

Fundamental Operating Systems

Lecture 07

CT4005NI - Computer Hardware and Software
Architectures

7. Introduction

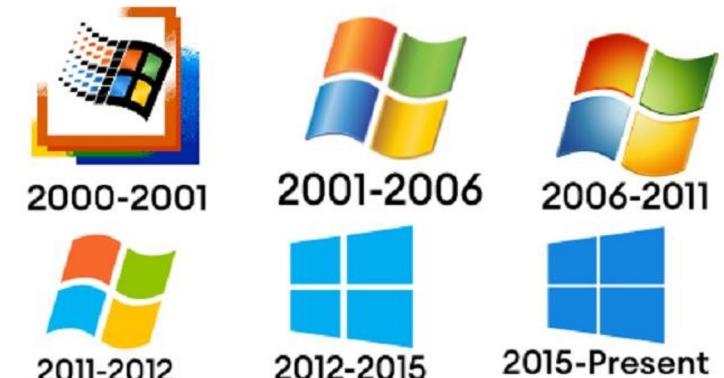


The operating system (OS) controls almost all functions on a computer.

You will learn about the components, functions, and terminology related to the OS.

Objectives

- Explain the purpose of an operating system.
- Describe and compare operating systems to include purpose, limitations, and compatibilities.
- Determine the operating system based on customer needs.
- Install an operating system.
- Navigate a Graphical User Interface (GUI).
- Identify and apply common preventive maintenance techniques for operating systems.



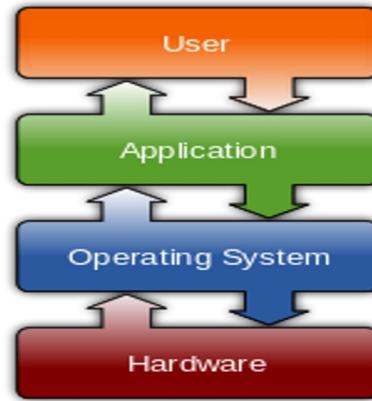
7.1 Explain the purpose of an OS

All computers rely on an OS to provide the *interface* for interaction between users, applications, and hardware.

1. Characteristics of modern OS

Control Hardware Access

- The operating system *manages* the *interaction* between *applications* and the *hardware* using 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.
- The process of *assigning* system resources and *installing* drivers can be performed with **Plug and Play (PnP)**.
- The OS then *configures* the device and *updates* the *registry*, a *database* that contains all the information about the computer.



7.1 Explain the purpose of an OS

All computers **rely** on an **OS** to provide the interface for interaction between users, applications, and hardware.

1. Characteristics of modern OS

File and Folder Management

- The operating system *creates* a file structure on the hard disk drive to allow data to be stored.

Examples: Files, Directories (Folders), Sub-Directories.

User Interface

- **Command Line Interface (CLI)** - The user types commands at a prompt
- **Graphical User Interface (GUI)** - The user interacts with menus and icons

7.1 Explain the *purpose* of an OS

All computers rely on an OS to provide the interface for interaction between users, applications, and hardware.

1. Characteristics of modern OS

Application Management

- The operating system *locates* an application and **loads it into the RAM** of the computer

Example: word processors, databases, spreadsheets, games and so forth.

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

7.1 Explain the purpose of an OS

All computers rely on an OS to provide the interface for interaction between users, applications, and hardware.

7.1.2 Explain operating system concepts

Terms used to compare OS

- **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.

7.1 Explain the purpose of an OS

- All computers rely on an OS to provide the interface for interaction between users, applications, and hardware.

2. Explain operating system concepts

Operating Modes

- The mode of operation determines how the *CPU* manages *applications* and *memory*.
- All modern CPUs can run in different modes of operation.

Real Mode

- A CPU can only execute 1 instruction at a time, and it can only address 1 MB of system memory.
- used by DOS and DOS applications. Such as Windows 3.x

7.1 Explain the *purpose* of an OS

Real Mode - MSDOS popular commands

COMMAND	FUNCTION
HELP	Provides command line help
DIR	Displays the contents of a directory
ATTRIB	Changes the attributes of a file to indicate a read-only, archive, system, or hidden file
EDIT	Opens a file for editing
COPY	Copies a file
XCOPY	Copies files and subdirectories
FORMAT	Formats a disk
MD	Makes a new directory
CD	Changes to a specified directory
RD	Removes a directory

7.1 Explain the *purpose* of an OS

- All computers rely on an OS to provide the interface for interaction between users, applications, and hardware.

2. Explain operating system concepts

Operating Modes

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.
- can execute multiple instructions simultaneously.
- used by 32/64-bit operating systems, such as Windows 2000 or Windows XP, Window 7 and Windows 10
- In protected mode, application are protected from using the memory reserved for another application that is currently running.

