Basic Concepts of System Software

Learning outcomes

At the end of this chapter, you will be able to:

- define system software
- identify the different types of operating systems
- describe the role of utility programs and device drivers

INTRODUCTION

In this chapter, you will learn about system software and the different operating systems such as Microsoft Windows, Linux, iOS and Android. You will learn about an 'operating system', the different functions that are carried out by an operating system, and how they help the user in operating a computing device.


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Command Prompt

For more information on a specific command, type HELP command-name
ASSOC          Displays or modifies file extension associations.
ATTRIB         Displays or changes file attributes.
BREAK          Sets or clears extended CTRL+C checking.
BCDEDIT        Sets properties in boot database to control boot loading.
CACLS          Displays or modifies access control lists (ACLs) of files.
CALL           Calls one batch program from another.
CD             Displays the name of or changes the current directory.
CHCP           Displays or sets the active code page number.
CHDIR          Displays the name of or changes the current directory.
CHKDSK         Checks a disk and displays a status report.
CHKNTFS        Displays or modifies the checking of disk at boot time.
CLS            Clears the screen.
CMD            Starts a new instance of the Windows command interpreter.
COLOR          Sets the default console foreground and background colors.
COMP           Compares the contents of two files or sets of files.
COMPACT        Displays or alters the compression of files on NTFS partitions.
CONVERT        Converts FAT volumes to NTFS.  You cannot convert the
               current drive.
COPY           Copies one or more files to another location.
DATE           Displays or sets the date.
DEL            Deletes one or more files.
DIR            Displays a list of files and subdirectories in a directory.
DISKPART       Displays or configures Disk Partition properties.
DOSKEY         Edits command lines, recalls Windows commands, and
               creates macros.
DRIVERQUERY    Displays current device driver status and properties
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Figure 4.1: *An example of what the MS-DOS command line interface, one of the first operating systems, looked like*

4.1 System software concepts

In Chapter 1 you learnt that software refers to the lines of code and computer instructions that tell the hardware of a computing device what to do. In this unit, we will learn more about system software and its other components, namely, operating systems, utility programmes, and device drivers.

SYSTEM SOFTWARE

A system software is a specific type of software that manages a computing device. The system software comprises the operating system, utility programmes, and device drivers. We will look at each of the three parts.

AN OPERATING SYSTEM

An operating system is software that manages hardware, software and other applications on a computing device. The operating system has different functions and tasks it carries out on a computing device. In order to make these functions easy to understand, they are grouped into the following categories:

- **Disk management:** Used to manage the drives installed in a computer e.g. partition drives, format drives, assign drive letters.
- **Hardware management:** Managing the interaction between hardware and software, as well as the different hardware devices.
- **Graphics User Interface (GUI)** management: Provides and manages the user interface that interacts with graphics and visual content on a computing device.
- **I/O management:** Managing the signals received from an input device and sending the correct signals to an output device.
- **Process management:** Managing the applications and the resources used by applications (Apps) on a computing device.
- **File management:** Managing the storage of files and folders on your storage device.
- **Memory management:** Managing the data stored on a computing device's memory and once the processing is complete, this function tends to free up some space.

- **Storage management:** Processes used to improve the performance of data storage resources.

GUI (or graphical user interface) – a visual way in which users can interact with a computer (including windows, buttons, menus, images, and text)

Activity 4.1 System software

4.1.1 Define each task in your own words and provide an example.

TASK	DEFINITION AND EXAMPLE
Hardware management	
Graphics User Interface (GUI) management	
I/O management	
Process management	
File management	
Memory management	
Disk management	
Storage management	

4.1.2 What is the advantage of the storage management system recording the date that a file was changed?

4.1.3 Use your computer to complete the following activity.

a. List the steps you should follow to see your computer's performance (using the *Task Manager*).

b. Open the *Task Manager* on Microsoft Windows and write down your computer's current usage for the following hardware.

i. CPU

ii. Memory

iii. Primary HDD

iv. Network

UNIT
4.2 Types of operating systems

Up to now, you have been learning about and working with Microsoft Windows as an example of an operating system. This particular type of operating system is commonly known as a stand-alone operating system. In this unit, we will focus on the following three types of operating systems namely, stand-alone, network and embedded operating systems.

THE STAND-ALONE OPERATING SYSTEM

These operating systems function entirely independently from a network on a computer or mobile device. This ensures that the tasks of an operating system can be performed on the device.

