

CMP 104 – COMPUTER SYSTEM DESIGN (3 UNITS)

Module 7; Week 11

TOPIC: Setting up Operating Systems: Installing Windows

Prepared by: Dr. T. A. Olowookere

The operating system is software that most types of computers need to function. It has many roles, such as of controlling system resources, device management, memory management, and the user interface. An operating system provides an interface for the user and manages how the hardware and applications are allocated resources. The OS boots the computer and manages the file system. Operating systems can support more than one user, task, or CPU.

PCs and laptops are two types of computers that require operating systems to be useful. There are many different operating systems available, including Linux, Unix, Macintosh, and Windows. In this module, you will learn about some of the Microsoft Windows operating systems and installation process.

Basic Functions of an Operating System

An operating system (OS) has a number of functions. One of its main tasks is to act as an interface between the user and the hardware connected to the computer. Figure 1 shows the OS interaction with other components of the system.

Regardless of the size and complexity of the computer and the operating system, all operating systems perform the same four basic functions:

- I. Control hardware access
- II. Manage files and folders
- III. Provide a user interface
- IV. Manage applications

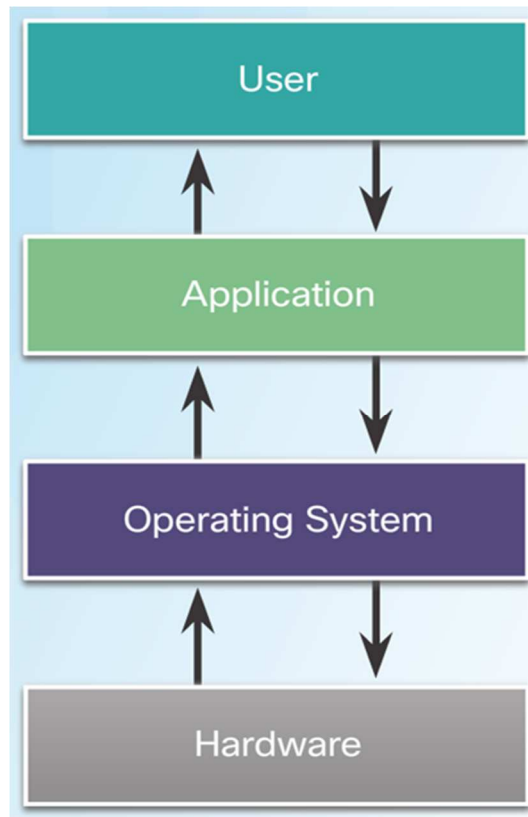


Figure 1: OS interaction with other components of the system

I. Hardware Access

The OS manages the interactions between applications and the hardware. To access and communicate with each hardware component, the OS uses a program called a *device driver*. When a hardware device is installed, the OS locates and installs the device driver for that component. Assigning system resources and installing drivers are performed with a *plug-and-play (PnP)* process. The OS then configures the device and updates the *registry*, which is a database that contains all the information about the computer.

If the OS cannot locate a device driver, a technician must install the driver manually either by using the media that came with the device or by downloading it from the manufacturer's website.

II. File and Folder Management

The OS creates a file structure on the hard disk drive to store data. 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*.

III. User Interface

The OS enables the user to interact with the software and hardware. Operating systems include two types of user interfaces:

- *Command-line interface (CLI)*—The user types commands at a prompt.
- *Graphical user interface (GUI)*—The user interacts with menus and icons.

IV. Application Management

The OS locates an application and loads it into the RAM of the computer. Applications are software programs, such as word processors, databases, spreadsheets, and games. The OS allocates available system resources to running applications.

To ensure that a new application is compatible with an OS, programmers follow a set of guidelines known as an application programming interface (API). An API allows programs to access the resources managed by the operating system in a consistent and reliable manner.

Types of Operating Systems

Desktop and *network* operating systems are two primary types of operating systems. *Desktop*, or *workstation*, operating systems are optimized to run applications, and although they can run services it is not their designed purpose. A *network operating system (NOS)*, or *server* operating system is designed to provide services to the desktop systems. Each can perform many of the same tasks, but their primary purposes are different, as described in this section.

A. Desktop Operating Systems

A *desktop operating system* is intended for use in a small office/home office (SOHO) environment with a limited number of users.

