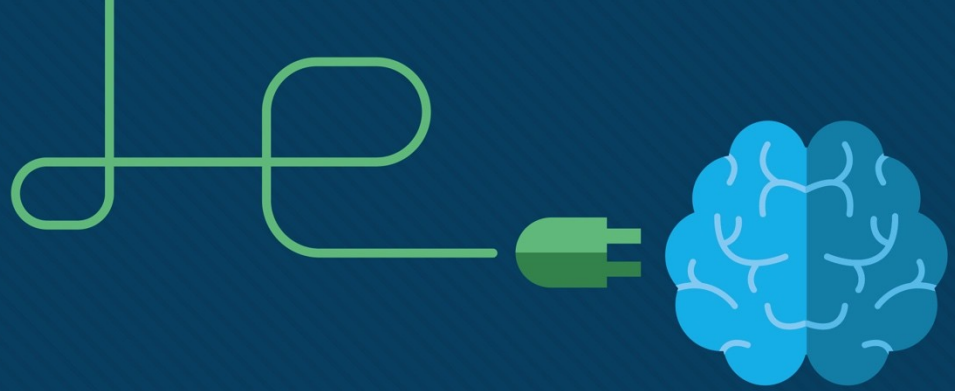
Chapter 10: Windows Installation

IT Essentials 8.0 Planning Guide



Chapter 10: Windows Installation

IT Essentials v8.0

Chapter 10 - Sections & Objectives

- 10.1 Modern Operating Systems
  - Explain operating system requirements.
    - Describe the functions of operating systems.
    - Describe operating system software and hardware requirements.
    - Explain the process of upgrading an operating system.
- 10.2 Disk Management
  - Create a partition in Windows using the Disk Management utility.
    - Explain disk management.

Chapter 10 - Sections & Objectives (Cont.)

- 10.3 Install Windows
  - Install a Windows operating system.
    - Install a Windows operating system.
    - Describe custom installation options.
    - Describe the boot sequence and registry files.

10.1 Modern Operating Systems

Terms

- The following terms are often used when describing an operating system (OS):
  - **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 CPUs.
  - **Multithreading** - A program can be broken into smaller parts that are loaded as needed by the operating system. Multithreading allows different parts of a program to be run at the same time.

- The OS boots the computer and manages the file system. Operating systems can support more than one user, task, or CPU.

Basic Functions of an Operating System

- The OS manages the interaction between the applications and the hardware.
- The OS creates a file structure on the hard disk drive to store data.
- The OS enables the user to interact with the software and hardware.
- The OS locates and application and loads it into the RAM of the computer.

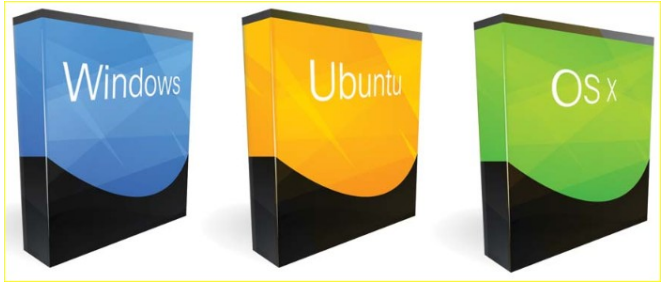
Windows Operating Systems

- Windows 10 is an update from the previous version of Windows designed for PCs, tablets, embedded devices, and Internet of Things devices.
- This version integrated the Cortana virtual assistant, combined the Windows 7 style start menu, the Windows 8 live tiles in desktop mode, and included the new Microsoft Edge Web browser.
- There are twelve different editions of Windows 10 with varying feature sets and use cases to meet the needs of consumer, business, and education environments.
- Like Windows 10, Windows 11 is an upgrade from the previous version.
- Most of the changes are superficial, like smaller taskbar icons that are placed in the center.
- There are also other visual additions such as a better dark mode, transparency changes, and animation changes, among others.
- Widgets have been expanded and are now more personalized.
- The settings application has been redesigned with a menu on the left, making navigation easier.
- There are also minor convenience additions for Windows tablets running Windows 11, including better spacing of taskbar icons and a three-finger swipe to customize actions.
- Windows 11 is more energy efficient, yet usually performs faster than previous versions.
- Finally, all versions of Windows 11 are 64-bit only, so it will not install on older, 32-bit computers.

Compatible System Software and Hardware Requirements

- To make an OS recommendation, a technician must review budget constraints, learn how the computer will be used, determine which types of applications will be installed, and whether a new computer may be purchased.

- These are some guidelines to help determine the best OS for a customer:
  - **Does the customer use off-the-shelf applications for this computer?** Off-the-shelf applications specify a list of compatible operating systems on the application package.
  - **Does the customer use customized applications that were programmed specifically for the customer?** If the customer is using a customized application, the programmer of that application specifies which OS to use.



Minimum Hardware Requirements and Compatibility with OS

Windows Recommended Minimum System Requirements

Component	Windows 11	Windows 10
Processor	1 GHz or faster or with 2 or more cores	1 GHz or faster
RAM	4 GB for 64-bit	1 GB for 32-bit or 2 GB for 64-bit
Hard drive space	64 GB for 64-bit	16 GB for 32-bit or 20 GB for 64-bit
Graphics card	DirectX 12 or later with WDDM 2.0 driver	DirectX 9 or later with WDDM 1.0 driver
Display	High definition (720p) display that is greater than 9" diagonally, 8 bits per color channel	800x600
Internet connection	Necessary to perform updates and some features	Necessary to perform updates and some features
Trusted Platform Module (TPM)	2.0	--

