

## 4 Hardware and Software

### 4.19 Hardware and Software

- **Hardware** is the electrical or electro-mechanical parts of a computer and its input/output and storage devices.
- **Software** comprises all the programs that are written to make computers function.

Software can be classified into **system software** and **application software**.

#### System Software

System software is the software needed to run the computer's hardware and application programs.

- An **operating system** is a set of programs that lies between application software and the computer hardware.

Functions include hardware **resource management** and provision of a **user interface**.

- **Utility software optimises the performance** of the computer or perform tasks such as backing up files, compressing and encrypting data before transmission, firewall, etc.
  - **Disk defragmenter** reorganises a hard disk so that files which have been split up into blocks and stored all over the disk is **recombined in a single series of sequential blocks**. This makes reading a file quicker.
  - **Virus checker** checks your hard drive and internet downloads for viruses and remove them.
- **Libraries** are ready-compiled programs which can be run when needed.

Libraries in Windows have a .dll extension.
- **Programming language translators** translate program code written by a programmer into machine code which can be run by the computer.

#### Application Software

Application software **performs specific user-oriented tasks**.

- **General-purpose software** can be used for many different purposes.

E.g. word-processor, spreadsheet.
- **Special-purpose software** performs a single specific task or set of tasks.

E.g. hotel booking systems.

- Software bought **off-the-shelf** are ready to use.
- **Bespoke software** package are specifically written by a team of programmers for a particular organisation, to satisfy their particular requirements.

Off-the-shelf software

- Cheaper to buy, as the cost is shared among all other people buying the package.
- It is **ready to be installed** immediately.
- Likely to be **well-documented, well-tested and bug-free**.

It may also contain a lot of features never used.

## 4.20 Role of an Operating System

An operating system is a set of program that **manages the operations of the computer** for the user. It **acts as a bridge** between the user and the computer's hardware, since a user cannot communicate with hardware directly.

- The operating system is held in **permanent storage** such as the hard disk.
- The **loader** is held in **ROM**.

When a computer is switched on, the loader in ROM **sends instructions to load the operating system** by copying it from storage into RAM.

The **Application Programming Interface** is provided to disguise the complexities of managing and communicating with its hardware from the user. So the user can complete their tasks without knowing the actual operations taking place behind the scenes to support their actions.

The operating system has the following functions

- **Memory management**
  - A PC allows a user to be working on several tasks at the same time.
  - Each program must be **allocated a specific area of memory** whilst the computer is running.
  - If the user wishes to switch from one application to another in a separate window, each application must be **stored in memory simultaneously**.
  - The allocation and management of space is controlled by the operating system.

**Virtual memory** uses the hard disk as an extension of memory, it is used when the computer's RAM is not large enough to store all these programs simultaneously.

1. If an opened program is not in use at a particular time, the operating system may copy it and data to hard disk to **free up RAM** for another software.
  2. When switched back to that program, the operating system will **reload it into memory**.
- **Processor scheduling** - with multiple programs running simultaneously, the operating system is responsible for **allocating processor time to each one** as they compete for the CPU.

While one application is using the CPU for processing, the OS can **queue up the next process required** by another application to make the most efficient use of the processor.

- A computer with a single-core processor can only process **one application** at a time.
- By carrying out **small parts of multiple larger tasks** in turn, the processor can give the appearance of **carrying out several tasks simultaneously**.
- This is called **multi-tasking**.

The **scheduler** is the operating system module responsible for making sure that processor time is used as efficiently as possible. Its objective are to

- Maximise throughput.
  - Be **fair to all users** on a multi-user system.
  - Provide **acceptable response time** to all users.
  - Ensure hardware resources are **kept as busy as possible**.
- **Backing store management** - the operating system keeps a directory of where the files are stored so that they can be quickly accessed.

It also needs to know which areas of storage are free so that new files and applications can be saved.

A file management system enables a user to

- Move files and folders.
  - Delete files.
  - Protect others from **unauthorised access**.
- **Peripheral management** - the operating system communicates and ensures that peripherals are allocated to processes without causing conflicts.

- **Interrupt handling** - the OS is responsible for detecting the interrupt signal and displaying an appropriate error message for the user if appropriate.

It is because a processor can be interrupted that **multi-tasking** can take place.