

Chapter 3: Operating Systems and File Management

In this chapter, you will learn how operating systems manage the hardware and software that make computers usable. You will explore how files and folders are organized, discover strategies for managing digital information, and understand how cloud storage makes files accessible across multiple devices. These skills will help you work more efficiently and keep your digital information organized.

Learning Objectives

- Define what an operating system is and explain its purpose.
- Identify the major functions of an operating system.
- Compare the features of common operating systems, including Microsoft Windows, macOS, Linux, Android, and iOS.
- Explain how the operating system manages hardware, software, memory, files, and user interfaces.
- Describe the difference between files, directories, and folders.
- Understand how to create, rename, move, copy, and delete files and folders.
- Explain the importance of organizing files using an effective folder structure.
- Identify common file types and file extensions.
- Describe different storage locations, including local drives, external drives, network drives, and cloud storage.
- Explain best practices for backing up and protecting important files.
- Apply file management skills to organize digital information efficiently.

Operating Systems

What would we do without operating systems?

Imagine that tomorrow morning every operating system in the world suddenly stopped working.

- Your computer would not start.
- Your smartphone would only display a blank screen.
- ATMs could not process transactions.
- Airline reservation systems would stop functioning.
- Hospitals would lose access to patient records.
- Traffic lights and many factory control systems could stop operating.

Although most people rarely think about operating systems, they are the software that makes every modern computer, smartphone, tablet, and many other everyday devices usable.

Think About It

- How many devices have you used today that rely on an operating system?
- Have you ever lost an important file because you couldn't remember where you saved it?
- What file organization system do you currently use? Does it help you find documents quickly?

As you read this chapter, think about how an operating system quietly manages your computer and how good file organization can save time, reduce frustration, and protect important information.

A Conductor Inside Every Computer

Every computer, smartphone, tablet, and smart device relies on an **operating system** to function. Similar to how the conductor of an orchestra directs the performance of every musician, the operating system manages all aspects of the computer: coordinating hardware, running applications, organizing files, and providing the interface that allows users to interact with their devices.

The operating system does much more than simply start the computer and launch applications. It works in the background, making sure that hardware and software work together efficiently. Every time you open an application, print a document, save a file, or connect to the Internet, the operating system is coordinating dozens of tasks behind the scenes.

Without an operating system, each application would have to communicate directly with every hardware device. This would make computers much more difficult to use and software much harder to develop.

Major Functions of an Operating System

1. Process Management

A **process** is a program that is currently running. The operating system allows multiple programs to run at the same time by deciding:

- which process gets to use the CPU next and for how long
- when one process should pause or resume so other processes can all take turns accessing the CPU without conflicts.

For example, you can listen to music, browse the web, edit a document, and receive email notifications all at the same time because the operating system rapidly switches the CPU between tasks.

2. Memory Management

The operating system manages the computer's **Random Access Memory (RAM)**. It decides:

- which applications receive memory
- how much memory each application may use
- when memory should be released

Efficient memory management allows many applications to operate without interfering with one another.

3. Device Management

Computers contain many hardware devices, including keyboards, printers, monitors, webcams, storage devices, etc.

The operating system communicates with these devices using **device drivers**. A device driver is software that allows the operating system to communicate with a specific piece of hardware.

4. File Management

One of the most visible responsibilities of the operating system is organizing files. It allows users to:

- create folders
- save files
- rename files
- move and copy files
- delete files
- search for files

5. Security

Operating systems offer various methods to protect computers and the data stored on them:

- user accounts
- passwords
- permissions
- encryption
- antivirus support
- automatic security updates

These features help prevent unauthorized access to information.

6. User Interface

The operating system provides the interface that allows people to interact with the computer. This includes:

- desktop
- icons
- windows
- menus
- taskbar or dock
- touch gestures

Without a user interface, operating a computer would require typing complex commands.

Putting It All Together

Every time you use a computer, the operating system performs thousands of tasks every second. Although most of this work happens behind the scenes, it is essential for keeping the computer organized, secure, and responsive.

Technology in Action

Suppose you are writing a paper while listening to music and participating in a video meeting. The operating system is simultaneously:

- managing the CPU
- allocating memory
- sending sound to your speakers
- displaying video
- saving your document
- monitoring your internet connection

All of these activities happen automatically.

Quick Check

1. What is a process?
2. Why is memory management important?
3. What is a device driver?
4. What is the purpose of file management?
5. Give two examples of operating system security features.

Major Functions of an Operating System

Function	What It Does:	Example:
Process Management	Runs multiple programs	Switching between a browser and a word processor
Memory Management	Allocates RAM	Giving memory to an application
Device Management	Controls hardware	Sending a document to a printer
File Management	Organizes data	Saving files into folders
Security	Protects users and data	Passwords and permissions
User Interface	Allows user interaction	Desktop, icons, and windows

Table 3.1 – Major Functions of an Operating System

Types of Operating Systems

After completing this section, you should be able to:

- Identify the major operating systems.
- Compare desktop and mobile operating systems.
- Describe where each operating system is commonly used.