THE NETWORK OPERATING SYSTEM

Network or server operating systems are operating systems designed to help computers work together on a network, rather than used in a stand-alone mode. For example, a large company may have a server running the Windows Server operating system in the organisation. A computer can connect to the same network to gain access to its information, resources, etc. Examples include: *Windows Server, Red Hat Enterprise, Ubuntu Server, and UNIX*.

THE EMBEDDED OPERATING SYSTEM

The embedded operating system is designed for a specific purpose e.g. Smart TVs that connect to the internet, a video camera (Wi-Fi) that can stream live footage and the GPS system that is installed in most mobile devices.

Activity 4.2

4.2.1 Indicate whether the following statements are TRUE or FALSE. Correct the false statements. Change the word(s) in bold text to make the statement TRUE where necessary.

a. **Embedded operating systems** help computers work together on a network.

b. A **network operating system** is an operating system that is designed to be used on its own.

c. **Stand-alone operating system** is designed to be used on a single device with a very specific purpose.

4.2.2 Compare the following operating systems by completing the table.

OPERATING SYSTEM	DESCRIPTION OF THE SYSTEM	EXAMPLE
Stand-alone operating systems		
Network operating systems		
Embedded operating systems		

UNIT
4.3 Utilities and drivers

Operating systems are not the only type of system software in the IT field. There are other additional types of system software. In this unit we will look at the following two types:

- utility programs
- device driver programs.

UTILITY PROGRAMS

A utility program is system software that helps users to analyse, configure, monitor, or help maintain their computers. Most operating systems include a set of basic utilities for users, and additional utilities that could be downloaded if needed. Examples of utilities include:

- back-up software that helps a user create back-up copies of the files on their computer
- a device manager that helps a user install new hardware such as a mouse, USB, etc.
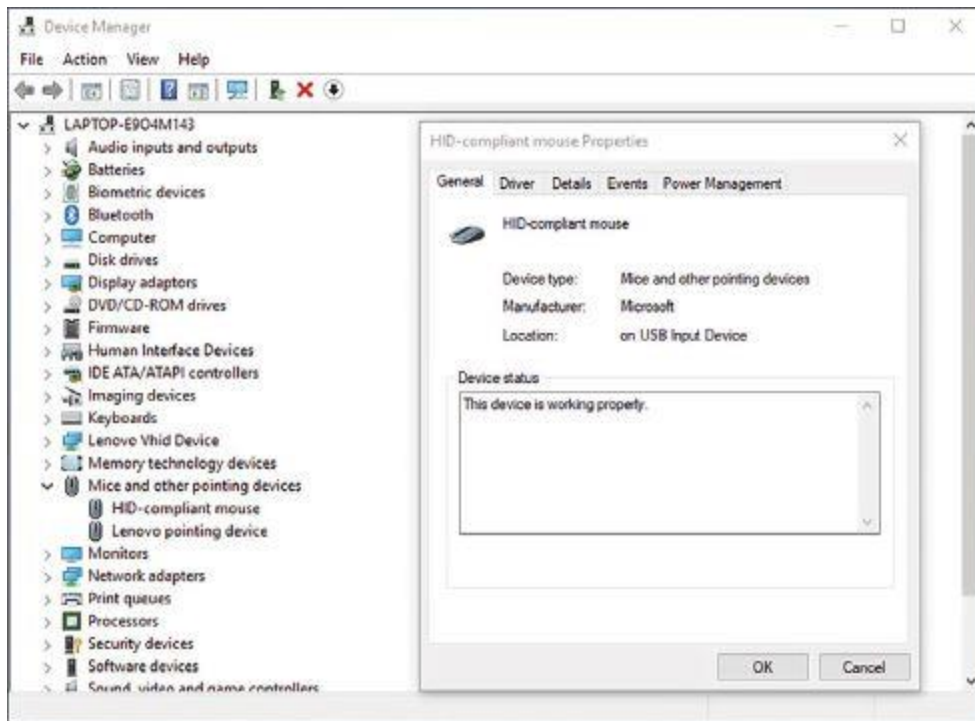
Figure 4.2: *This is a device manager indicating that a device has been installed and is working properly*

- disk cleaners that helps a user to free up space on a storage device
- file managers that allow users to manage the files that are stored on their computers
- system (Task Managers) monitors that summarise a computer's performance for the user.

Without these utilities it would be a lot harder for users to manage and keep their computers running optimally.

