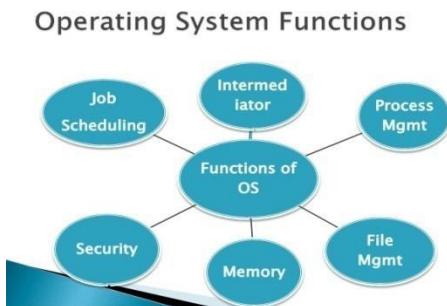
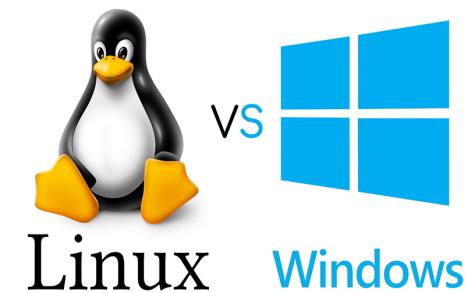


Week1Day1 : Course Objectives, Software and Applications Grading Criteria, Operating System Functions, Desktop, Server, API's and System Utilities



Course Objectives

- **Overview of Operating Systems (Operating Systems, Client/Server, Linux/Windows, Server Roles)**
- **Installing, Configuring Operating Systems using virtualized Platform (Virtual Box, VmWayer) (Linux , Windows)**
- **Operating System Components (Boot up, Run Levels, Directory Structure, CLI, Shell Scripting)**

Course Objectives

- **Monitor Disks, Volumes and devices to optimize utilities and system performance**
- **Process and Memory Management (Process and Thread Management, Virtual and Shared Memory)**
- **File Systems and I/O Management**

Course Objectives

- **Network Services (Assigning IP, Network Printing, NFS, FTP, Web Server (LAMP), Database)**
- **Virtual Computing and Virtual Networking**
- **Cloud Computing architectures and Services**
- **OS Security Management**
- **OS Updates, Maintenance, Monitoring and Troubleshooting**

- Linux Desktop
 - Install virtual image (CentOS)



• Install Windows Server 2016/2019/2022

The screenshot shows a Microsoft Edge browser window with the URL <https://www.microsoft.com/en-us/evalcenter/evaluate-windows-server-2022>. The page displays information about Windows Server 2022 evaluations, including a 180-day trial period. It provides options to get started for free (choosing to try it on Azure), download ISO or VHD files, or explore other resources like the Windows Admin Center. A sidebar on the right lists various resources with plus signs.

Try Windows Server 2022 on Mic... + New tab

Windows Server products & resources

(-) Windows Server 2022
Evaluations | 180 days

In addition to your trial experience of Windows Server 2022, you can more easily add and manage languages and Features on Demand with the new Languages and Optional Features ISO. Download this ISO.

This ISO is only available on Windows Server 2022 and combines the previously separate Features on Demand and Language Packs ISOs, and can be used as a FOD and Language pack repository. To learn about Features on Demand, see Features on Demand. To learn about adding languages, see Add Languages.

(-) Get started for free

Please select your experience:

Try Windows Server on Azure
 Create a Windows Server VM in Azure
 Download the ISO
 Download the VHD

Continue

(+) Description
(+) Prerequisites
(+) Explore
(+) Try
(+) Learn
(+) Buy

(+) Windows Admin Center
Evaluations | Unlimited

Type here to search

S&P 500 -1.73% 8:46 AM 1/18/2022

• Install Windows Server 2016/2019/2022 (PowerShell)

The screenshot shows a Microsoft Edge browser window with the URL <https://www.microsoft.com/en-us/evalcenter/evaluate-windows-server-2022>. The page displays information about Windows Server 2022, including a trial period of 180 days. It provides options to download ISO files or try it on Azure. Below this, there's a sidebar with links for Description, Prerequisites, Explore, Try, Learn, and Buy. At the bottom, there's a link to the Windows Admin Center.

Try Windows Server 2022 on Mic... + New tab

Windows Server products & resources

(-) Windows Server 2022
Evaluations | 180 days

In addition to your trial experience of Windows Server 2022, you can more easily add and manage languages and Features on Demand with the new Languages and Optional Features ISO. Download this ISO.

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(-) Get started for free

Please select your experience:

Try Windows Server on Azure
 Create a Windows Server VM in Azure
 Download the ISO
 Download the VHD

Continue

(+) Description
(+) Prerequisites
(+) Explore
(+) Try
(+) Learn
(+) Buy

(+) Windows Admin Center
Evaluations | Unlimited



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Server 2016/2019/2022 (CAL)

Standard | MyChoiceSoftware.com

https://www.mychoicesoftware.com/collections/microsoft-windows-server-standard?gclid=EA1alQobChMlsLzH8eC79QlVnQutBh0_HwxwEAAYASAAEgKPZvD_BwE

Apps ICICI Bank Money2l... https://www.pharm... Indian Visa | India V... Indian Visa | India V... Settings CalJOBS - Job Details Spectrum.net Cisco Press - Home COMP 424 COMP S... https://portal.ucr.e... Welcome to Your N... linux architecture p... Reading list

Call 800-318-1439 Sales and Support: M - Th 5:00 am to 5:00 pm PT, F 5:00 am to 4:00 pm PT

Someone from LIVERPOOL, recently purchased Microsoft Windows Server 2016 Standard 16 Core + 5 User CALs + 5 RDS CALs 3 HOURS AGO

My Choice SOFTWARE

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10 yrs American Owned and Operated

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0

Storewide Sale 10% Off Code NEWYEAR22

Products > Windows Server > Standard

EASY COMPARE CHARTS > for your shopping convenience

SERVER LICENSE CALCULATOR

COMPARE SERVER EDITIONS

COMPARE SQL EDITIONS

Standard

Best Sellers

Sort 17 results by Featured

Product	Description	Price	Save	Add to Cart	Buy It Now	
Microsoft Windows Server Standard	Microsoft Windows Server Standard - 16 Core License CSP	\$1,200.00	SAVE: 5%	\$1,149.99	ADD TO CART	BUY IT NOW
Microsoft Windows Server Standard	Microsoft Windows Server 2022 Standard - 2 Core License CSP	\$160.00	SAVE: 7%	\$149.99	ADD TO CART	BUY IT NOW
Microsoft Windows Server 2022	Microsoft Windows Server 2022 Standard 16 Core License	\$799.99	SAVE: 26%	\$599.99	ADD TO CART	BUY IT NOW
Microsoft Windows Server 2022	Microsoft Windows Server 2022 Standard 16 Core License - Business Starter Pack	\$1,550.00	SAVE: 17%	\$1,299.99	ADD TO CART	BUY IT NOW

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NASDAQ -1.74% 8:50 AM 1/18/2022

PROF. HARJIT DHILLON

CSUN COLLEGE OF ENGINEERING AND COMPUTER SCIENCE

Software and Applications

• Install Windows Client Windows 10/11

The screenshot shows a web browser window for the Microsoft Evaluation Center. The URL is https://www.microsoft.com/en-us/evalcenter/evaluate-windows-10-enterprise. The page displays the Windows 10 Enterprise evaluation offer (90 days) and a 'Start your evaluation' button. Below this, users can select their evaluation file type: ISO - Enterprise (selected) or ISO - LTSC. A 'Continue' button is present. To the right, there's a sidebar with links: Description, Preinstall Information, Explore, Try, Learn, and Buy. Below the sidebar, three lab kits are listed with download icons:

- Windows and Office Deployment Lab Kit (Evaluations)
- Windows 10 Web Application Compatibility Lab Kit (Evaluations)
- Windows Insider Lab Kit (Preview) (Evaluations)

