OCR Computer Science GCSE

1.5 – Systems software

Advanced Notes

1.5.1 Operating systems

Operating systems, such as Windows, macOS and Linux, are a type of software that manage and control the computer. Without an operating system, a computer would not be usable. Operating systems have several main functions.

Providing a user interface

Operating systems provide a user interface that allows users to interact with the computer. There are a few different kinds of user interfaces:

Graphical user interfaces

A graphical user interface (GUI) is a visual way for users to interact with electronic devices. It allows them to interact with the computer by using graphical elements (such as icons and menus).

Command line interfaces

Command line interfaces are less visual, and the user interacts with the computer by typing in text-based commands.

Memory management and multitasking

The operating system allocates sections of the computer's memory to different applications, keeping track of which parts of memory are in use. All programs must be moved into the RAM when they are being processed, although when the programs are closed they're overwritten by other tasks that take their place in RAM.

Multitasking refers to the ability of the operating system to run more than one program at the same time. The operating system achieves this by switching rapidly between tasks, giving each program a small slice of the processor's time. This happens so quickly that it seems to the user as though all the programs are running at once. The operating system ensures that each program gets the memory and processing time it needs, and that no program interferes with another.

Peripheral management and drivers

The operating system is also responsible for managing peripherals, which are devices connected to the computer such as keyboards, mice, printers, and monitors. Data must be transferred between these devices and the processor; this process needs to be carefully managed to ensure the system works properly. The OS sends signals to the appropriate device when data needs to be sent or received.

To do this, the operating system uses software called drivers. A driver is a small program that acts as a translator between the operating system and the hardware device. Each type of hardware needs its own specific driver. Without the correct driver, the OS cannot communicate with the device, meaning it may not function correctly or at all. For example, a printer will not work unless the correct driver is installed.

User management

User management is another key function of the operating system. Many systems allow multiple users to have separate accounts, each with its own files, settings, and preferences. The OS is responsible for creating and managing these accounts. This includes setting up usernames and passwords, managing login processes, and assigning different levels of access to different users. For example, an administrator account might have permission to install software, while a standard user does not.

Security is an important part of user management. The OS ensures that users can only access their own files and that personal data is kept private. It can also log user activity and enforce security policies, such as requiring strong passwords or locking accounts after too many failed login attempts.

File management

File management involves controlling how data is stored, organised, and retrieved on a computer. The operating system handles all the basic tasks involved in dealing with files. This includes creating files, giving them names, saving them to storage, and placing them into folders. The OS also allows users to move, copy, delete, or rename files.

In addition to managing the organisation of files and folders, the OS keeps track of where each file is stored on the disk. It ensures that data is saved correctly and that files do not overwrite each other unless specifically instructed to do so.

1.5.2 Utility software

Utility software is needed to perform additional “housekeeping” tasks that may not be carried out by an operating system. Therefore, computers often come with utility software pre-installed. Types of utility software include encryption software, defragmentation software and data compression software.

Encryption software

Encryption is a method of converting data into a coded format so that only authorised users with the correct decryption key can understand it. Encryption software uses complex algorithms to encrypt data, so that it can only be understood by authorised users. It can either be used to encrypt just some specified files, or the whole of the hard disk where all files are stored.

Defragmentation software

Defragmentation software is used to reorganise files stored on a hard disk drive so that they take up fewer separate spaces, or fragments. Over time, as files are created, modified, and deleted, the data on a hard drive can become scattered in non-continuous blocks. This is known as fragmentation. When a file is fragmented, the computer has to look in several different places on the disk to read the whole file, which slows down performance.

It is important to note that defragmentation is only useful for magnetic hard drives (HDDs) and not solid state drives (SSDs). This is because HDDs have a moving read/write head, so accessing fragmented data takes longer. SSDs, on the other hand, have no moving parts so can access data equally fast no matter where it is stored.

The purpose of defragmentation is to improve the efficiency of the system by putting all the pieces of each file together and grouping related files close to each other. This makes it quicker for the operating system to access and open files.

Data compression software

Data compression software reduces the size of files so that they take up less storage space and can be transmitted more quickly. Compression is covered in more detail in the notes for Topic 1.2.