

Internet and Information Technology

Lecture 5

ITC202

Operating Systems and Utility Programs

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Chapter 5:
**Operating
Systems and
Utility
Programs**

The Operating System

Operating Systems for Personal
Computers and Servers

Operating Systems for Mobile Phones

Utility Programs

Functions of an Operating System

Processing Techniques for Increased Efficiency

DOS

Windows

UNIX

Mac OS

Linux

Android

iPhone OS

File Management Programs

Search Tools

Diagnostic and Disk Management Programs

Uninstall and Cleanup Utilities

File Compression Programs

Backup and Recovery Utilities

Antivirus, Antispyware, Firewalls

Learning Objectives

1. Understand the difference between system software and application software.
2. Explain the different functions of an operating system and discuss some ways that operating systems can enhance processing efficiency.
3. List several ways in which operating systems differ from one another.
4. Name today's most widely used operating systems for personal computers and servers.

Learning Objectives

5. Discuss the role of utility programs and outline several tasks these programs perform.
6. Describe what the operating systems of the future might be like.

System Software and Application Software

- **System software:** The operating system and utility programs that control a computer system and allow you to use your computer.
 - Enables the boot process, launches applications, transfers files, controls hardware configuration, manages hard drive, and protects from unauthorized use.
- **Application software:** Programs that allow a user to perform specific tasks on a computer.
 - Word processing, playing a game, preparing taxes, browsing the Web, and so forth.

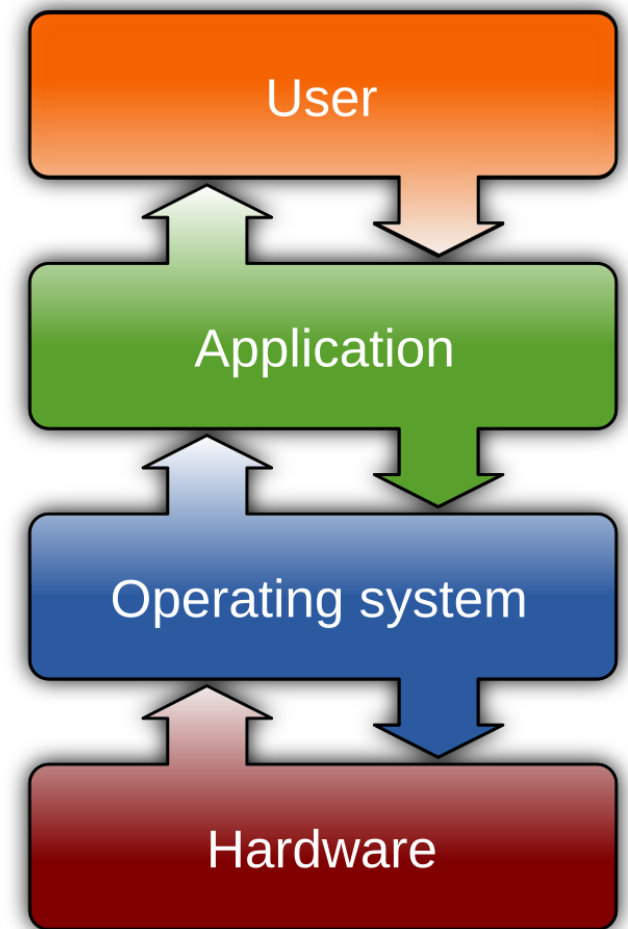


The Operating System

- **Operating system:** is a collection of programs that **manage** and **coordinate** the activities taking place within the computer and it is the most critical piece of software installed on the computer.
- The operating system **boots** the computer, **launches** application software, and ensures that all actions requested by a user are valid and processed in an orderly fashion.
- When you issue the command for your computer to store a document on your hard drive, the operating system must perform the **following steps**:
 1. Make sure that the specified hard drive exists
 2. Verify that there is adequate space on the hard drive to store the document and then store the document in that location
 3. Update the hard drive's directory with the filename and disk location for that file so that the document can be retrieved again when needed.

