

Module 1: Concepts of Information Technology (IT)

Section 1: General Concepts

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1.1.1 Hardware, Software, Information Technology

1.1.1.1 Understand the terms hardware, software, Information Technology (IT).

Hardware

Hardware refers to the physical components of a computer. These are the parts that you can see, feel and hear. Examples are the CPU, the keyboard, the monitor, memory, cables, mouse, printer and power supply.

Software

Software refers to the **programs** that control the computer and make it function.

Note the spelling is program and not programme.

A **program** is a set of instructions that the computer obeys. Computer programs can be extremely long and complex sets of instructions. It is quite common for computer programs to be tens of thousands of lines long. The application programs that you use on your PC for word processing and spreadsheets are in fact even longer.

Information Technology

Information Technology is a broad term which covers all aspects of the use of computer technology. It includes not only hardware and software, but also communication technology applied to linking computer systems, software engineering, and the administration and use of computer systems.

1.1.2 Types of Computer

1.1.2.1 Understand and distinguish between mainframe computer, network computer, personal computer, laptop, personal digital assistant (PDA) in terms of capacity, speed, cost, and typical users.

In the early days of computer technology, it was easy to categorise computers. Today, even the basic desktop machines are extremely powerful by the standards of a few years ago and rival the early mainframes in computing power.

Mainframes

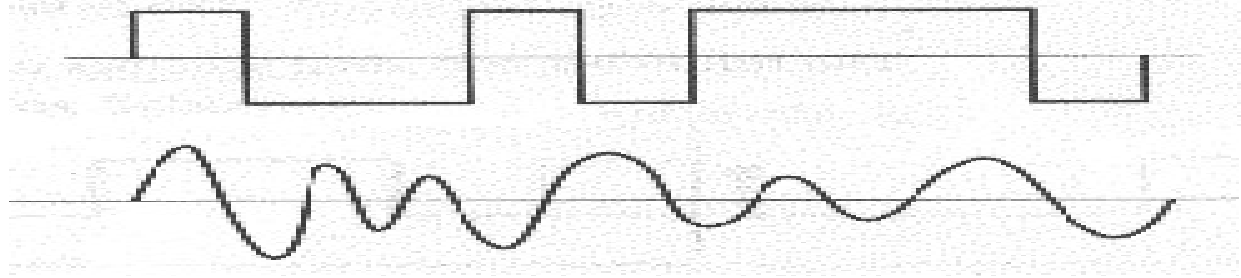
These are the largest and most powerful of computers. The biggest of these are sometimes called **Supercomputers**. Mainframes are usually only found in large corporate institutions, research organisations, government ministries and tertiary academic institutions.

They provide centralised processing and storage of data. They are usually used for large database systems such as the accounts of a municipality, patient information at a large hospital or student records at a university.

Because desktop (personal computers) and laptops are relatively cheap, many activities such as word processing, creation of spreadsheets and general office tasks are carried out using these types of computers. This frees the mainframe for processing large databases.

Networking, in which computers are connected together and are able to communicate, allows data to be **downloaded** from the mainframe to the personal computer or be **uploaded** from the

personal computer to the mainframe. In effect, networking creates one large system comprising all the different computers linked together.



Capacity and speed: Mainframes have the largest capacity in terms of data storage and processing speed. The capacity of a modern mainframe can be hundreds or even thousands of times that of a modern personal computer.

Cost: Mainframes are also the most expensive machines in terms of both initial cost and maintenance. A mainframe can cost millions of Rands.

Typical users: Because the mainframe provides services to all sectors of a large corporation or institution, users can include systems analysts, programmers, database administrators, data capturers, accountants, accounts administrators

Network computer

Network computers are also sometimes known as **thin clients** or **dumb terminals**. They provide access to a mainframe via a network and have little, if any, computing capacity of their own. Network computers provide remote access to a mainframe. They allow the user to input data or commands and receive output. The actual processing would be done on the mainframe.

Capacity and speed: Network computers do not have any processing capacity of their own. Their speed will depend on i: the speed and capacity of the mainframe; ii: the speed of the network to which they are attached; iii: the number of users accessing the mainframe. Thus in periods of low demand, they will appear to function very quickly but would appear to slow down when the demand on the system is high.

Cost: Network computers are relatively simple devices, hence they are fairly cheap.

Typical users: These would generally be the end-users of the system such as managers, accountants, receptionists, accounts clerks and data capturers.

Personal computers

Personal computers or **PCs** for short are the type of computer that most users are familiar with. Because they are usually found on users desks, they are also sometimes called **desktop computers**. **Operating systems** such as **Linux** and **Windows** were designed specifically for personal computers. The same applies to the thousands of application packages that are available including **OpenOffice.org** and Microsoft **Office**. A typical PC consists of a main unit housing the CPU and disk drives, a VDU (Video Display Unit), a keyboard and a mouse. PCs are self contained computing systems that can be used for thousands of different tasks from creating a simple document to controlling a large industrial machine.

