ICT 700 Business Information Systems

Lecture 3
Infrastructure and Services in IS
Technology Infrastructure and networks

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Reading Chapters:

Chapter 4 and 7 – Stair & Reynolds (2020)

Learning Objectives

1. Describe the functions of the four fundamental hardware components of every computer.
2. Explain the difference between multiprocessing, parallel processing and grid computing.
3. Describe how each of the three primary classes of computers is used within an organization.

Why Learn About Hardware and Software?

I. State-of-the-art hardware and software
II. Enables enhanced network and data security
III. Increases productivity
IV. Improves employee morale
V. Lowers costs
VI. Enables organization competitiveness
VII. Managerial expectation regarding hardware and software investments
VIII. Define business needs
IX. Ask relevant questions and evaluate options

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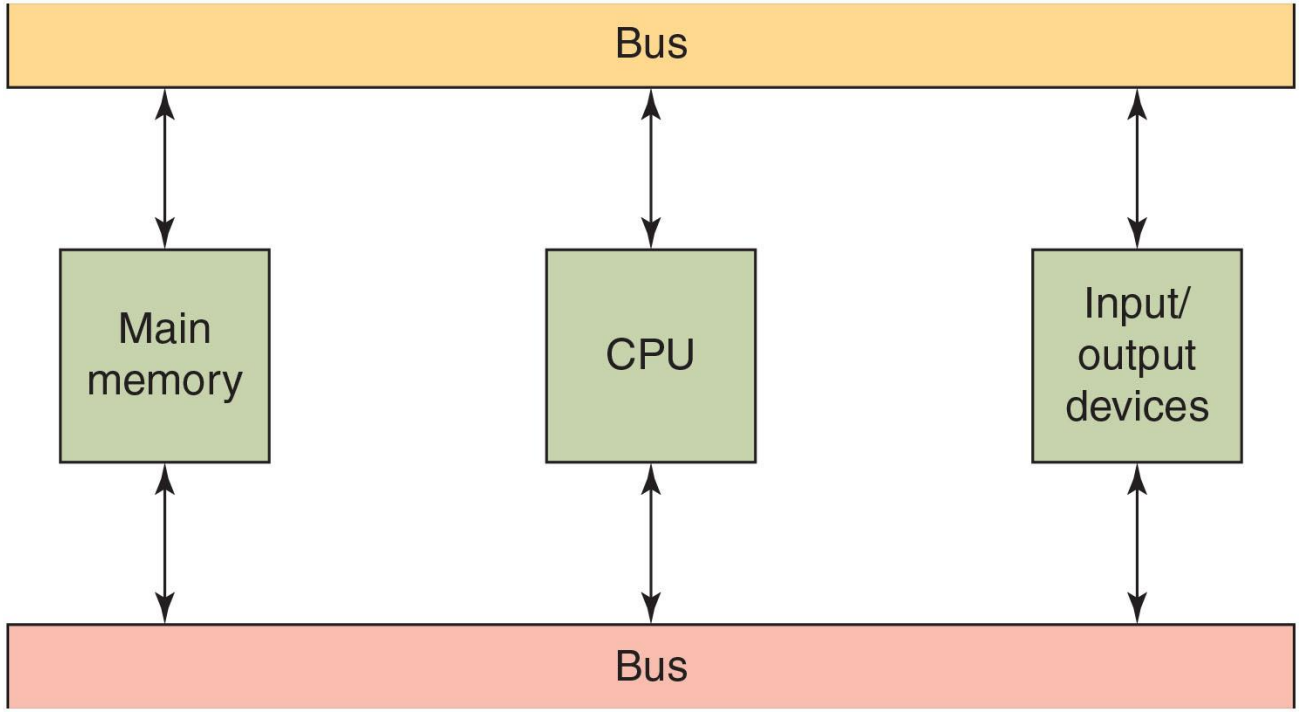
Anatomy of a Computer (1 of 3)



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Anatomy of a Computer (2 of 3)

