

4.1 Introduction

The operating system (OS) controls almost all functions on a computer. In this lecture, you will learn about the components, functions, and terminology related to the Windows 2000, Windows XP, and Windows Vista operating systems.

4.2 Explain the purpose of an operating system

All computers rely on an OS to provide the interface for interaction between users, applications, and hardware. The OS boots the computer and manages the file system. Almost all modern operating systems can support more than one user, task, or CPU.

4.2.1 Describe characteristics of modern operating systems

Regardless of the size and complexity of the computer and the operating system, all operating systems perform the same four basic functions. Operating systems control hardware access, manage files and folders, provide a user interface, and manage applications.

Control Hardware Access

The operating system manages the interaction between applications and the hardware. To access and communicate with the hardware, the operating system installs a device driver for each hardware component. A device driver is a small program written by the hardware manufacturer and supplied with the hardware component. When the hardware device is installed, the device driver is also installed, allowing the OS to communicate with the hardware component.

The process of assigning system resources and installing drivers can be performed with Plug and Play (PnP). The PnP process was introduced in Windows 95 to simplify the installation of new hardware. All modern operating systems are PnP-compatible. With PnP, the operating system automatically detects the PnP-compatible hardware and installs the driver for that component. The operating system then configures the device and updates the registry, which is a database that contains all the information about the

computer.

NOTE: The registry contains information about applications, users, hardware, network settings, and file types.

File and Folder Management

The operating system creates a file structure on the hard disk drive to allow data to be stored. A file is a block of related data that is given a single name and treated as a single unit. Program and data files are grouped together in a directory. The files and directories are organized for easy retrieval and use. Directories can be kept inside other directories. These nested directories are referred to as subdirectories. Directories are called folders in Windows operating systems, and subdirectories are called subfolders.

User Interface

The operating system enables the user to interact with software and hardware.

There are two types of user interfaces:

- Command Line Interface (CLI) – The user types commands at a prompt, as shown in Figure 1.
- Graphical User Interface (GUI) – The user interacts with menus and icons, as shown in Figure 2.

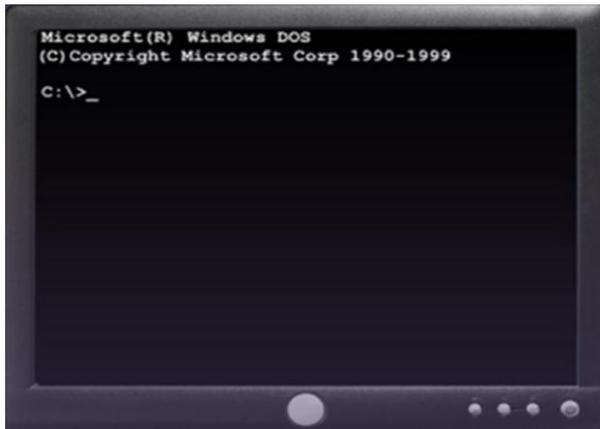


Figure (1)



Figure (2)

Most operating systems, such as Windows 2000 and Windows XP, include both a GUI and a CLI.

Application Management

The operating system locates an application and loads it into the RAM of the computer. Applications are software programs, such as word processors, databases, spreadsheets, games, and many other applications. The operating system ensures that each application has adequate system resources.

An Application Programming Interface (API) is a set of guidelines used by programmers to ensure that the application they are developing is compatible with an operating system. Here are two examples of APIs:

- Open Graphics Library (OpenGL) – Cross-platform standard specification for multimedia graphics
- DirectX – Collection of APIs related to multimedia tasks for Microsoft Windows

4.2.2 Explain operating system concepts

To understand the capabilities of an operating system, it is important to understand some basic terms. The following terms are often used when comparing operating systems:

- **Multi-user** – Two or more users can work with programs and share peripheral devices, such as printers, at the same time.
- **Multi-tasking** – The computer is capable of operating multiple applications at the same time.
- **Multi-processing** – The computer can have two or more central processing units (CPUs) that programs share.
- **Multi-threading** – A program can be broken into smaller parts that can be loaded as needed by the operating system. Multi-threading allows individual programs to be multi-tasked.

Almost all modern operating systems are multi-user and multi-tasking, and they support multi-processing and multi-threading.

Modes of Operation

All modern CPUs can run in different modes of operation. The mode of operation refers to the capability of the CPU and the operating environment. The mode of operation determines how the CPU manages applications and memory. The four common modes of operation are real mode, protected mode, virtual real mode, and compatible mode.

Real Mode

A CPU that operates in real mode can only execute one program at a time, and it can only address 1 MB of system memory. Although all modern processors have real mode available, it is only used by DOS and DOS applications in old operating systems or by 16-bit operating environments, such as Windows 3.x.

Protected Mode

A CPU that operates in protected mode has access to all of the memory in the computer, including virtual memory. Virtual memory is hard disk space that is used to emulate RAM. Operating systems that use protected mode can manage multiple programs simultaneously. Protected mode provides 32-bit access to memory, drivers, and transfers between input and output (I/O) devices. Protected mode is used by 32-bit operating systems, such as Windows 2000 or Windows XP. In protected mode, applications are protected from using the memory reserved for another application that is currently running.