7.1 Explain the *purpose* of an OS

Virtual Real Mode

- A CPU that operates in virtual real mode allows a real-mode application to run within a protected-mode operating system.
- Example: Dos running in 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.

Example: running a setup file of any software in windows 10 with the compatibility mode of windows 7

7.1 Explain the *purpose* of an OS

- All computers rely on an OS to provide the interface for interaction between users, applications, and hardware.

7.1.2 Explain operating system concepts

Processor Architecture

- Two common architectures used to process data: x86 (32-bit architecture) and x64 (64-bit architecture).
- Registers are storage areas used by the CPU when performing calculations.
- The additional registers of the x64 architecture allow the computer to process much more complex instructions at a much higher rate.

7.2 Describe and compare operating systems

- There are two distinct types of operating systems and network operating systems.

Desktop OS - Small Office/Home Office (SOHO)

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



systems: desktop operating



7.2 Describe and compare operating systems

Microsoft Windows

- one of the most popular operating systems today.
- Example: Windows 10, Window 7 , Windows Vista Home Basic, Business, Ultimate and so forth.



Apple Mac OS

- Apple computers are proprietary and use an operating system called Mac OS.
- Current versions of Mac OS are now based on a customized version of UNIX.



7.2 Describe and compare operating systems

Desktop OS - Small Office/Home Office (SOHO)

UNIX/Linux

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

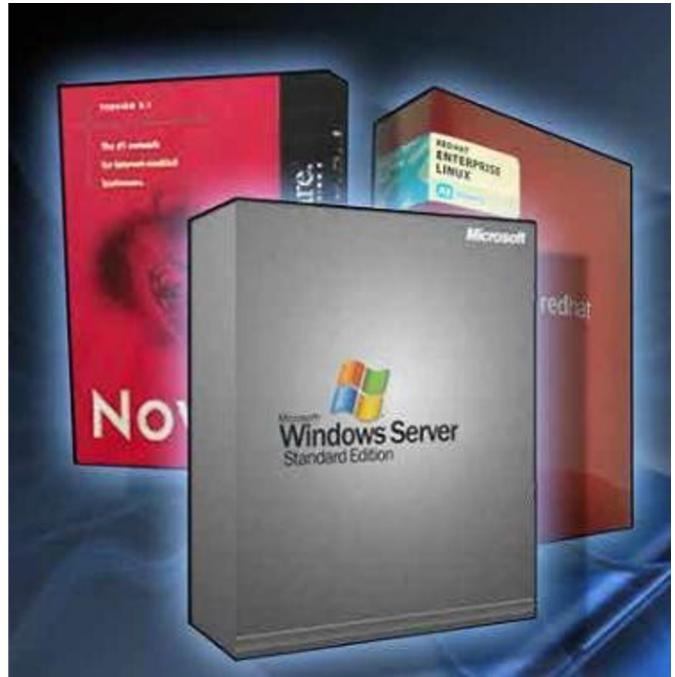
7.2 Describe and compare operating systems

Network OS - corporate environment

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

Examples:

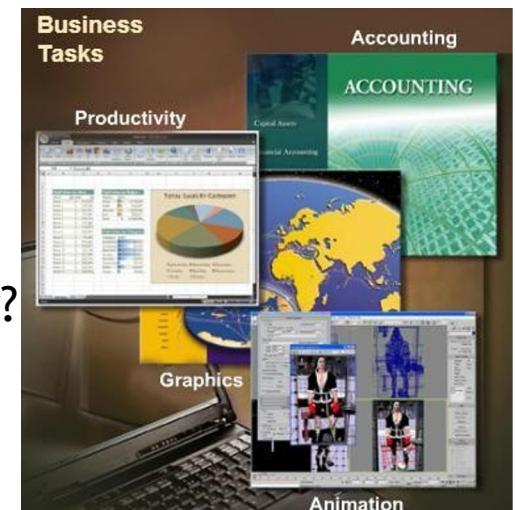
- Microsoft Windows: Windows Server 2003, and Windows Server 2008 and Server 2012.
- Linux: Red Hat, Fedora, CentOS and so forth.



7.3 Determine operating system based on customer needs

7.3.1 Identify applications and environments

- An operating system should be compatible with all applications that are installed on a computer.
- Before recommending an OS to your customer, investigate the types of applications that your customer will be using.
- Does the computer have “off-the-shelf” applications or customized applications that were programmed specifically for this customer?
 - Are the applications programmed for a single user or multiple users?
 - Are any data files shared with other computers, such as a laptop or home computer?
 - To ensure compatibility



7.3 Determine operating system based on customer needs

7.3.2 Determine minimum hardware requirements

- Operating systems have minimum hardware requirements that must be met for the OS to install and function correctly.