- Phases for completing an instruction
  - Instruction phase
    - Fetch instruction
    - Decode instruction
  - Execution phase
    - Execute instruction
    - Store results

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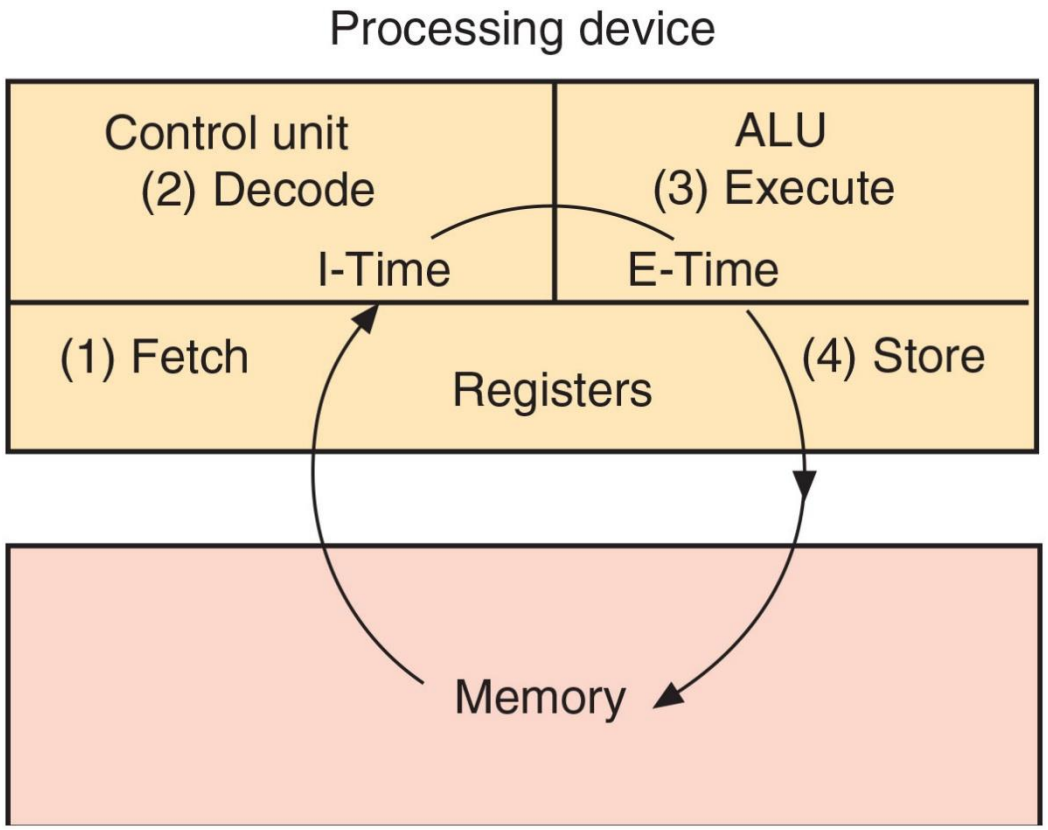
Anatomy of a Computer (3 of 3)



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Portable Computers (1 of 2)