A *desktop OS* has the following characteristics:

- ✓ It supports a single user.
- ✓ It runs single-user applications.
- ✓ It 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 Linux. Some Microsoft operating systems include:

Windows 10— Windows 10 is a major version of the Microsoft Windows operating system that was released on July 29, 2015. It is built on the Windows NT kernel and follows Windows 8. One of the primary aims of Windows 10 is to unify the Windows experience across multiple devices, such as desktop computers, tablets, and smartphones. As part of this effort, Microsoft developed Windows 10 Mobile alongside Windows 10 to replace Windows Phone – Microsoft's previous mobile OS. Windows 10 also integrates other Microsoft services, such as Xbox Live and the Cortana voice recognition assistant.

Windows 8.1—Windows 8.1 is an update for Windows 8. The update includes improvements to make Windows more familiar for the users with devices that use touch or mouse and keyboard interfaces.

Windows 8—Windows 8 introduced the Metro user interface that unifies the Windows look and feel on desktops, laptops, mobile phones, and tablets. Users can interact with the OS using a touchscreen or a keyboard and mouse. Another version, Windows 8 Pro, is aimed at business and technical professionals with additional features.

Windows 7—Windows 7 is an upgrade from Windows XP or Vista. It is designed to run on personal computers. This version provided improved graphical user interface and better performance from the previous versions.

Windows Vista—Windows Vista is a personal computer operating system. As the successor to Windows XP, it offers improvement on security and introduced the Windows Aero user interface.

B. Network Operating Systems

A *network operating system (NOS)* is designed for a corporate environment, serving multiple users with a wide range of needs. A *network operating system (NOS)* contains features that increase functionality and manageability in a networked environment. Windows Server is an example of a NOS.

A NOS has these specific characteristics:

- ✓ It supports multiple users.
- ✓ It runs multiuser applications.
- ✓ It provides network services to remote clients.
- ✓ It provides increased security compared to desktop operating systems.

A NOS provides certain network resources to computers:

- ❖ Server applications, such as shared databases
- ❖ Centralized data storage
- ❖ Centralized repository of user accounts and resources on the network
- ❖ Network print queue
- ❖ Redundant storage systems, such as RAID and backups

OPERATING SYSTEM INSTALLATION

Operating systems have varying system requirements, so be sure your system meets the ones needed for your OS installation choice. A decision needs to be made about the method of installation, such as installation media or over-the-network, and about the type of installation: Will it be a clean install, an upgrade, or even a dual boot? You also must determine where the OS will be stored upon installation. In this section, you learn about the many choices and decisions necessary for a proper OS installation.

OS Installation with Default Settings

The installation process for Windows OS is similar across Windows 8.x, 7, and Vista. The process is described in detail below using Windows 8.1 as an example.

Windows 8.1

When a computer boots with the Windows 8.1 installation disc (or USB flash drive), the installation wizard presents two options:

- ✓ **Install Now**—Allows the users to install Windows 8.1.
- ✓ **Repair your computer**—Opens the Recovery Environment to repair an installation. Select the Windows 8.1 installation that needs repair and click Next. Select from a number of recovery tools, such as Startup Repair. Startup Repair locates and repairs problems with the OS files. If Startup Repair does not solve the problem, additional options, such as System Restore or System Image Recovery, are available.

If you select the **Install now** option, two other options are available:

- ✓ **Upgrade**—Install Windows and keep files, settings, and applications; upgrades Windows but keeps your current files, settings, and programs. Use this option to repair an installation.
- ✓ **Custom**—Install Windows only (advanced)—Installs a new copy of Windows in your choice of location and allows you to change disks and partitions.

If existing Windows installations are not found, the Upgrade option is disabled.

A. Windows OS Upgrade installation option

The process of upgrading the OS can be quicker than performing a new installation. The upgrade process varies depending on the version. For example, the Windows 8.1 setup utility replaces existing Windows files with Windows 8.1 files. However, the existing applications and settings are saved.

When only upgrading the Windows OS, the previous Windows folder is retained, along with the Documents and Settings and Program Files folders. During the Windows 8.1 installation, these folders are moved to a folder named *Windows.old*. You can copy files from the previous installation to the new installation.