Processor:	1 gigahertz (GHz) or faster processor or System on a Chip (SoC)
RAM:	1 gigabyte (GB) for 32-bit or 2 GB for 64-bit
Hard drive space:	16 GB for 32-bit OS 32 GB for 64-bit OS
Graphics card:	DirectX 9 or later with WDDM 1.0 driver
Display:	800x600

Hardware Compatibility List

- Most operating systems have a **Hardware Compatibility List (HCL)** that can be found on the manufacturer's website.

7.4 Install an operating system

As a *technician*, you might have to perform a clean installation of an operating system.

- When, a computer is passed from one employee to another
- When, the operating system is corrupted
- When, a new replacement hard drive is installed in a computer

7.4.1 Identify hard drive setup procedures

- Although it is possible to install an operating system over a network from a server or from a local hard drive, the most common installation method is with CDs and DVDs.

7.4 Install an operating system

7.4.1 Identify hard drive setup procedures

Partitioning and Formatting

- Before installing an operating system on a hard drive, the hard drive must be partitioned and formatted.
- During the installation phase, most operating systems automatically partition and format the hard drive.
- **Primary partition** - This partition is usually the first partition. Cannot be subdivided into smaller sections.

There can be up to four partitions per hard drive.

- **Active partition** - This partition is the partition used by the operating system to boot the computer.
Only primary partition can be marked active.
- **Extended partition** - This partition normally uses the remaining free space on a hard drive.
- It can be subdivided into smaller sections called **logical drives**.

7.4 Install an operating system Contd.

- **Logical drive** - This drive is a section of an extended partition that can be used to separate information for administrative purposes.

An extended partition can contain up to **24 logical partitions**.

- **Formatting** - This process prepares a file system in a partition for files to be stored.

- **Sector** - A sector contains a fixed number of bytes, generally at least 512 bytes.

- **Cluster** - file allocation unit.

It is the smallest unit of space used for storing data, made up of one or more sectors.

- **Track** - A track is one complete circle of data on one side of a hard drive platter.

A track is broken into groups of sectors.

7.4 Install an operating system

Contd.

- **Cylinder** – A cylinder is a stack of tracks lined up one on top of another to form a cylinder shape.
- **Drive mapping** – Drive mapping is a letter assigned to a physical or logical drive.