Portable computers

- Small enough to carry easily

Four categories

- Smartphones
- Laptops
- Notebooks
- Tablets

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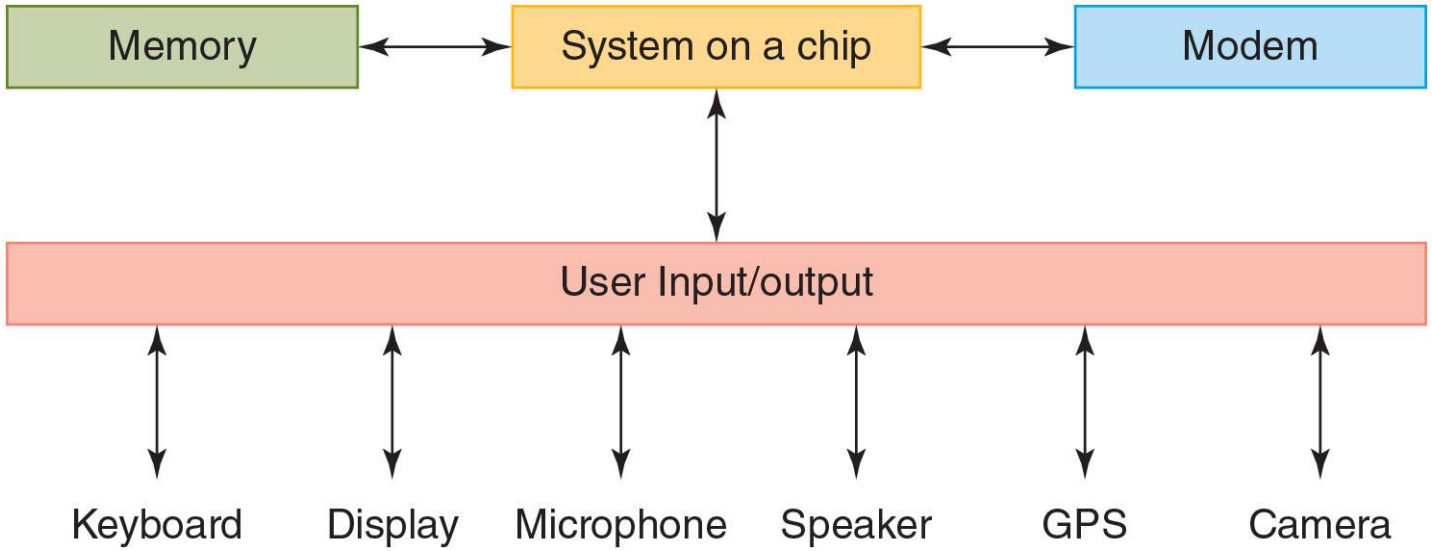
Portable Computers (2 of 2)



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Nonportable, Single-User Computers (1 of 2)

Thin clients

- Low-cost, centrally managed computers
- No internal or external attached drives for data storage

Desktop computers

- Single-user computer systems
- Highly versatile
- Provide sufficient computing power, memory, and storage for most business computing tasks

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Nonportable, Single-User Computers (2 of 2)

Desktop computer

- Very small, inexpensive desktop computer
- Used for Internet access, email, accessing Web-based applications, document processing, and audio/video playback
- Require one-tenth the amount of power

Workstations

- More powerful than personal computers
- Small enough to fit on a desktop
- Support engineering and technical users

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Servers, Mainframes, and Supercomputers (1 of 3)

- **Server**
  - Computer employed by many users to perform a specific task
  - Several types
    - Web server, enterprise server, file server
  - Offers great **scalability**
    - The ability to increase the processing capability of a computer system so that it can handle more users, more data, or more transactions in a given period

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Servers, Mainframes and Supercomputers (2 of 3)

- **Mainframe computer**
  - Large, powerful computer
  - Shared by dozens or hundreds of concurrent users connected to the machine over a network
  - **Backward compatibility**
    - Key feature allowing current mainframes to run software created decades ago
- **Supercomputers**
  - Special-purpose machines
    - Designed for applications requiring extensive and rapid computational capabilities

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Servers, Mainframes and Supercomputers (3 of 3)

Rank	Name	Where Deployed	Location	Speed (Petaflops)
1	Summit	Oak Ridge National Laboratory (ORNL)	Oak Ridge, TN, United States	122.3
2	Sunway TaihuLight	National Supercomputing Center	Wuxi, China	93
3	Sierra	Lawrence Livermore National Laboratory	Livermore, CA, United States	71.6
4	Tianhe-2A	National Supercomputing Center	Guangzho, China	33.9
5	AI Bridging Cloud Infrastructure (ABCI)	National Institute of Advanced Industrial Science and Technology (AIST)	University at Shinagawa, Tokyo, Japan,	19.9

Quantum Computers

- Based on qubits
- Follow quantum physics principles
  - Superposition and entanglement
- Five-qubit quantum computers exist
- Goal: 50-qubit computer
- Quantum computer might break current encryption technology