What's new

Microsoft Store

Education

Enterprise

Developer

Company

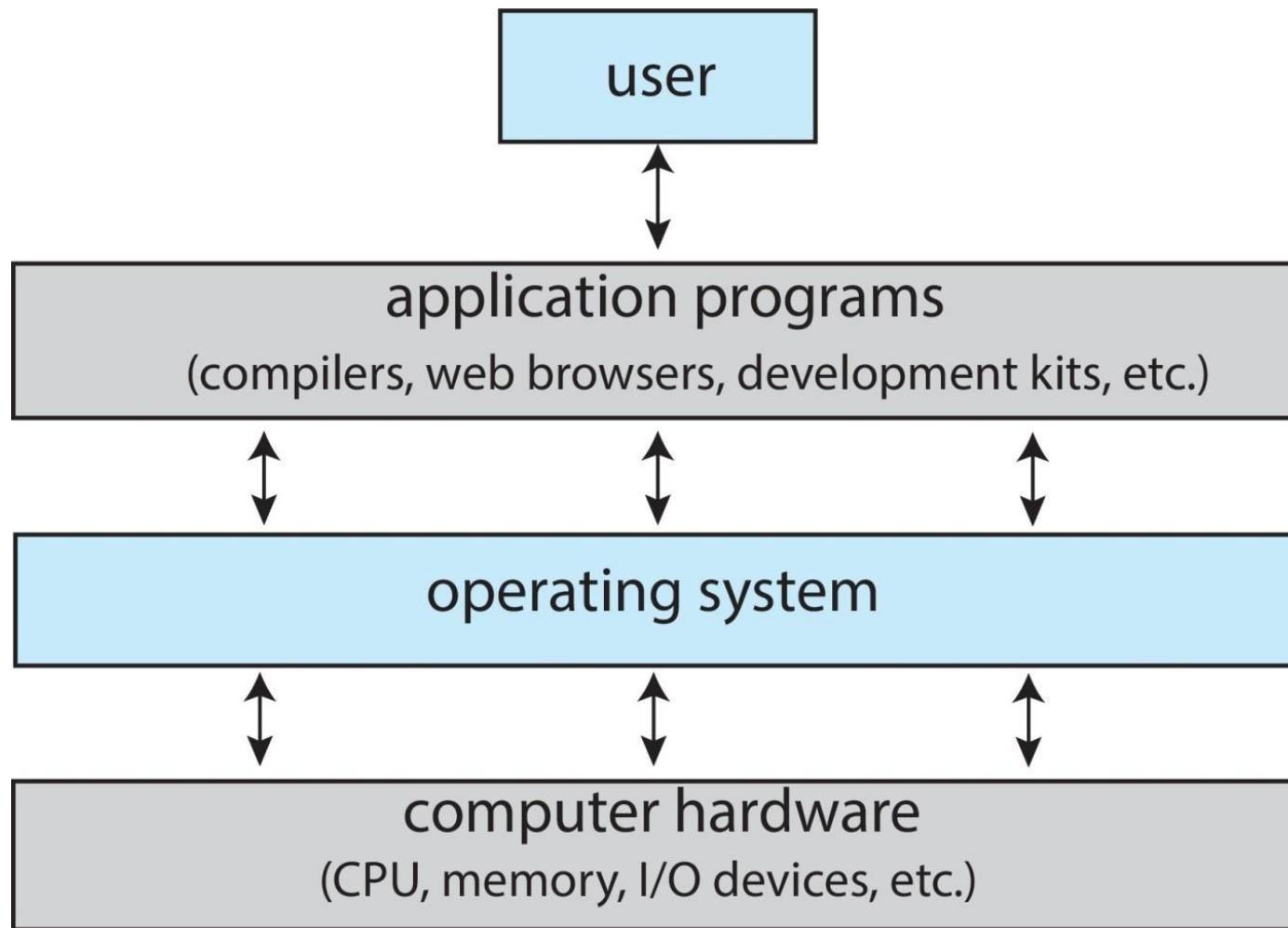


Type here to search



9:21 AM
5/27/2019

Abstract View of Components of Computer



What Operating Systems Do

- Depends on the point of view
- Users want convenience, ease of use and good performance
 - Don't care about resource utilization
- But shared computer such as mainframe or minicomputer
 - Operating system is a resource allocator and control program making efficient use of HW and managing execution of user programs
- Users of dedicate systems such as workstations have dedicated resources but frequently use shared resources from servers
- Mobile devices like smartphones and tables are resource poor, optimized for usability and battery life
 - Mobile user interfaces such as touch screens, voice recognition
- Some computers have little or no user interface, such as embedded computers in devices and automobiles
 - Run primarily without user intervention

- Term OS covers many roles
 - Because of myriad designs and uses of OSes
 - Present in toasters through ships, spacecraft, game machines, TVs and industrial control systems
 - Born when fixed use computers for military became more general purpose and needed resource management and program control
- OS is a resource allocator
 - Manages all resources
 - Decides between conflicting requests for efficient and fair resource use
- OS is a control program
 - Controls execution of programs to prevent errors and improper use of the computer

- No universally accepted definition
- “Everything a vendor ships when you order an operating system” is a good approximation
 - But varies wildly
- “The one program running at all times on the computer” is the kernel, part of the operating system
- Everything else is either
 - a system program (ships with the operating system, but not part of the kernel) , or
 - an application program, all programs not associated with the operating system
- Today’s OSes for general purpose and mobile computing also include middleware – a set of software frameworks that provide addition services to application developers such as databases, multimedia, graphics

- **Abstract Machine**
 - Hides complex details of the underlying hardware
 - Provides common API to applications and services
 - Simplifies application writing
- **Command Interpreter**
 - Part of a OS that understands and executes commands that are entered interactively by a human being or from a program
 - Shell

- **Interrupt driven**
- **Until an interrupt comes, OS remains Idle**
- **User program invokes OS code by generating Interrupt, system call**
 - To perform some task reserved for OS
 - Accessing I/O devices (read, write files)
- **Any difference in execution between user and OS program?**

- The operating system preserves the state of the CPU by storing registers and the program counter
- Determines which type of interrupt has occurred:
 - polling
 - vectored interrupt system
- Separate segments of code determine what action should be taken for each type of interrupt

- Must distinguish between the user level code and OS code
 - User mode and kernel mode
 - Mode bit provided by hardware
 - Provides ability to distinguish when system is running user code or kernel code
 - System call changes mode to kernel, return from call resets it to user

- I/O devices and the CPU can execute concurrently
- Each device controller is in charge of a particular device type
- Each device controller has a local buffer
- Each device controller type has an operating system device driver to manage it
- CPU moves data from/to main memory to/from local buffers
- I/O is from the device to local buffer of controller
- Device controller informs CPU that it has finished its operation by causing an interrupt

- An operating system (OS) is a set of programs containing instructions that work together to coordinate all the activities among computer and mobile device hardware

Start and shut down a computer or mobile device

Provide a user interface

Manage programs

Manage memory

Coordinate tasks

Configure devices

Establish an Internet connection

Monitor performance

Provide file management and other device or media-related tasks

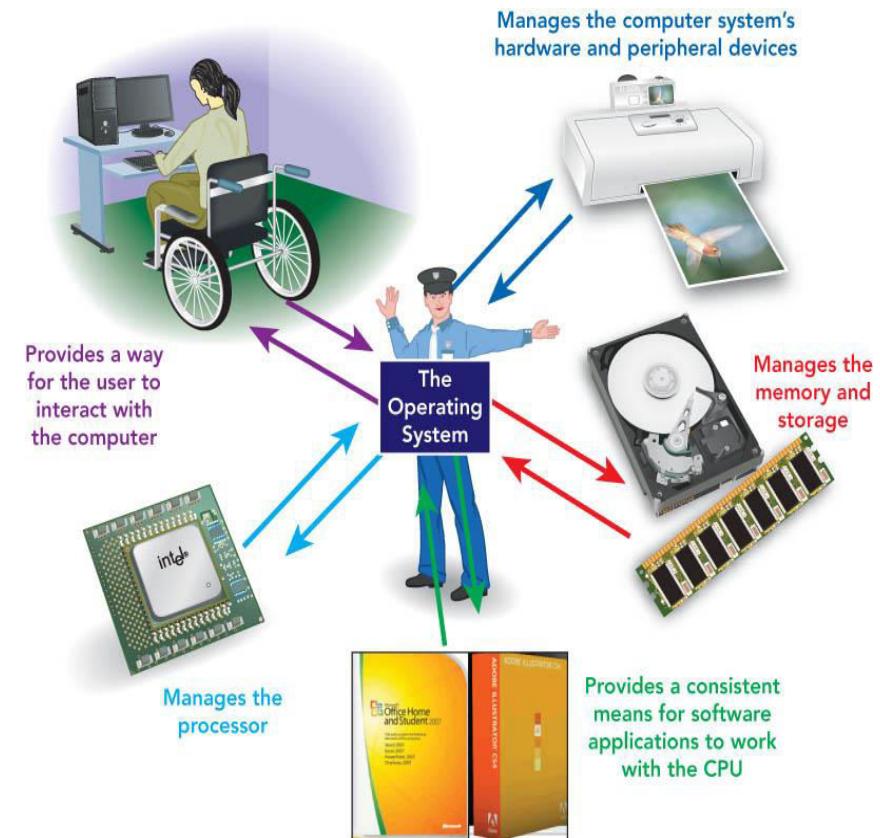
Updating operating system software

Control a network

Administer security

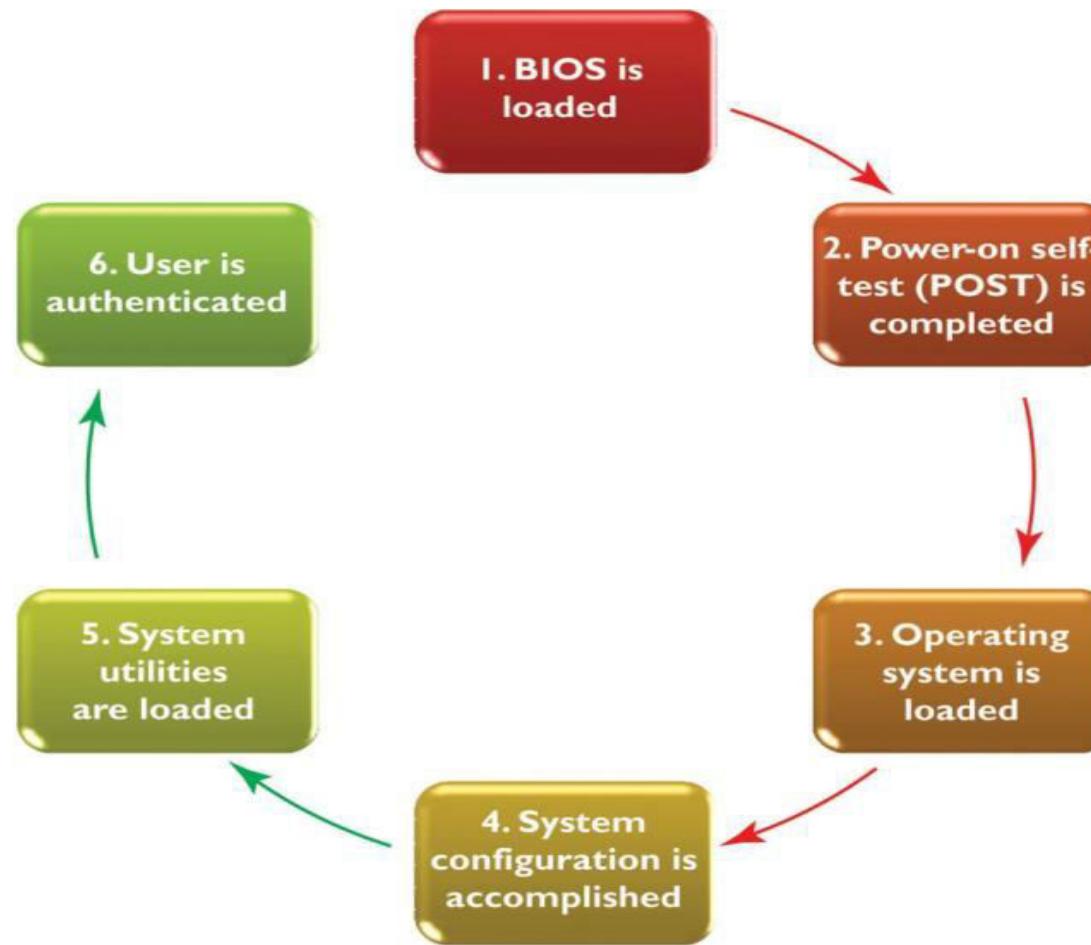
The Operating System

- Five basic functions
 - Starts the computer
 - Manages applications
 - Manages memory
 - Handles input and output device messages
 - Provides a user interface for communication