32-bit vs. 64-bit Processor Architecture

32-bit vs. 64-bit Processor Architecture

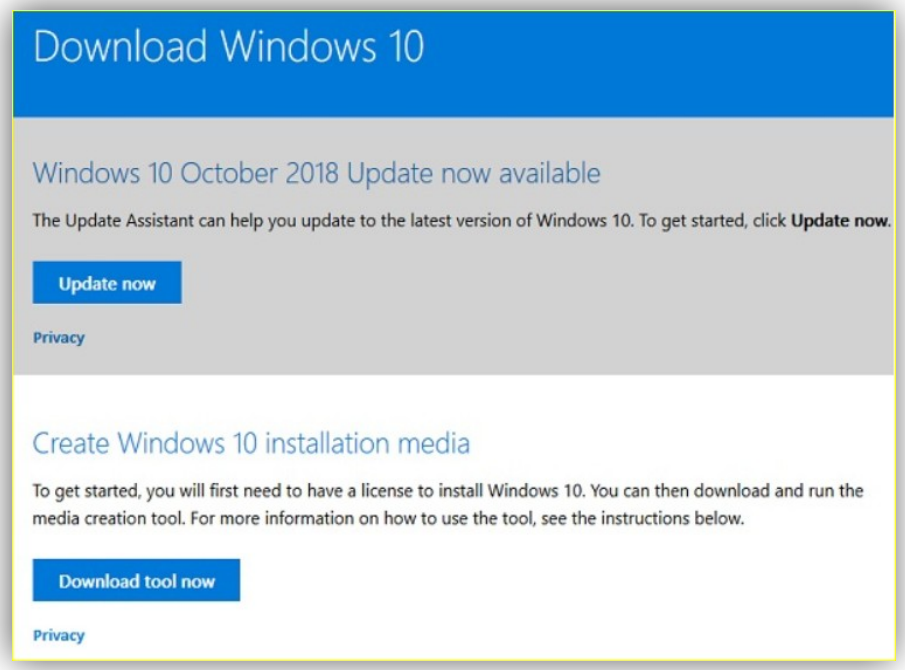
Architecture	Description
32-bit (x86-32)	• Processes multiple instructions using a 32-bit address space • Supports maximum of 4 GB of RAM memory • Supports 32-bit operating systems only • Supports 32-bit applications only
64-bit (x86-64)	• Adds additional registers specifically for instructions that use a 64-bit address space • Is backward compatible with the 32-bit processor • Supports 32-bit and 64-bit operating systems • Supports 32-bit and 64-bit applications

Checking OS Compatibility

- An OS must be upgraded periodically to remain compatible with the latest hardware and software.
- It is also necessary to upgrade an OS when a manufacturer stops supporting it.
- Upgrading an OS can increase performance.
- New hardware products often require that the latest OS version be installed to operate correctly.
- While upgrading an OS may be expensive, you can gain enhanced functionality through new features and support for newer hardware.
- Before upgrading the operating system, check the minimum hardware requirements of the new OS to ensure that it can be installed successfully on the computer.
- **Note**: When newer versions of an OS are released, support for older versions is eventually withdrawn.

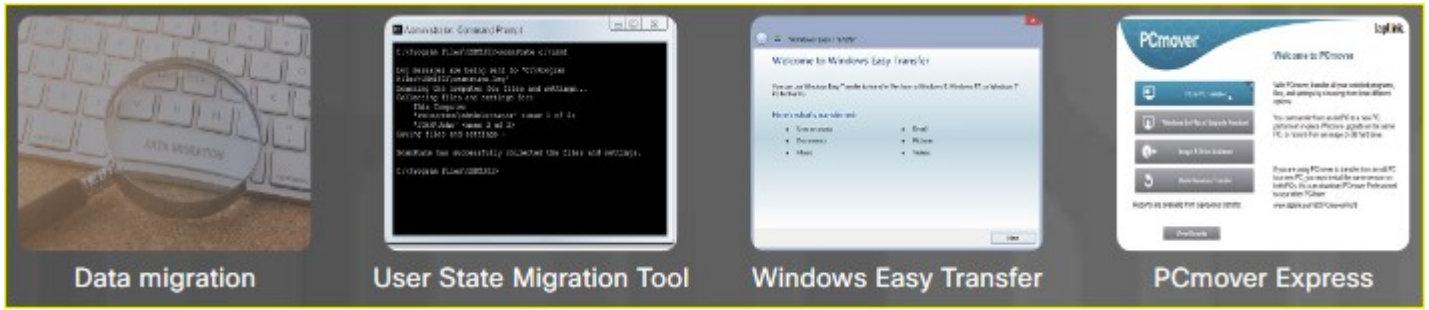
Windows OS Upgrades

- The version of an OS determines available upgrade options.
- For example, a 32-bit OS cannot be upgraded to a 64-bit OS.
- Windows 7 and Windows 8 can be upgraded to Windows 10, but Windows Vista and Windows XP cannot.
- To upgrade Windows 7 or Windows 8 to Windows 10, use the Windows 10 Update Assistant available on the Download Windows 10 website.
- It walks you through all the steps in the Windows 10 setup process.
- Computers running Windows XP or Windows Vista do not have an upgrade path to Windows 10 and require a clean installation.
- Windows 10 installation media can be created using the Create Windows 10 installation media tool.



Data Migration

- When a new OS installation is needed, user data must be migrated from the old OS to the new one.
- The User State Migration Tool (USMT) is a command line utility to simplify user state migration.
- Use Windows Easy Transfer when switching from an old computer to a new one.
- PCmover Express is a tool for transferring selected files, folders, profiles and applications from an old Windows PC to a Windows 10 PC.



10.2 Disk Management

Storage Device Types

- The two most common types of data storage devices used today are hard disk drives and flash memory-based drives such as solid-state hard drives and USB drives.
- When the storage device type has been chosen, it must be prepared to receive the new operating system.
- Modern operating systems ship with an installer program.
- Installers usually prepare the disk to receive the operating system, but it is crucial for a technician to understand the terms and methods involved in this preparation.