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Server Farms

Server farm

Large number of servers in the same room

Access to machine can be controlled

Blade server

Houses many individual computer motherboards

Motherboard's components:

- One or more processors
- Computer memory
- Computer storage
- Computer network connections

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Green Computing (1 of 2)

- **Green computing**
  - Efficient and environmentally responsible design, manufacture, operation, and disposal of IT-related products
    - Includes all types of computing devices
- **Electronic Product Environmental Assessment Tool (EPEAT)**
    - Ranking system based on 51 environmental criteria
    - Three tiers of environmental performance
      - Bronze, Silver, and Gold

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Green Computing (2 of 2)

Tier	Number of Required Criteria That Must Be Met	Number of Optional Criteria That Must Be Met
Bronze	All 23	None
Silver	All 23	At least 50%
Gold	All 23	At least 75%

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System Software

System software

- Includes operating systems, utilities, and middleware
- Coordinates the activities and functions of the hardware and other programs throughout the computer system

Application software

- Consists of programs that help users solve computing problems

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Operating Systems (1 of 3)

Operating system (OS)

- Set of programs controlling a computer's hardware
- Interface with application software

Kernel

- Heart of the OS controlling critical processes
- Ties OS components together
- Regulates other programs

- Various combinations of OSs, computers, and users exist

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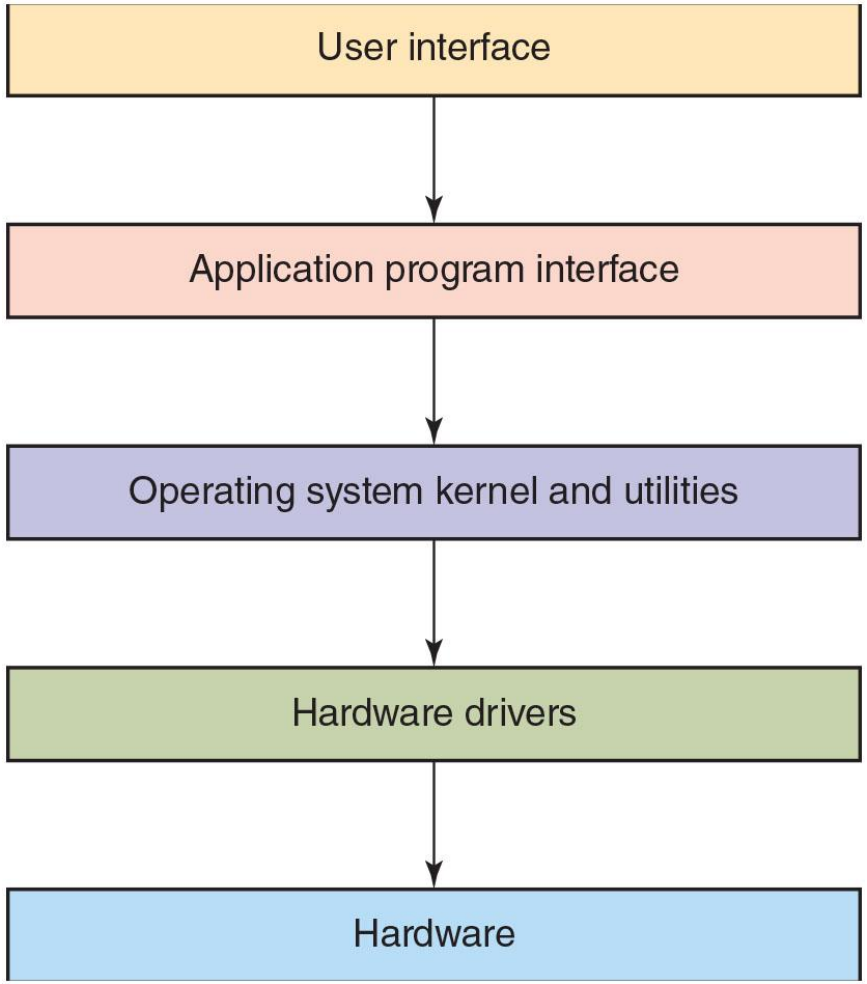
Operating Systems (2 of 3)