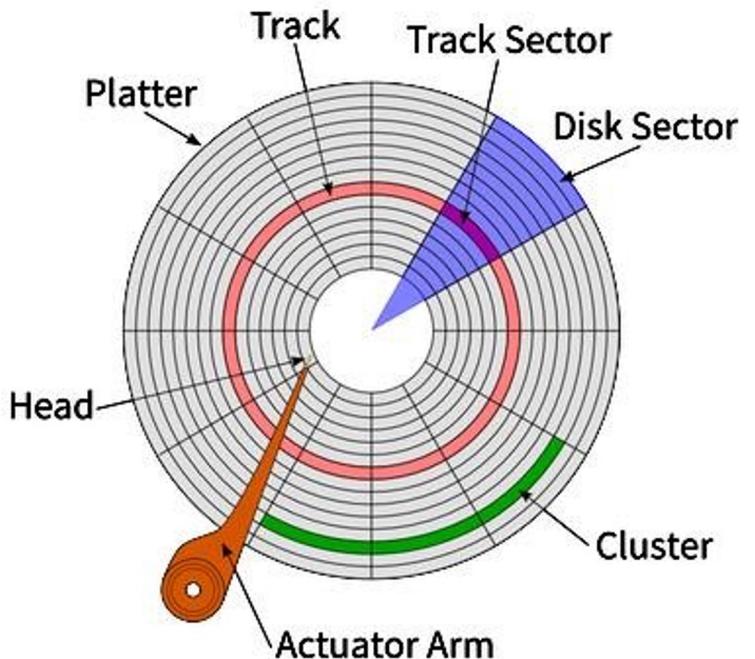


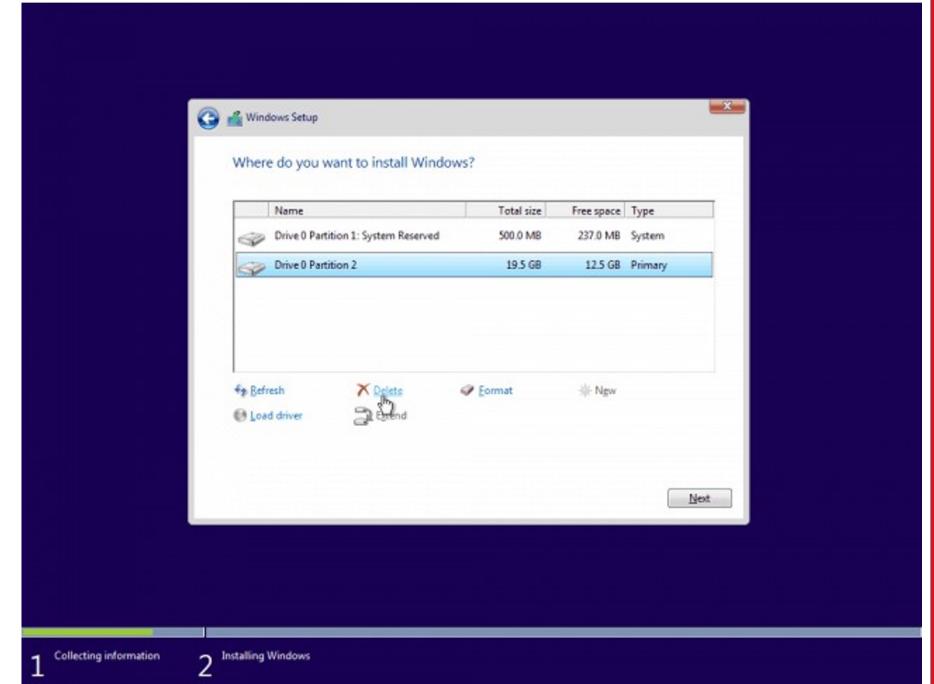
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7.4 Install an operating system Contd.

7.4.2 Prepare hard drive

The file system provides the directory structure that organizes the user's operating system, application, configuration, and data files.

This process prepares the disk to accept the file system.



- **File Allocation Table, 32-bit (FAT32)** - A file system that can support partition sizes up to 2 TB or 2,048 GB.
- **New Technology File System (NTFS)** - A file system that can support partition sizes up to 16 Exabytes, in theory.
- It incorporates more file system security features and extended attributes.

7.4 Install an operating system

Contd.

7.4.3 Install the operating system

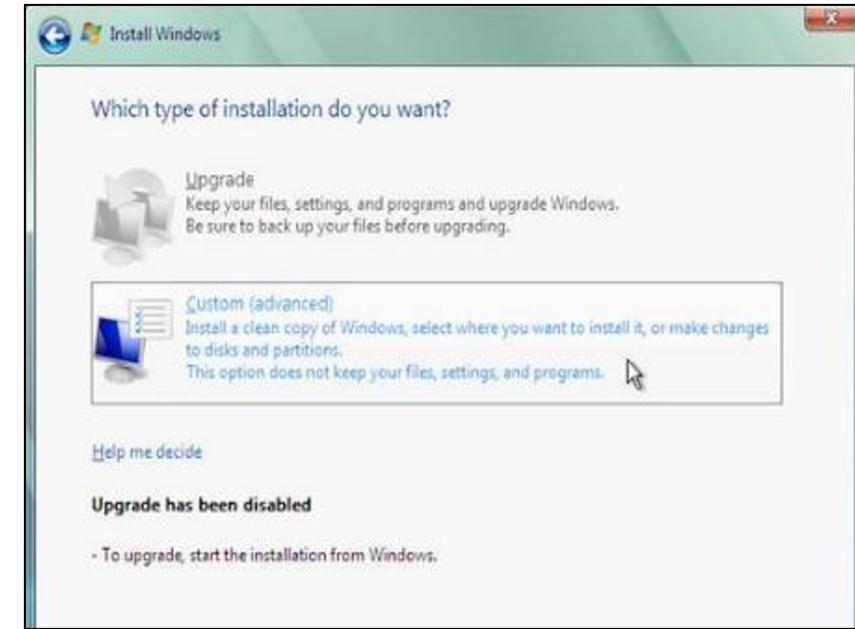
- There might be three options that you may encounter during OS installation.

Upgrade

- Keep your files, settings, and programs and upgrade Windows. Also use this option to repair an installation.

Custom (advanced)

- Install a clean copy of Windows, select where you want to install it, or make changes to disks and partitions.
- Quit - To quit Setup, click the x in the Close box.
- Further, during the installation process you also have to install certain information like **Product Key, Date and Time and so forth.**