- Starting the computer
 - Booting—loading the OS into RAM
 - Cold boot: Starting computer when it has not yet been turned on
 - Warm boot: Restarting a computer that is already on

The Six Steps of Booting a System



- **Bootstrap program – simple code to initialize the system, load the kernel**
- **Kernel loads**
- **Starts system daemons (services provided outside of the kernel)**
- **Kernel interrupt driven (hardware and software)**
 - Hardware interrupt by one of the devices
 - Software interrupt (exception or trap):
 - Software error (e.g., division by zero)
 - Request for operating system service – **system call**
 - Other process problems include infinite loop, processes modifying each other or the operating system

- **Step 1: Activate the BIOS and Setup Program**
 - **BIOS (Basic Input/Output System) instructions provide the computer with descriptions of the internal equipment**
 - Bios is encoded on ROM (read-only memory)
 - Does not control external devices
 - **Adjustable energy settings**
 - **Setup program**
 - Includes settings that control computer hardware
 - Do not alter—making incorrect changes to a BIOS device will cause the system not to boot

- **Step 2: Initiate the Power-On Self-Test**
 - **Power-on self-test (POST)—to confirm that both the computer and its peripheral devices are working properly**
 - **If the POST fails:**
 - A beep will sound.
 - An error message will appear on the monitor.
 - The computer will stop.

- Step 3: Load the Operating System
 - BIOS
 - Looks for the operating system
 - Loads the **kernel** into memory—the central part of the operating system
 - The operating system loads the system configuration information.

- Step 4: Configure the System
 - Operating system
 - Checks the **registry**
 - Database that stores information about software and peripherals choices, for configuration information
 - Checks the configuration for **drivers**
 - Utility programs containing instructions for the proper functioning of peripheral devices.
 - Automatically detects plug-and-play (PnP) devices
 - Checks for conflicts between devices
 - Installs and loads needed drivers

- **Step 5: Load System Utilities**
 - **Antivirus software**
 - **Speaker volume control**
 - **Power management options**

- **Step 6: Authenticate a User**
 - **Verifies authorized users**
 - Enter an **authentication/login** user name and password
 - **Profile—a record of a specific user's preferences for the desktop theme, icons, and menu styles**
 - **Account—for multiuser computer systems each user has an account**
 - Consists of user name, password, and storage space
 - Created by server/computer administrator

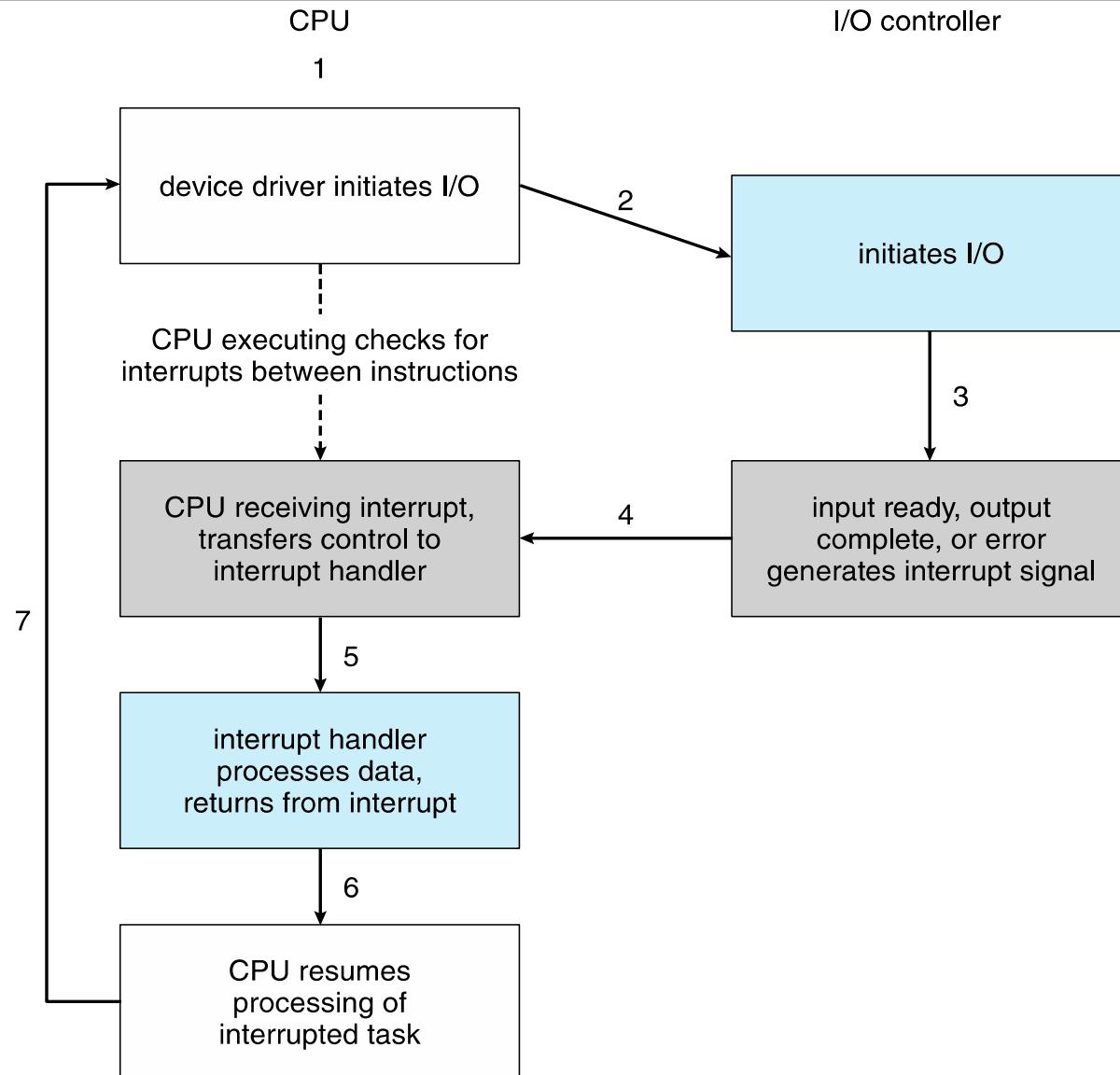
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- Each device controller is in charge of a particular device type
- Each device controller has a local buffer
- Each device controller type has an operating system device driver to manage it
- CPU moves data from/to main memory to/from local buffers
- I/O is from the device to local buffer of controller
- Device controller informs CPU that it has finished its operation by causing an interrupt

Common Functions of Interrupts

- **Interrupt transfers control to the interrupt service routine generally, through the interrupt vector, which contains the addresses of all the service routines**
- **Interrupt architecture must save the address of the interrupted instruction**
- **A trap or exception is a software-generated interrupt caused either by an error or a user request**
- **An operating system is interrupt driven**

- The operating system preserves the state of the CPU by storing registers and the program counter
- Determines which type of interrupt has occurred:
 - polling
 - vectored interrupt system
- Separate segments of code determine what action should be taken for each type of interrupt

Interrupt-drive I/O Cycle



- After I/O starts, control returns to user program only upon I/O completion
 - Wait instruction idles the CPU until the next interrupt
 - Wait loop (contention for memory access)
 - At most one I/O request is outstanding at a time, no simultaneous I/O processing
- After I/O starts, control returns to user program without waiting for I/O completion
 - System call – request to the OS to allow user to wait for I/O completion
 - Device-status table contains entry for each I/O device indicating its type, address, and state
 - OS indexes into I/O device table to determine device status and to modify table entry to include interrupt