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Operating Systems (3 of 3)

- Functions performed
  - Control common computer hardware functions
  - Provide a user interface
  - Manage input/output operations
  - Provide a degree of hardware independence
  - Manage memory
  - Manage processing tasks
  - Provide networking capabilities
  - Control access to system resources
  - Manage files

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Current Operating Systems

- **Middleware**
  - Provides messaging services
    - Applications communicate and exchange data
  - Lies between OS and applications running on it
  - **Service-oriented architecture (SOA)**
    - Discrete modules provide specific functions to applications
  - **Application programming interfaces (API)**
    - Set of programming instructions and standards
    - Microservices can interact via APIs

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Software as a Service (SaaS) (1 of 2)

Software as a service (SaaS)

- Third-party provider hosts applications
  - Become available to subscribers over the Internet

Advantages

- Available from any computer or any device
- SaaS provider handles upgrades and patches
- Lower costs for software licensing
- SaaS provider manages service levels and availability

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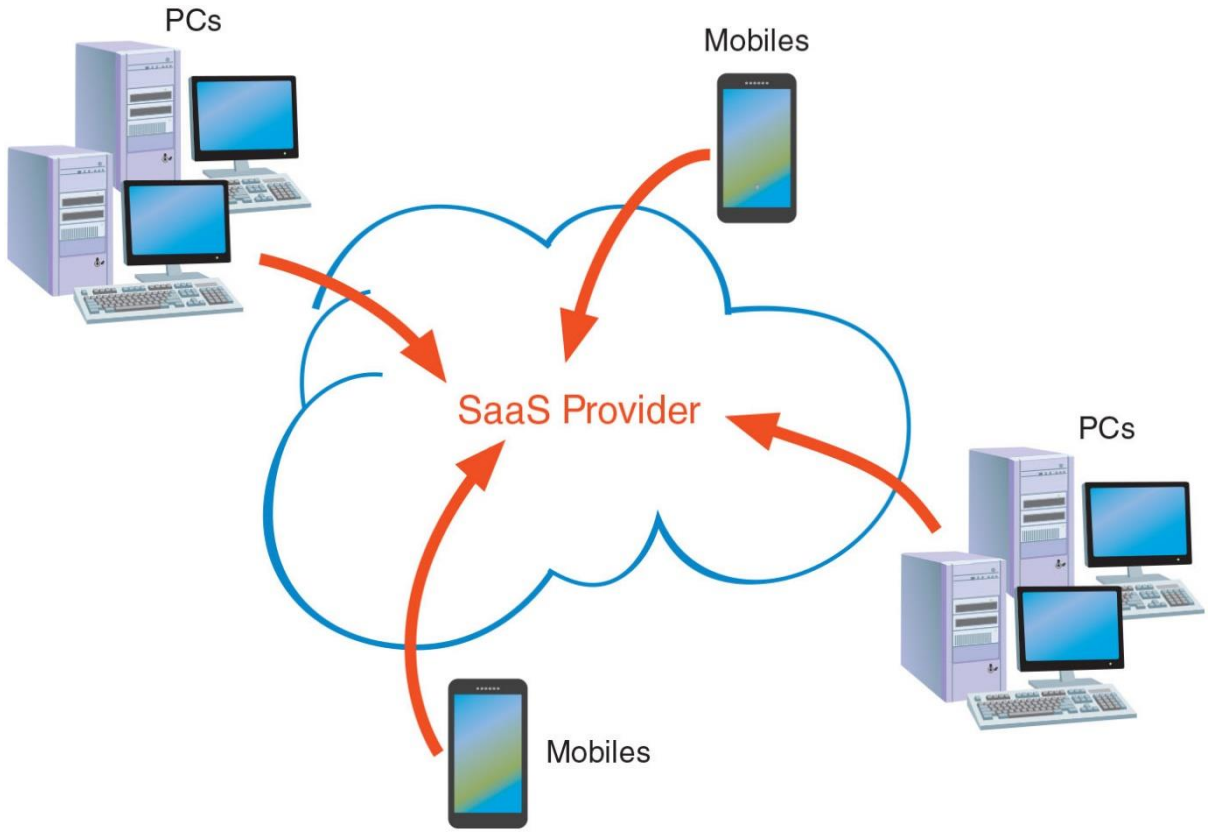
Software as a Service (SaaS) (2 of 2)