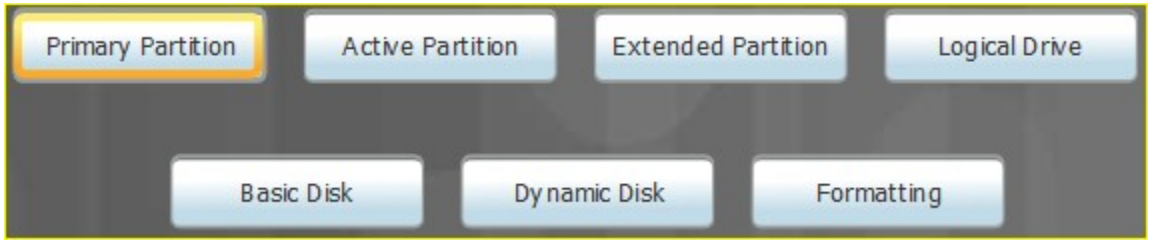
Hard Drive Partitioning

- Finding and launching the operating system is one of the responsibilities of computer firmware, which needs to know the partition scheme.
- Two partition scheme standards are master boot record (MBR) and globally unique identifier (GUID) partition table (GPT).
  - **Master Boot Record - It** contains information on how the hard drive partitions are organized. It is 512 bytes long and contains the boot loader, an executable program that allows a user to choose from multiple operating systems. It is commonly used in computers with BIOS-based firmware.

  - **GUID Partition Table -** Also designed as a partition table scheme standard for hard drives, the GPT makes use of a number of modern techniques to expand on the older MBR partitioning scheme. GPT is commonly used in computers with UEFI firmware.

MBR	GPT
Maximum of 4 primary partitions	Maximum of 128 partitions in Windows
Maximum partition size of 2TB	Maximum partition size of 9.4 ZB (9.4 × 10^21 bytes)
No partition table backup	Stores a partition table backup
Partition and boot data stored in one place	Partition and boot data stored in multiple locations across the disk
Any computer can boot from MBR	Computer must be UEFI-based and run a 64-bit OS

Partitions and Logical Drives

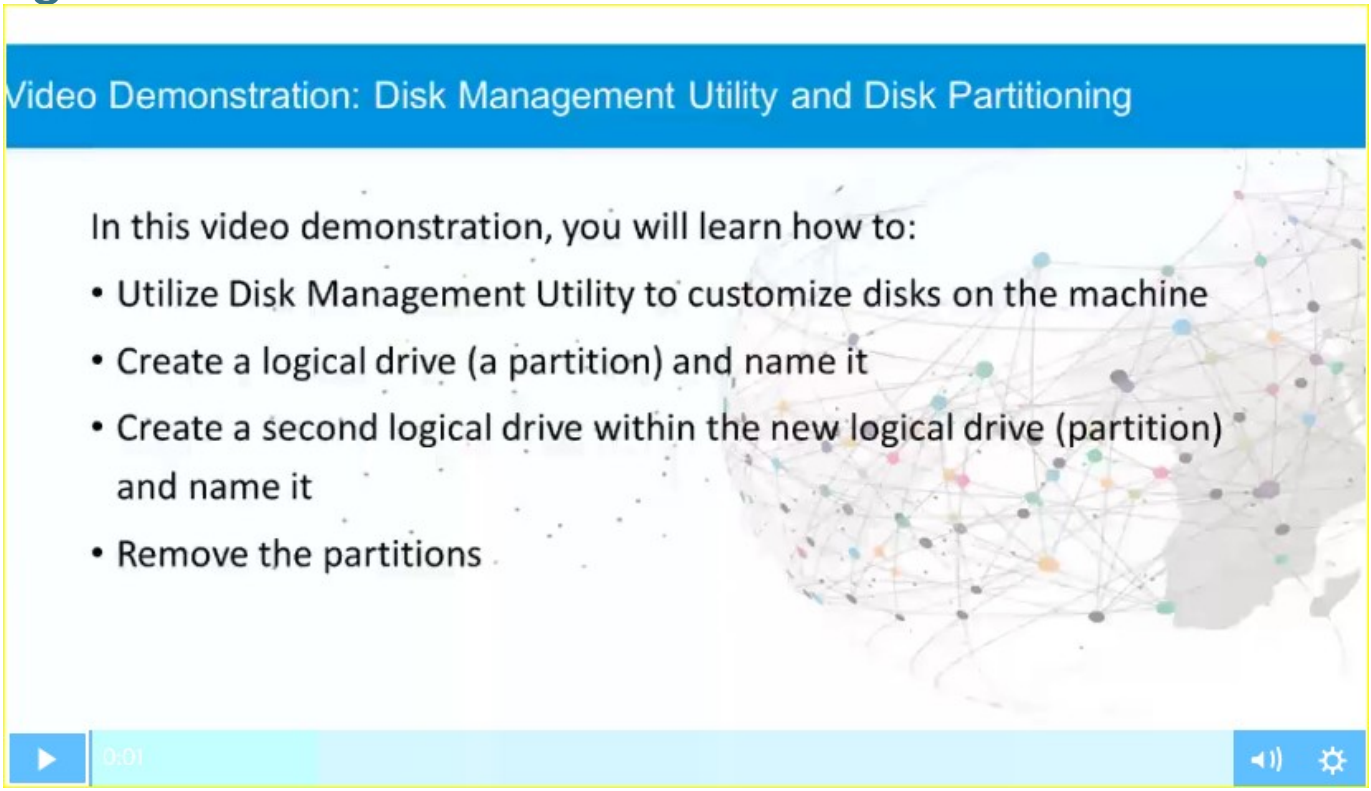


- The primary partition contains the OS files and is usually the first partition.
- On MBR disks, the active partition is used to store and boot an OS.
- If more than 4 partitions are needed on an MBR disk, one partition can be designated an extended partition.
- A logical drive is a section of an extended partition, used to separate information for administrative purposes.
- A basic disk (the default) contains partitions such as primary and extended, as well as logical drives which are formatted for data storage.
- A dynamic disk can create volumes that span across more than one disk.
- Formatting creates a file system on a partition for file storage.