The Operating System

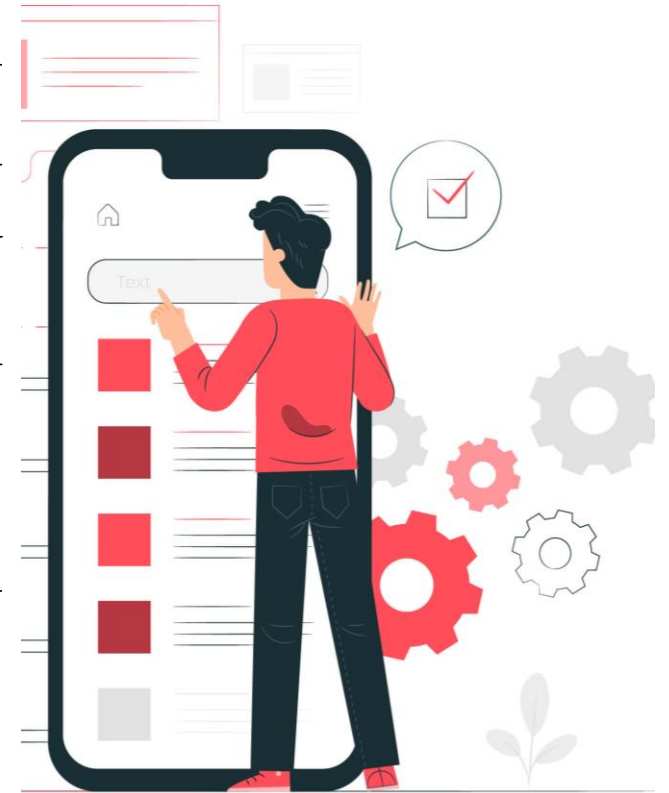
- Operating system serves as an **intermediary** between the user and the computer, as well as between application programs and the computer system's hardware
- Without an operating system, no other program can run, and the computer cannot function.
- Many tasks performed by the operating system, however, go unnoticed by the user because the operating system works in the background much of the time.



Functions of an Operating System

Interfacing with Users

- Translate user instructions into a form the computer can understand. It also translates any feedback from hardware—such as a signal that the printer has run out of paper or that a new hardware device has been connected to the computer—into a form that the user can understand.
- The means by which an operating system or any other program interacts with the user is called the **user interface**
- **User interfaces** can be text-based or graphics-based.



Functions of an Operating System

Booting the Computer

- kernel is loaded into memory. The kernel remains in memory the entire time the computer is on so that it is always available; other parts of the operating system are retrieved from the hard drive and loaded into memory when they are needed.
- Before the boot process ends, the operating system determines the hardware devices that are connected to the computer and configured properly.



Functions of an Operating System

Configuring Devices

- Small programs called drivers are used to communicate with peripheral devices, such as monitors, printers, and keyboards.
- Drivers often come on a CD packaged with the peripheral device, or they can be downloaded from the manufacturer's Web site.
- Operating systems look for and recognize new devices each time the computer boots. If a new device is found, the operating system typically tries to install the appropriate driver automatically in order to get the new hardware ready to use.

Functions of an Operating System

Managing and Monitoring Resources and Jobs

- Operating system continuously manages your computer's resources (such as software, disk space, and memory) and makes them available to devices and programs when they are needed.
- If a problem occurs—such as a program stops functioning or too many programs are open for the amount of memory installed in the computer—the operating system notifies the user and tries to correct the problem, often by closing the offending program
- If the problem cannot be corrected by the operating system, then the user typically needs to reboot the computer.

