



# Chapter 5: Windows Installation



**IT Essentials v6.0**

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# Chapter 5 - Sections & Objectives

- 5.1 Modern Operating System
  - Explain operating system requirements.
- 5.2 Operating System Installation
  - Install a Microsoft Windows operating system.
- 5.3 Chapter Summary



## 5.1 Modern Operating Systems



# The Purpose of an Operating System

- The Operating System (OS) controls almost all functions on a computer.
- In this chapter, you will learn about the components, functions, and terminology related to the Windows 7, Windows Vista , and Windows XP operating systems.
- **Windows 8 introduced the Metro user Interface.**
- **It is critical to consider what customized applications will be installed when determining the version of Windows to install on a desktop computer.**

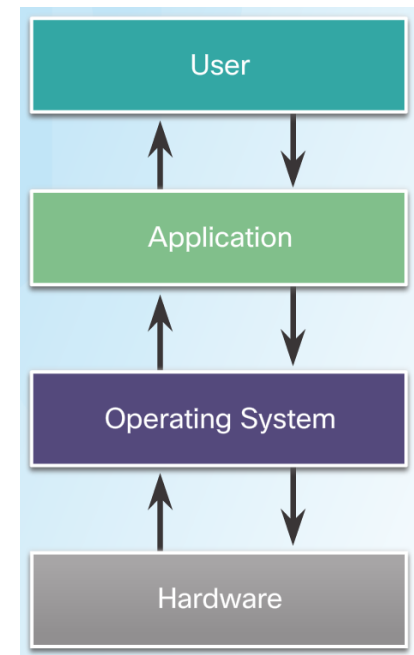


# Characteristics of an Operating System

- **Multi-user** – Two or more users have individual accounts that allow them to work with programs and peripheral devices at the same time.
- **Multitasking** – The computer is capable of operating multiple applications at the same time.
- **Multiprocessing** – The operating system can support two or more processors.
- **Multithreading** – A program can be broken into smaller parts that are loaded as needed by the operating system. Multithreading allows individual programs to be multitasked.

# Basic Function of an Operating System

- All computers rely on an operating system (OS) to provide the interface for interaction between users, applications, and hardware.
- The operating system boots the computer and manages the file system.
- The operating system has four main roles:
  - Control hardware access
  - Manage files and folders
  - Provide user interface
  - Manage applications

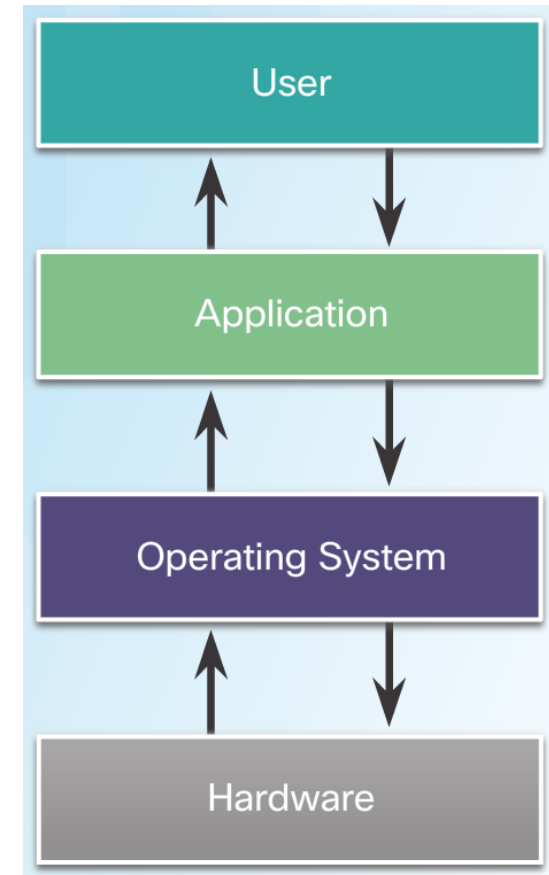


# Processor Architecture

- 32-bit Windows Operating System and x86 Processor Architecture
  - Capable of addressing 4 GB of RAM
  - x86 uses a Complex Instruction Set Computer (CISC)
  - x86 processors use fewer registers than x64 processors
  - 32-bit programs are stored in the C:\Program Files (x86) folder.
- 64-bit Windows Operating System and x64 Processor Architecture
  - Capable of addressing 128+ GB of RAM
  - Enhanced performance for memory management
  - Additional security features
  - x64 architecture is backward compatible with x86
  - Process much more complex instructions at a much higher rate