Common Operating Systems

Although all operating systems perform similar basic functions, they are designed for different types of devices and users. The five operating systems encountered most often are: Windows, macOS, Linux, Android, and iOS.

Windows

Microsoft Windows is the most widely used desktop operating system. It is commonly found on:

- home computers
- schools
- businesses
- gaming computers

Advantages include:

- broad software compatibility
- extensive hardware support
- large user community

macOS

macOS is Apple's operating system for Mac computers (short for Macintosh). It is known for:

- ease of use
- strong integration with Apple devices
- creative software
- stability

Linux

Linux is an open-source operating system. It is widely used for:

- servers
- cloud computing
- programming
- cybersecurity
- supercomputers

Many versions of Linux exist; they are called **distributions**.

Android

Android is Google's mobile operating system. It powers many:

- smartphones
- tablets
- televisions
- wearable devices

Because it is open source, many manufacturers customize Android for their own devices.

iOS

iOS is Apple's mobile operating system. It is used on iPhones.

Apple's iPad uses **iPadOS**, which is closely related to iOS but includes additional features designed specifically for tablets. iOS is known for:

- security
- reliability
- consistent user experience

The Job of Every Operating System

Although each operating system has a different appearance, they all perform the same fundamental responsibilities:

- managing hardware
- running applications
- organizing files
- providing security
- offering a user interface

Common Operating Systems

Operating System	Common Devices	Developed By	Typical Users
Windows	PCs	Microsoft	Home, education, business users
macOS	Mac computers	Apple	Education, creative professionals
Linux	Servers and PCs	Open-source community	Developers, researchers, business users
Android	Phones and tablets	Google	Mobile users
iOS / iPadOS	iPhone and iPad	Apple	Mobile users

Table 3.2 – Common Operating Systems

Quick Check

1. Which operating system is open source?
2. Which company develops Windows?
3. Which operating system is commonly used on iPhones?
4. Which operating system powers many servers?
5. Name two similarities shared by all operating systems.

The User Interface

After completing this section, you should be able to:

- Identify common graphical user interface (GUI) elements.
- Navigate a desktop environment.
- Explain how windows, icons, and menus improve usability.

The **User Interface (UI)** is the part of the operating system that allows people to interact with a computer.

Most modern operating systems use a **Graphical User Interface (GUI)**, which enables users to interact with pictures, icons, buttons, and menus instead of typing commands.

Although Windows, macOS, Linux, Android, and iOS look different, they all include similar interface elements.

Desktop

The desktop is the main workspace that appears after you sign in. It may contain:

- shortcuts
- folders
- files
- wallpaper
- taskbar or dock

Think of the desktop as the top of a physical desk where frequently used items are kept within easy reach.

Icons

Icons are small pictures that represent:

- applications
- files
- folders
- storage devices
- system settings

Double-clicking (or tapping) an icon usually opens it.

Menus

Menus display lists of commands and options. Examples include:

- File
- Edit
- View
- Help

Menus organize commands so users can easily find them.

Windows

A **window** is a rectangular area where a program runs. Most windows include:

- title bar
- minimize button
- maximize button
- close button
- scroll bars

Multiple windows allow users to multitask efficiently.

Taskbar or Dock

Most operating systems provide quick access to applications.

- Windows uses the Taskbar.
- **macOS** uses the **Dock**.

These areas display frequently used applications and programs that are currently running.

Touch Interfaces

Smartphones and tablets replace the mouse with gestures such as:

- tap
- swipe
- pinch
- drag

Touch interfaces make mobile devices easy to operate.

Common User Interface Elements

Interface Element	Purpose
Desktop	Main workspace
Icons	Represent programs, files, and folders
Windows	Display running applications
Menus	Organize commands
Taskbar / Dock	Quick access to applications
Pointer or Touch	Selects and manipulates objects

Table 3.3 – Common User Interface Elements

Technology in Action

Whether you use Windows, a Mac, an Android phone, or an iPhone, you'll notice many familiar interface features. Once you learn the basic ideas of desktops, icons, windows, and menus, adapting to a new operating system becomes much easier because the underlying concepts remain similar.

Quick Check

1. What is a graphical user interface?
2. What is the purpose of an icon?
3. What is displayed inside a window?
4. How is a taskbar similar to a dock?
5. Name two common touch gestures.

File Organization

Files, Directories, and Folders

One function of the operating system, as we touched on above, is managing the computer's file system. This is the way all data is stored, whether it is on the computer's internal drives, portable drives, or remote cloud storage. This data is arranged in files, folders, and directories.

Files

These contain the actual data the computer interacts with. Some files contain text, some contain the lines of code a program uses to run, and some contain the information that makes up a digital image, an audio track, or a video.

Directories

These are the containers in which files are stored. Directories can contain files or other directories. The first level on any storage device is the **root directory**; all directories inside other directories are called **subdirectories**.

A **directory tree** is the structure in which these files and directories are organized: long branches of directories inside directories and the files inside them, all spreading out from the root.

Folders

A folder is the visual representation of a directory as viewed through a graphical user interface (GUI.) When you click to open a folder on a modern computer, the window that pops up represents the corresponding directory in the computer's file system. Inside this window are various icons representing different types of files located here and folder icons that represent any subdirectories.