Capacity and speed: Because of the rapid advances in technology, the PC of today is more powerful than many mainframes of a few years ago. There is little sign that the rate of development is slowing down. Typically, a modern PC can store the equivalent of a few million pages of printed text and carry out millions of instructions in a second. What complicates the

issue of speed in talking about PCs is the use of graphics. Most applications make intensive use of graphics. This demands enormous computing power. Computers, which would otherwise appear to be very fast, can appear to be quite slow because of the demands placed on them by the graphics used in an application. Other components, such as the graphics card, also play a role in the speed of a PC.

Cost: There has been a steady decline in the cost of computing power. Although the cost of PCs has been fairly steady, the computing power that has been supplied has increased drastically. The cost of a personal computer is greater than that of a network computer or PDA but less than that of a laptop and a very small fraction of the price of a mainframe.

Typical users: Everyone is a potential user of a personal computer since there is virtually no sphere of human activity that does not make use of information technology. The list could include scientists, researchers, mathematicians, statisticians, technologists, engineers, students, teachers, accountants, actuaries, managers, doctors, librarians, receptionists, book-keepers, writers, and journalists. These are just a very few.

Laptop

Laptops are similar to personal computers except that they comprise an integrated unit. Instead of a separate monitor, the lid contains a screen. The keyboard is built into the base. Usually they make use of a touchpad instead of a mouse. The term **notebook computer** is often used instead of laptop computer.

The main feature of a laptop is its portability. This is possible, not only because of the reduced size and weight, but also through the use of a built-in battery which is able to power the computer for a few hours without being connected to a mains power supply. Laptops are also designed around low power and smaller devices. For example, laptops use small 2½" hard drives as opposed to the 3½" drives of desktops. In addition, these drives have special components built-in to protect them against movement.

Capacity and speed: These are the same as for personal computers.

Cost: Because of the more expensive components and the smaller market for laptops, these are usually quite a bit more expensive than personal computers. Increased volumes and improvements in manufacturing techniques will bring the price of laptops down in the future.

Typical users: Although the users could be any of those mentioned under personal computers, cost tends to limit the users to those who need portability or who can afford the cost. You would find them most commonly used by people such as managers and journalists. It is quite common to see a laptop and the desk of senior members of staff and personal computers on the desk of staff. This is not always a matter of status but often due to the fact that managers tend to take work home with them.

PDA / Personal Digital Assistant

The **PDA** is the smallest of all computers. Their main task is to maintain a diary and keep contact lists. On many you are able to make use of a word processor or spreadsheet, but, because of physical constraints, the amount that can be done is far more limited than on a PC. PDAs vary considerably in the features they contain. Top of the range cell phones now contain a PDA.

Usually, all the components of a PDA are solid state – they do not contain any moving parts. Some of the larger PDAs, often called subnotebooks, may contain a miniature 1½" hard drive. One feature that distinguishes a PDA from a subnotebook is that the latter has a built-in keyboard whereas the PDA makes use of a light pen and character recognition for data input.

Most PDAs are able to connect to a personal computer so that data can be exchanged. A common

feature is **synchronisation** where software on the PC automatically updates both the PC and PDA at the same time by using the most up-to-date data on each.

Capacity and speed: PDAs have much less storage capacity and are slower than personal computers. They were designed with convenience and low power requirements in mind rather than power.

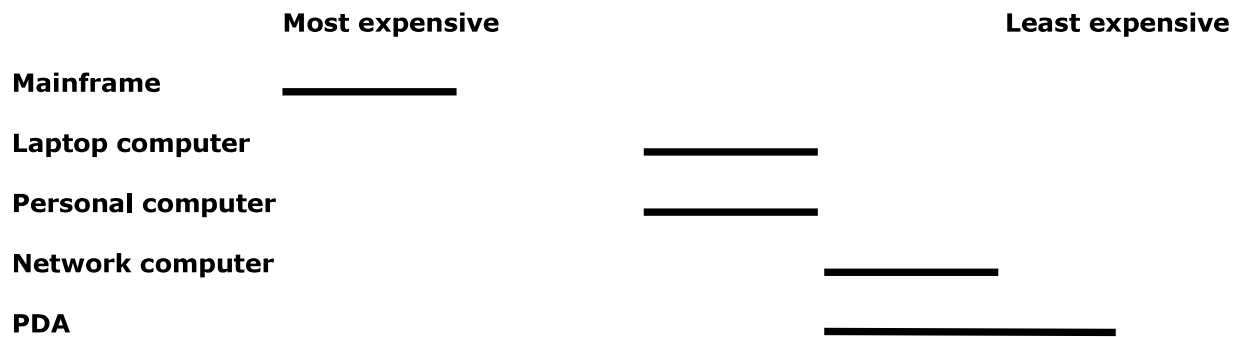
Cost: Usually a PDA is less expensive than a personal computer, but top of the range PDAs can actually be more expensive than an average personal computer.

Typical users: Typical users are those with high mobility who need to keep track of their agendas. These would include managers, representatives and doctors.

Cost comparisons

The cost of a computer depends on a range of factors including the components, labour and demand. As a result, any price that is quoted will be out of date within weeks. Further, as demand increases for one type of computer and decreases for another, their relative prices will change.