# Types of Operating Systems

- Desktop Operating Systems
  - Intended for use in SOHO environment.
  - Supports a single user.
  - Shares files and folders on a small network with limited security.
  - Microsoft Windows, Apple Mac OS, and Linux are a few examples.
- Network Operating Systems
  - Contains features that increase functionality in a networked environment
  - Supports multiple users.
  - Provides increased security compared to desktop operating systems



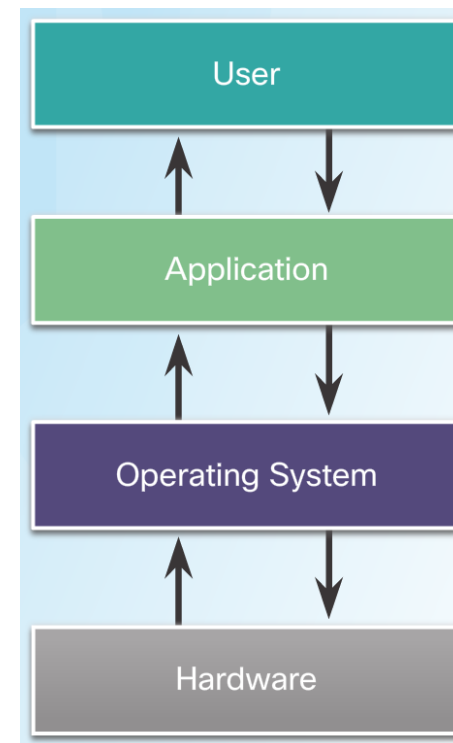


# Network Operating Systems (NOS)

- Common NOS include:
  - Microsoft Windows Server
  - Linux
  - UNIX
  - Mac OS X Server
- NOS has the following characteristics:
  - Supports multiple users
  - Runs multi-user applications
  - Robust and redundant
  - Provides increased security compared to desktop operating systems

# Customer Requirements for an Operating System

- OS Compatible Applications and Environments
  - Before recommending an OS, the technician must:
    - Customized applications to be installed.
    - Review budget constraints.
    - Learn how the computer will be used.
    - Determine which types of applications will be installed.
    - Determine if a new computer needs to be purchased?
- Use **Compatibility Mode** when you have an application that was created for the earlier version of Windows.



# Customer Requirements for an Operating System

- Most operating systems have an HCL.
- HCLs can be found on the manufacturer's website.
- HCL includes list of hardware that is known to work with the operating system.
- Minimum Hardware Requirements and Compatibility with the OS Platform
  - The OS minimum requirements must be met for optimal operation.
  - Some applications may also have specific hardware requirements.
  - Upgrades may be necessary.
  - RAM, hard drives, CPU, video card, motherboard are a few common upgradable components.
  - **Microsoft Compatibility Center** can be a good resource.
  - Use the **Windows 7 Upgrade Advisor** to generate a report on recommended hardware changes.