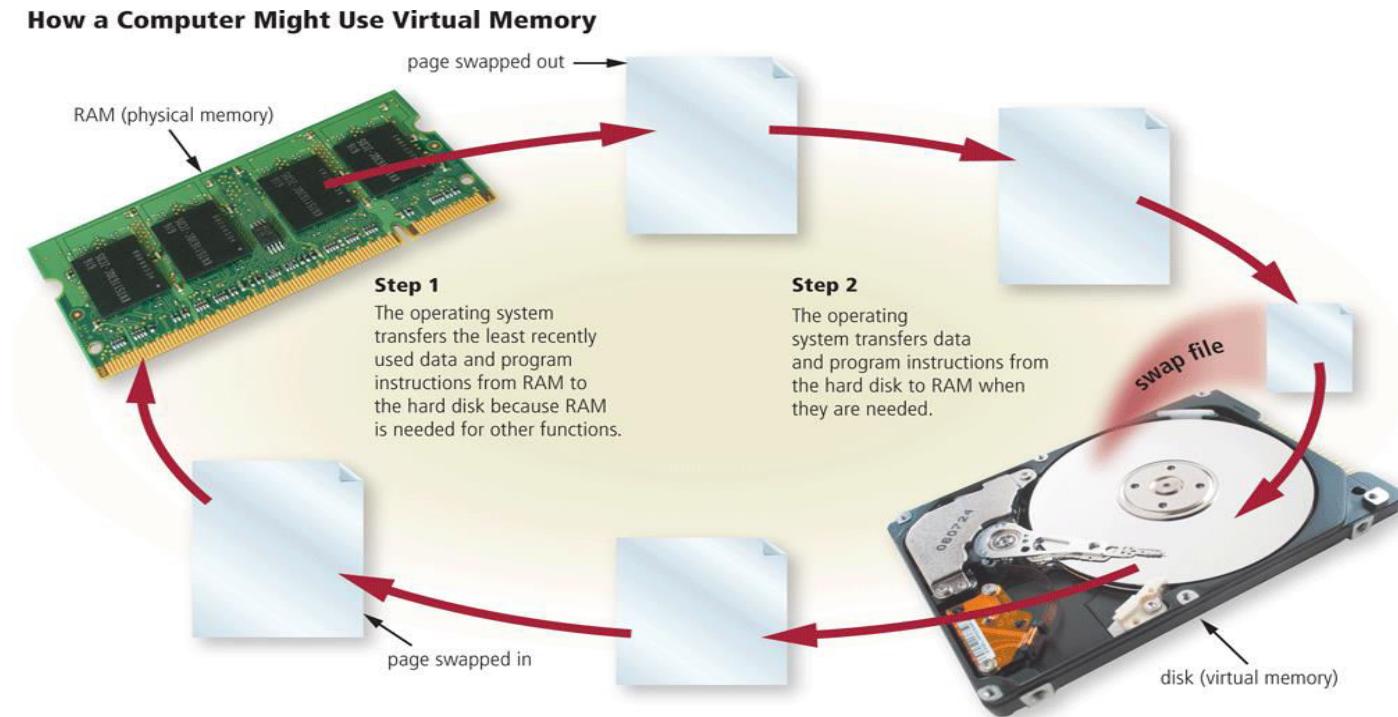
- Managing applications
 - Single-tasking operating systems—run only one application at a time
 - Multitasking operating systems—permit more than one application to run at the same time
 - The foreground application is the active one.
 - Background applications appear inactive.
 - Preemptive multitasking—ensures all applications have fair access to the CPU

- Main memory – only large storage media that the CPU can access directly
 - Random access
 - Typically volatile
 - Typically random-access memory in the form of Dynamic Random-access Memory (DRAM)
- Secondary storage – extension of main memory that provides large nonvolatile storage capacity
- Hard Disk Drives (HDD) – rigid metal or glass platters covered with magnetic recording material
 - Disk surface is logically divided into tracks, which are subdivided into sectors
 - The disk controller determines the logical interaction between the device and the computer
- Non-volatile memory (NVM) devices – faster than hard disks, nonvolatile
 - Various technologies
 - Becoming more popular as capacity and performance increases, price drops

- **Managing memory**
 - **Buffer**
 - Area that holds data and instructions temporarily
 - Makes programs run faster
 - **RAM memory functions as the buffer.**
 - **OS gives each program a portion of RAM memory and keeps them from interfering with each other.**

The Operating System

- **Memory management optimizes the use of the computer or device's internal memory**
- **Virtual memory—uses portion of hard disk to extend RAM**



- **Managing memory (con't.)**
 - **Adding more RAM—best way to improve computer performance:**
 - Paging slows computer.
 - Accessing data from hard disk is slower than accessing from RAM.
 - **Windows 10 and Windows 11 come with Windows ReadyBoost**
 - Allows allocation of space on removable memory devices such as USBs that can be used to increase the size of RAM
 - Better performance than hard disk virtual memory because accessing files on flash memory is quicker than accessing the hard drive

- Manages interactions with the CPU
- Starts, manages, and schedules programs that handle I/O activities
- Handles basic computer security
- Manages RAM use
- Manages program priority levels

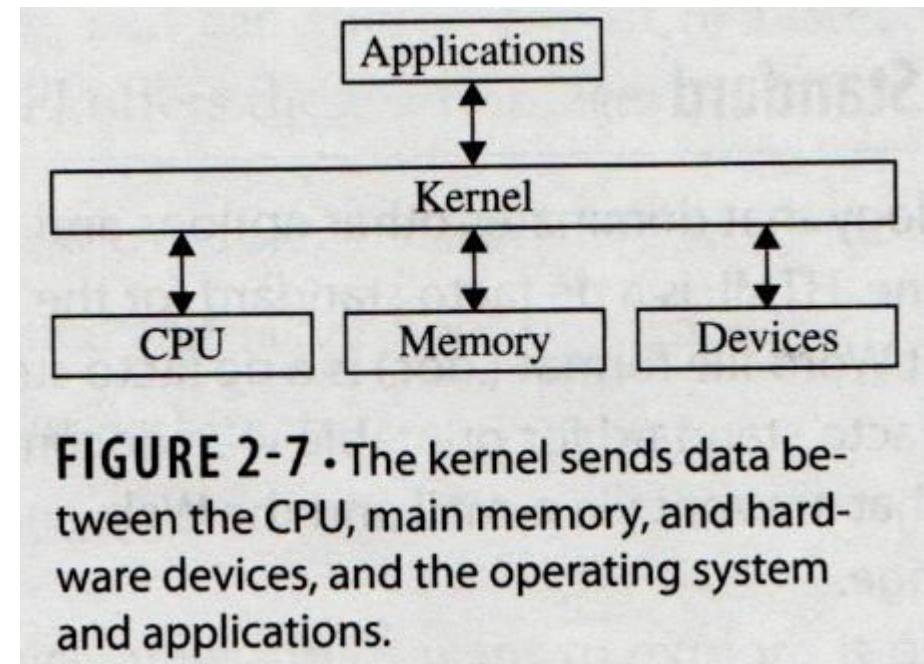
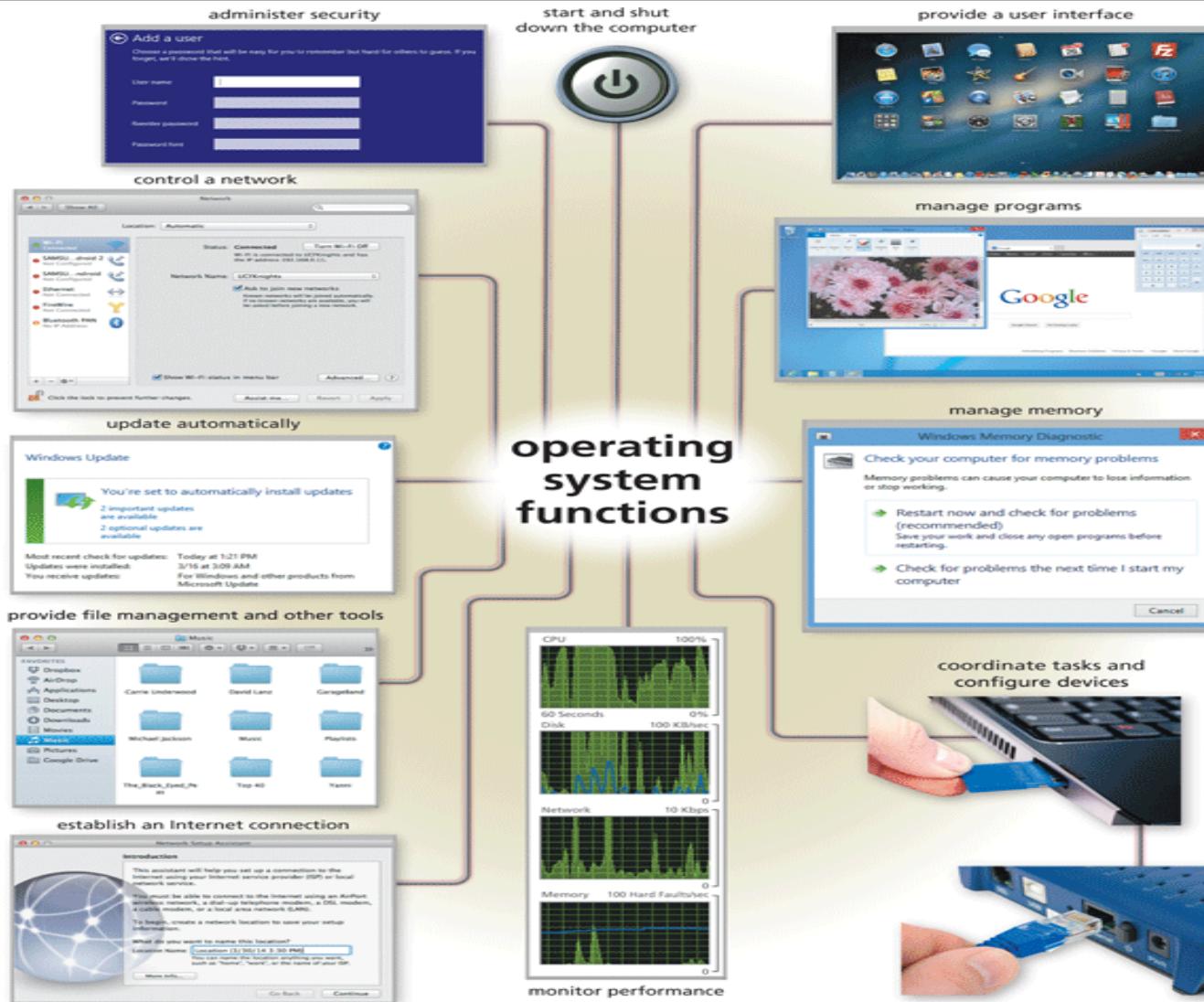


FIGURE 2-7 • The kernel sends data between the CPU, main memory, and hardware devices, and the operating system and applications.