Manipulating Files and Folders

On operating systems that use a text-based user interface, manipulating files requires typing in precise commands to create, rename, or delete files or directories, or to move or copy them to a different location.

On operating systems that use a graphical user interface, this is all much easier. To move a file, simply drag the icon from one folder to another, and it will appear visually in the new location. Right-clicking or Control-clicking a file or folder brings up a context menu with options for renaming, deleting, and performing multiple other operations.

File Types

Most filenames are composed of a descriptive **base name**, followed by a period, then a three- or four-letter **file extension**. The file extension tells you what type of file it is and tells the operating system which application to open it with.

Common File Extensions

File Extension	File Type	Application
.txt	Plain text file	Notepad
.doc or .docx	Word document	Microsoft Word
.xls or .xlsx	Excel spreadsheet	Microsoft Excel
.ppt or .pptx	PowerPoint presentation	Microsoft PowerPoint
.pdf	Portable document format	Adobe Acrobat or the default pdf viewer
.htm or .html	Web page markup file	The default web browser
.jpg or .jpeg	Compressed image format	The default image viewer
.mp3	Compressed audio format	The default music player
.mov	Apple QuickTime movie format	The default video player

Table 3.4 – Common File Extensions

Modern operating systems sometimes hide the file extension and only show the base name. Usually, the file icon will be a distinctive image that indicates visually what kind of file it is.

A Note About File Types

Some operating systems like Linux and older versions of macOS identify the file type by code within the file, but Microsoft Windows uses the file extension to determine what program to open the file with.

You can rename the file, but manually changing the file extension does not change the file type. For example, changing the file extension of a Word document from .docx to .pdf does not convert the file to portable document format. If you try to open the renamed file, your pdf program will not know how to read it and you will get an error.

To convert a Word document to .pdf, open the .docx file in Word and save a copy in the pdf format.

The Importance of Good File Organization

Emma is a first-year college student taking five classes. During the first week of the semester, she saves assignments wherever it's convenient: some on her laptop's desktop, others in the Downloads folder, and a few in cloud storage. She gives files names like "Homework," "Essay," and "Final Version."

A month later, one of her instructors asks her to revise a paper she submitted earlier in the semester. Emma searches her laptop but finds six different files with similar names:

- Essay
- Essay Final
- Essay Final New
- Essay Final Really Final
- Essay Latest
- Essay Final Revised

She can't remember which one she submitted, and some versions are missing important changes. Frustrated, she spends more time searching for the correct file than revising the assignment.

By using good file management skills, Emma could stay organized and save herself a lot of time. Imagine how easy it would be to locate the latest version of that essay if she had created an effective folder structure and used descriptive file names:

```
<School>
  <History 101>
    History_Essay1-01.docx
    History_Essay1-02.docx
    History_Essay1-03-final.docx
```

Tech Tip

Good file management is more than keeping your computer organized, it is an essential skill for success in college and the workplace.

Data Storage

File organization does not just apply to the internal storage on your computer. There are multiple options for storing data:

Internal Computer Storage (Hard Drive or SSD)

Advantages: Fast. Convenient to access

Disadvantages: If something happens to your computer, the data may be lost.

Portable Physical Storage (USB Flash Drive)

Advantages: Easy to carry. Accessible from any computer.

Disadvantages: Slower than internal storage. If something happens to the drive, the data may be lost.

Network Drive (Company or Home Server)

Advantages: The server can be set to run periodic backups. Files are accessible from any computer on the network.

Disadvantages: If the network or server is down or inaccessible, you will not be able to access your data.

Online Cloud Storage

Advantages: Cloud platforms keep secure backups. Files are accessible from any computer connected to the internet.

Disadvantages: Slow to access. If you don't have an internet connection, you will not be able to access your data.

The best solution is a combination of the above methods. Keep multiple copies of your data and perform regular backups so your files are replicated across multiple locations. There are backup programs that can automate this process. If you use good file organization and maintain the same structure of folders in all locations, the backup software can scan your data and make sure the latest version of each file is copied to every location.

Quick Check

1. What is the difference between files, directories, and folders?
2. How does a graphical user interface affect file management?
3. What are file types?
4. Why is file management important?
5. What options are available for Data storage?

Chapter Summary

Every computer, smartphone, tablet, and smart device relies on an operating system to function. The OS works in the background, making sure that hardware and software work together efficiently. It manages processes, memory, devices, the file system, security, and the user interface.

The User Interface (UI) is the part of the operating system that allows people to interact with a computer. Most modern operating systems use a Graphical User Interface (GUI), which allows you to interact visually instead of with text commands.

File organization is the way files and folders are arranged on a storage device. It is good practice to maintain an organized file and folder structure. This makes it easier to find files and keep secure backups across multiple storage devices.

Think about it

Employers expect employees to know how to navigate operating systems, organize information, and protect valuable data. These skills are essential in nearly every profession, from healthcare and education to business, engineering, and information technology. By mastering the concepts in this chapter, you will develop practical computer skills that will help you succeed in college, in your career, and in your personal life.