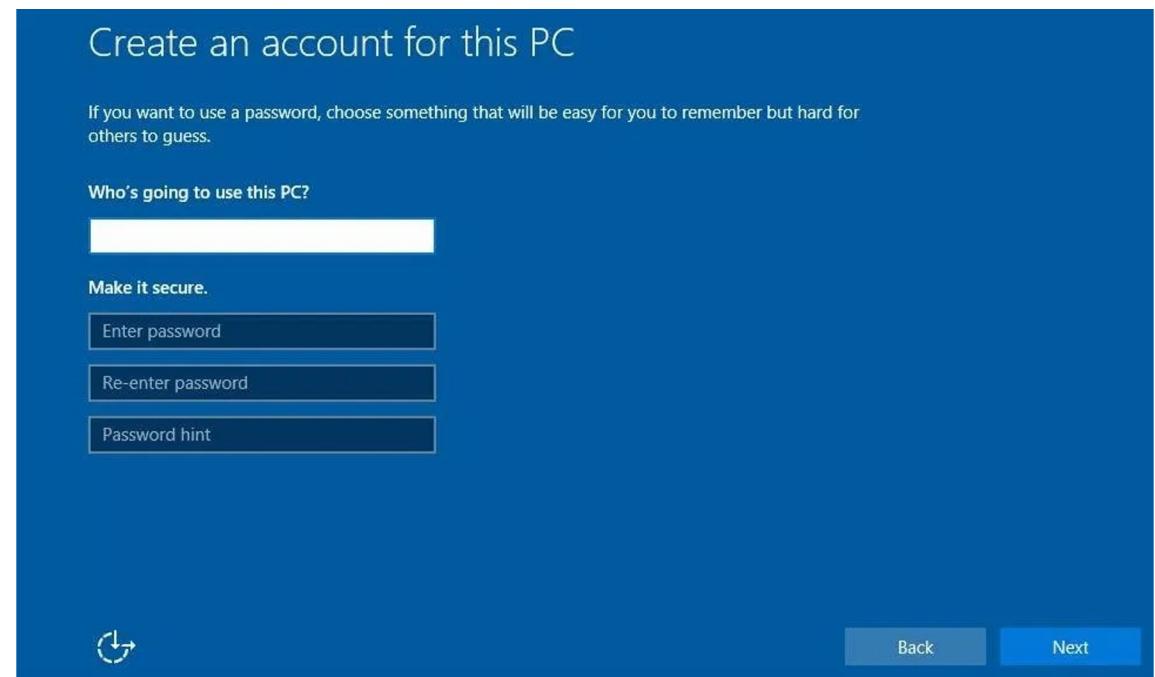
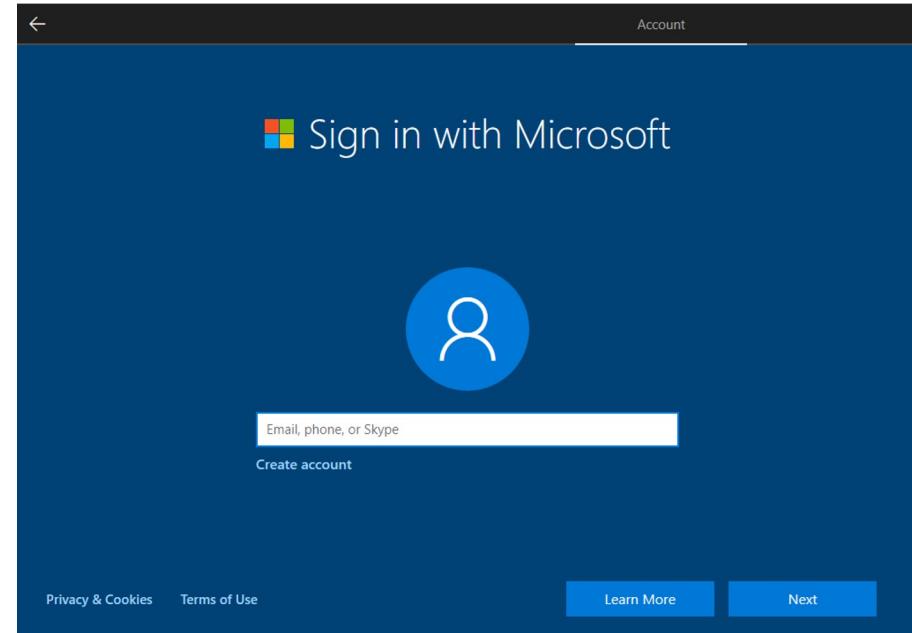


7.4 Install an operating system

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7.4.4 Create accounts

- Create a user account when prompted during the installation process. Unlike the administrator account, user accounts can be created at any time.
- A user account has fewer permissions than the computer administrator.

