What is an OS (Operating System)?

Introduction To CLI Commands

What is an OS (Operating System)?

An **Operating System (OS)** is system software that serves as a bridge between computer hardware and the user. It manages the computer's hardware and software resources and provides essential services for computer programs, enabling the system to function smoothly.

Why is an OS Needed?

- An OS is needed because:
- **Resource Management:**
  - **Example:** When you open a web browser and a word processor simultaneously, the OS allocates CPU time and memory to each application, ensuring that they run without interfering with each other.
- **User Interface:**
  - **Example:** On Windows, you interact with your computer through a graphical user interface (GUI) with icons, windows, and menus. In contrast, Linux might offer a command-line interface (CLI) where you type commands directly.
- **Program Execution:**
  - **Example:** When you launch Microsoft Word, the OS loads the application into memory, manages its execution, and handles the interaction with your computer's hardware, like the keyboard and display.

- **File Management:**
  - **Example:** When you save a document on your computer, the OS handles the process of writing that file to the hard drive and organizing it within the file system (e.g., in the "Documents" folder).

- **Security:**
  - **Example:** When you log into your computer, the OS verifies your username and password, ensuring that only authorized users can access the system.
- **Device Management:**
  - **Example:** When you connect a printer to your computer, the OS uses a device driver to manage the communication between the computer and the printer, allowing you to print documents.

How an OS Works behind the scene?

An operating system (OS) is the software that manages computer hardware and software resources and provides services for computer programs. Here's a short explanation of how an OS works, including the key terms:

Booting: When a computer is powered on, the OS is loaded into the main memory through a process called **booting**. The system's firmware (BIOS/UEFI) initializes the hardware and loads the OS, making the computer ready for use.

Multitasking: The OS manages multiple tasks or processes simultaneously through multitasking. It allocates CPU time to each task, rapidly switching between them to create the illusion that they are running at the same time.

Threading: Within a process, the OS can handle multiple threads, which are smaller units of execution. Threading allows different parts of a process to run concurrently, improving efficiency, especially on multi-core processors.

Security: The OS ensures security by managing user access controls, protecting data, and preventing unauthorized access. It also manages processes and memory to prevent one program from interfering with another, ensuring the system remains stable and secure

What is the role of Task Manager?

Task Manager in Windows is a powerful utility that provides detailed information about your computer's performance and running processes.

1. View Running Applications and Processes

Processes Tab: It displays all the applications and background processes currently running on your system. You can see which programs are using the most CPU, memory, disk, and network resources.

2. Monitor System Performance

Performance Tab: This tab provides real-time graphs showing your CPU, memory, disk, network, and GPU usage. It's useful for identifying performance bottlenecks.

3. End Tasks

Ending Processes: If a program is unresponsive or consuming too many resources, you can force it to close by selecting it and clicking "End Task.“

4. Startup Management

Startup Tab: This tab allows you to manage which programs start automatically when your computer boots up. Disabling unnecessary startup programs can speed up your system's startup time.

5. User Management

Users Tab: It shows all the users currently logged into the computer and the resources each user is consuming. You can log off or disconnect users from this tab.

6. Service Management

Services Tab: You can view, start, stop, and manage the Windows services running in the background. Services are essential for various system functionalities.

7. App History

App History Tab: This tab provides information about resource usage over time, particularly useful for monitoring app usage and network activity.

8. Detailed Process Information

Details Tab: Offers more granular control and information about processes, including the ability to set process priority, view process IDs (PIDs), and more.

9. Resource Monitoring

Resource Monitor Access: Task Manager can link to the Resource Monitor, where you can get more detailed information about resource usage, such as network and disk activity.

Task Manager is a crucial tool for troubleshooting and optimizing system performance, as well as managing applications and processes running on your Windows computer.

Functions of an OS

- **Process Management:**
  - **Example:** When you are editing a video, listening to music, and downloading a file at the same time, the OS ensures that each of these processes gets the necessary CPU time without crashing the system.
- **Memory Management:**
  - **Example:** If you open multiple tabs in a web browser, the OS allocates memory to each tab. If your RAM is insufficient, it may use virtual memory (part of the hard drive) to temporarily store data.
- **File System Management:**
  - **Example:** The OS organizes files into directories (folders) so that you can easily locate and manage them. For instance, you might store images in the "Pictures" folder and documents in the "Documents" folder.