DEVICE DRIVER PROGRAMS

A device driver is software that contains a set of instructions that command a computer's operating system on how to communicate with the hardware so that it can function properly. Device drivers allow communication between the operating system and all the devices, such as the mouse, keyboard, printer, etc.

The field of IT is forever changing, so it would be impossible to create an operating system that knows how each device functions or works (especially devices those that

have not yet been invented). It is for this reason that each hardware manufacturer is responsible for developing drivers for their own manufactured devices.

INSTALLING OF DEVICES (USING PLUG & PLAY)

Each time new hardware is connected to a computer, the operating system detects and identifies the hardware. Installation of a new device can then happen in either of the following manners:

- **Automatic   driver   installation**
  The operating system locates the correct driver for the identified device in its driver database. Then it installs them automatically, allowing the computer to communicate with the new device without having to reboot the computer.
- **Manual   driver   installation**
  If a driver is not available from the operating system, a manual installation is required. A manual installation is usually done in Windows via the device manager or the file set-up. This can be found on the hardware's accompanying DVD or downloaded from the manufacturer's website. The DVD will include the driver for that hardware, and it will allow it to function and communicate with the operating system.
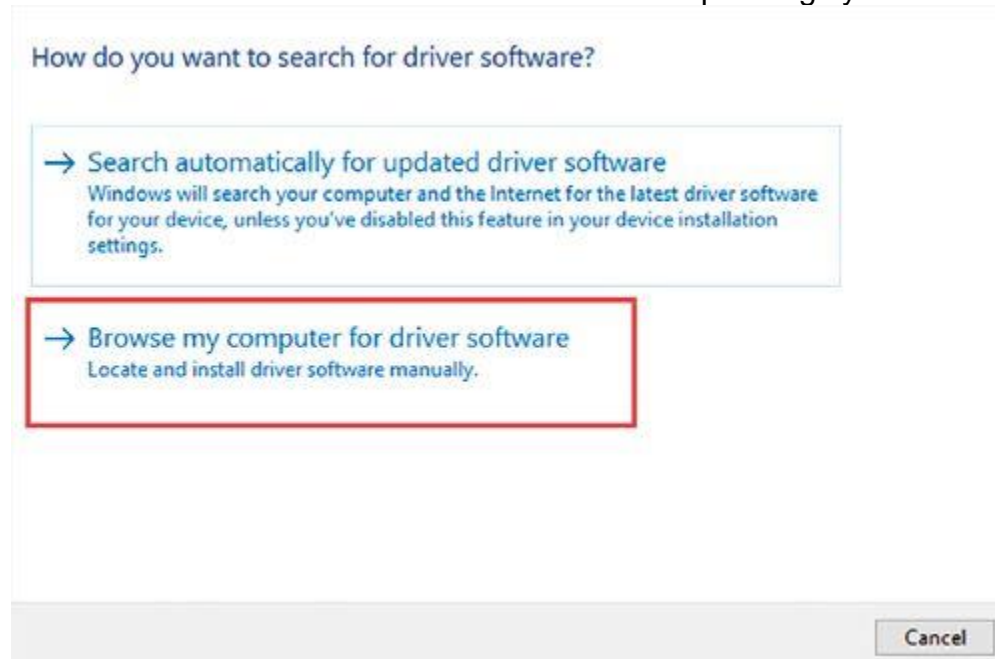
How do you want to search for driver software?

→ Search automatically for updated driver software
Windows will search your computer and the Internet for the latest driver software for your device, unless you've disabled this feature in your device installation settings.

→ Browse my computer for driver software
Locate and install driver software manually.

Cancel

Figure 4.3: *The installation of a USB connected device*

Activity 4.3

4.3.1 What does the term, utility, refer to? Explain this term using your own words.

4.3.2 Which utility program would you use in the following scenarios?

    a. You want to prevent a virus and other dangerous programs from damaging your computer.

    b. You need to install new hardware on your computer.

    c. Your computer is slow, and you need to solve this problem.

    d. You need to ensure that you do not lose any important information and files because there have been more and more error messages on your computer. These error messages tell you that you cannot save your files, and you realise that your hard drive is busy breaking.

    e. You want to keep an eye on how your computer performs.

4.3.3 What role does a device driver play.

4.3.4 Why is a device driver necessary?

4.3.5 Illustrate the steps to install a device, manually and automatically.

CONSOLIDATION ACTIVITY Chapter 4: Basic concepts of system software

Choose the correct answer.