Functions of an Operating System

File Management



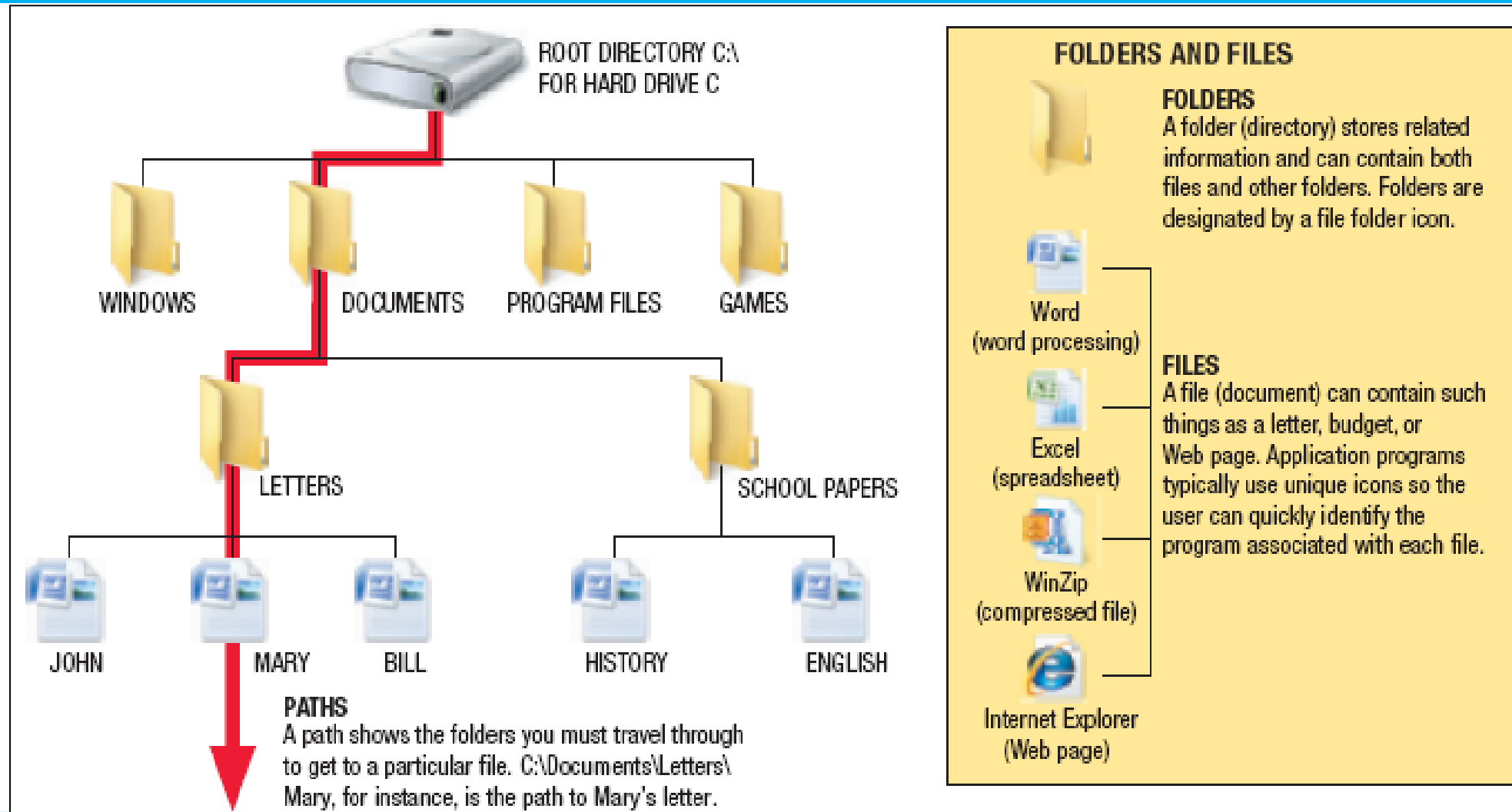
- Keeping track of the files stored on a computer so that they can be retrieved when needed.
- Operating system files are stored inside one folder (such as a windows folder), and each application program is stored in its own separate folder inside a main programs folder (such as program files).
- Files and folders are usually viewed in a hierarchical format