- **Device Management:**
  - **Example:** If you plug in a USB drive, the OS detects it, installs the necessary drivers, and makes the drive accessible for file transfers.
- **Security and Access Control:**
  - **Example:** On a shared computer, the OS can restrict access to certain files or settings based on user accounts, ensuring that each user can only access their own data.
- **User Interface:**
  - **Example:** The Windows OS provides a desktop environment with icons, taskbars, and windows that allow you to interact with your applications. On the other hand, macOS offers a similar GUI with a unique "Dock" for application shortcuts.

Examples of OS

Windows:

Example: Windows 10 is widely used in both personal and professional environments, offering a user-friendly interface and compatibility with a vast range of software.

macOS:

Example: macOS Ventura is known for its sleek design and is the default OS for Apple Mac computers, offering features like Spotlight search and Mission Control.

Linux:

Example: Ubuntu is a popular Linux distribution used by developers and IT professionals due to its open-source nature and flexibility. It often employs a command-line interface for advanced operations.

Android:

Example: Android OS powers the majority of smartphones and tablets, offering a customizable interface and access to millions of apps through the Google Play Store.

iOS:

Example: Apple's iOS is used in iPhones and iPads, known for its smooth performance, security features, and a tightly controlled app ecosystem.

Unix:

Example: Unix is commonly used in servers and workstations. Many modern OSes like Linux and macOS are derived from Unix, making it a cornerstone in computing history.

Chrome OS:

Example: Chrome OS is used in Chromebooks, focusing on cloud-based applications and offering a lightweight, fast environment for users who rely on web applications.

What is an AOS (Application Operating System)?

An **Application Operating System (AOS)** refers to specialized operating systems designed to run specific applications or to be used in particular environments. These are often lightweight and tailored to serve a specific purpose.

Examples of AOS:

Google's Android OS for Mobile Devices:

- **Example:** Android OS is optimized for touchscreens and mobile devices, allowing for features like multitasking and push notifications, specifically designed for smartphones and tablets.

Apple's iOS for Mobile Devices:

- **Example:** iOS is tailored for Apple's mobile devices like the iPhone and iPad, providing a seamless experience with integrated apps and services like Siri, Apple Pay, and FaceTime.

Windows IoT Core for IoT Devices:

- **Example:** Windows IoT Core is a version of Windows designed for Internet of Things (IoT) devices. It’s used in smart devices like thermostats and home automation systems.

Real-Time Operating Systems (RTOS) like FreeRTOS:

- **Example:** FreeRTOS is used in embedded systems, such as automotive control systems, where precise timing and reliable performance are critical.

Gaming Consoles OS:

- **Example:** The PlayStation OS is a customized operating system designed specifically for Sony's gaming consoles, offering features tailored to gaming performance and multimedia entertainment.

- **1. What do you think an Operating System (OS) is, and why do you think it's important for computers?**

Role of OS as a Bridge:

- An OS acts as a mediator between hardware and software. It translates user commands into machine language that the hardware can understand and execute. Without this translation, software applications would not be able to interact with hardware components like the CPU, memory, or storage.

Interactivity with Hardware:

- The OS manages how hardware components are used. For example, when you open a file, the OS instructs the hard drive to retrieve the data and sends it to the screen. This coordination ensures that all hardware functions properly and efficiently.

Usability and Management:

- The OS provides a user interface that allows users to interact with the computer through graphical elements (windows, icons) or text commands. It also manages system resources, handles multitasking, and ensures applications run smoothly without conflicts.

2. Can you name any operating systems you have used or heard about? What do you know about them?

Experience Sharing:

- **Windows:** Known for its broad compatibility with software and hardware. It's commonly used in personal and professional environments.
- **macOS:** Offers a seamless experience with Apple hardware and software. It's recognized for its sleek interface and robust performance.
- **Android:** A versatile mobile OS that supports a wide range of devices and customization options.
- **iOS:** Designed for Apple's mobile devices, emphasizing security and integration with other Apple services.
- **Linux:** An open-source OS known for its flexibility and security. It's used in servers, desktops, and embedded systems.

