

UNIT 2

Computer Architecture

INTRODUCTION

There are different types of computer of varying size and power, including the following:

Supercomputer (the most powerful type of mainframe)

Mainframe (large, very powerful, **multi-user** i.e. can be used by many people at the same time, **multi-tasking** i.e. can run many programs and process different sets of data at the same time)

Minicomputer (smaller than a mainframe, powerful, multi-user, multi-tasking)

Personal computer (PC) (single user)

Desktop computer (suitable size for sitting on an office desk)

Workstation (most powerful type of desktop, used for graphic design, etc.)

Portable (can be carried around, can operate with batteries)

Laptop (large portable, can be rested on user's lap)

Notebook (size of a sheet of notebook paper)

Handheld (can be held in one hand)

Pen-based (main input device is an electronic pen)

PDA (personal digital assistant, has functions such as task lists, diary, address book)

Note that the term **PC** usually refers to an IBM compatible personal computer i.e. an Apple Mac personal computer is not referred to as a PC. A computer that provides a service on a network e.g. storing files, sharing a printer, is known as a **server** computer. Server computers usually have a **UPS** (uninterruptible power supply) attached to them. This is a battery that automatically provides an electricity supply to allow the server to shut itself down properly if the main supply fails.

The **processor** e.g. Pentium, is the most important part of the computer. It processes the data and controls the computer. Powerful computers used as servers often have more than one processor. There are two main types of **memory**:

- a **RAM** (random access memory) holds the program instructions and the data that is being used by the processor.
- b **ROM** (read only memory) holds the program instructions and settings required to start up the computer.

The combination of the processor and memory is sometimes referred to as the **CPU** (central processing unit), although sometimes the processor itself is referred to as the CPU. The other parts connected to the CPU are known as **peripherals**. These can include input devices, output devices, storage devices and communications devices. **Input devices** include: keyboards, scanners, barcode readers, digital cameras, microphones and video cameras e.g. webcams (small digital video cameras used on the Web). **Output devices** include: **monitors** (VDU display screens), printers, plotters, loudspeakers and headphones. **Storage devices** include: magnetic tape, **floppy disks** (diskettes), hard disks, CD-ROMs, CD-R disks, CD-RW disks, DVDs and MO disks. A common **communications device** is a **modem** (a modulator/demodulator used for converting digital signals to analogue signals and vice versa to allow a computer to be connected to the ordinary telephone system).

A set of connectors used for carrying signals between the different parts of a computer is known as a **bus**. Data is transferred constantly between the processor and memory along the **system bus**. Each part of memory has its own **memory address** and

the processor determines where processed data is stored by sending an address signal along an **address bus** and data along a **data bus**. This is synchronised by an electronic **clock** in the CPU that determines the operating speed of the processor. Transferring data between the processor and RAM can slow up the computer; therefore, some very expensive, extremely fast memory is usually used as a **cache** to hold the most frequently used data.

In a desktop computer, the **CPU** (central processing unit) and **storage devices** (pieces of equipment used for reading from and writing to a storage medium) are normally built inside a **system unit** which consists of a metal chassis enclosed in a flat desktop or a tower shaped case. Other peripherals are attached to the system unit by cables. Each peripheral uses its own **driver card** or **controller** (an expansion card that is plugged into special **expansion slots** in the system unit). **Expansion cards** contain the electronics required to communicate with and control the device e.g. **video** or **graphics cards** are used for monitors, **soundcards** are used for audio input/output and **NICs** (network interface cards) are used for connecting to other computers in a **network** (computing devices connected together). Extra memory can also be added to the computer using special **memory expansion slots** inside the computer. A portable computer that does not have enough space inside to fit expansion cards may use an external device called a **port replicator** to provide connections for peripherals.