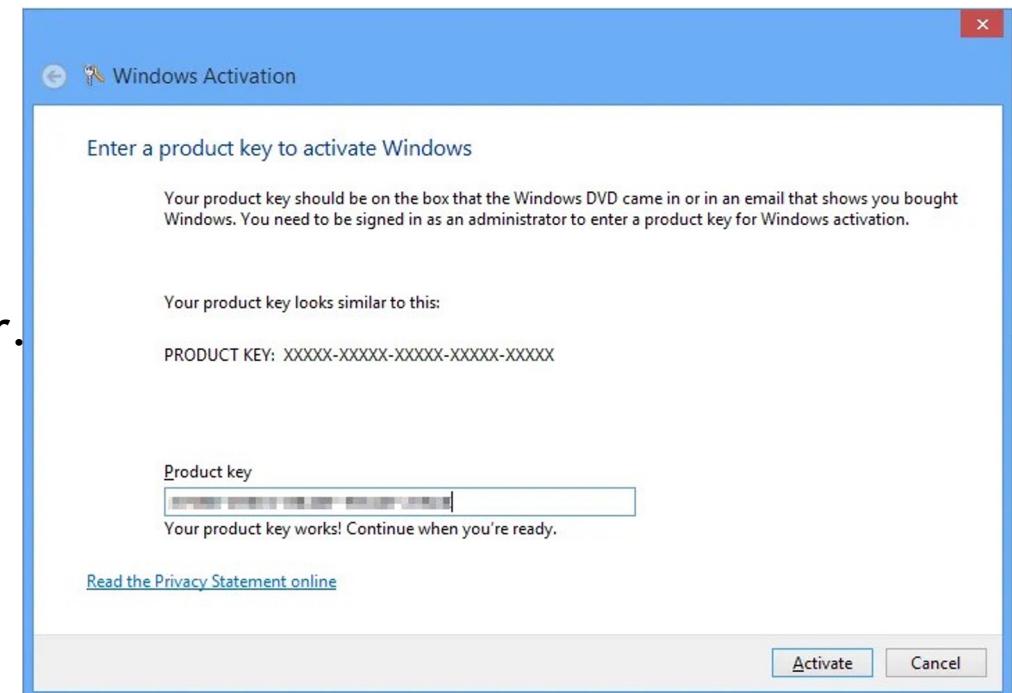


7.4 Install an operating system

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7.4.6 Complete the installation

- You must **register your OS** and complete the verification that ensures that you are using a legal copy of the OS.
- Doing so enables you to download patches and service packs.
- Install all **service packs** and all patches from Windows Update.
- Verify that all hardware is installed correctly in **Device Manager**.



7.4 Install an operating system

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7.4.6 Custom Installation Options

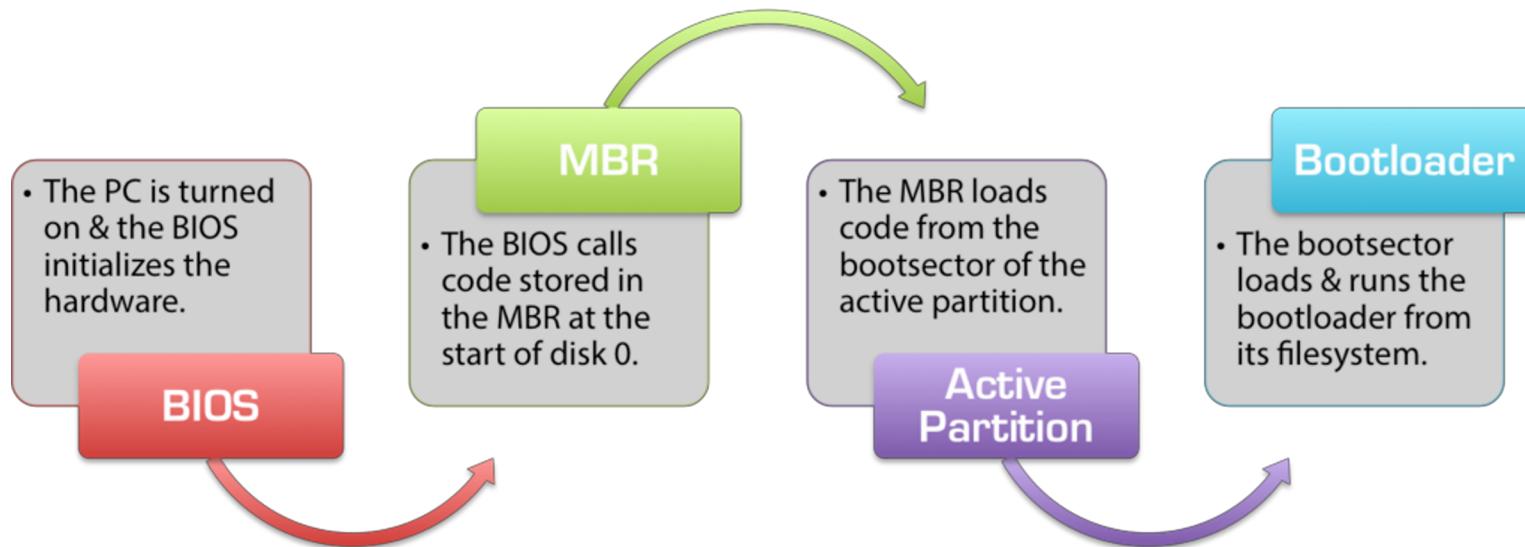
Installing OS in one computer takes time, imagine to install OS in corporate environment that contains large number of computers.

There are number of ways so that technicians are able to quickly install an operating system.

- **Disk Cloning** - Disk cloning creates an image of a hard drive in a computer.
- **Network Installation** - Installing windows over a network.
- **Recovery Disc** - You can use a recovery disc when there has been a system failure and other recovery options have failed.
- **Factory Recovery Partition** - Some computers that have OS from factory contain a section of disk that contains an image of the bootable partition.