Feature Comparison:

Target Audience and Use Cases:

•**Windows** is used widely in business and education due to its software ecosystem.
•**macOS** is often chosen by creative professionals for its design and multimedia capabilities.
•**Android** caters to a broad range of mobile users with its flexibility.
•**iOS** is preferred for its seamless integration with Apple's ecosystem and high-security standards.
•**Linux** is favored by developers and IT professionals for its open-source nature and customization.

Features of Windows, iOS and Linux OS

Windows	mac OS	Linux	Android	iOS
Microsoft	Apple	Open Source	Mobile	Mobile
Paid	Paid	Free	With device	With device
Known for its broad compatibility with software and hardware. It's commonly used in personal and professional environments	Offers a seamless experience with Apple hardware and software. It's recognized for its sleek interface and robust performance	An open-source OS known for its flexibility and security. It's used in servers, desktops, and embedded systems.	A versatile mobile OS that supports a wide range of devices and customization options.	Designed for Apple's mobile devices, emphasizing security and integration with other Apple services
is used widely in business and education due to its software ecosystem	is often chosen by creative professionals for its design and multimedia capabilities	is favored by developers and IT professionals for its open-source nature and customization.	caters to a broad range of mobile users with its flexibility	is preferred for its seamless integration with Apple's ecosystem and high-security standards.

3. How do you think a computer would work if it didn't have an operating system?
Inoperability:

Without an OS, a computer would lack the necessary software to manage hardware functions. Users would be unable to run applications or perform tasks because there would be no intermediary to handle instructions between the hardware and software.

Complexity of Direct Hardware Control:

Managing hardware directly without an OS would require complex programming and extensive knowledge of hardware specifics. Each application would need to handle hardware interactions on its own, which is impractical and inefficient.

Practical Examples:
For instance, tasks like opening multiple applications simultaneously or saving and organizing files would be impossible without an OS. The OS handles these tasks by managing resource allocation and coordinating between various components.

4. What do you think happens behind the scenes when you click on an icon to open an application?

Process Initialization:
When you click an icon, the OS identifies the associated application and loads it into the computer's memory. This involves reading the application's files from storage and preparing it for execution.

Resource Allocation:
The OS allocates CPU time and memory to the application. It ensures the application has the necessary resources to run without interfering with other processes.

Interaction Management:
The OS manages interactions between the application and the user. It handles input from the keyboard and mouse, and coordinates output to the screen. It also ensures that the application runs smoothly by managing its interactions with other applications and system resources.

5. Have you ever used a smartphone or tablet? How do you think its operating system differs from the one on a desktop or laptop computer?

Mobile vs. Desktop OS Features:
Mobile OSes like Android and iOS are optimized for touch interactions, power efficiency, and mobile hardware. They are designed to handle apps in a way that conserves battery life and supports gestures and touch input.

Desktop OSes like Windows and macOS are designed for more powerful hardware, supporting multitasking and a wide range of applications with a focus on keyboard and mouse input.

User Interface Differences:
Mobile OSes feature interfaces that prioritize touch controls and app management on smaller screens, while desktop OSes provide interfaces with larger screens, supporting more complex interactions and multitasking capabilities.

Resource Management:
Mobile OSes focus on managing battery life and optimizing performance for less powerful hardware, while desktop OSes are designed to leverage more powerful processors and larger amounts of RAM, supporting more intensive applications.

6. **Why do you think different devices (like phones, computers, gaming consoles) might use different operating systems?**

Specialization:
Different devices have different requirements. For example, gaming consoles need an OS that optimizes performance for graphics and gaming, while mobile devices need an OS that manages battery life and touchscreen interactions.

Hardware Optimization:
The OS is tailored to work efficiently with the specific hardware of each device. For instance, gaming consoles have OSes designed to maximize gaming performance and multimedia capabilities, while mobile OSes are optimized for energy efficiency and touch interactions.

User Experience:
The OS is designed to provide an optimal user experience based on the device's purpose. Mobile OSes offer a user-friendly interface for on-the-go use, while desktop OSes offer robust tools for productivity and complex tasks.

7. What do you think the term 'user interface' means in the context of an operating system? Can you give examples?

Definition of User Interface (UI):
The UI is the component of the OS that allows users to interact with the computer. It includes elements like icons, windows, menus, and command lines that facilitate communication between the user and the system.