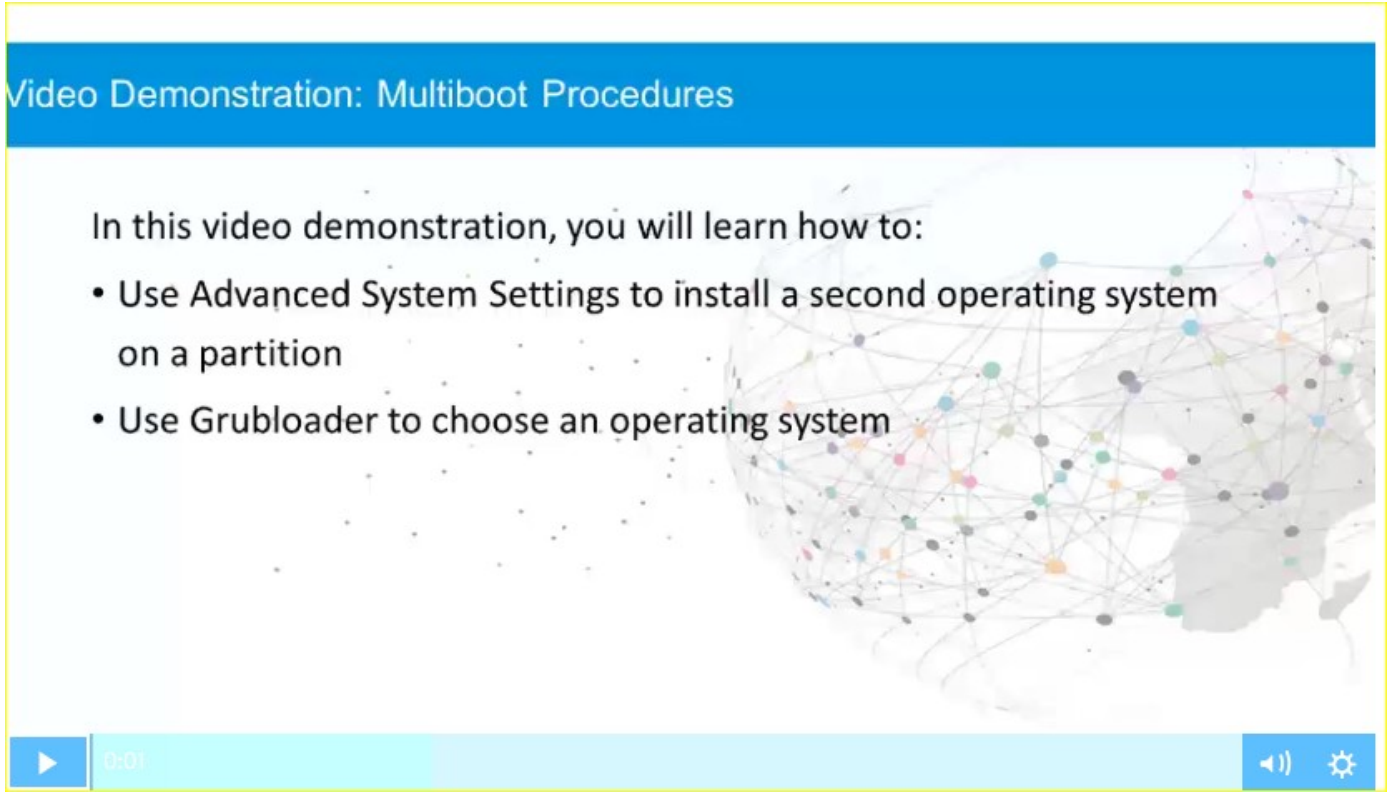
File Systems

- File systems differ in properties of speed, flexibility, security, size and more. Here are five common file systems:
  - **File Allocation Table, 32 bit (FAT32)** - Supports partition sizes up to 2 TB or 2,048 GB. Used by Windows XP and earlier OS versions.
  - **New Technology File System (NTFS)** - Supports partition sizes up to 16 exabytes, in theory. NTFS incorporates file system security features and extended attributes.
  - **exFAT (FAT 64)** - Created to address some of the limitations of FAT, FAT32, and NTFS when formatting USB flash drives, such as file size and directory size. One of the primary advantages of exFAT is that it can support files larger than 4GB.
  - **Compact Disc File System (CDFS)** - Created specifically for optical disk media.
  - **NFS (Network File System)** - NFS is a network-based file system, that allows file access over the network. NFS is an open standard which allows anyone to implement it.

Video Demonstration – Disk Management Utility and Disk Partitioning



Video Demonstration – Multiboot Procedures



Lab – Create a Partition in Windows

- In this lab, you will create a FAT32 formatted partition on a disk.
  - You will convert the partition to NTFS.
  - You will then identify the differences between the FAT32 format and the NTFS format.

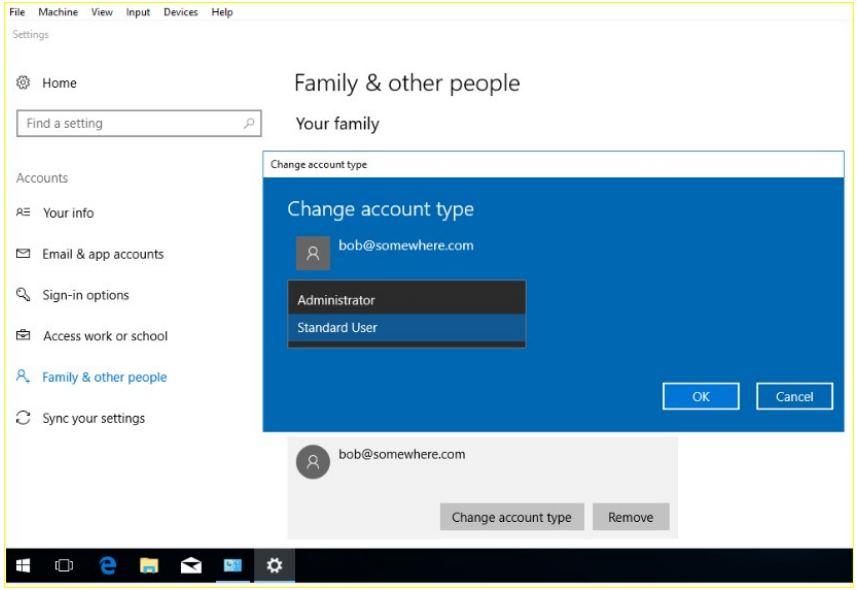
10.3 Install Windows

Lab – Windows Installation

- In this lab, you will install the Windows 10 operating system.