The version of an OS determines available upgrade options. For example, a 32-bit OS cannot be upgraded to a 64-bit OS. Another example is that Windows XP cannot be

upgraded to Windows 8.1. Before attempting an upgrade, check the OS developer's website for a list of possible upgrade paths.

Windows upgrade utilities differ very little across versions of the OS.

The steps below are an example of upgrading to Windows 8.1 but would be valid for any Windows version:

Step 1. Insert the Windows 8.1 disc into the optical drive. The Set Up window appears.

Step 2. Select the **Install now** option.

Step 3. You are prompted to download any important updates for installation.

Step 4. Agree to the End User License Agreement (EULA), and click **Next**.

Step 5. Click **Upgrade**. The system begins copying the installation files.

Step 6. Follow the prompts to complete the upgrade. When the install is complete, the computer restarts.

The installer copies the files and reboots a few times before presenting the Personalization screen. To simplify the process, Windows 8.1 automatically partitions and formats the drive if no partitions are found. The installation also erases any data previously stored in the drive. If partitions exist in the drive, the installer displays them and allows for partition scheme customization.

In the Personalization screen, the installer asks for a name for the computer and allows the user to select a colour to be used as the basis for a theme.

The installer now attempts to connect to the network. If a network card (NIC) is present and a cable is connected, the installer will request a network address. If a wireless card is installed, the installer will list the wireless networks in range and prompt the user to pick one and to provide the password for it, if needed. If no network is available at this point, the network configuration is skipped, but this can be done later after the system is installed.

The installer presents a list of the express settings. These are the values recommended by the installer after a computer scan. Click **Use express settings** to accept and use the

default settings. Alternatively, it is possible to change the default settings by clicking **Customize**.

The installer prompts for an email address for signing into a Microsoft account. Although optional, this grants access to the Windows Online Store. Enter an email address and click **Next**. To skip the account linkage and create a local user account, click **Sign In without a Microsoft account**.

The installer displays the screen to allow the creation of a local account, if no Microsoft account was created. The installer allows the user to create a Microsoft account or to use a local account. If a local user account is created, the next screen shows the request for information of a local user account.

Windows finishes the process and displays the Start Screen. When the Windows 8.1 Start Screen is presented, the installation is complete, and the computer is ready for use.

B. Custom Installation Options

A custom install can save time and money when having to deploy multiple systems with new operating system installations. Using a system image for installation can also be useful if you need to recover a system that has stopped working properly. As discussed in this section, one custom installation option is *Disk Cloning*, which involves copying the contents of an entire hard drive to another hard drive, thereby decreasing the time it takes to install drivers, applications, updates, and so forth on the second drive. Other custom installation options are *Network Installation*, *Image-based Internal Partition Installation* etc.

I. Disk Cloning

Installing an OS on a single computer takes time. Imagine the time it would take to install operating systems on multiple computers, one at a time. To simplify this activity, administrators usually elect a computer to act as base system and go through the regular operating system installation process. After the operating is installed in the base computer, a specific program is used to copy all the information in 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 installed copy of the base operating system. Because the target disk now contains a sector-to-sector mapping of the original disk, the contents of the target disk is an image of the original disk. This is an image-based installation.

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. Sysprep can be used to install and configure the same OS on multiple computers. Sysprep prepares the OS with different hardware configurations. With Sysprep, technicians can quickly install the OS, complete the last configuration steps, and install applications.

A standard installation of Windows is sufficient for most computers used in a home or small office environment, but there are cases when a custom installation process is required.

Take, for example, an IT support department; technicians in these environments must install hundreds of Windows systems. Performing these many installations in the standard way is not feasible.

A standard installation is done via the installation media (DVD or USB drive) provided by Microsoft and is an interactive process; the installer prompts the user for settings such as time zone and system language.

A custom installation of Windows can save time and provide a consistent configuration across computers within a large organization. A popular technique to install Windows across many computers is to perform an installation on one computer and use it as a reference installation. When the installation is completed, an image is created. An *image* is a file that contains all the data from a partition.

When the image is ready, technicians can perform a much shorter installation by simply replicating and deploying the image to all computers in the organization. If the new installation requires any adjustments, those can be done quickly after the image is deployed.