1. Embedded computers are found in …

    a. IOT devices

    b. motor cars

    c. all of the above.

2. A device manager is ...

    a. an application programme

    b. a utility programme

    c. an application tool

3. A desktop computer will typically have …

    a. a stand-alone operating system

    b. a server operating system

    c. none of the above.

4. Storage is usually associated with an …

    a. HDD

    b. SSD

    c. all of the above.

5. What is your option should your computer not have an automatic driver?

    a. Download the driver from the manufacturer's website.

b. Install the driver from the CD/DVD that comes with the hardware.

c. Both A and B.

6. A driver's role is to _____

    a. explain to your operating system how to communicate with the plug-and-play device.

    b. explain to your operating system how to communicate with the hardware device and make it function properly.

    c. explain to your operating system how to communicate with the software device and make it function properly.

7. The following operating systems work directly on computers to ensure sure that the tasks of an operating system are completed.

    a. Stand-alone systems

    b. Embedded operating systems

    c. Network operating systems

8. In order to optimise your computer by playing music and using another application for your essay, you want your operating system to allocate the exact number of resources to these applications that they need to run so that they can both run at the same time. We call this the _____.

    a. Process management system

    b. I/O management system

    c. Hardware management system.

9. Choose a term/concept from COLUMN B that matches a description in COLUMN A. Write only the letter next to the question number (e.g. 1– A). There can be more than one answer to a question. Some of the questions (column A) may have more than one correct answer (column B).

COLUMN A	COLUMN B
1. Manages hardware, software and other applications on a computing device.	A. Storage management system
2. Managing the signals received from an input device and sending the correct signals to an output device.	B. Utility program
3. Lines of code and computer instructions that tell the hardware of a computing device what to do.	C. Embedded
4. Managing the applications and the resources used by applications (Apps) on a computing device.	D. I/O management system
5. Software that contains a set of instructions that command a computer's operating system on how to communicate with the hardware.	E. Software
	F. Operating system
	G. Process management
6. An operating system designed for a specific purpose.	H. Device driver
7. Processes used to improve the performance of data storage resources.	
8. System software that helps users in maintaining their computers	

10. Indicate whether the following statements are TRUE or FALSE. Write 'true' or 'false' next to the question number. Correct the statement if it is FALSE. Change the word(s) in bold text to make the statement TRUE where necessary. You may not simply use the word 'NOT' to change the statement. NO mark will be awarded if only FALSE is written down.

    a. The **I/O manager** makes sure that files are stored correctly.
    b. **File managers** allow users to manage files that are stored on their computers.
    c. **Embedded** operating systems form the backbone of the internet.
    d. **RAM** is responsible for keeping information that the computer is currently using.

11. In your own words, explain why it is important to use drivers.
12. Look at the following advertisements for two computers and answer the questions below:

COMPUTER 1	COMPUTER 2
Intel Core i5 CPU (2.5 GHz)	Intel Core i7 CPU (3.8 GHz)
4GB 2133 MHZ RAM	Nvidia GeForce RTX 2060 GPU
1 TB HDD	8GB 2400 MHZ RAM
Windows 10	256 GB SSD
Mouse, keyboard and speakers	Windows 10
21" HD monitor	Mouse, keyboard and speakers
2-year warranty	27" Full HD monitor
Norton anti-virus standard	2-year warranty

a. Your friend wants to play a game on his computer, but the game keeps crashing with the following error message – "Error: Insufficient Memory".

   i. Which of the two computers advertised above will most likely solve this problem?

   ii. Explain the reason for your choice.

   iii. What does it mean when we say that the operating system is responsible for the memory management in a computer?

b. The advertisements states that, one computer has 8 GB RAM and a 256 GB SSD and the other has 4GB RAM and a 1 TB HDD. What do RAM, SSD and HDD mean?

c. Explain the role of a device driver.

d. Explain system software in your own words.

e. Every computing device must have an operating system loaded, whether it is Windows, Linux, macOS, or Android.

   i. Which operating system is used by both computers in the advertisements?

   ii. What is the main role played by a computer's OS?

   iii. Utility programs are included when an OS is pre-installed on a computer. Give an example of a utility program that is preinstalled.

f. Which computer has another type of system software loaded apart from the operating system?

   i. Write down the computer number.

   ii. Write down the name of the system software referred to.