Account Creation

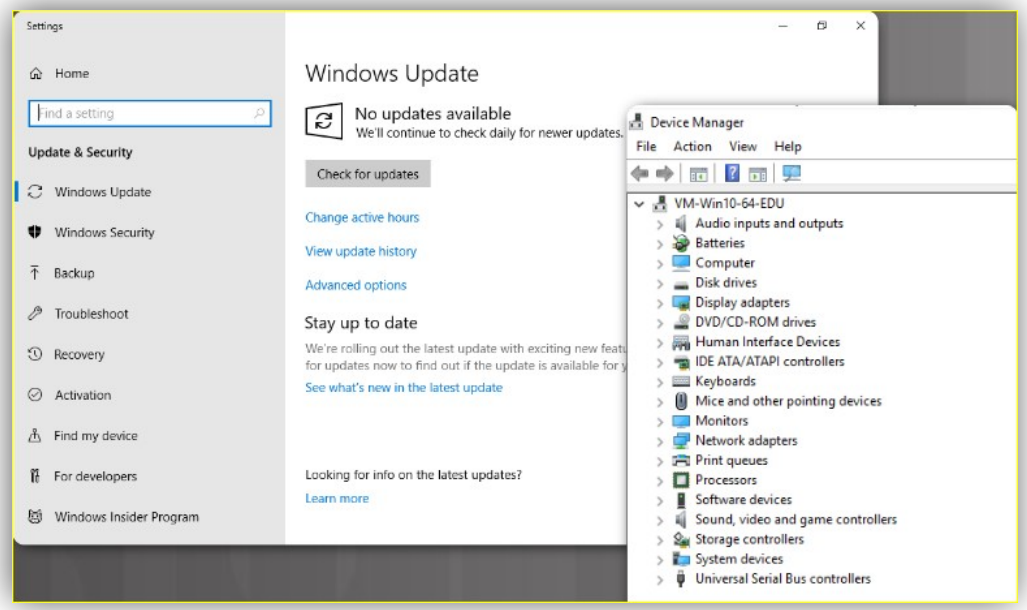
- Authentication is when users enter a username and password to access a user account.
- Windows uses Single-Sign On (SSO) authentication, which allows users to log in once to access all system resources.
- User accounts allow multiple users to share a single computer using their own files and settings.
- Windows 10 offers two account types: Administrator and Standard User.
- Administrator accounts have complete control over a computer.
- Users with this type of account can change settings globally and install programs.
- Standard user accounts have limited control over a computer.
- Users with this type of account can run applications, but they cannot install programs.



Finalize the Installation

- **Windows Update**
  - To update the OS after the initial installation, Microsoft Windows Update is used to scan for new software and install service packs and patches.

- **Device Manager**
  - After installation, verify that all hardware is installed correctly.
  - The Device Manager is used to locate device problems and install the correct or updated drivers in Windows.
  - The figure shows the Windows Update and Device Manager utilities on Windows 10.

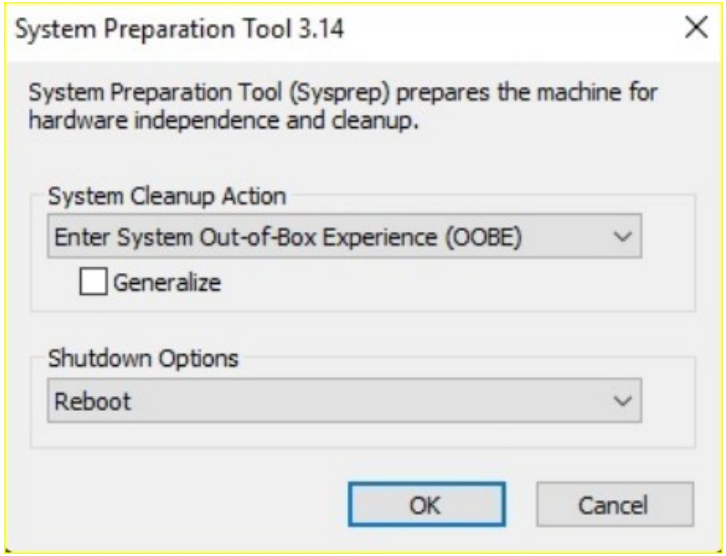


Lab - Finalize the Windows Installation

- In this lab, you will add user accounts and finalize an installation of Windows 10.

Disk Cloning

- Installing an OS on multiple computers takes time.
- To simplify, administrators usually elect a computer to act as a base system and go through the regular operating system installation process.
- After the OS is installed in the base computer, a specific program is used to duplicate all the information on its disk, sector by sector, to another disk.
- This new disk, usually an external device, now contains a fully deployed operating system and can be used to quickly deploy a fresh copy of the base operating system and any installed applications and data.
- If an undesirable setting is accidentally included during the base installation, an administrator can use Microsoft's System Preparation (Sysprep) tool to remove it before creating the final image.