# Identify Minimum Hardware Requirements

- Customer may need to upgrade or purchase additional hardware to support the required applications and OS.
- A cost analysis will indicate if purchasing new equipment is a better idea than upgrading.
- Possible hardware upgrades:
  - RAM capacity
  - Hard drive size
  - CPU
  - Video card memory and speed
  - Motherboard

Windows 7 Professional	1 GHz or faster 32-bit (x86) or 64-bit (x64) processor	1 GB RAM (32-bit) GB RAM (64-bit)
Windows 7 Ultimate	1 GHz or faster 32-bit (x86) or 64-bit (x64) processor	1 GB RAM (32-bit) GB RAM (64-bit)
Windows 7 Enterprise	1 GHz or faster 32-bit (x86) or 64-bit (x64) processor	1 GB RAM (32-bit) GB RAM (64-bit)

# Operating Systems Upgrade

- **Checking OS Compatibility**
  - New version of an OS brings new functionality and better performance.
  - Support for older hardware may be dropped.
  - New hardware may require latest OS versions.
  - Make sure to check OS compatibility before upgrading the OS.
  - Microsoft's Upgrade Assistant and Upgrade Advisor can be helpful tools.
- **Windows OS Upgrades**
  - Upgrading Windows may be faster than performing a full install.
  - The installed version of an OS determine the upgrades options.
  - A full data backup is strongly recommended before upgrading.
- **Data Migration**
  - User data must be transferred after a new installation.
  - User State Migration Tool and Windows Easy Transfer are tools designed to help the transfer process.

OS can upgrade to:	Windows 2000	Windows XP	Windows Vista	Windows 7
Windows 98	Supported	Supported	Supported	Unsupported
Windows 2000	N/A	Supported	Supported	Unsupported
Windows 98	N/A	N/A	Supported	Unsupported
Windows Vista	N/A	N/A	N/A	Supported

## 5.2 Operating System Installation



# Installing the Operating System

- Reasons to perform a clean installation of an OS:
  - When a computer is passed from one employee to another.
  - When the operating system is corrupted.
  - When the primary hard drive is replaced in a computer.
- Before performing a clean installation:
  - Back up all data first.
  - Explain to the customer that existing data will be erased.
  - Confirm that all needed data has been successfully transferred.

# Advantages of NTFS

## Advantages of NTFS over FAT32:

- NTFS supports larger files.
- NTFS provides more security features.
- NTFS supports compression.
- NTFS support quotas.
- NTFS support encryption.



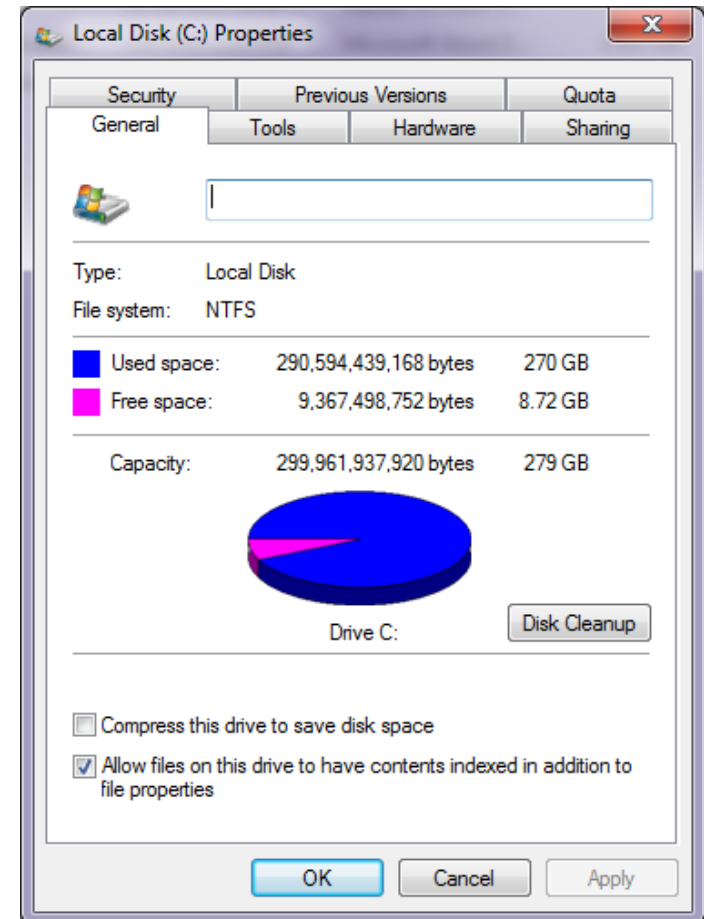
# Converting from FAT to NTFS

- If a drive is formatted using FAT or FAT32, it can be converted to NTFS by using the `CONVERT` command from the CLI.
- This will convert without the loss of data, but it's a good idea to back it up before converting.