Functions of an Operating System

File Management

- Top of the hierarchy for any storage medium is called the root directory (such as C: for the root directory of the hard drive C)
- To access a file, you generally navigate to the folder containing that file by opening the appropriate drive, folder, and subfolders. Alternatively, you can specify the path to a file's exact location.
- For example: c:\ documents\ letters\ mary

Functions of an Operating System



Functions of an Operating System

File Management

- Filenames typically include a file extension at the end of the filename.
- **File extensions** are three or four characters preceded by a period and are automatically added to a filename by the program in which that file was created.
- File extensions should not be changed by the user because the operating system uses them to identify the program that should be used to open the file.

Functions of an Operating System

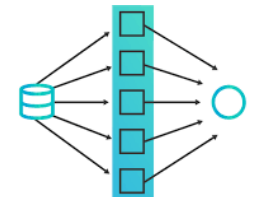
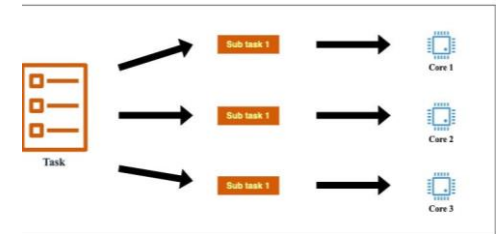


Security

- Operating system can use passwords, biometric characteristics (such as fingerprints), and other security procedures to prevent outsiders from accessing system resources that they are not authorized to access.
- Most operating systems have other security features available, such as an integrated firewall to protect against unauthorized access via the Internet
- Operating system passwords can also be used to ensure that administrative level operating system tasks (such as installing programs or changing system settings) are performed only by authorized users.

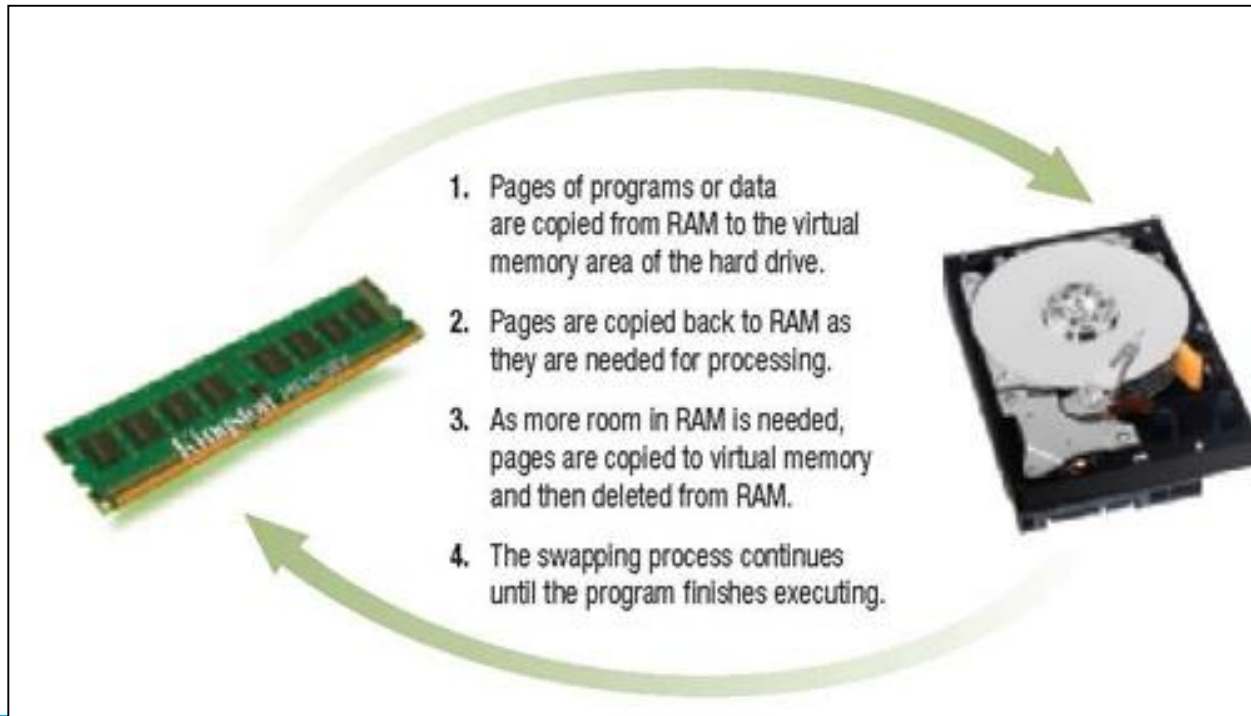
Processing Techniques for Increased Efficiency