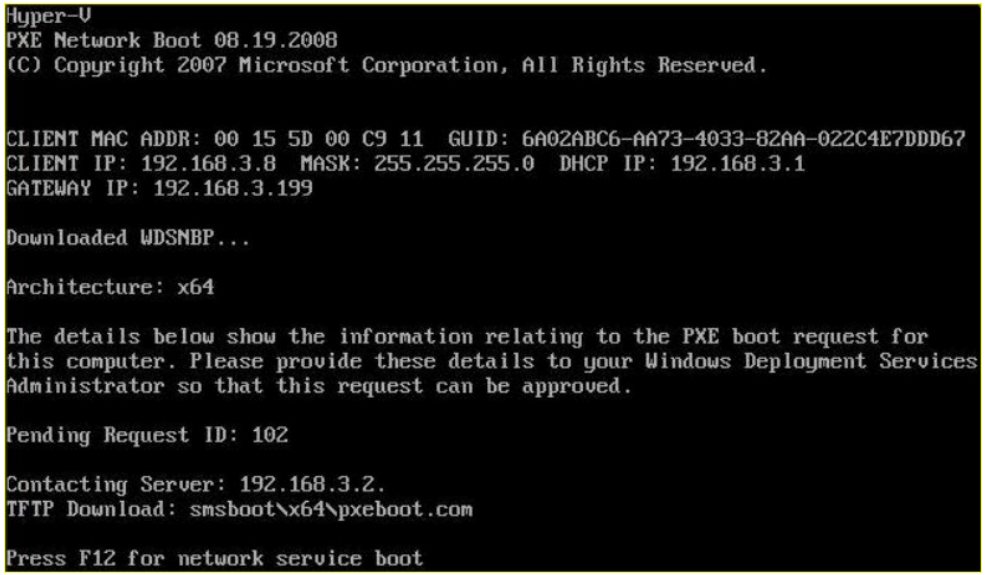
Other Installation Methods

- Windows has several different types of custom installations:
  - **Network Installation** – This includes Preboot Execution Environment (PXE) Installation, Unattended Installation, and Remote Installation.
  - **Image-based Internal partition Installation** - This is a Windows image stored on an internal (often hidden) partition that can be used to restore Windows to its original state when it was shipped from the factory.
  - **Other Types of Custom Installations** – This includes Windows Advanced Startup Options, Refresh your PC (Windows 8.x only), System Restore, Upgrade, Repair installation, Remote network installation, Recovery partition, and Refresh/restore.

Custom Installation Options

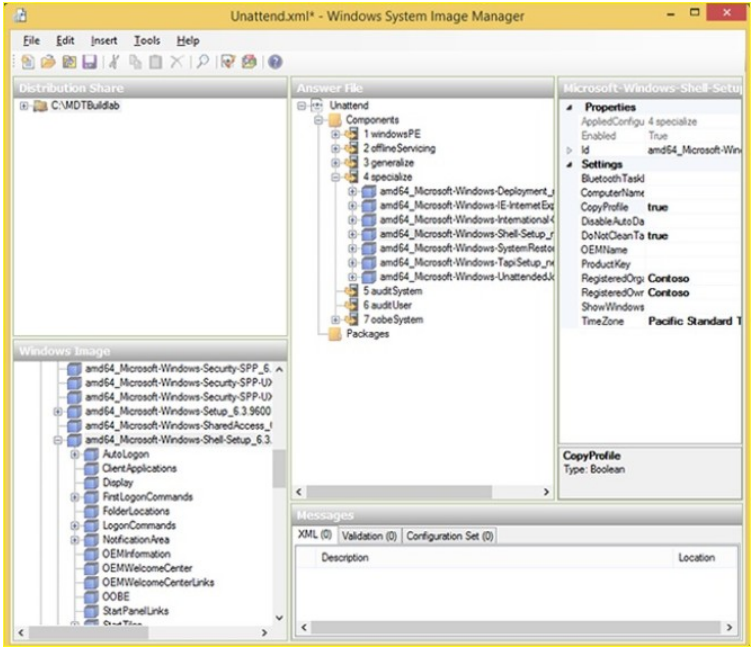
Remote Network Installation

- With remote network installation, the OS installation files are stored on a server.
- The client computer can access the files remotely.
- A software package such as Remote Installation Services (RIS) communicates with the client, stores the setup files, and provides the necessary instructions for the client to access the setup files, download them, and begin the OS installation.
- Because the client computer does not have an OS installed, a special environment must be used to boot the computer, connect to the network, and communicate with the server to begin the installation process.
- This special environment is known as the Preboot eXecution Environment (PXE).



Unattended Network Installation

- To perform a Windows Unattended installation, setup.exe must be run with the user options found in the answer file.
- Instead of prompting the user, Setup uses the answers listed in the file.
- To customize a standard Windows 10 installation, use the System Image Manager (SIM), to create the setup answer file.
- The answer file is copied to the distribution shared folder on a server.
- At this point, you can do one of two things:
  - Run the unattended.bat file on the client machine to prepare the hard drive and install the OS from the server over the network.
  - Create a boot disk that boots the computer and connects to the distribution shared folder on the server. You then run a batch file containing a set of instructions to install the OS over the network.