The following table attempts to give a graphical representation of the relative prices of different types of computer:



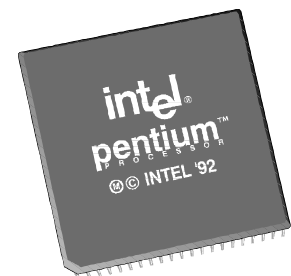
1.1.3 Main Parts of a Personal Computer

1.1.3.1 Know the main parts of a personal computer such as: central processing unit (CPU), hard disk, common input and output devices, types of memory. Understand the term peripheral device.

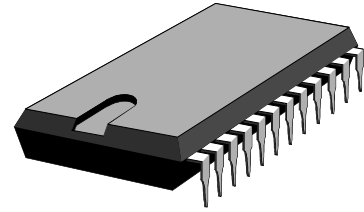
Central Processing Unit

The **Central Processing Unit** or **CPU** can be thought of as the brain of the computer. The function of the CPU is to execute the instructions in the programs. At the heart of its operations are **arithmetic** and **logical operations**.

The CPU is made up of millions of electronic components called transistors, capacitors and resistors. Transistors are the active components of the CPU. Modern CPUs contain millions of transistors.



It was the miniaturisation of components and the creation of the **integrated circuit** that has made the development of modern computers possible. Although integrated circuits contain enormous numbers of components and connectors, the whole object is manufactured as a single item through special manufacturing techniques. From the outside, the integrated circuit looks like a small black box with a number of electrical connectors on the outside.



Hard disk

The hard disk is the component that stores data and programs even after the computer has been switched off. It consists of a number of rotating platters which are covered with a magnetic film. Information is stored using the magnetic properties of the film. The platters rotate from between 5000 and 8000 rpm or faster.

Heads are attached to the end of arms that are able to move backwards and forwards across the surface. These heads move very close to the surface, typically only a speck of smoke could fit between the head and the surface.

Because a hard drive is both mechanical and electronic in construction, it is called an **electro-mechanical device**.



Input devices

Input devices are components which are used to feed commands and data into the computer. These include devices such as keyboards and mice.

Output devices

Output devices are devices that the computer uses to send us the results of the processing. These include the VDU (monitor) and printers.

Peripheral devices

A computer system comprises the case which houses the motherboard, CPU, hard drives, power supply and various other components. Devices such as printers, monitor, keyboard and mouse which are connected to the main unit by various types of cables and connectors are called **peripheral devices**.

Memory

There are two general categories of memory: primary and secondary.

Secondary memory consists of the various devices that are able to store data and programs even when the power is off. This includes devices such as hard drives, floppy drives, tape drives, CD drives and DVD drives.

Primary memory is the memory that is intimately associated with the actual working of the computer. This includes memory that holds the start-up routines as well as the current program and data it is working with. There are various forms of primary memory: RAM, ROM and Cache

memory.

RAM or **Random Access Memory** holds the current running program and its associated data.

ROM or **Read Only Memory** contains certain key routines (small programs). One example, is the set of start-up routines. These take control of the computer when you switch on and ensure that the computer **boots-up**. Booting-up is the process of starting the computer up so that it is able to load and run computer programs.

Cache memory is very high speed memory that is used by the CPU in executing the individual instructions of the program. It is used to hold items such as instructions that are next in line to be executed and data that is likely to be needed by the CPU.

All of these concepts will be dealt with in more detail in the next chapter.

1.1.4 Computer Performance

1.1.4.1 Know some of the factors that impact on a computer's performance such as: CPU speed, RAM size, the number of applications running.

The performance of a computer is determined by a number of factors, all of which work together. Often a single item that is functioning poorly will cause a bottleneck resulting in poor performance.

CPU: The model of the CPU and its speed are the first factors that determine computer performance. Generally, the CPU so far outperforms the other components, that poor performance is usually due to other factors. One important factor in the performance of the CPU is the amount of on-board cache memory. If the CPU has sufficient cache memory it can queue future instructions and data in cache. Since access to cache memory is far faster than that to RAM, the overall processing performance is improved. On-board cache memory helps especially where the CPU is involved in processing of graphics.

RAM: If a computer does not have sufficient RAM, it has to make use of the hard disk to store intermediate data that it would normally store in RAM. This is referred to as **virtual memory**. Since hard disk access is much slower than access to RAM, this will slow down the computer. The more RAM a computer has, the less need there will be to make use of virtual memory.

Number of applications: Modern computers are designed to run more than one application at a time and to allow applications to be working on multiple sets of data at the same time. For example, a user may be working on four documents at once. However, the more open applications and documents there are, the more this will place a burden on the processing power of the computer. For best performance, only open the applications and documents you need. Close others.

Graphics cards: The graphics card is the unit that converts the signals from the CPU into a form that can be displayed on the monitor. A good graphics card can take over many of the tasks of the CPU in generating the output. This leaves the CPU free to do other processing tasks. The quality of the graphics card is a key factor in the performance of a computer, yet is one which is often overlooked.