- **Multitasking:** The ability of an operating system to have more than one program (task) open at one time
 - CPU rotates between tasks.
 - Switching is done quickly.
 - Appears as though all programs executing at the same time.
- **Multiprocessing and parallel processing:** Multiple processors (or multiple cores) are used in one computer system to perform work more efficiently.
 - **Multiprocessing:** Each CPU typically works on a different job.
 - Used with personal computers with multi-core processors.
 - **Parallel processing:** CPUs or cores typically work together to complete one job more quickly.
 - Used with servers and mainframes.



Processing Techniques for Increased Efficiency

- **Memory management:** Optimizing the use of main memory (RAM)
 - Virtual memory: Memory-management technique that uses hard drive space as additional RAM.



Differences Among Operating Systems



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- ```
Starting MS-DOS...

HIMEM is testing extended memory...done.

C:\>C:\DOS\SMARTDRV.EXE /X

MODE prepare code page function completed

MODE select code page function completed
C:\>dir

Volume in drive C is MS-DOS_6
Volume Serial Number is 40B4-7F23
Directory of C:\

DOS <DIR> 12.05.20 15:57
COMMAND.COM 54 645 94.05.31 6:22
WINA20 9 349 94.05.31 6:22
CONFIG.SYS 144 12.05.20 15:57
AUTOEXEC.BAT 188 12.05.20 15:57
5 file(s) 64 326 bytes
24 760 320 bytes free