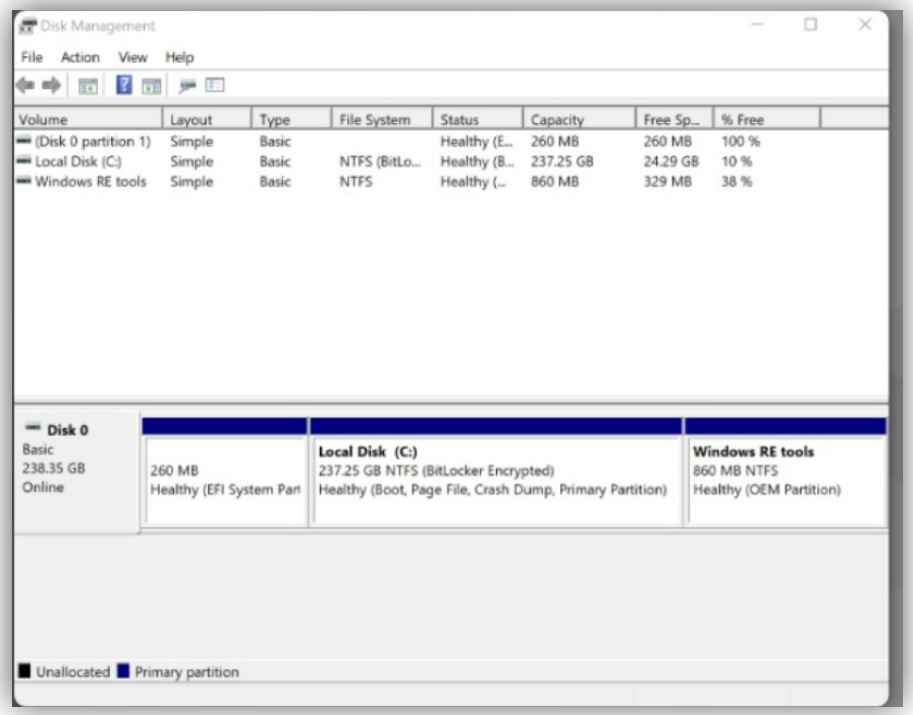


Video Demonstration – Windows Restore and Recovery

Custom Installation Options

Recovery Partition

- Some Windows computers contain a section of the disk that is inaccessible to the user.
- This partition, called a recovery partition, contains an image that can be used to restore the computer to its original configuration.
- The recovery partition is often hidden to prevent it from being used for anything other than restoration.
- To restore the computer using the recovery partition, you often must use a special key or key combination when the computer is starting.
- Sometimes, the option to restore from the factory recovery partition is located in the BIOS or found in Windows.

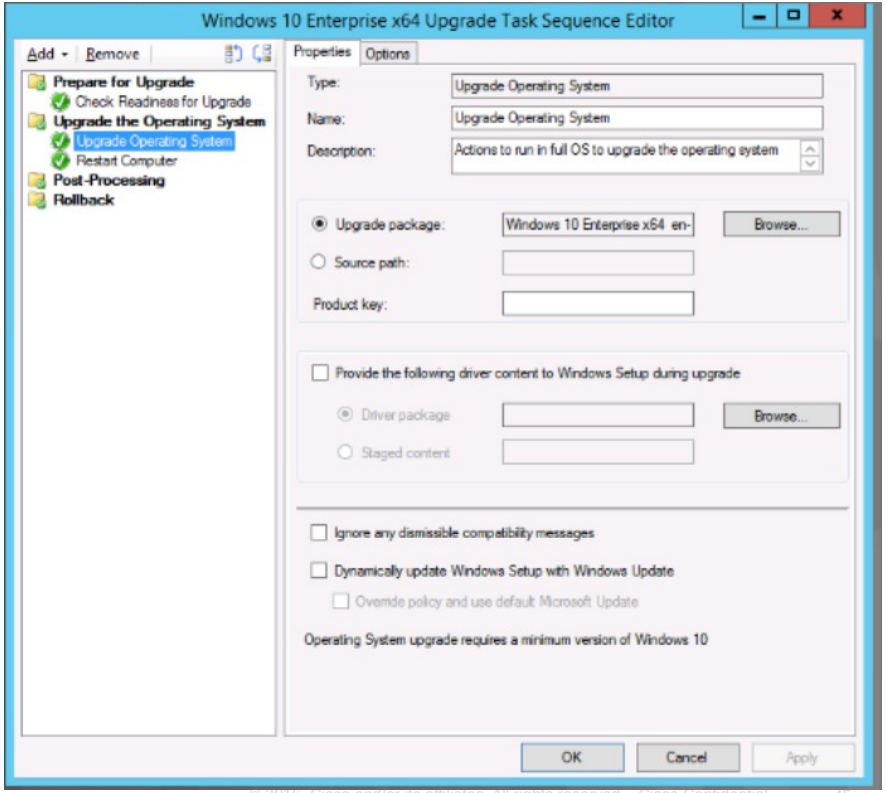


Custom Installation Options

Upgrade Methods

- **In-place upgrade** - This will update the OS and migrate apps and settings to the new OS. The System Center Configuration Manager (Configuration Manager) task sequence can be used to completely automate the process. When upgrading Windows 7 or Windows 8 to Windows 10, the Windows installation program (Setup.exe) will perform an in-place upgrade, which automatically preserves all data, settings, applications, and drivers from the existing OS version.

- **Clean install** - Another way to upgrade to a newer version of Windows is to perform a clean upgrade. Because a clean install will wipe the drive completely, all files and data should be saved to some form of backup drive.

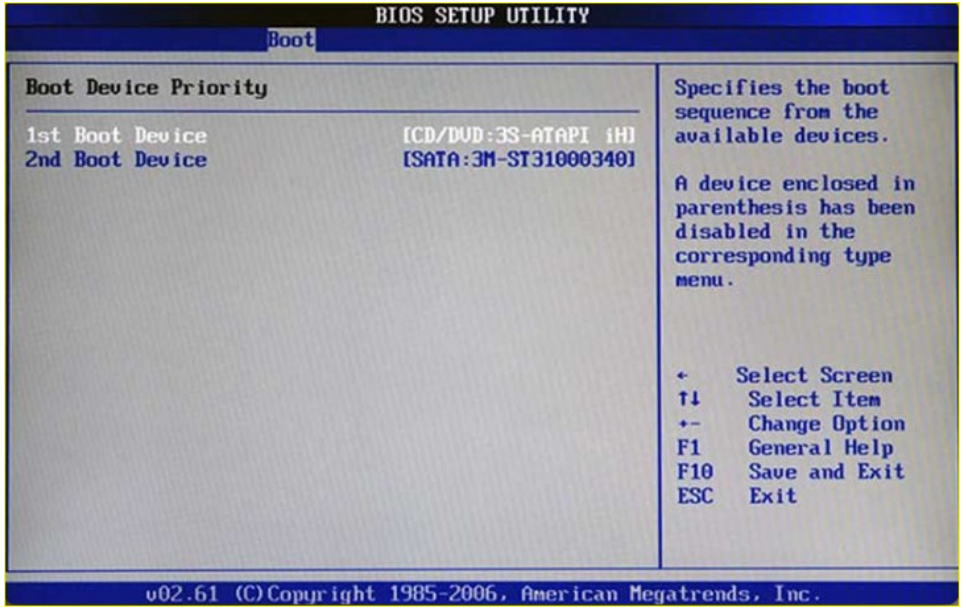


Lab – Operating System Upgrades

- In this lab, you will explore the process to upgrade an operating system.
  - Part 1: Recovery Partition
  - Part 2: Unattended Installation
  - Part 3: Upgrade Considerations before Installation
  - Part 4: Post Upgrade Installation