7.4 Install an operating system Contd.

7.4.7 Identify the boot sequence files and Registry files



7.4 Install an operating system Contd.

7.4.7 Identify the boot sequence files and Registry files

HKEY	DESCRIPTION
HKEY_CLASSES_ROOT	Information about which file extensions map to a particular application
HKEY_CURRENT_USER	Information, such as desktop settings and history, related to the current user of a PC
HKEY_USERS	Information about all users who have logged onto a system
HKEY_LOCAL_MACHINE	Information relating to the hardware and software
HKEY_CURRENT_CONFIG	Information relating to all active devices on a system

7.4 Install an operating system

Contd.

7.4.8 Describe how to manipulate operating system files

The following applications are used extensively for post-installation diagnostics and modifications:

- **Msconfig** - This boot configuration utility allows you to set the programs that run at startup and to edit configuration files.
- **Regedit** - This application allows you to edit the registry
- **Msinfo32** - This utility displays a complete system summary of your computer including hardware components and details, and installed software and settings.
- **Dxdiag** - This utility shows details about all of the DirectX components and drivers that are installed in your computer.
- **Cmd** - This is used to execute command line programs and utilities

7.4 Install an operating system Contd.

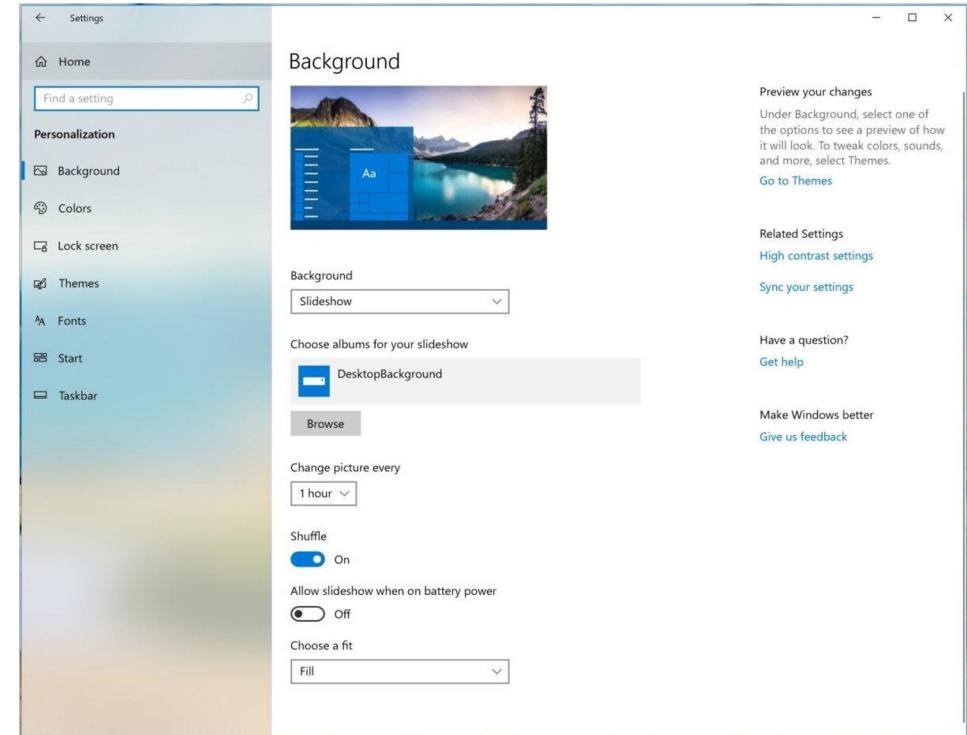
Startup Modes

- You can boot Windows in one of many different modes by pressing the F8 key during the boot process.
- **Safe Mode** - Starts Windows but only loads drivers for basic components, such as the keyboard and display.
- **Safe Mode with Networking Support** - Starts Windows identically to Safe Mode and also loads the drivers for network components.
- **Safe Mode with Command Prompt** - Starts Windows and loads the command prompt instead of the GUI.
- **Last Known Good Configuration** - Enables a user to load the configuration settings of Windows that were used the last time that Windows started successfully .

7.6 Navigate a GUI (Windows)

7.7.1 Manipulate items on the desktop

- After the operating system has been installed, the desktop can be customized to suit individual needs.
- A desktop on a computer is a graphical representation of a workspace.
- The desktop has icons, toolbars, and menus to manipulate files.
- Examples: Desktop Properties, Desktop Item, My Computer, My Network Places and so forth.