Disk cloning creates an image of a hard drive in a computer. For disk cloning, follow these steps:

Step 1. Create a master installation on one computer by performing a full Windows installation on that computer. This master installation includes the OS, software applications, and common configuration settings that will be used by the other computers in the organization.

Step 2. Run Sysprep.

Step 3. Create a disk image of the configured computer using a third-party disk-cloning software tool such as **imageX**.

Step 4. The result should be one large image file containing a copy of the entire OS installation currently present on the reference system.

Step 5. Copy the disk image onto a server. When the destination computer is booted, a shortened version of the Windows setup program runs. The setup installs the drivers for the hardware components, creates user accounts, and configures network settings to finish the installation.

Windows has several other different types of Custom Installations:

- II. **Network Installation**— Requires all setup files to be copied to a network server. This type of custom installation includes *Preboot Execution Environment (PXE) Installation*, *Unattended Installation*, and *Remote Network Installation*. Network installations can reduce the costs incurred and time needed to install the operating system (OS) when physically visiting each client computer.

Remote Network Installation and Preboot Execution Environment (PXE)

A popular method for OS installation in environments with many computers is a ***remote network installation***. With this method, the operating system installation files are stored on a server so that a client computer can access the files remotely to begin the installation. A software package such as ***Remote Installation Services (RIS)*** is used to communicate with the client, store the setup files, and provide the necessary instructions for the client to access the setup files, download them, and begin the operation system installation.

Because the client computer does not have an operating system 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)*. For the PXE to work, the NIC must be PXE-enabled. This functionality may come from the BIOS or the firmware on the NIC. When the computer is started, the NIC listens for special instructions on the network to start PXE. As shown in Figure below, this is the first screen displayed during the PXE Windows installation boot. The installation options shown are installation files that were created on a Windows-based server as PXE images and then placed in a TFTP folder. PXE clients can locate and fetch files over TFTP.

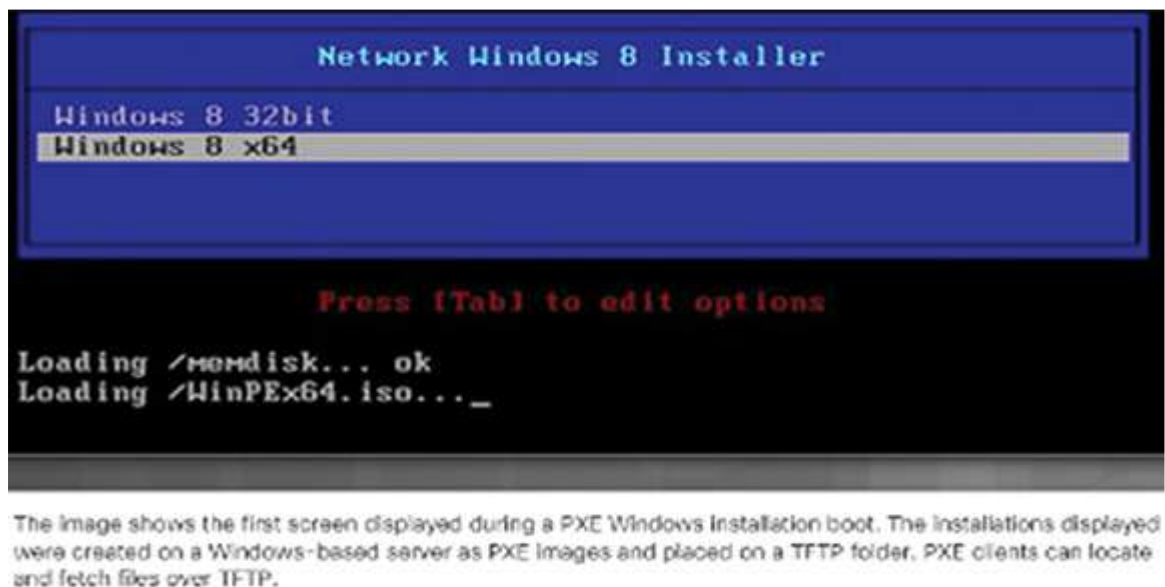


Figure: Windows PXE Installation

- III. **Image-based Internal Partition Installation**—This includes the pointer files to the compressed image, plus free space for any new files created by the end user, including registry files, page files, hibernation files, user data, and user-installed apps and updates.
- IV. **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.