# Storage Device Setup Procedures

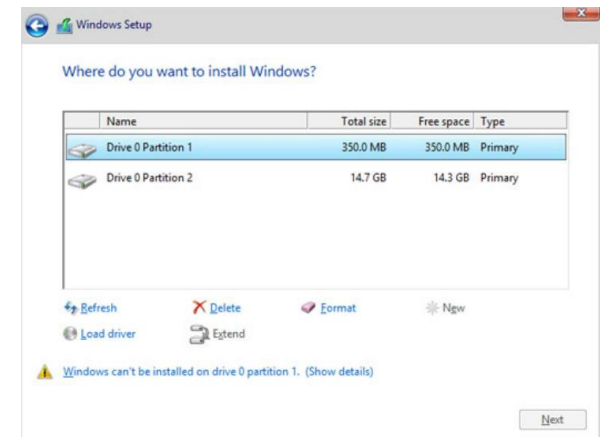
## ■ File Systems

- File systems define how data is written within a partition.
- Different OSs, support different file systems.
- FAT32, NTFS, exFAT, CCFS and NFS are common file systems supported by Windows-based OSs.



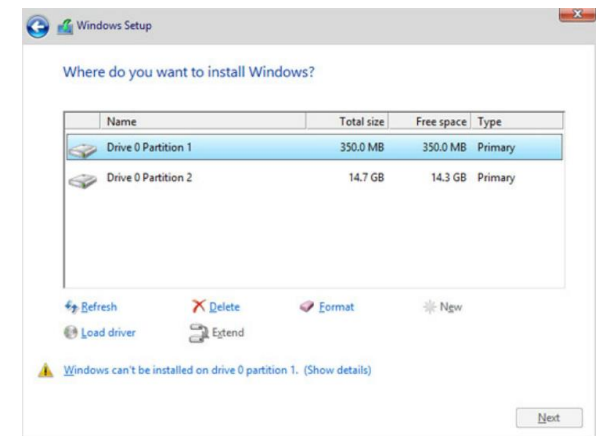
# Storage Device Setup Procedures (Cont.)

- Storage Device Types
  - Hard Disk Drives
  - Flash Memory-Based Drives (USB Flash Drives, SSDs, SSHDs and eMMC)
- Hard Drive Partitioning
  - Logical divisions inside a disk.
  - Proper partitioning is crucial for a correct boot process.
  - MBR and GPT are the two most popular partition scheme standards.
  - The active partition must be a primary partition.
  - The OS uses the active partition to boot the system.
  - File system must be created on the hard drive.
  - During the installation phase, most operating systems will automatically partition and format the hard drive.



# Storage Device Setup Procedures (Cont.)

- OS Installation with Default Settings
  - The installer program applies the most common settings.
  - Preferred by inexperienced users.
  - Allows for very little customization.
  - Windows allows for granular customization after the default setting installation is complete.
- Account Creation
  - User accounts allow multiple users to share a computer.
  - Common Windows account types are Administrator, Standard, and Guest.
- Finalize the Installation
  - Use Windows Update to check for updates after the installation is complete.
  - Use Device Manager to verify that all hardware was properly installed.



# RAID



1. Redundant **A**rray of **I**ndependent (or **I**nexpensive) **D**isks
2. Uses multiple hard drives
3. Increases performance
4. Provides protection against data loss

# RAID Levels

Level	Features
Level 0	Striped Disk Array without Fault Tolerance
Level 1	Mirroring and Duplexing
Level 2	Error-Correcting Coding
Level 3	Parallel transfer with parity
Level 4	Independent Data disks with shared Parity disk
Level 5	Striping with distributed parity blocks
Level 6	Independent Data disks with two independent distributed parity schemes
Level 7	Optimized Asynchrony for High I/O Rates
Level 10	A Stripe of Mirrors
Level 53	High I/O Rates and Data Transfer Performance
Level 0+1	A Mirror of Stripes

On a spanned volume, data is seen as one volume, but is stored across two or more disks.