Virtual Real Mode

A CPU that operates in virtual real mode allows a real-mode application to run within a protected-mode operating system. This can be demonstrated when a DOS application runs in a 32-bit operating system, such as Windows

XP.

Compatibility Mode

Compatibility mode creates the environment of an earlier operating system for applications that are not compatible with the current operating system. As an example, an application that checks the version of the operating system might be written for Windows NT and require a particular service pack. Compatibility mode can create the proper environment or version of the operating system to allow the application to run as if it is in the intended environment.

32-bit vs. 64-bit

There are three main differences between 32-bit and 64-bit operating systems. A 32-bit operating system, such as Windows XP Professional, is capable of addressing only 4 GB of RAM, while a 64-bit operating system can address more than 128 GB of RAM. Memory management is also different between these two types of operating systems, resulting in enhanced performance of 64-bit programs.

Processor Architecture

There are two common architectures used by CPUs to process data: x86 (32-bit architecture) and x64 (64-bit architecture). x86 uses a Complex Instruction Set Computer (CISC) architecture to process multiple instructions with a single request. Registers are storage areas used by the CPU when performing calculations. x86 processors use fewer registers than x64 processors. x64 architecture is backward compatible with x86 and adds additional registers specifically for instructions that use a 64-bit address space. The additional registers of the x64 architecture allow the computer to process much more complex instructions at a much higher rate.

Registers

In computer architecture, a processor register is a small amount of storage available on the CPU whose contents can be accessed more quickly than storage available elsewhere. Most, but not all, modern computer architectures operate on the principle of moving data from main memory into registers, operating on them, then moving the result back into main memory—a so-called load-store architecture. A common property of computer programs is locality of reference: the same values are often accessed repeatedly; and holding these frequently used values in registers improves program execution performance.

4.3 Describe and compare operating systems to include purpose, limitations, and compatibilities

A technician might be asked to choose and install an operating system for a customer. The type of OS selected depends on the customer's requirements for the computer. There are two distinct types of operating systems: desktop operating systems and network operating systems. A desktop operating system is intended for use in a Small Office/Home Office (SOHO) with a limited number of users. A Network Operating System (NOS) is designed for a corporate environment serving multiple users with a wide range of needs.

4.3.1 Describe desktop operating systems

A desktop OS has the following characteristics:

- Supports a single user
- Runs single-user applications
- Shares files and folders on a small network with limited security

In the current software market, the most commonly used desktop operating systems fall into three groups: Microsoft Windows, Apple Mac OS, and UNIX/Linux.

Microsoft Windows

Windows is one of the most popular operating systems today. The following products are desktop versions of the Microsoft Windows operating systems:

- Windows XP Professional – Used on most computers that will connect to a Windows Server on a network
- Windows XP Home Edition – Used on home computers and has very limited security
- Windows XP Media Center – Used on entertainment computers for viewing movies and listening to music
- Windows XP Tablet PC Edition – Used for tablet PCs
- Windows XP 64-bit Edition – Used for computers with 64-bit processors
- Windows 2000 Professional – Older Windows operating system that has been replaced by Windows XP Professional
- Windows Vista Home Basic – Used on home computers for basic computing
- Windows Vista Home Premium – Used on home computers to expand personal productivity and digital entertainment beyond the basics
- Windows Vista Business – Used on small business computers for enhanced security and enhanced mobility technology
- Windows Vista Ultimate – Used on computers to combine all the needs of both home and business users

Apple Mac OS

Apple computers are proprietary and use an operating system called Mac OS. Mac OS is designed to be a user-friendly GUI operating system. Current versions of Mac OS are now based on a customized version of UNIX.

UNIX/Linux

UNIX, which was introduced in the late 1960s, is one of the oldest operating systems. There are many different versions of UNIX today. One of the most

recent is the extremely popular Linux. Linux was developed by Linus Torvalds in 1991, and it is designed as an open-source operating system. Open-source programs allow the source code to be distributed and changed by anyone as a free download or from developers at a much lower cost than other operating systems.

4.3.2 Describe network operating systems

A network OS has the following characteristics:

- Supports multiple users
- Runs multi-user applications
- Is robust and redundant
- Provides increased security compared to desktop operating systems

These are the most common network operating systems:

- **Microsoft Windows** – Network operating systems offered by Microsoft are Windows 2000 Server, Windows Server 2003, and Windows Server 2008. Windows Server operating systems use a central database called Active Directory to manage network resources.
- **Novell NetWare** – Novell NetWare was the first OS to meet network OS requirements and enjoy widespread deployment in PC-based Local Area Networks (LANs) back in the 1980s.
- **Linux** – Linux operating systems include Red Hat, Caldera, SUSE, Debian, Fedora, Ubuntu, and Slackware.
- **UNIX** – Various corporations offer proprietary operating systems based on UNIX.