Operating Systems



Operating System Functions

- A user interface (UI) controls how you enter data and instructions and how information is displayed on the screen
- With a graphical user interface (GUI), you interact with menus and visual images



Operating System Functions

- In a command-line interface, a user types commands represented by short keywords or abbreviations or presses special keys on the keyboard to enter data and instructions



- How an operating system handles programs directly affects your productivity

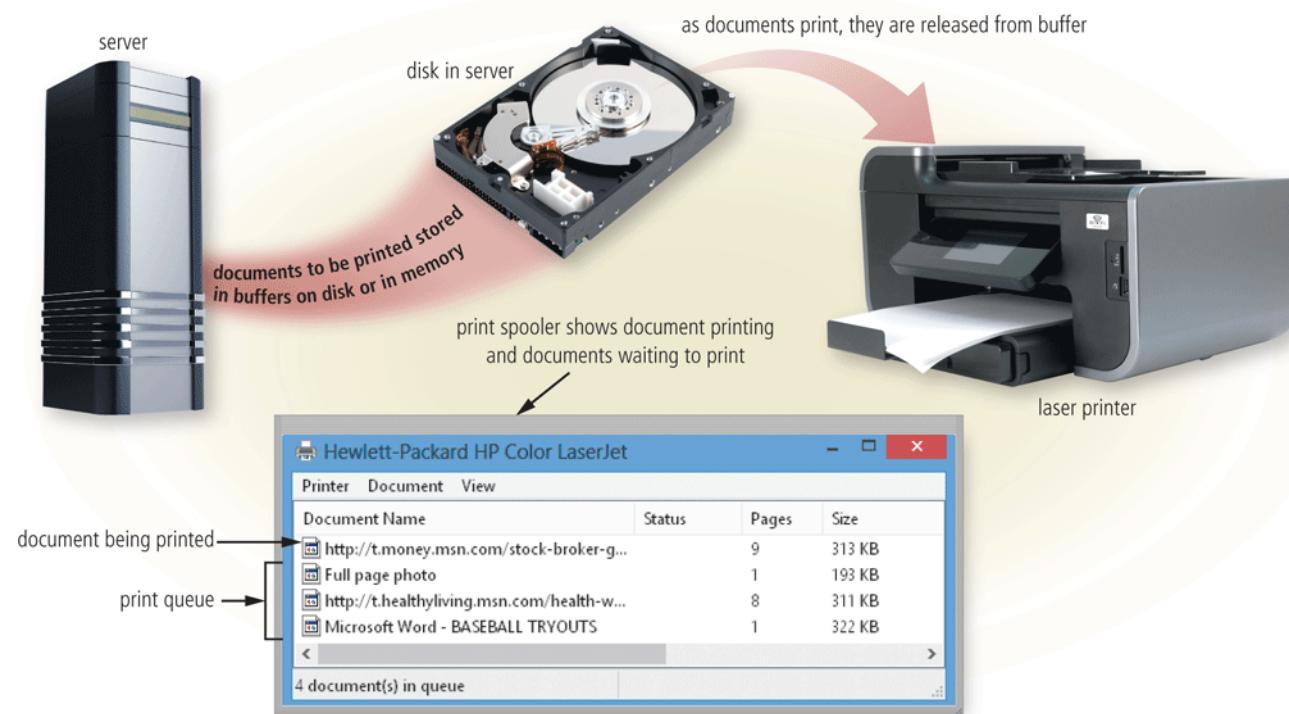
Single
tasking and
multitasking

Foreground
and
background

Single user
and
multiuser

Operating System Functions

- The operating system determines the order in which tasks are processed

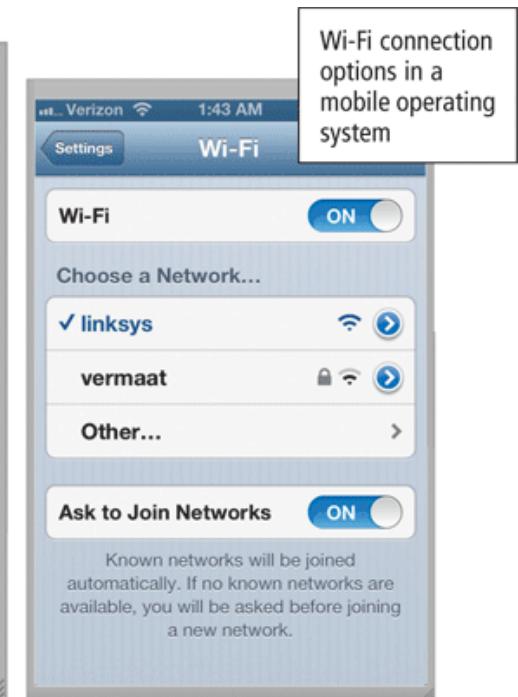
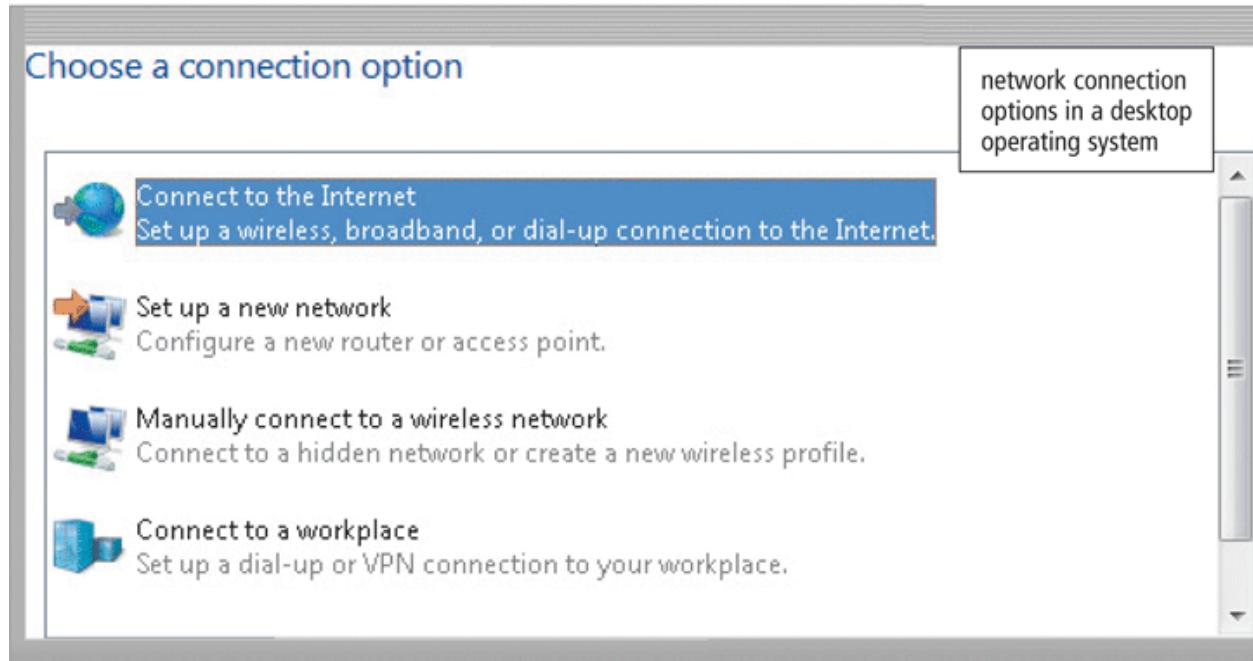


A **driver** is a small program that tells the operating system how to communicate with a specific device

Plug and Play automatically configures new devices as you install them

Operating System Functions

- Operating systems typically provide a means to establish Internet and network connections



Operating System Functions

- A performance monitor is a program that assesses and reports information about various computer resources and devices



Operating System Functions

- Operating systems often provide users with a variety of tools related to managing a computer, its devices, or its programs

File Manager

Search

Image Viewer

Uninstaller

Disk Cleanup

Disk Defragmenter

Screen Saver

File Compression

PC Maintenance

Backup and Restore

Operating System Functions

- Automatic update automatically provides new features or corrections to the program



- Some operating systems are designed to work with a server on a network
- These multiuser operating systems allow multiple users to share a printer, Internet access, files, and programs
- A network administrator uses the server operating system to:
 - Add and remove users, computers, and other devices
 - Configure the network, install software and administer network security

Operating System Functions

- A user account enables a user to sign in to, or access resources on, a network or computer
 - A user name, or user ID, identifies a specific user
 - A password is a private combination of characters associated with the user name



Types of Operating Systems

Table 9-2 Examples of Operating Systems by Category

Category	Name
Desktop	Windows
	OS X
	UNIX
	Linux
	Chrome OS
Server	Windows Server
	Mac OS X Server
	UNIX
	Linux
Mobile	Google Android
	Apple iOS
	Windows Phone

- A desktop operating system is a complete operating system that works on desktops, laptops, and some tablets