Examples of UIs:

GUI (Graphical User Interface): Windows desktop with icons, taskbars, and windows that allow users to perform tasks through visual elements.

CLI (Command-Line Interface): Linux terminal where users type text commands to perform tasks, often used by developers and system administrators.

Importance of UI Design:
A well-designed UI enhances user experience by making the system intuitive and easy to use. Poor UI design can make it difficult for users to perform tasks and navigate the system effectively.

8. How do you think the operating system helps keep your computer secure from viruses and unauthorized access?

Security Features:
The OS includes features such as user authentication (passwords, biometrics) to prevent unauthorized access. It manages file permissions to control who can read, write, or execute files.

Antivirus and Firewalls:
The OS works with antivirus programs to detect and remove malicious software. Firewalls monitor and control incoming and outgoing network traffic to protect against unauthorized access and cyber threats.

Regular Updates:
The OS regularly releases updates to patch security vulnerabilities and enhance protection against new threats. Keeping the OS updated is crucial for maintaining system security.

9. What role do you think an operating system plays in managing the files and folders on your computer?

File System Management:

The OS organizes files and folders on storage devices using a file system. It manages the creation, deletion, and retrieval of files, ensuring that they are stored efficiently and can be accessed when needed.

Directory Structure:

The OS uses a hierarchical directory structure to organize files into folders, making it easier to locate and manage them. For example, you might have folders for Documents, Pictures, and Videos, each containing related files.

File Permissions:

The OS controls access to files and folders through permissions. This ensures that only authorized users can access or modify files, maintaining data security and integrity.

General Shortcuts:

- **Ctrl + C**: Copy the selected item.
- **Ctrl + X**: Cut the selected item.
- **Ctrl + V**: Paste the copied/cut item.
- **Ctrl + Z**: Undo an action.
- **Ctrl + Y**: Redo an action.
- **Ctrl + A**: Select all items in a document or window.
- **Ctrl + S**: Save the current document.
- **Ctrl + P**: Print the current page/document.
- **Alt + F4**: Close the active window or application.
- **Alt + Tab**: Switch between open apps.
- **Alt + Enter**: Display the properties of the selected item.
- **Windows Key + D**: Show or hide the desktop.
- **Windows Key + L**: Lock your PC or switch accounts.
- **Windows Key + E**: Open File Explorer.
- **Windows Key + R**: Open the Run dialog box.
- **Windows Key + I**: Open the Settings window.
- **Windows Key + S**: Open Search.
- **Windows Key + X**: Open the Quick Link menu.
- **Windows Key + M**: Minimize all windows.
- **Windows Key + Shift + M**: Restore minimized windows.
- **Windows Key + Tab**: Open Task View (view and manage open windows).
- **F2**: Rename the selected item.
- **F5**: Refresh the active window.

Task Manager:

