

# FACTFILE: GCE DIGITAL TECHNOLOGY

## AS2: FUNDAMENTALS OF DIGITAL TECHNOLOGY



### HARDWARE AND SOFTWARE - SYSTEM SOFTWARE

#### Learning Outcomes

##### Students should be able to:

- describe the purpose of an operating system;
- describe different types of operating system: single user, multi-user, multiprocessing, multitasking and multithreading;
- explain the need for utility programs;
- describe some common utility programs: data compression, file backup, archive software and disk defragmenters;

#### Content in System Software

- ✓ Purpose of operating systems
- ✓ Types of operating systems
  - Single-user
  - Multi-user
  - Multiprocessing
  - Multitasking
  - Multithreading
- ✓ Utility Programs
  - Data compression
  - File backup
  - Archive software
  - Disk defragmenters
- ✓ Questions

#### Purpose of operating systems

An operating system is a program or suite of programs that controls the operation of a computer system. The operating system manages the hardware and software resources of the system and allows the end user to interact with the computer. A large number of operating systems are available for use with computer systems today and each one is tailored to the needs of a specific user type. Some of the operating systems available today include:–

- Windows – A graphical user interface suitable for most personal computers
- Linux – an open source operating system based on the UNIX system
- MS-DOS – A command line based interface used by those who have an understanding of the underlying components of computer architecture
- UNIX – written originally for larger machines known as mainframe computers
- Mac OS – A graphical user interface used on Apple Mac personal computers

#### Types of operating systems

A range of categories of operating systems exist.

##### Single user

A single user operating system will essentially provide access to the computer for any one user at any given time; it will have one keyboard and one screen to support user interaction. If another user needs to access the device they must wait until the person currently using the device finished their task.

This type of operating system can be further sub-divided:-

- Single user, single task – here the operating system is designed so that one user can effectively do one thing at any one time. Some older mobile phone devices operated on this principle, for example consider how it might only have been possible to perform one task at a time on older devices so being able to listen to music and surf the internet at the same time would not have been possible on a single user, single-task operating system.
- Single user, multi-tasking – most computers and now operate using a platform which allows the end user to have a number of programs running at any given time

### Multi-user

While most PC's will effectively support multi-tasking by a single user, there are times when more than one user may need to gain access to the facilities provided by a much more powerful computer, for example in a university setting where many chemical reactions are being monitored at the same time or in the stock exchange where many individuals are monitoring stocks and shares across the world. In these instances a multi-user operating system will support use of the computers facilities by many different users at any one time; generally via a network. In a multi-user operating system it is important that all user requests are dealt with in such a way so as to ensure that they do not interfere with each other. The operating must share the devices effectively to ensure that all tasks are processed effectively. Where many processing tasks are being carried out simultaneously, a multi-user system must also ensure that processor time is shared between each user and a process known as time-slicing may sometimes be implemented.

### Multiprocessing

Multiprocessing can refer to the use of two or more processors within one computer system. In a multiprocessing system two or more different portions of the same program may be carried out simultaneously. The processors will work together, sometimes each may handle specific tasks, other times sharing the processing for a more complex task. The main advantage of such a system is speed. Since each processor is assigned a specific function it can complete the task assigned to it, pass the results on to the next processor and start work on a new set of tasks (instructions).

### Multi-tasking

When we refer to multi-tasking in reference to an

operating system we are referring to the ability of the operating system to allow the user to perform more than one task at any given time. In a multi-tasking environment the user could for example be working on a spreadsheet application while the computer is running a series of reports from a database application. While refer to this process as multi-tasking it is important to note that only one application is ever truly running at any one time. The processor automatically switches from one task to the next that it only appears as though the programs are running simultaneously. Multitasking does not however support an unlimited number of tasks can be juggled at the same time. As more tasks are added the demand on storage and other resources increases meaning the system may slow down.

### Multithreading

Some processors have the ability to carry out different parts (threads) from the same application or program at the same time but through the effective sharing of the resources available to a single processor. Threads are processes which are independent parts of the process or program being executed and as a result they are carried out in parallel on a single CPU.

For example, in a multi-thread environment, while one thread waits for the printer, another thread can perform a read task on the file.

### Utility Programs

A utility program is a systems program that performs a specific task related to the management of computer functions. A utility program may be designed to do one or two tasks well and nothing else, for example file backup, data compression, archive software and disk defragmenters.

**File backup** – backup software is designed to create an exact duplicate of data in the event of file corruption, user error or some other event that leads to data loss. The file backup utility program may use these copies at a later stage to complete a restore or a recovery procedure in the event of data loss.

**Data compression** – compression software stores data in a format which requires less space than usual. This is particularly useful in communications as it allows devices to transmit or store data in fewer bits. Data compression is widely used in backup utilities and in archive utilities as the reduction of the file size ensures the backup file or archived data takes up less storage space.

**Archive software** – an archive utility is an application that can create a single file containing multiple other files. Additional files can still be added to the archive and existing files can be extracted from the archive file.

**Disk defragmenters** – a utility application which rearranges files on a disc surface to ensure they occupy contiguous locations on the disc surface. Disc defragmentation removes the ‘white space’ from the surface of the disc, reduces read/write head movement during file read and write actions. This in turn can increase read/write times.

## Questions

- 1** A range of operating systems are available for use by computer users today. Identify the key purposes of an operating system. [2]

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- 2** Single user operating systems can fall into the categories of single user, single task and multiuser, multi-tasking.
- a. Identify the main characteristics of each type of operating system. [4]
- b. Identify one potential use for each type of operating system listed above. [2]

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- 3** Explain how a multi-user operating system can ensure that all user requests are being effectively managed by the processor. [2]

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- 4** Many devices now support multi-tasking. [2]
- a. Explain the term multi-tasking. [2]
- b. Describe how multi-tasking is different from multi-processing. [4]
- c. Describe how increased multi-tasking can impact upon the operation of a computer system. [2]

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5 Identify two differences between multithreading and multiprocessing. [2]

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6 How can utility programs support a user in the management of computing resources? [2]  
a. Explain how an archive utility application can be used to support the back-up process. [2]  
b. Explain how a disc defragmenting utility application can be used to speed up the speed of file read/writes on a hard disc drive. [2]

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Bibliography  
BCS Academy Glossary Working Party, 2013, *BCS Glossary of Computing and ICT*, 13<sup>th</sup> Edition, Swindon, BCS Learning and Development Ltd