Windows

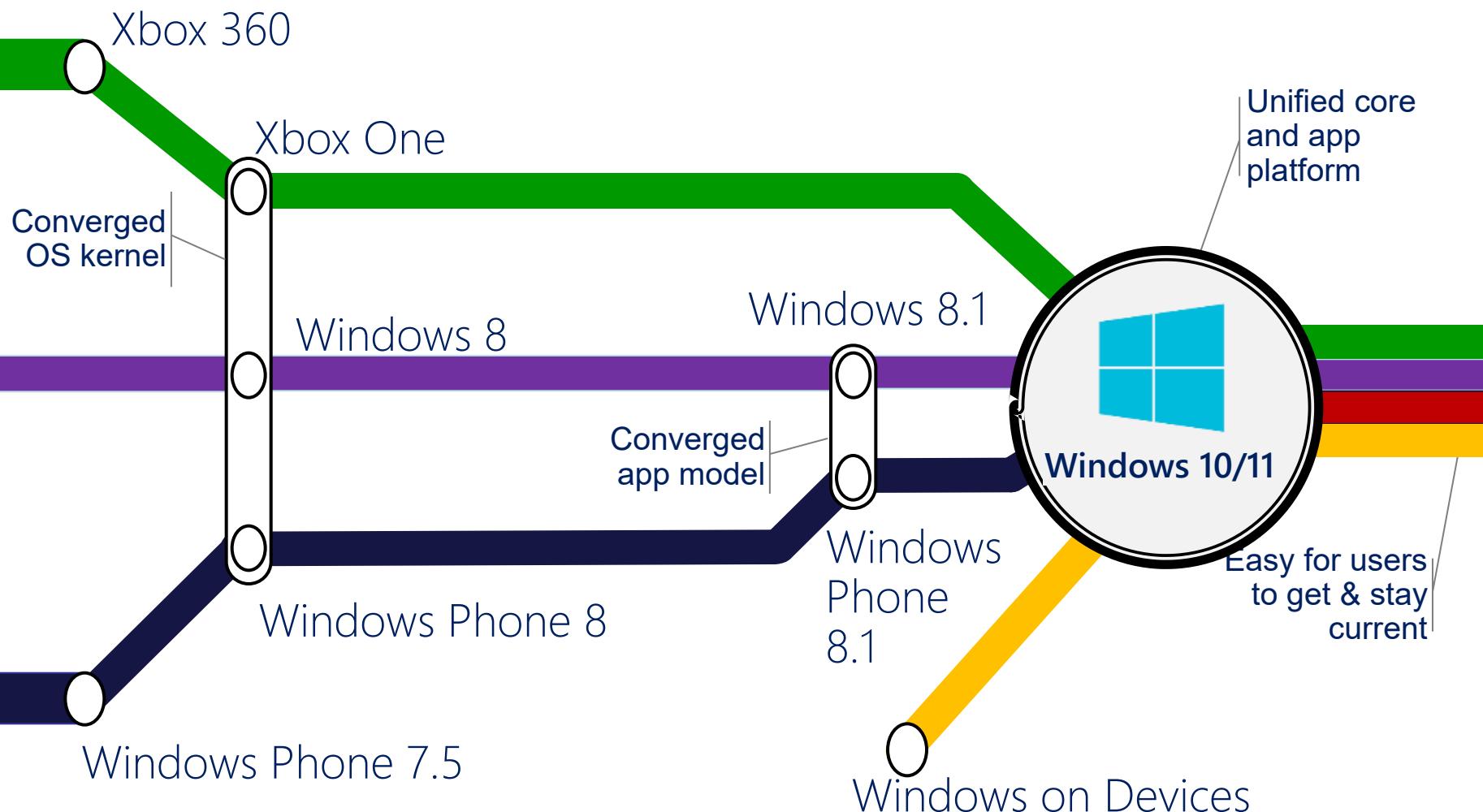
Mac OS

UNIX

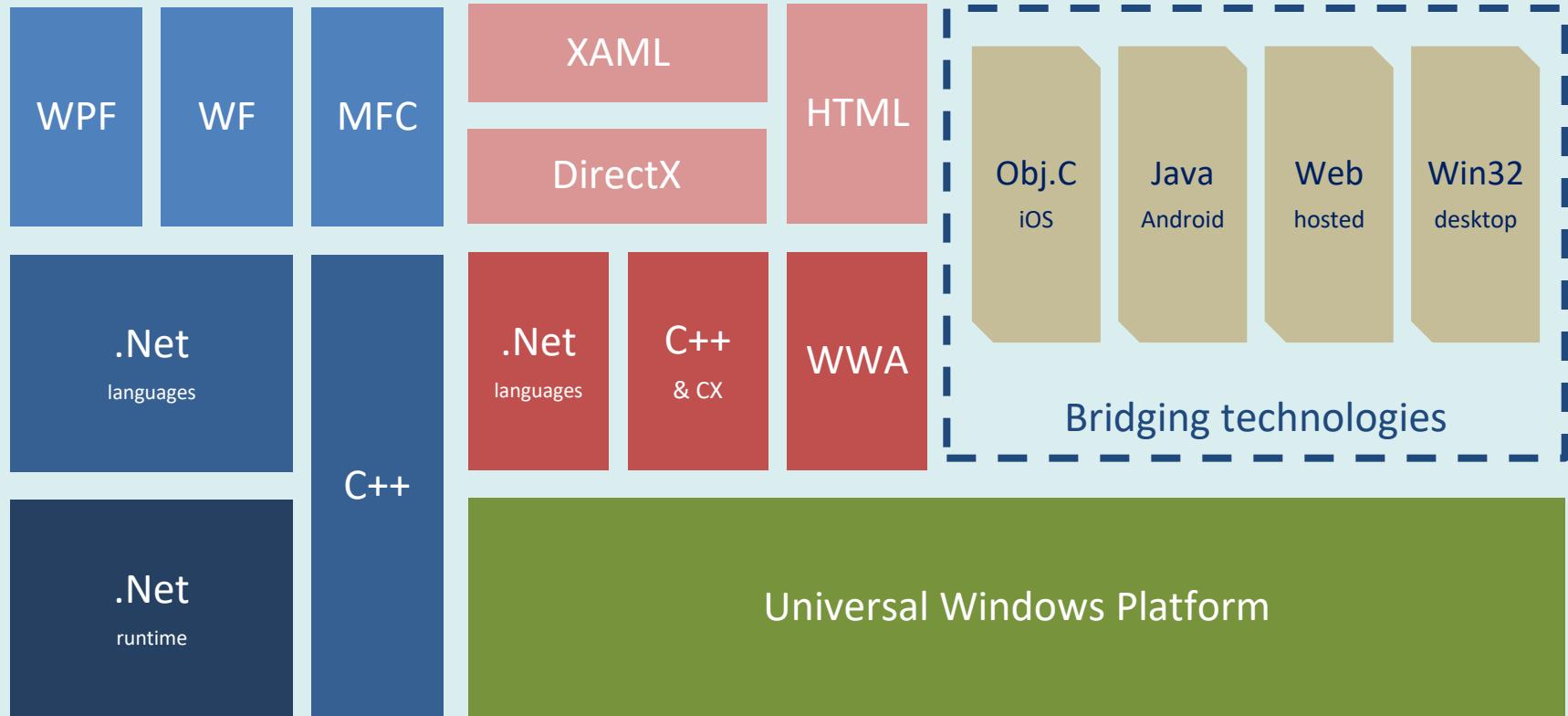
Linux

Chrome
OS

The convergence journey



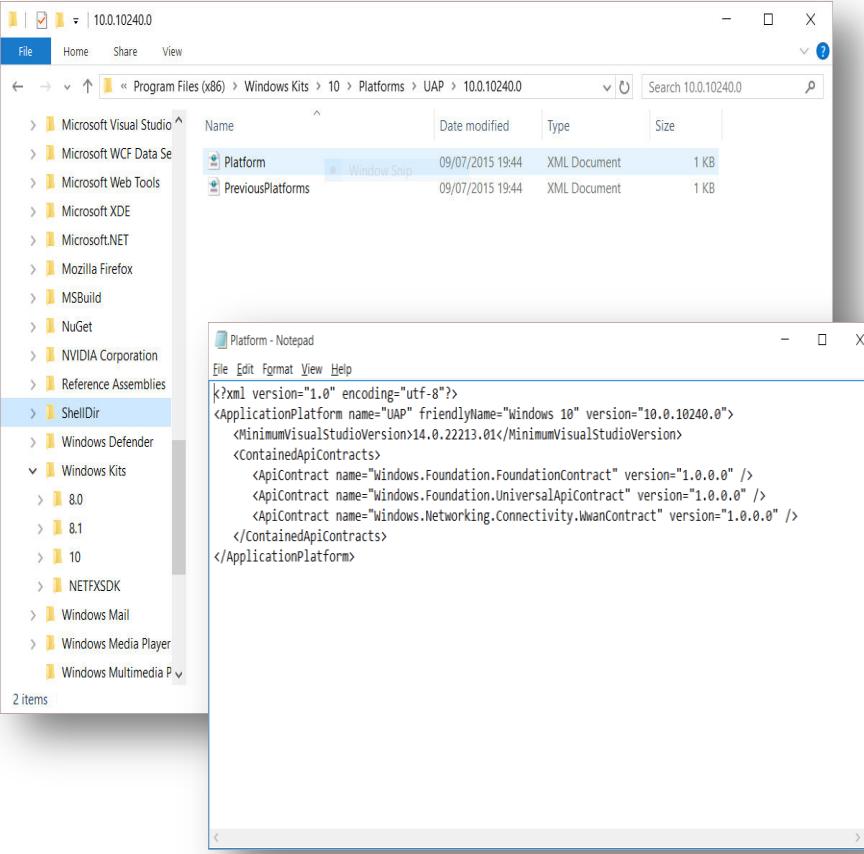




Windows 10/11
operating system

Universal Windows Platform

A single API surface
A guaranteed API surface
The same on all devices



Universal Windows Platform

Windows Core

Desktop
Device

Phone
Device

Xbox
Device

A whole lot of APIs...