7.6 Navigate a GUI (Windows)

7.7.2 Control Panel applets

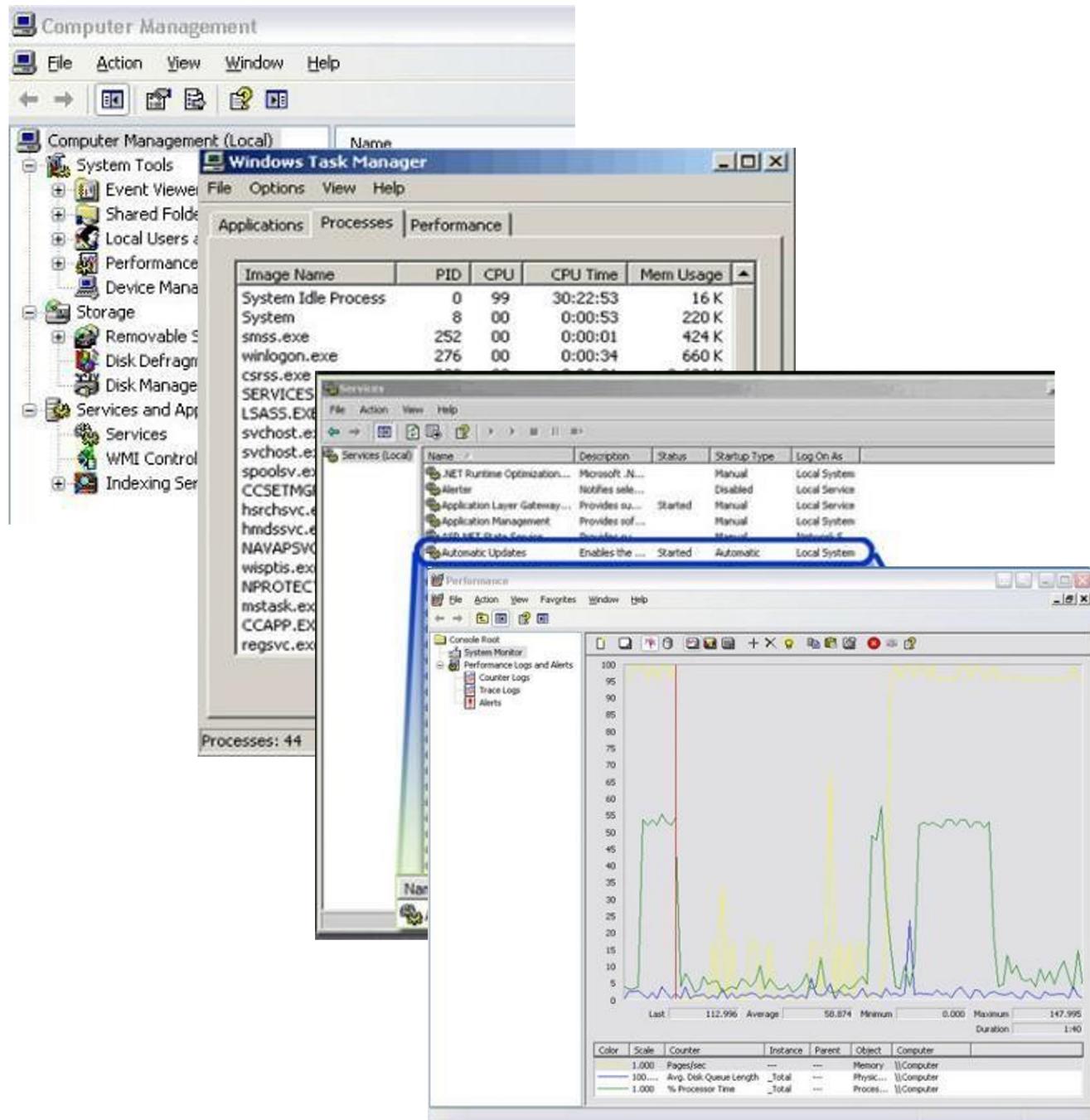
- The names of various applets in the Control Panel differ slightly depending on the version of Windows installed.
- Examples: Appearance and Themes, Network and Internet Connections, Add or Remove Programs, Sounds, Speech, and Audio Devices, and so forth.



7.6 Navigate a GUI (Windows)

3. Administrative Tools

- Computer Management
- Device Manager
- Task Manager
- Services
- Performance Monitor
- Event Viewer
- Microsoft Management console (MMC)
- Remote Desktop
- Performance Settings



7.6 Navigate a GUI (Windows)

7.7.4 Upgrading an Operating System

Upgrade Matrix			
Initial OS	Final OS	Media (ISO)	Windows Update
Windows 7 RTM	Windows 10	○	∅
Windows 7 SP1	Windows 10	○	○
Windows 8	Windows 10	○	∅
Windows 8.1 RTM	Windows 10	○	∅
Windows 8.1 S14	Windows 10	○	○
Windows RT	-	∅	∅
Windows Phone 8.0	-	NA	∅
Windows Phone 8.1	Windows Mobile 10	NA	○

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