# Install the Operating System

- When a computer boots up with the Windows installation CD, the Windows 7 installation process starts with three options:
  - Install now - Sets up and installs the Windows 7 OS.
  - What to know before installing Windows - Opens Help.
  - Repair your computer - Opens the System Recovery Options.
- Under Install now three options are available:
  - **Upgrade** - Upgrades Windows but keeps your current files, settings, and programs. You can use this option to repair an installation.
  - **Custom (advanced)** - Installs a clean copy of Windows in your choice of location and allows you to change disks and partitions. It is also known as a clean installation.
  - Quit - Exits Setup.

# Custom Installation Options

- Other Installation Methods
  - Windows has several different types of Custom Installations including network installation and image-based installation.
  - Other types of Custom Installations include Windows Advanced Startup Options, Refresh your PC (Windows 8.x only), System Restore, Upgrade, Repair installation, Remote network installation, Recovery partition, and Refresh/restore.
- Network Installation
  - Relies on a network connection to deploy
  - the installation files.
  - Network Installation methods include
  - Remote Network Installation and Unattended Installation.



# Custom Installation Options

- Windows 7 has several different types of custom installations.
  - **Network Installation** - Requires all setup files to be copied to a network server.
  - **Preboot Execution Environment (PXE) Installation** - Uses a PXE boot program and a client's network card to access the setup files.
  - **Unattended Installation** - Uses a network distribution point that uses an answer file.
  - **Image-based Installation** - Uses Sysprep and a disk-imaging program, that copies an image of the OS directly to the hard drive with no user intervention.
  - **Remote Installation** - Downloads the installation across the network.

# Custom Installation Options (Cont.)

- Restore, Refresh, and Recover
  - Some tools are also used to perform Custom Installations
  - These tools include Windows System Restore, Windows Refresh your PC, and Windows Recovery Partition.
- System Recovery Options
  - Used to recover after a system failure.
  - Create a system image after all applications are installed and the system is complete. Used to restore from failure.
  - Popular recovery tools are:
    - Windows Advanced Startup Options
    - System Recovery Options (Windows 7 & 8)
    - **Factory Recovery Partition** – used to restore the computer to its factory state.
    - **Refresh Your PC** – A Windows 8 tool that allows a computer to be rolled back to its factory start.

# System Recovery Options

- **Repair Disc-** For Windows 7. Use the system repair disc to boot the computer
- **System Image Recovery** – For Windows 7. It allows users to back up the contents of their hard drive, including personal files and settings.
- **Factory Recovery Partition** – Some computers with Windows 7 preinstalled from the factory contain a hidden recovery partition with an image of the bootable partition.
- **Automated System Recovery (Windows XP Professional only)** – The ASR is a backup of the system state, services, and OS components. Used with Windows installation disc to recover computer.

# The Boot Sequence for Windows 7

## Boot Sequence for Windows 7

Power on Self Test (POST)

POST for each adapter card that has a BIOS

BIOS reads the MBR

MBR takes over control of the boot process and starts BOOTMGR

BOOTMGR reads the Boot Configuration Data file to know which OS to load and where to find the OS on the boot partition

BOOTMGR invokes WINLOAD.EXE in order to load the NTOSKRNL.EXE file and HAL.DLL

BOOTMGR reads the registry files and loads device drivers

NTOSKRNL.EXE starts the WINLOGON.EXE program and displays the Windows login screen

# Startup Modes

- Pressing the **F8** key during the boot process opens the Windows **Advanced Startup Options** menu, which allows you to select how to boot Windows.
  - **Safe Mode** – Starts Windows but only loads drivers for basic components, such as the keyboard and display. Disables the auto restart function.
  - **Safe Mode with Networking** – 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 interface.
  - **Last Known Good Configuration** – Enables a user to load the configurations settings of Windows that was used the last time that Windows successfully started. It does this by accessing a copy of the registry that is created for this purpose.

