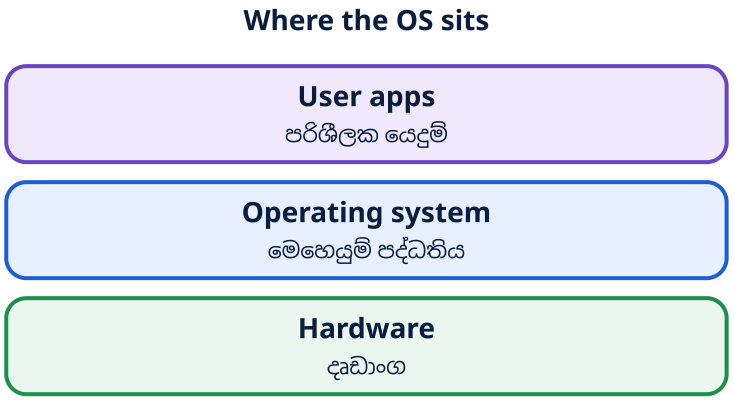
Grade 12 A/L ICT · Lesson 5

5.1 Introduction to Operating Systems: Need, Functions and Classification

Syllabus 5.1. An **operating system (OS)** is the system software that sits between you and the hardware. It provides interfaces, manages processes and resources, and protects the machine. In this part you learn **what an OS is**, a short **history**, its **main functions**, and how we **classify** OS types (single-user, multi-user, multi-tasking, multi-threading, real-time and time-sharing).

1. What is an operating system?

Without an OS you would talk to the CPU in machine code for every file, screen update and key press. The OS is the **manager**: it hides messy hardware details and gives you a safe, useful view – windows, folders, printers and apps.



The OS sits between apps and hardware

💡 Common examples: **Windows**, **macOS**, **Linux**, **Android**, **iOS**, and school lab systems based on Ubuntu or Windows.

2. A short evolution of the OS

- Early machines (1950s): **no OS** – operators loaded one job at a time by hand.
- Batch systems: jobs collected on punched cards and run in a **batch** with little interaction.
- Multi-programming: several jobs stay in memory so the CPU is **rarely idle** while one waits for I/O.
- Time-sharing: many users share the CPU in short **time slices** so each feels interactive.
- Personal and mobile OS: GUI desktops, then smartphones with always-on multitasking.

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3. Main functions of an OS

Interfaces
CLI (commands) and GUI (windows, icons, menus) so people and programs can use the machine.

Process management
Creates, schedules, switches and ends processes (you study this in 5.3).

Resource management
Shares CPU, memory, disks and devices fairly and safely among programs.

Security and protection
Accounts, passwords, permissions and isolation so one program cannot wreck another.

The OS also gives useful **abstractions**: **files** (named streams of bytes), **directories/folders** (named collections of files), and **data** organised for programs. You do not care which disk sector holds your essay – you open a path like `/home/amma/essay.docx`.

🧱 **Worked example: Name the four main OS functions and one abstraction each for "files" and "directories".**
Functions: interfaces, process management, resource management, security/protection.
Abstractions: a **file** is a named byte stream; a **directory** is a named folder of files.

4. Classification of operating systems

Type	Idea	Example flavour	
Single user – single task	One person, one program at a time.	Early MS-DOS style.	
Single user – multi task	One person, many programs at once.	D	ඒ
Multi user – multi task	Many people, many programs, shared machine.	L	L
Multi-threading	One process has several threads of control.	B	ට
Real time	Must meet strict deadlines (cars, robots, medical).	R	ර
Time sharing	CPU switched in short slices among users/jobs.	C	ස

🧱 **Worked example: Is Android on a phone "single user – multi task" or "multi user – multi task"? Explain briefly.**
Mostly **single user – multi task**: one human owner, but many apps run together. (Under the hood Linux can support more users, but the phone UI is single-user.)

💡 **Multi-programming** keeps several jobs in memory to raise CPU use. **Time-sharing** emphasises interactive sharing with short slices. They often appear together on modern OS.

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🚀 **Beyond the syllabus (2026 update)** *Not required for the exam – read for interest.* In 2026, cloud "OS" layers (Linux containers, Kubernetes nodes, Android/iOS) still rest on the same ideas: isolate processes, share CPU and memory, and protect users. Chromebooks and school thin clients often stream a full desktop from a server – that is multi-user time-sharing in a modern jacket.

Key Words

Operating system – System software that manages hardware and provides services to users and apps.

Interface – How you talk to the OS – CLI or GUI.

CLI – Command-line interface – typed commands.

GUI – Graphical user interface – windows, icons, menus, pointer.

Process management – Creating, scheduling and ending running programs.

Resource management – Sharing CPU, memory, disk and devices among programs.

Security and protection – Keeping users and programs from harming each other or the system.

File abstraction – A named stream of bytes managed by the OS.

Directory – A named folder that organises files (and other directories).

Multi-programming – Keeping several jobs in memory so the CPU stays busy.

Time sharing – Giving each user/job a short turn on the CPU.

Real-time OS – An OS that must answer within a fixed deadline.

Sample Q&A

1. Define an operating system.

> **Answer:** System software that manages computer hardware and provides a convenient, safe interface for users and application programs.

2. List four main functions of an OS.

> **Answer:** Providing interfaces; process management; resource management; security and protection.

3. What abstractions does an OS give for stored data?

> **Answer:** Files (named byte streams) and directories/folders that organise them.

4. Distinguish multi-programming and time-sharing.

> **Answer:** Multi-programming keeps several jobs in memory to reduce CPU idle time; time-sharing switches the CPU in short slices for interactive sharing.