C:\>
```

# Windows history

```
C:\>_
```



# Operating Systems for Personal Computers and Servers

- **UNIX:** Operating system developed in the late 1960s for midrange servers.
  - Multiuser, multitasking operating system.
  - More expensive, requires a higher level of technical knowledge; tends to be harder to install, maintain, and upgrade.
- **Mac OS:** Proprietary operating system for computers made by Apple Corporation
  - Based on the UNIX operating system; originally set the standard for graphical user interfaces



# Linux

Guru99.com

# Linux

- **Free open-source** software that has been collaboratively modified by volunteer programmers all over the world.
- Linux's source code is freely available for anyone to view, modify, and distribute, leading to numerous versions known as **Linux distributions** such as Ubuntu, Fedora, or Debian, each offering different features and user interfaces. .
- It powers a vast range of devices, from servers and Android smartphones to supercomputers, and is highly valued in tech for its flexibility, security, and customization.



Linux™

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## Case Study: The Fall of Windows Mobile – Strategic Missteps in Tech Management

- In the early 2000s, **Microsoft** was a dominant force in desktop operating systems. Seeing the rise of mobile computing, it launched **Windows Mobile** to capture the smartphone market. Initially, it had a strong presence, especially among business users.
- However, by the mid-2010s, Windows Mobile had virtually disappeared, overtaken by **Apple's iOS** and **Google's Android**. This case explores the strategic and managerial reasons behind this failure.



## Strategic Analysis of the Windows Mobile Failure:

### 1. Lack of Market Vision

- ❖ Mistake: Microsoft treated smartphones as mini-PCs, not as a new category with unique user needs.
- ❖ Impact: The interface was complex and not optimized for touchscreens, unlike the intuitive design of the iPhone.
- 🎓 Lesson: A successful strategy requires understanding the unique dynamics of emerging markets, not just applying old models.



## Strategic Analysis of the Windows Mobile Failure:



### 2. Slow Response to Disruption

- ❖ Mistake: After the iPhone launched in 2007, Microsoft took three years to release Windows Phone 7.
- ❖ Impact: The delay allowed Apple and Android to dominate the market and build strong ecosystems.
- 🎓 Lesson: In fast-moving industries, speed and agility are critical to survival.

## Strategic Analysis of the Windows Mobile Failure:

### 3. Weak Developer Ecosystem



- ❖ Mistake: Microsoft failed to attract app developers due to complex tools and low user adoption.
- ❖ Impact: The app store lacked variety, making the platform less attractive to consumers.
- 🎓 Lesson: A product's success often depends on the strength of its ecosystem, not just its core features.

## Strategic Analysis of the Windows Mobile Failure:



### 4. Poor Strategic Partnerships

- ❖ Mistake: Microsoft partnered with Nokia too late and eventually acquired it in a costly move.
- ❖ Impact: The acquisition failed to revive Windows Mobile and led to massive financial losses.
- 🎓 Lesson: Strategic alliances must be timely, well-integrated, and aligned with long-term goals.

## Strategic Analysis of the Windows Mobile Failure:

- Windows Mobile's failure was not just technological—it was a result of **strategic misjudgments**, including:
  - ❖ Misreading market trends
  - ❖ Delayed innovation
  - ❖ Weak ecosystem development
  - ❖ Mismanaged partnerships

# Operating Systems for Mobile Phones and Other Devices



- **Android:** Linux-based mobile operating system developed by Google and used on a wide variety of devices including smartphones, tablets, smartwatches, TVs, and cars.
- **Android characteristics**
  - ❖ **Open-Source:** Android's source code is freely available for developers, device makers, and designers to use, modify, and redistribute, fostering innovation and a wide ecosystem of devices.
  - ❖ **Google-Developed:** Android was initially developed by Android, Inc. and later acquired by Google, which continues to maintain and develop it for the Android Open-Source Project.
  - ❖ **Versatile:** It's used across numerous device types beyond just phones and tablets, including smartwatches, Android-powered TVs, and in-car systems.



# Operating Systems for Mobile Phones and Other Devices

- **iOS:** Apple's proprietary mobile operating system that powers its iPhones and other devices, providing the software platform for apps and device functions through a user-friendly interface and robust security.



- **Key characteristics of iOS:**

- ❖ **Apple-exclusive:** iOS is designed exclusively for Apple's hardware, including the iPhone and, historically, the iPod Touch.
- ❖ **Closed-Source:** The source code for iOS is proprietary to Apple, meaning only the company can modify and develop it.
- ❖ **Ecosystem Integration:** iOS is part of Apple's broader ecosystem, integrating seamlessly with other Apple products, services, and hardware.
- ❖ **App Store:** Applications for iOS devices are available through the Apple App Store, which hosts millions of apps for various needs.