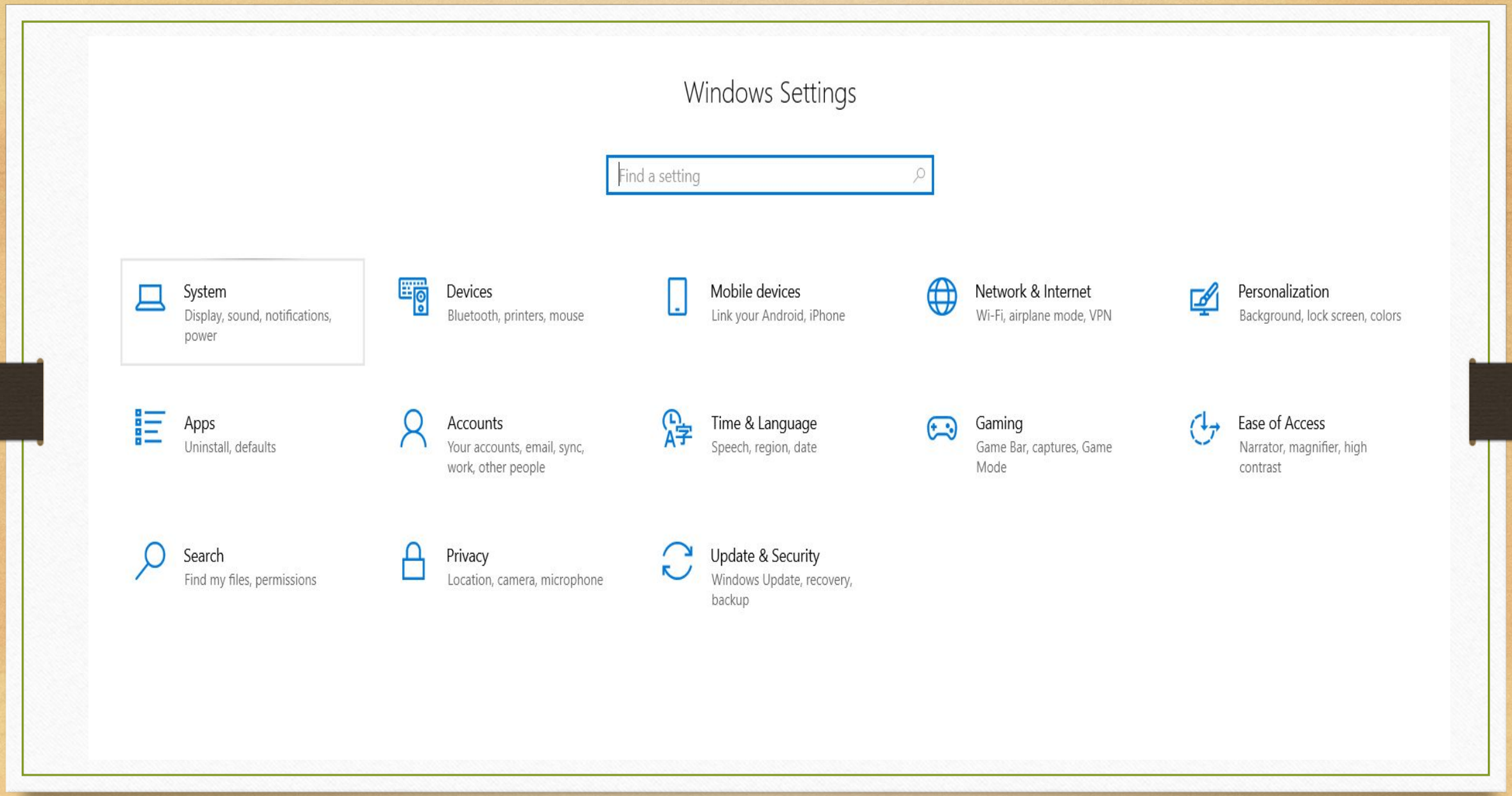
- **Ctrl + Shift + Esc**: Open Task Manager directly.

File Explorer:

- **Alt + Up Arrow**: Go up one level in File Explorer.
- **Alt + Left Arrow**: Go back.
- **Alt + Right Arrow**: Go forward.
- **Ctrl + Shift + N**: Create a new folder.
- **F11**: Maximize or minimize the active window.

Text Editing:

- **Ctrl + Left Arrow**: Move the cursor to the beginning of the previous word.
- **Ctrl + Right Arrow**: Move the cursor to the beginning of the next word.
- **Ctrl + Up Arrow**: Move the cursor to the beginning of the previous paragraph.
- **Ctrl + Down Arrow**: Move the cursor to the beginning of the next paragraph.
- **Ctrl + Backspace**: Delete the previous word.
- **Ctrl + Delete**: Delete the next word


Windows Settings
Find a setting
System
Display, sound, notifications, power
Devices
Bluetooth, printers, mouse
Mobile devices
Link your Android, iPhone
Network & Internet
Wi-Fi, airplane mode, VPN
Personalization
Background, lock screen, colors
Apps
Uninstall, defaults
Accounts
Your accounts, email, sync, work, other people
Time & Language
Speech, region, date
Gaming
Game Bar, captures, Game Mode
Ease of Access
Narrator, magnifier, high contrast
Search
Find my files, permissions
Privacy
Location, camera, microphone
Update & Security
Windows Update, recovery, backup

Vocabulary

1. Multitasking
2. Threading
3. Open Source
4. File Permissions
5. User Authentication
6. Antivirus
7. Firewall
8. Security patch
9. User Interface
10. Graphical User Interface
11. Command Line Interface

Check for understanding: Quiz