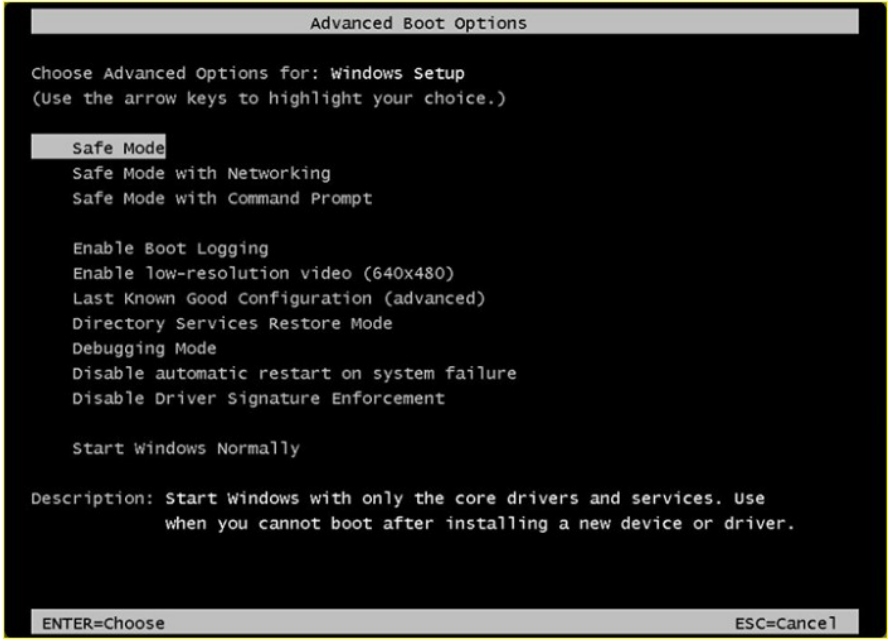
Windows Boot Sequence

- After POST, the BIOS locates and reads the configuration settings stored in the CMOS memory.
- The boot device priority is the order in which devices are checked to locate the bootable partition.
- The BIOS boots the computer using the first drive that contains a valid boot sector.
- This sector contains the Master Boot Record (MBR).
- The MBR identifies the Volume Boot Record (VBR) which loads the boot manager, which for Windows is bootmgr.exe.
- Hard drives, network drives, USB drives, and even removable media can be used in the boot order, depending on the capabilities of the motherboard.



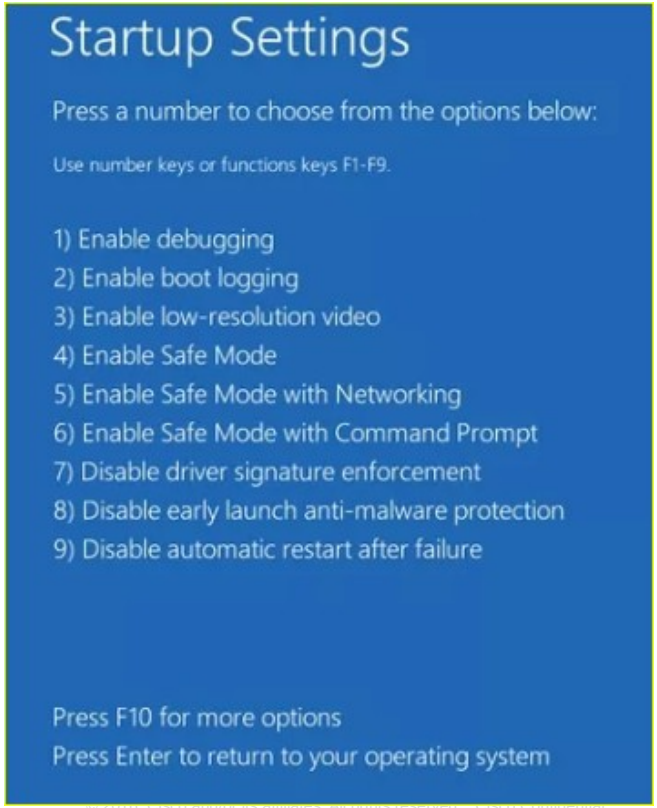
Windows 7 Startup Modes

- Pressing the F8 key during the boot process opens the Windows Advanced Boot Options menu.
- Users can select how to boot Windows. 4 startup options:
  - **Safe Mode** – A diagnostic mode used to troubleshoot Windows and Windows startup. Functionality is limited as many device drivers are not loaded.
  - **Safe Mode with Networking** - Starts Windows in Safe Mode with networking support.
  - **Safe Mode with Command Prompt** - Starts Windows and loads the command prompt instead of the GUI.
  - **Last Known Good Configuration** - Loads the configuration settings that were used the last time that Windows started successfully.



Windows 8 and 10 Startup Modes

- Both Windows 8 and Windows 10 boot too quickly to use F8 to access startup settings.
- Instead, hold the Shift key and select the Restart option in the Power menu.
- This will display the Choose an Option screen. To get the startup settings, select Troubleshoot, then from the next screen select Advanced options.
- Inside Advanced options select Startup settings, then on the next screen select Restart.
- The computer will then restart and display the Startup Settings menu shown in the figure.
- To choose a startup option use number or function keys F1-F9 that corresponds to the desired option.



Lab – Boot Methods

- In this activity, you will investigate some of the available Windows installation boot methods and boot into another operating system using a bootable USB flash or optical media.
  - Part 1: Research Boot Methods
  - Part 2: Access BIOS / UEFI
  - Part 3: Use a bootable USB media

10.4 Chapter Summary

Conclusion

Chapter 10: Windows Installation

- Explain operating system requirements.
- Create a partition in Windows using the Disk Management utility.
- Install a Windows operating system.