# Startup Modes

- Access the **Advanced Startup** options menu before the OS loads to disable the auto restart function. This allows you to examine any error messages before the computer restarts.

# The Windows Registry Files

- Settings that are chosen during the installation process stored are stored in the Registry.
- It important to register a DLL file in Windows. Any program needing to use that specific program code, like a DLL file, can locate the file through the Registry.
- Always use Programs and Features or the uninstall program to remove an application from your computer. Otherwise, registry values will not be removed.

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

# Multiboot Procedures

- Multiple OS can be installed on one computer
- To create a dual-boot system in Microsoft Windows:
  - Must have more than one hard drive or a hard drive with more than one partition.
  - Install the oldest OS on the primary partition or the hard drive marked with an active partition.
  - Install the second OS on the second partition or hard drive.
  - The boot files are automatically installed in the active partition.
- During the dual-boot process:
  - The BOOTMGR file indicates that more than one OS is present.
  - You are prompted to choose the OS that you want to load.
  - NOTE: In Windows XP, the BOOT.INI file fills the role of the BOOTMGR file.



# Disk Management Utility

- This utility can be used to complete the following tasks:
  - View drive status
  - Extend partitions
  - Split partitions
  - Assign drive letters
  - Add drives
  - Add arrays
  - Determine if a dynamic disk is corrupt
- To access the Disk Management utility in Windows 7 and Windows Vista, use the following path:  
 Select Start > right-click Computer > Manage > select Disk Management

# Boot Sequence and Registry Files

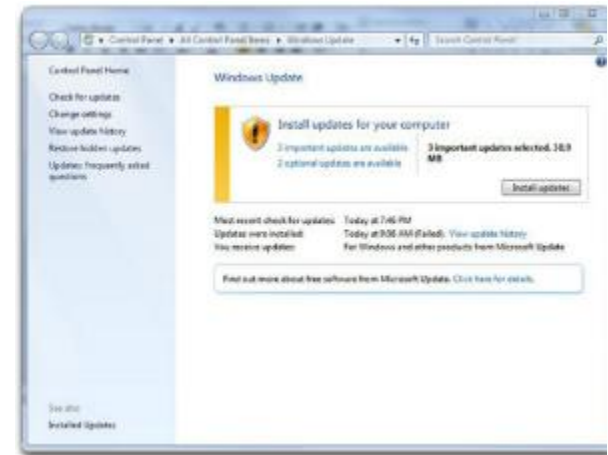
- Windows Boot Process
  - Common boot steps are: POST execution, locating and loading CMOS configurations, locating and loading bootloaders, locating and loading the OS.
  - Windows Boot Loader and Windows Boot Manager are programs used to manage Windows startup.
- Startup Modes
  - Windows Startup Modes allow for troubleshooting when Windows fails to start.
  - Windows Startup Modes include: Safe Mode, Safe Mode with Networking, Safe Mode with Command Prompt and Last Known Good Configuration.
- Windows Registry
  - All Windows settings are stored as key-values pairs in the Windows Registry
  - Extreme caution must be taken when working with the Registry.

# Account Creation

- Windows 7 has three types of user accounts: Administrator, Standard, and Guest.
- The Administrator Account must be created when Windows 7 is installed.
- To create or remove a user account in Windows 7 use the following path :
  - Start > Control Panel > User Accounts > Add or remove user accounts