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Application Software

Primary function

- Apply the power of a computer system
- Enable people, workgroups, and entire enterprises to solve problems and perform specific tasks

Many categories of applications exist

Many options exist, too

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Overview of Application Software

Proprietary software

- One-of-a-kind software
- Designed for a specific application and for an individual company, organization, or person that uses it
- Can give a company a competitive advantage

Off-the-shelf software

- Produced by software vendors to address needs that are common across businesses, organizations, or individuals

Case Study

How do I connect a network ?

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Mobile Application Software (1 of 3)

Category	Description
Books and reference	Access e-books, subscribe to journals, or look up information on the Merriam-Webster or Wikipedia Web sites
Business and finance	Track expenses, trade stocks, and access corporate information systems
Entertainment	Access all forms of entertainment, including movies, television programs, music videos, and information about local night life
Games	Play a variety of games, from 2D games such as Pacman and Tetris to 3D games such as Need for Speed, Call of Duty, and Minecraft
Health and fitness	Track workout and fitness progress, calculate calories, and even monitor your speed and progress from your wirelessly connected Nike shoes

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Mobile Application Software (2 of 3)

Category	Description
Lifestyle	Find good restaurants, make a dinner reservation, select wine for a meal, and more
Music	Find, listen to, and create music
News and weather	Access major news and weather providers, including Reuters, AP, the New York Times, and the Weather Channel
Photography	Organize, edit, view, and share photos taken on your phone's camera
Productivity and utilities	Create grocery lists, practice PowerPoint presentations, work on spreadsheets, synchronize with PC files, and more

Mobile Application Software (3 of 3)

Category	Description
Social networking	Connect with others via major social networks, including Facebook, Twitter, and Instagram
Sports	Keep up with your favorite team or track your own golf scores
Travel and navigation	Use the GPS in your smartphone to get turn-by-turn directions, find interesting places to visit, access travel itineraries, and more

Workgroup Application Software

- **Workgroup application software**
  - Designed to support teamwork
  - Team member's location does not matter
- **Web-based software**
  - Ideal for group use
- **Personal application software**
  - Can extend into the workgroup application arena

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Enterprise Application Software

Enterprise application

- Software for organization-wide business needs
- Shares data with other enterprise applications used within the organization

Major considerations when selecting enterprise software

- Total cost
- Ease of installation
- Level of training and support required
- Integration with other enterprise applications

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Programming languages

- **Programming languages**
  - Sets of keywords, commands, symbols, and rules for constructing statements
- **Compiler**
  - Translates programmer's source code into the machine-language instructions
- Integrated development environment
  - Combines the tools required for software engineering into one package

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End User License Agreement (EULA)

End User License Agreement (EULA)

- Legal agreement between the software manufacturer and the user of the software
- Stipulates the terms of usage

Three primary types of end user licenses

- Single-user license
- Individual/multiuser licenses
- Network/multiuser licenses

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Open-Source Software (1 of 2)

- **Open-source software**
  - Typically free and distributed with source code
  - Available for study, change, and improvement
- **GNU General Public License (GPL) protects** open-source software
- **Disadvantages**
  - May have hidden costs
  - Software support issues

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Open-Source Software (2 of 2)

Software	Category
Apache HTTP Server	Web server
Apache OpenOffice	Application software
Drupal	Web publishing
Firefox	Web browser
Gimp	Photo editing
Grisbi	Personal accounting
Linux	Operating system
MySQL	Database software
ProjectLibre Open Project	Project management