- ❖ **Security:** iOS incorporates strong security features, such as encryption and regular system updates, to protect user data.



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# Utility Programs

- **Utility program:** Software that performs a specific task, usually related to managing or maintaining the computer system.
- Many utilities are built into operating systems (for finding files, viewing images, backing up files, etc.).
- Utilities are also available as stand-alone products and as suites.



# Utility Programs

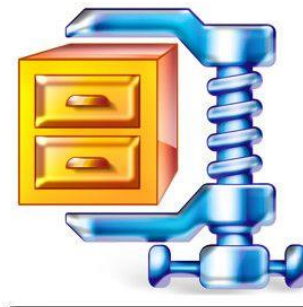
- **File management programs:** Enable the user to perform file management tasks, such as:
  - ❖ Looking at the Folders and Files Stored on a Computer
  - ❖ Copying, moving, and renaming files and folders.
  - ❖ Deleting files and folders.
  - ❖ File management program in Windows is **Windows Explorer**.

# Utility Programs

- **Search tools:** Designed to search for files on the user's hard drive. 
- **Diagnostic programs:** Evaluate your system and make recommendations for fixing any errors found. 
- **Disk management programs:** Diagnose and repair problems related to your hard drive. Programs to optimize your hard drive (by rearranging the data on the hard drive so all files are stored in contiguous locations— *disk defragmentation*)
- **Uninstall utilities:** Remove programs from your hard drive without leaving bits and pieces behind. Important to properly uninstall programs, not just delete them.

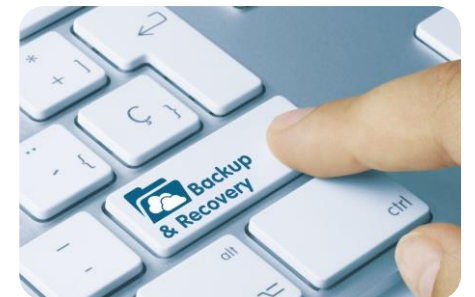
# Utility Programs

- **Clean up utilities:** Delete temporary files (such as deleted files still in the Recycle Bin, temporary Internet files, temporary installation files)
- **File compression programs:** Reduce the size of files so they take up less storage space on a storage medium or can be transmitted faster over the Internet. WinZip (Windows users)



# Utility Programs

- **Backup and recovery utilities:** Make the backup and restoration process easier.
  - Backup: Duplicate copy of data or other computer content.
  - Good backup procedures are critical for businesses.
  - Individuals should back up important documents, e-mail, photos, home video, etc.
  - Store backup data on a DVD, second hard drive, flash memory drive, or upload to the Internet.
  - Back up your entire computer once all programs have been installed, so your system can be restored to that configuration.



# Utility Programs

- **Security programs:** Protect computers and users.
  - Antivirus programs.
  - Antispyware programs.
  - Firewalls.
  - Many are included in Windows and other operating systems.



# The Future of Operating Systems

- Will continue to become more user-friendly.
- Will eventually be driven primarily by a voice interface. A green audio waveform with a central purple circle containing a white microphone icon.
- Likely to continue to become more stable and self-healing. A green rectangular icon showing a red heart with a white bandage and a hand holding it.
- Will likely continue to include improved security features and to support multiple processors and other technological improvements.
- May be used primarily to access software available through the Internet or other networks.

# Operating Systems as Strategic Infrastructure

- In modern organizations, operating systems are not viewed merely as technical tools, but rather as part of a strategic architecture that impacts:
  - ❖ **Operational efficiency:** such as order processing speed, database management, and systems integration.
  - ❖ **Decision-making:** by supporting analytics tools, business intelligence, and providing a stable environment for running management applications.
  - ❖ **Legal and security compliance:** through operating systems that support encryption, privilege management, and activity logging.

# Total Cost of Ownership (TCO) Analysis for OS Selection

- Business leaders must evaluate operating systems not only based on functionality but also on long-term financial implications. TCO includes:
  - ❖ Initial acquisition cost
  - ❖ Training and onboarding expenses
  - ❖ Maintenance and support
  - ❖ Downtime risks and recovery costs
- **Scenario:** A startup compares Linux (free, open-source) with Windows Server (licensed) and finds that while Linux reduces licensing costs, it may require higher technical expertise, impacting training budgets.

# Risk Management and Business Continuity

- Operating system failures can lead to significant operational disruptions:
  - ❖ Production downtime
  - ❖ Loss of customer data.
  - ❖ Direct financial losses.
  - ❖ A negative impact on the organization's reputation.
- Business administrators must understand:
  - ❖ Risks of system crashes or incompatibility
  - ❖ Importance of backup and recovery utilities
  - ❖ Role of OS in cybersecurity frameworks
- **Case Study:** A logistics firm experiences a system failure due to outdated drivers. The lack of automated OS updates led to delayed shipments and client dissatisfaction.

# Decision-Making: Choosing the Right OS for the Organization

- Managers should consider:

| Criteria              | Windows                  | Linux     | MacOS                    |
|-----------------------|--------------------------|-----------|--------------------------|
| User-Friendliness     | High                     | Moderate  | High                     |
| Cost                  | Licensed                 | Free      | Licensed                 |
| Security              | Good                     | Excellent | Excellent                |
| Customization         | Limited                  | Extensive | Limited                  |
| Ecosystem Integration | Strong (Microsoft tools) | Flexible  | Strong (Apple ecosystem) |

## System software vs. Application software

- System software consists of the programs that coordinate the activities of a computer system.
- The basic role of system software is to act as a mediator between **application software** (programs that allow a user to perform specific tasks on a computer, such as word processing, playing a game, preparing taxes, browsing the Web, and so forth) and the computer system's hardware, as well as between the computer and the user.

## The operating system

- A computer's operating system is the primary system software program; it manages the computer system's resources and interfaces with the user.
- The essential portion, or core, of an operating system is called its kernel.
- The functions of the operating system include booting the computer, configuring devices and device drivers (often simply called drivers), communicating with the user, managing and monitoring computer resources, file management, and security.
- File management programs allow the user to manage the enormous collection of files typically found on a computer's hard drive by organizing files hierarchically into folders. To access a file in any directory, the user can specify the path to the file; the path identifies the drive and folders the user must navigate through in order to access the file.

## The operating system

- A variety of processing techniques can be built into operating systems to help enhance processing efficiency.
- **Multitasking** allows more than one program to be open at one time
- Multiprocessing and parallel processing involve using two or more CPUs (or CPU cores) to perform work at the same time.
- Operating systems typically use virtual memory to extend conventional memory by using a portion of the hard drive as additional memory

## Operating systems for personal computers and servers

- One of the original operating systems for IBM and IBM-compatible personal computers was **DOS** (Disk Operating System), which is still in existence but not widely used. Most desktop computers today run a version of Windows.
- **Mac OS** is the operating system used on Apple computers
- **UNIX** is a flexible operating system that was originally developed for use with midrange servers, but is now available for a variety of devices
- The **open source Linux** operating system has gathered popularity because it is distributed free over the Internet and can be used as an alternative to Windows and Mac OS.

## **Operating systems for mobile phones**

- Widely used mobile operating systems include Android, iPhone OS
- Android: Linux-based mobile operating system developed by Google and used on a wide variety of devices including smartphones, tablets, smartwatches, TVs, and cars.
- iOS: Apple's proprietary mobile operating system that powers its iPhones and other devices, providing the software platform for apps and device functions through a user-friendly interface and robust security.

## Utility programs

A utility program is a type of system software written to perform specific tasks usually related to maintaining or managing the computer system.

- File management programs enable users to perform file management tasks, such as copying, moving, and deleting files.
- The file management system built into Windows is Windows Explorer.
- Search tools are designed to help users find files on their hard drives

## Utility programs

- **Diagnostic and disk management** programs are used mainly to diagnose and repair computer problems, such as hard drive errors and files deleted accidentally, as well as maintenance tasks, such as performing disk defragmentation.
- **Uninstall** utilities remove programs from a hard drive without leaving annoying remnants behind
- **File compression** programs reduce the stored size of files so they can be more easily archived or sent over the Internet
- **Backup** programs make it easier for users to back up the contents of their hard drive.
- **Security programs** such as antivirus, antispyware, and firewall programs.

## **The future of operating systems**

- In the future, operating systems will likely become even more user-friendly, voice-driven, and stable, repairing themselves when needed and causing errors and conflicts much less frequently.
- They will also likely continue to include improved security features, support for new technologies, and assistance for coordinating data and activities among a user's various computing and communications devices.

# Reference

15th Edition

## Understanding Computers

Today and Tomorrow

Comprehensive



Deborah Morley