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5. What is a real-time OS used for?

> **Answer:** Systems that must meet strict timing deadlines, such as vehicle controllers, robots and medical devices.

6. Give one example of single-user multi-task and one of multi-user multi-task.

> **Answer:** Single-user multi-task: a home Windows PC. Multi-user multi-task: a Linux school server with many logins.

MCQ

1. An operating system is best described as

A. the CPU chip itself
B. only a word processor
C. system software that manages hardware and serves apps/users
D. a printer cable
E. a single application game

2. Which is an OS function?

A. smelting iron
B. drawing paper maps only
C. tax collection
D. writing novels for the user
E. process management

3. GUI means

A. Graphical User Interface
B. Gateway User Internet
C. Graphics Under Integer
D. General USB Input
E. Global Unit Index

4. A file, to the OS, is mainly

A. a password only
B. a network cable
C. always a picture
D. a named stream of bytes
E. the CPU cache

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5. Time-sharing emphasises

A. turning the machine off
B. one job until it ends with no switching
C. short CPU slices for interactive users
D. only printing
E. disk formatting only

6. A real-time OS must

A. never use memory
B. meet strict timing deadlines
C. support only one font
D. avoid all files
E. run only on paper

7. Single user – single task means

A. one person, one program at a time
B. only real-time control
C. no users
D. only networking
E. many people, many programs

8. Multi-threading means

A. formatting a disk
B. many CPUs with no OS
C. one process has several threads of control
D. no processes at all
E. only one bit of RAM

9. Which sits between apps and hardware?

A. the monitor cable
B. only the keyboard
C. a blank CD
D. the chair
E. the operating system

10. Resource management includes sharing the

A. school timetables on paper
B. CPU, memory, disk and devices
C. only the wallpaper
D. only the font size
E. weather only

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11. Batch systems historically

A. had no CPU
B. gave each user a smartphone GUI
C. printed nothing
D. were only used in cars
E. ran collected jobs with little interaction

12. Security and protection help to

A. remove all passwords
B. make the screen brighter only
C. increase font size only
D. stop programs/users harming each other or the system
E. disable the disk

13. Which term means: “System software that manages hardware and provides services to users and apps”?

A. Time sharing
B. Resource management
C. File abstraction
D. Operating system
E. CLI

14. Which term means: “How you talk to the OS – CLI or GUI”?

A. Interface
B. Security and protection
C. Directory
D. GUI
E. Real-time OS

15. Which term means: “Command-line interface – typed commands”?

A. CLI
B. Multi-programming
C. Process management
D. File abstraction
E. Operating system

16. Which term means: “Graphical user interface – windows, icons, menus, pointer”?

A. Interface
B. Time sharing
C. Directory
D. Resource management
E. GUI

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17. Which term means: “Creating, scheduling and ending running programs”?

A. CLI
B. Process management
C. Real-time OS
D. Multi-programming
E. Security and protection

18. Which term means: “Sharing CPU, memory, disk and devices among programs”?

A. GUI
B. Time sharing
C. Resource management
D. File abstraction
E. Operating system

19. Which term means: “Keeping users and programs from harming each other or the system”?

A. Real-time OS
B. Security and protection
C. Interface
D. Directory
E. Process management

20. Which term means: “A named stream of bytes managed by the OS”?

A. Multi-programming
B. CLI
C. Resource management
D. File abstraction
E. Operating system

Structured Questions

1. Define an OS and state why a computer needs one. *(2 marks)*

> System software managing hardware / serving apps (1); without it users would handle every device detail and sharing would be unsafe/hard (2).

2. List the four main OS functions with one sentence each. *(4 marks)*

> Interfaces (1); process management (1); resource management (1); security/protection (1).

3. Explain file and directory abstractions. *(3 marks)*

> File = named byte stream (1); directory = named container of files/dirs (1); hide physical sectors (1).

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4. Compare single-user multi-task and multi-user multi-task OS. *(3 marks)*

> Single: one login, many apps (1); multi-user: many logins share machine (1); example each (1).

5. Distinguish multi-programming and time-sharing; mention real-time OS briefly. *(3 marks)*

> Multi-programming: several jobs in memory / CPU busy (1); time-sharing: short interactive slices (1); real-time: strict deadlines (1).

Summary

- An OS manages hardware and offers a safe interface to users and apps.
- Main functions: interfaces, processes, resources, security/protection.
- Abstractions include files and directories.
- OS types: single/multi user, multi-task, multi-thread, real-time, time-sharing.
- Evolution moved from no OS → batch → multi-programming → time-sharing → personal/mobile.

MCQ answer key – 5.1

1. **C** – OS = system software manager.
2. **E** – Process management is a core OS role.
3. **A** – Windows/icons/menus.
4. **D** – File abstraction.
5. **C** – Short turns on the CPU.
6. **B** – Deadlines matter.
7. **A** – Classic early PC/DOS style.
8. **C** – Threads inside a process.
9. **E** – OS layer.
10. **B** – Classic resources.
11. **E** – Punched-card batches.
12. **D** – Isolation and permissions.
13. **D** – Operating system – System software that manages hardware and provides services to users and apps.
14. **A** – Interface – How you talk to the OS – CLI or GUI.
15. **A** – CLI – Command-line interface – typed commands.
16. **E** – GUI – Graphical user interface – windows, icons, menus, pointer.
17. **B** – Process management – Creating, scheduling and ending running programs.
18. **C** – Resource management – Sharing CPU, memory, disk and devices among programs.
19. **B** – Security and protection – Keeping users and programs from harming each other or the system.
20. **D** – File abstraction – A named stream of bytes managed by the OS.

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