Storage

DirectX 12

Speech and
Cortana

Networking

NFC and
Bluetooth

Holographi-
c

Audio and
Video

Appointmen-
t/Calendar

Authenticati-
on Broker

Background
Transfer

Maps and
Location

Sensors:
Accelerome-
ter, light,
magnet

Tiles and
Notifications

App to App
and App
Services

Inking

XAML

Background
Tasks

Data
Roaming

Data.XML

Media
Casting

Many, many more....



UNIX is a multitasking operating system developed in the early 1970s



Linux is a popular, multitasking UNIX-based operating system

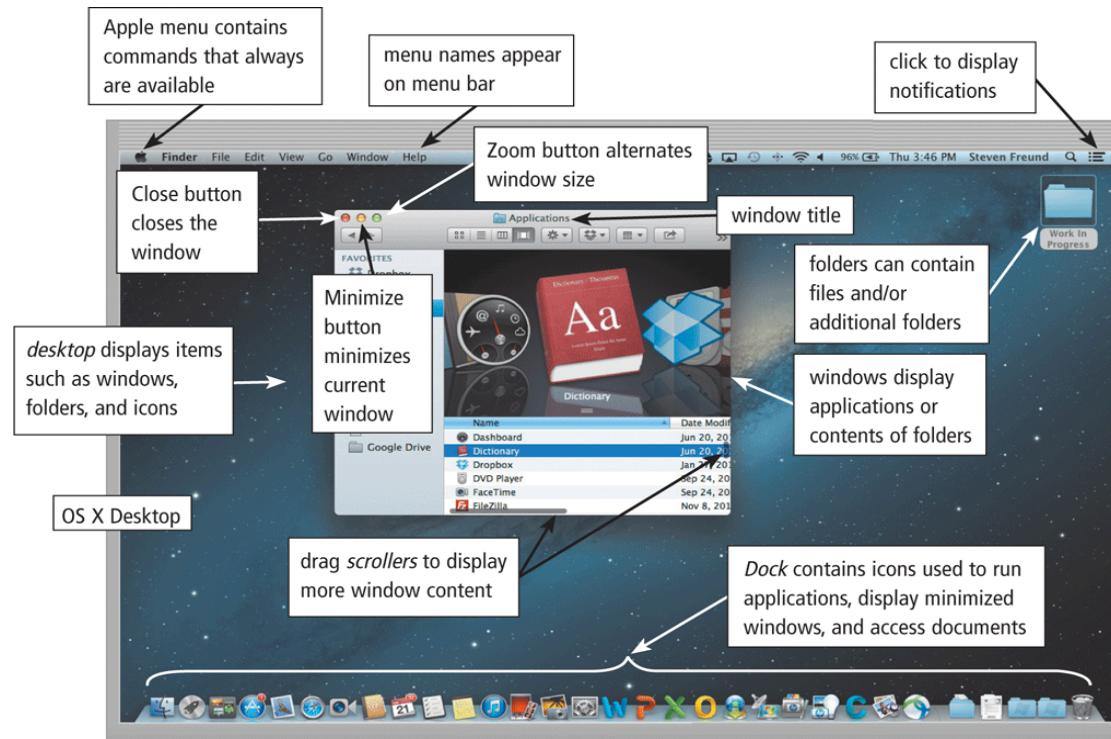
- **UNIX**
 - Features preemptive multitasking
 - Has many versions that are not compatible
 - Hard to use—defaults to a command-line user interface
 - Mac OS X is based on UNIX

- **Linux**
 - Developed by Linus Torvalds in 1991
 - Open source software—source code is available to users
 - Powerful, free
 - Features such as
 - Multitasking
 - Virtual memory
 - Internet support
 - GUI

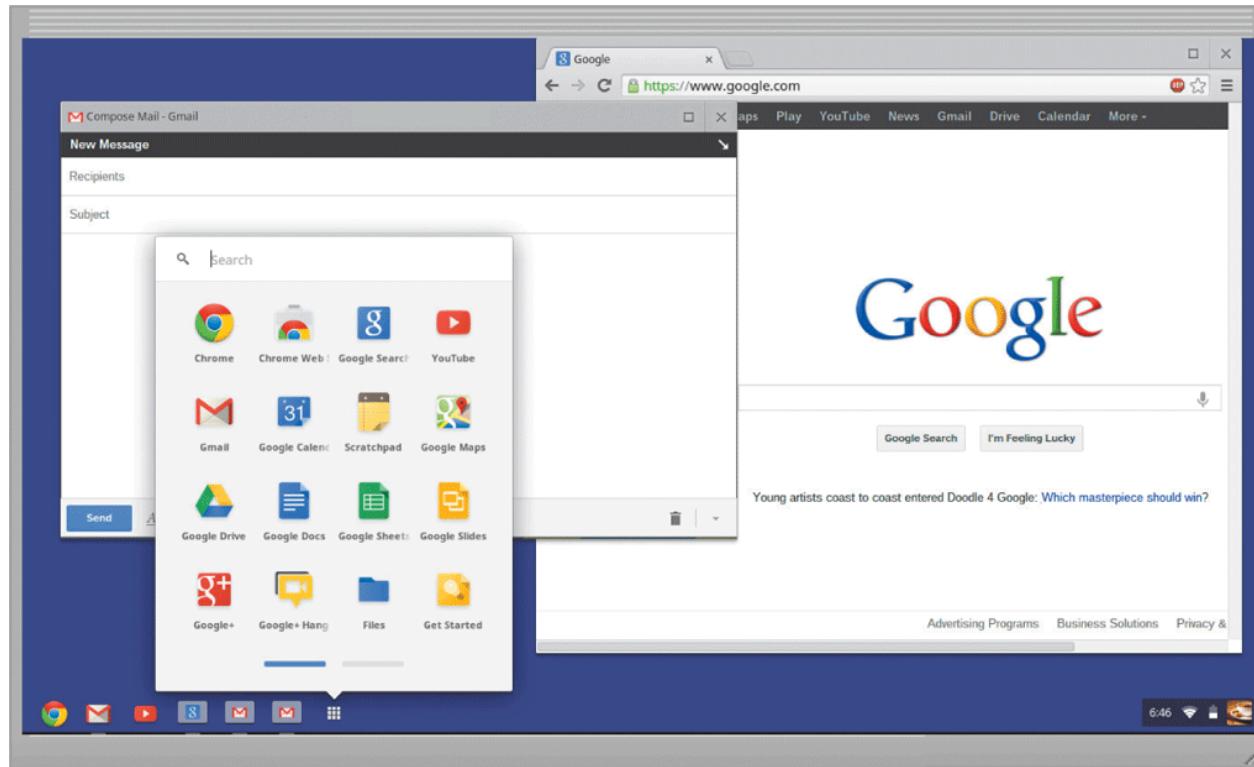
- **PC Versus Mac Versus Linux**
 - Platform—determined by combination of microprocessor chip & OS
 - PCs
 - Dominate marketplace
 - Windows OS
 - Intel or AMD chip
 - More software available
 - Macs
 - Mac OS
 - Motorola/IBM or Intel Chip
 - Most current OS can run Windows software
 - **Creative fields are almost exclusive to Mac**
 - Linux
 - Can be installed on PC or Mac
 - More secure—fewer viruses

Desktop Operating Systems

- The Macintosh operating system has earned a reputation for its ease of use



- Chrome OS is a Linux-based operating system designed to work primarily with web apps



Windows
Server

OS X
Server

UNIX

Linux

- **Server operating systems**
 - Microsoft Windows Server 2016/2019/2022
 - Used in corporate environments to support client/server systems
 - Benefits include:
 - Security
 - Web server
 - Administration
 - Virtualization
 - Other server operating systems
 - Unix
 - Linux
 - Netware by Novell
 - Solaris
 - Mac OS X Server

- **Embedded operating systems**
 - **Designed for specific applications**
 - **Compact and efficient**
 - **Eliminate many unneeded features of OSs**
 - **Used in PDAs, cell phones, kitchen appliances, point-of-sale devices, industrial robots, etc.**

- The operating system on mobile devices and many consumer electronics is called a mobile operating system and resides on firmware

Android

iOS

**Windows
Phone(Obsolete)**

- **Android is an open source, Linux-based mobile operating system designed by Google for Smart Phones and tablets**



- iOS, developed by Apple, is a proprietary mobile operating system specifically made for Apple's mobile devices