Storage devices in the form of a **disk** or **tape** are used to store the programs and data that are not being used. Note that the American spelling of *disk* is commonly used, although the British spelling, *disc*, is sometimes used. Before a program or data can be used, it must be transferred from the

storage device to the main RAM memory. **Hard disks** consist of a set of magnetic coated metal disks that are vacuum-sealed inside a case to keep out the dust. The magnetic surfaces of the disks are **formatted** using a **read/write head** to provide magnetic storage areas. These storage areas form concentric circles called **tracks** and each track is subdivided into sections called **sectors**. The disks are rotated at high speed and read from or written to by the read/write head that moves across the surface of the disks. In server computers, hard disks can be connected together and made to operate as one unit using **RAID** (a redundant array of inexpensive disks – see Unit 17). This can speed up the system and provide a way of recovering data if the system **crashes** (fails suddenly and completely, usually referring to the failure of a hard disk). There is a variety of optical storage devices that use laser light to read or write to a disk, including: **CD-ROMs** (compact disk read only memory), **CD-R** (recordable compact disk), **CD-RW** (re-writable compact disk), **DVD** (digital versatile disk – previously known as digital video disk).

An **input device** called a **barcode reader** is a special type of **scanner** for reading **barcodes** (a set of printed bars of varying thickness that are used to identify a product e.g. used to price items in supermarkets).

When comparing computers, the **power** of the computer is important. This is mainly determined by the **speed** and **capacity** (size) of each part of the computer.

Speed is measured in **hertz** (Hz) i.e. cycles per second.

Capacity is measured in **bytes** (B) where 1 byte = 8 **bits** (binary digits) = 1 character.

When specifying a computer the following are normally quoted:

- a the speed of the processor (MHz – megahertz, GHz – gigahertz)

- b the capacity (size) of the memory (MB – megabytes)
- c the capacity (size) of the **magnetic storage devices** e.g. hard disk, floppy disk (MB – megabytes, GB – gigabytes)
- d the speed of the **optical storage devices** e.g. CD-ROM, DVD (given as a multiple of the speed of the first devices produced e.g. $24\times = 24$ times, $12\times = 12$ times)
- e the display monitor size (measured in inches diagonally across the screen surface)
- f the monitor image quality (**resolution**) given by the number of **pixels** (picture elements) that are used across and down the screen e.g. 800×600 , or by the graphics standard used e.g. **VGA** (video graphics array), **SVGA** (super video graphics array)
- g the graphics card memory size (MB – megabytes)
- h the speed of the modem (measured in **kbps** – kilobits per second)

Two different number systems are used in computer specifications:

- a The **decimal system**, which consists of ten digits from 0 to 9, is used for measuring speed.

- b The **binary system**, which only has two digits (1 and 0), is used for measuring capacity.

The following prefixes are also used in measurements:

	Decimal system	Binary system
kilo	$10^3 = 1$ thousand	$2^{10} = 1,024$
mega	$10^6 = 1$ million	$2^{20} = 1,048,576$
giga	$10^9 = 1$ thousand million	$2^{30} = 1,073,741,824$

- e.g. 1.7 GHz = one point seven thousand million cycles per second
 $256 \text{ MB} = 256 \times 2^{20} \text{ bytes} =$
 approximately two hundred and fifty six million bytes

Communication is provided between **applications programs** (wordprocessors, drawing programs, etc.) and the computer **hardware** (the physical components of a computer system) by a set of programs collectively known as the **operating system** e.g. Microsoft Windows, MacOS.

OBJECTIVES

By the end of this unit, Ss should be better at:

- reading for specific information
- understanding computer advertisements.

They should understand and be able to use:

- structures for expressing function
- prepositions of place.

They should know and be able to use names of types of computers, computer features and sequence words.

STARTER

- 1 This provides an opportunity to revise the names of types of computer: *supercomputer, mainframe, workstation, desktop, portable, pen-based computer, PDA (Personal Digital Assistant)*. Have Ss do the task individually and then compare answers in small groups. Where there is disagreement, Ss should justify their answers. You can then compare answers in plenary.