# Complete the Installation

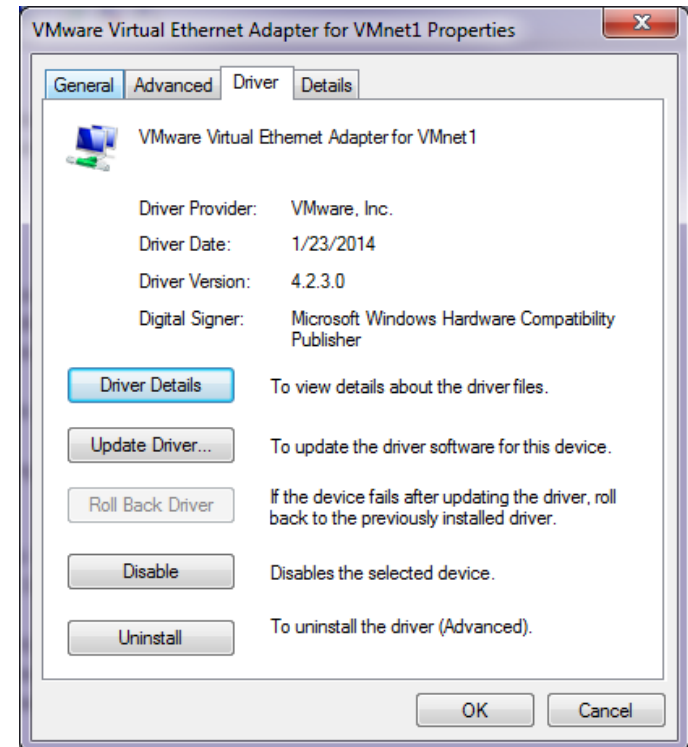
- When Windows 7 installation completes:
  - Computer will reboot
  - Prompts to create user account
  - Register Windows 7 and verify that you are using a legal copy of the OS
  - Verification enables you to download patches and service packs
- Use **Microsoft Update Manager** to scan for new software.



# Update Device Drivers

- Device Drivers are used by an OS to communication with hardware components.
- Methods to update device drivers:
  - Use the media that came with the device.
  - Download the driver from the website of the manufacturer.

The **DirectX** application interface is comprised of multiple APIs that support multimedia tasks in Windows operating systems.



# Disk Directories

- Directory Structures
  - Designed to store files and folders.
  - A disk must be initialized and formatted if Windows cannot recognize its file systems.
  - Formatting a disk or partition creates a file system.
  - Formatted disks or partitions must be mounted before use.
- User and System File Locations
  - System files are files critical to the OS operation.
  - User files are files belonging to a user and of little significance to the OS.

# Disk Directories (Cont.)

- Attributes
  - File extensions identify file types in Windows and must adhere to Windows Naming Convention.
  - File attributes define how files can be handled.
  - Common file attributes are READ, ARCHIVE, SYSTEM and HIDDEN.
- Application, File, and Folder Properties
  - Right-click on a file, application or folder to see its properties.
  - Application and File Properties are different than Folder Properties.

# Directory Structures

- The root level of the Windows directory structure, the partition, is usually labeled drive C.
  - Contains a set of standardized directories, called folders, for the operating system, applications, configuration information, and data files.
  - Directories may contain subdirectories. Subdirectories are commonly called subfolders.
- **Drive Mapping** - letters are used to name physical or logical drives.
- **Mounting a Volume** - mapping a drive to an empty folder on a volume. Mounted drives are assigned drive paths instead of letters.



# Data Migration

- One of the following tools can be used to migrate data and settings:
- **User State Migration Tool** migrates all user files and settings to the new OS.
- **Windows Easy Transfer** migrates personal files and settings when switching from an old computer to new.
- Note: Windows Easy Transfer replaced the Windows XP File and Settings Transfer Wizard.
- If you have an application that was create for an earlier version of Windows it might be able to operate in **Compatibility Mode**.

## 5.3 Chapter Summary



# Summary

- This chapter introduced computer operating systems. As a technician, you should be skilled at installing Windows® operating systems. The following concepts from this chapter are important to remember:
  - Several different operating systems are available, and you must consider the customer's needs and environment when choosing an OS.
  - The main steps in setting up a customer's computer include preparing the drive, installing the OS, creating user accounts, and configuring installation options.

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