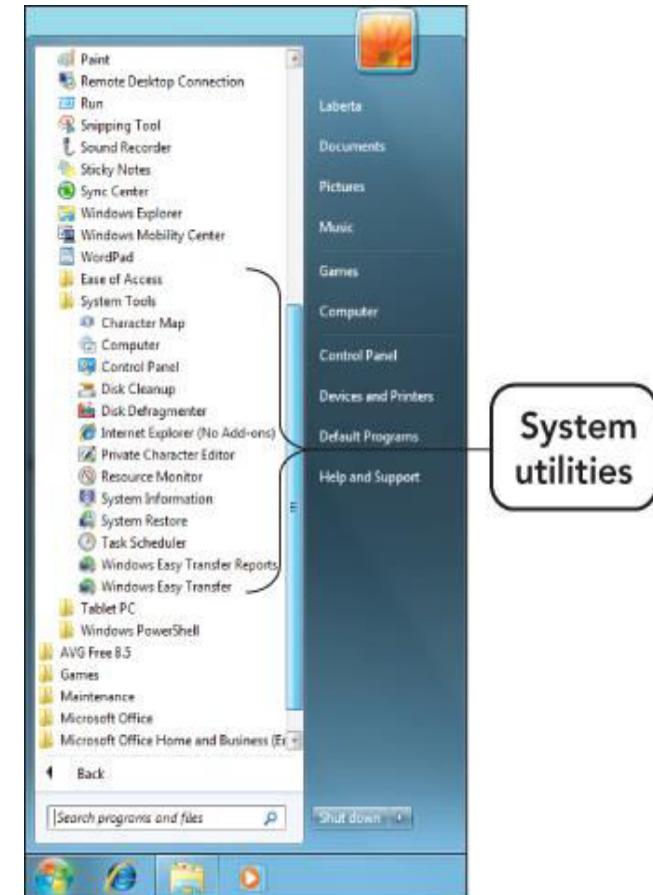


- Windows Phone, developed by Microsoft, is a proprietary mobile operating system that runs on some smartphones

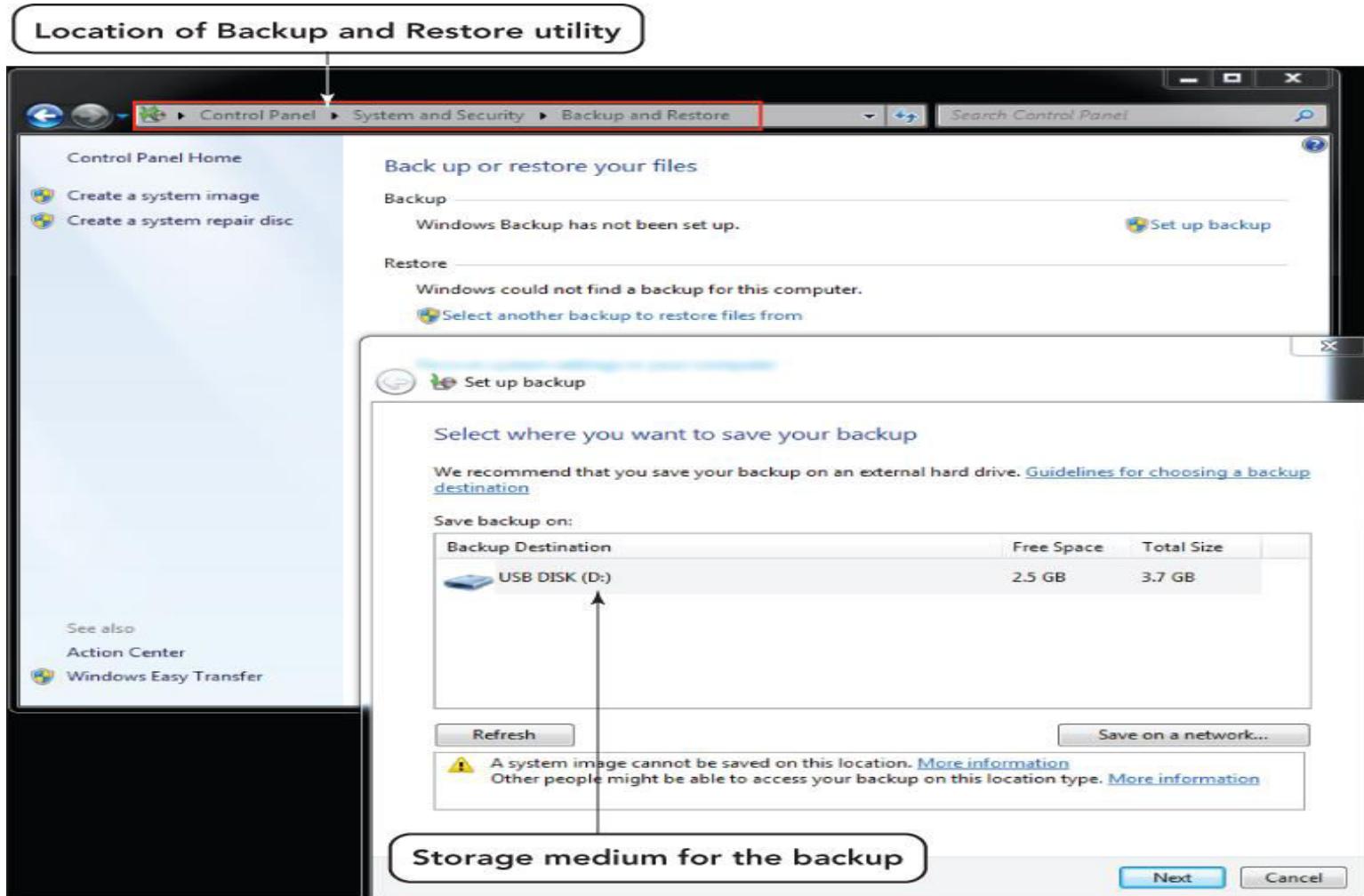


- **System utilities (utility programs)**
 - **Software programs—essential to effective management of the computer system**
 - **Perform tasks such as:**
 - **Backing up files**
 - **Providing antivirus protection**
 - **Searching for and managing files**
 - **Compressing files**
 - **Providing accessibility utilities to individuals with special needs**

- **Backup software**—copies data found on the hard disk to a backup device
 - Full backups—include all files and data
 - Incremental backups—include only those files changed or added since the previous backup
 - Drive imaging software—creates a mirror image of the entire hard drive



System Utilities



- **Antivirus Software Protects the computer from Malicious Software and Activities**
 - **Popular antivirus programs:**
 - BitDefender Antivirus
 - Kaspersky Anti-virus
 - Webroot AntiVirus wit SpySweeper
 - Norton AntiVirus
 - ESET Nod32 Antivirus
- **Multiple Antivirus Software Available**

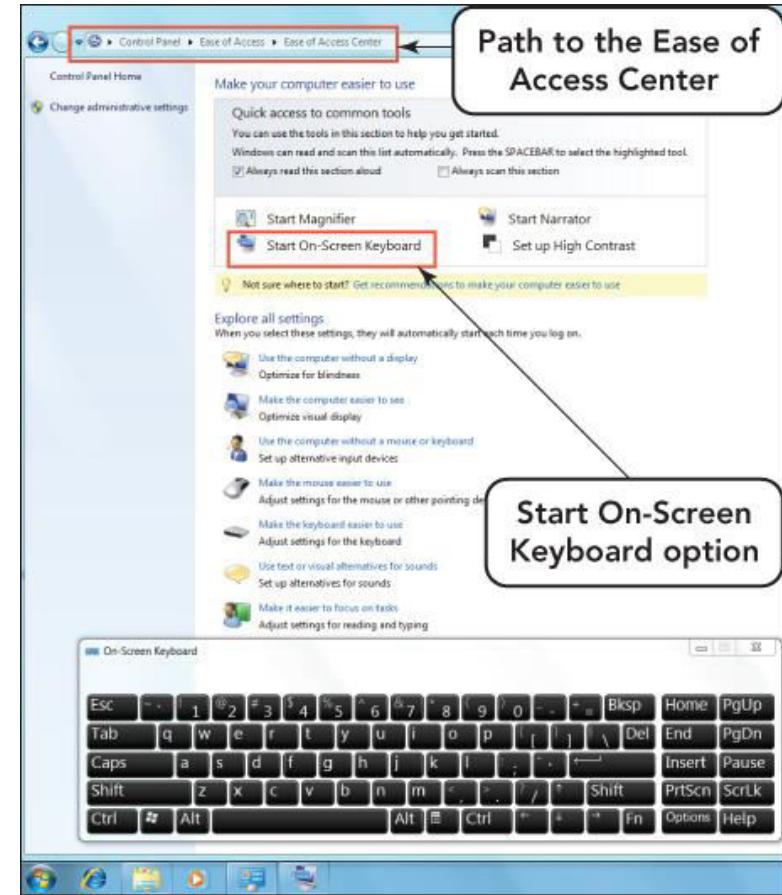
- **Searching for and managing files**
 - **File manager—utility software that organizes and manages data**
 - Copy files
 - Determine how and where files are stored
 - Delete files
 - **Search utility—enables you to locate files**

- **Scanning and defragmenting disks**
 - **Disk scanning programs**—find and resolve disk file storage problems
 - **Bad sector**—irregularity on the disk's surface that renders a portion of the disk unable to store data reliably
 - **Disk cleanup utilities**—remove unnecessary files to save space
 - **Fragmented disk**—results from computer creating and erasing files on hard disk
 - Causes disk access to slow while system looks in several locations to find all file segments
 - **Disk defragmentation programs**—reorganize stored data in a more efficient manner

- **File compression utilities**
 - Decrease the size of files, resulting in faster downloads
 - Create archives by storing files in a special format

System Utilities

- **Accessibility utilities**
 - Designed to make computing easier for individuals with special needs
 - Magnifier
 - On-screen keyboard
 - Speech recognition
 - Narrator





- **Systems update**
 - **Windows Update for Windows 10 and 11 automatically downloads and installs updates.**
 - **Includes service packs, version upgrades, and security updates**

System Utilities

- **Safe mode**
 - Windows loads a minimal set of drivers known to function correctly
 - Use Control Panel to discover devices that are causing the problem



- Reliability and Performance Monitor
 - Helps determine when system's performance began to degrade
 - Gives details about events that may have caused the problem
- Help and Support
 - Available from Start menu
 - Includes several ways to manage and maintain the computer