sign-up for their service, or they may ask you who to share information with any time you make a post. However, by using their services, you allow them to sell your information.



QR CODE



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

<https://qrs.ly/cza5pk1>

COOKIES

This has been explained in detail in Chapter 1. Let's revise this topic briefly. A cookie is a small amount of data generated by a website and saved by your web browser. Its purpose is to remember information about you, similar to a preference file created by a software application.

ANONYMITY

As you know, most websites allow people to use them anonymously. Even when they require people to create accounts, very few websites require people to prove their identity. As a result, people can create accounts with any name or surname they want. This allows greater freedom of expression, but also less accountability for any comments made.

Anonymity offers the following advantages to internet users:

- It allows people to be more honest and have more honest conversations.
- It allows people to give and receive more honest feedback.
- It allows people to seek help and support on personal or embarrassing issues.
- It allows people to have more balanced conversations with all anonymous users being treated equally.
- It allows people to anonymously **whistle blow** on illegal activities.

However, due to a lack of accountability, anonymity also has several disadvantages:

- It can protect people committing crimes or gathering information about illegal activities.
- It can be used for legal but unethical activities.
- It can be used to make statements that are not socially acceptable, without fear of censure.
- It can be used to target and bully specific people.

In 2011, Google implemented a “real names only” policy on Google+ (its social network). This name would then be used across the range of Google’s services, including Gmail and YouTube. The internet was furious and campaigned against the policy for months. After almost a year, Google softened the policy before removing it completely in 2014.



Did you know

In 1999, companies realised that each document created in Microsoft Office contained a global unique identifier (or GUID) which could be linked to specific computers. As a result, employees across the world who believed they had anonymously shared private information or had revealed how their companies were breaking the law, lost their jobs as their identities were revealed.



Activity 11.8

11.8.1 In your opinion, are cookies beneficial or not? Explain.

11.8.2 In 2014, the game developer Zoë Quinn was the target of intense online harassment in a controversy known as Gamergate. As part of the harassment, Zoë's personal information (including her home address) was posted publicly on the internet while she was receiving thousands of death threats.

Zoë was targeted for harassment because she created a game called Depression Quest which helped people to understand depression. This was not a “proper” game according to some internet users. The harassment then became significantly worse when Zoë's ex-boyfriend falsely accused her of having a relationship with a gaming journalist to get a positive review for Depression Quest.

Gamergate highlights many of the problems with online anonymity, including bullying and harassment by anonymous online users. However, it also shows how removing anonymity can cause problems, with the harassment becoming personal and threatening once Zoë's personal relationships and home address were placed on the internet. Answer the following questions:

- a. Do you think it is important to keep the internet anonymous?
- b. Do you think cyberbullying is something that occurs within your school or community?
- c. Would you feel comfortable linking everything you have done on the internet to your real name and surname?
- d. Are there any kinds of websites that should force people to use their real name?
- e. How would they ensure that users use their real name and surname?

GLOBAL UNIQUE IDENTIFIERS

A GUID (global unique identifier) is a term used by Microsoft. It is a number that its programming generates to create a unique identity for an entity such as a Word document.

GUIDs are widely used in Microsoft products to identify interfaces, replica sets, records, and other objects.

One concern is that an author of a document can be traced by the GUID in the document, even in circumstances where the author has taken care to maintain their anonymity.

FILE SHARING (MOVIES, MUSIC)

The internet is quickly becoming many users preferred source of music, films and other forms of entertainment.

File-sharing sites can cause problems in three ways:

- The free-to-use ones are probably breaching copyright laws (either downloading or uploading is illegal).
- Some sites are used to distribute pornography, racist or other inappropriate or unlawful material, often masked as respectable content.
- These services also enable strangers to gain access to areas of your or your child's computer, leaving it open to viruses, spyware and 'botnet' software.

CONSOLIDATION ACTIVITY

Chapter 11: Social implications

Debate one of the following topics:

1. The evolution of social networking has benefitted us globally and personally.
2. Computers can provide solutions to real-world problems.

Role play the following scenario:

Explain to your peer how and why you need to keep your personal information safe. Provide examples to convince your peer to be more cautious when going online on social media sites.

Glossary

A

anomaly something that deviates from what is standard, normal, or expected

API (application programming interface) a set of routines, protocols, and tools for building software applications

atomic (database transaction) atomic means data which cannot be divided further

B

bitcoins digital money, used on the Internet for various services

C

catfishing when someone creates a fake online profile with the intention of deceiving someone else

clone a computer that operates in a very similar way to the one that it was copied from

cookie a small amount of text-only data saved on your computer while you browse a certain website to help create custom pages for you upon your return visits or save session information

copyright protection for any published work that helps to prevent that work from being used without prior authorisation

CSS (or cascading style sheets) it allows web developers to change the layout and appearance of their web pages

D

data cap a term used to describe the data limit

dependency when one field's value depends on another field's value. When one field's value changes, the other field's value needs to change as well

divisible capable of being divided

E

entity something that is distinct or on its own, like a table

entry-level (model) the most basic or affordable version of something

e-sport a multiplayer video game played competitively for spectators, typically by professional gamers

ethical conforming to accepted standards of conduct

F

freemium a business model, especially on the Internet, whereby basic services are provided free of charge while more advanced features must be paid for

H

hotlinking the action of linking to an object on another server

I

infringement the action of breaking the terms of a law or agreement

IP address a unique string of numbers separated by full stops that identifies each computer using the internet protocol to communicate over a network

K

key a field used to uniquely identify records in a table

M

mediated search a specific website's search being completed by a general search engine

N

NAS (network attached storage) a dedicated server, also referred to as an appliance, used for file storage and sharing

network adapter/dongle a piece of hardware that can be added to a computer which allows it to connect to a network

normalise the action of converting a database to a standardised form

O

ONT (optical network terminal) device a type of network interface device used with fibre-to-the-premises applications

P

- Pagefile** a file on a hard drive used as a temporary location to store information not being used by the computer RAM
- partial dependency** a database dependency in which a field is only dependent on some items within the same record
- protocol** a standard used to define a method of exchanging data over a computer network, such as LAN, Internet, Intranet, etc.

Q

- query** a field or option used to locate information within a database or other location

R

- ransomware** a malicious program that infects a computer and then locks some part of it, preventing the user access to their computer or data

S

- sandbox** a security mechanism for separating running programs to prevent system failures or software vulnerabilities from spreading
- sanitise** the act of cleaning data and removing problems from it
- scraper** a program that scans through websites, saving the visible information to a database
- shape (the connection)** a technique used to reduce the amount of traffic on a network by limiting the speed of applications that use the most bandwidth

SMART scan a powerful QR reader and barcode scanner that supports all kinds of major barcode formats

static fixed or unchanging

system software a type of computer program that is designed to run a computer's hardware and application programs

T

throttle (the connection) limiting the speed of a network connection

transitive dependency a dependency in which a field is dependent on a single, specific field within a table, rather than on the whole a record

U

ultrabook a type of laptop that falls in the thin and lightweight laptop category

utilities small programs which help users to maintain their computers

W

WAP (wireless access point) a wireless receiver which enables a user to connect wirelessly to a network or the internet

web crawler a program or script written to browse the World Wide Web in a systematic manner for the purpose of indexing websites

whistleblow to inform on a person or organisation regarded as doing something unlawful or immoral

world wide web refers to the millions of websites that are hosted on the internet

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