Network Fundamentals

Computer network

Communications media, devices, and software

Connects two or more computer systems or devices

Communications media

Any material substance that carries an electronic signal to support communications between a sending and a receiving device

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Network Topology (1 of 2)

1. Network topology

Shape or structure of a network

2. Star network

Devices connect through a single central device called the hub node

3. Bus network

Devices connected to a common backbone

Serves as a shared communications medium

4.Mesh networks

Multiple access points link a series of devices across a large area

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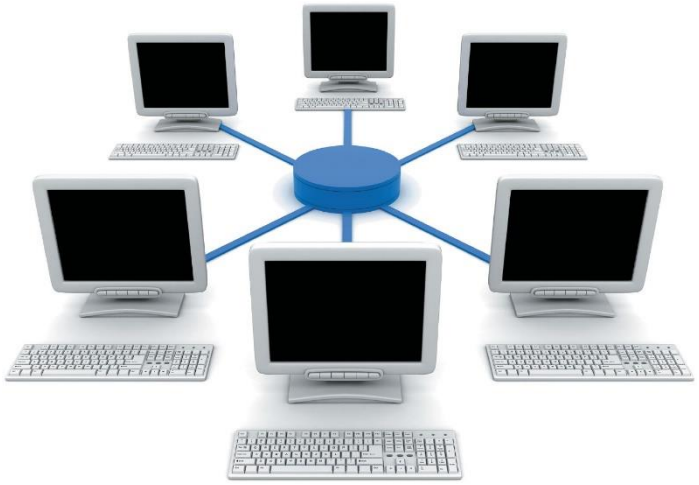
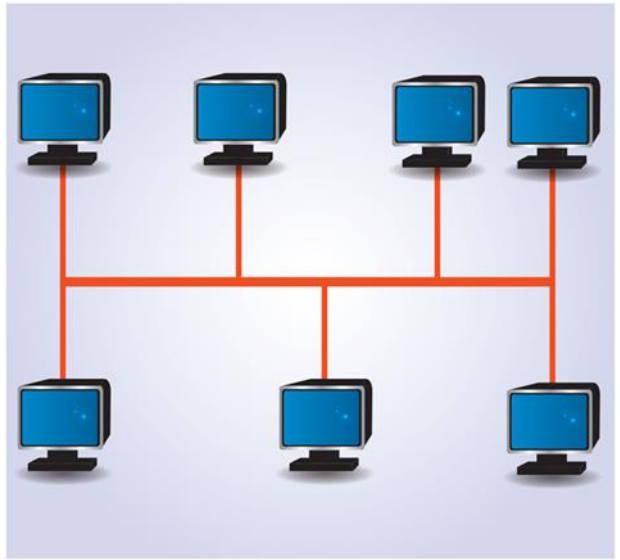
Network Topology (2 of 2)





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Activity

Communications Media

4G wireless communications
Delivers more advanced features over 3G
Based on the **Long Term Evolution (LTE)** standard

5G wireless communications
Advantages over 4G networks
More bandwidth
Lower latency
Supports many more devices
Enables exciting new applications

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Communications Software (1 of 2)

1. Network operating system (NOS)
Controls network computer systems and devices

2. Network-management software
Desktop manager monitors individual computers and shared hardware use, scans for viruses, and ensures software license compliance

3. Mobile device management (MDM) software
Remotely manages and troubleshoots devices

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Communications Software (2 of 2)

- **Software-Defined Networking (SDN)**

  Emerging approach to networking
  Network administrators manage a network through a controller
  No physical access required
  Automates tasks
  Enables dynamic response to application requirements

Client/Server Architecture (1 of 2)

1. Client/server architecture
Many clients request and receive services from servers on the network
2. **Domain name system (DNS)**
Maps the name people use to locate a Web site to the IP address that a computer uses to locate a Web site
3. **Uniform Resource Locator (URL)**
Web address specifying the exact location of a Web page using letters and words that map to an IP address and a location on the host

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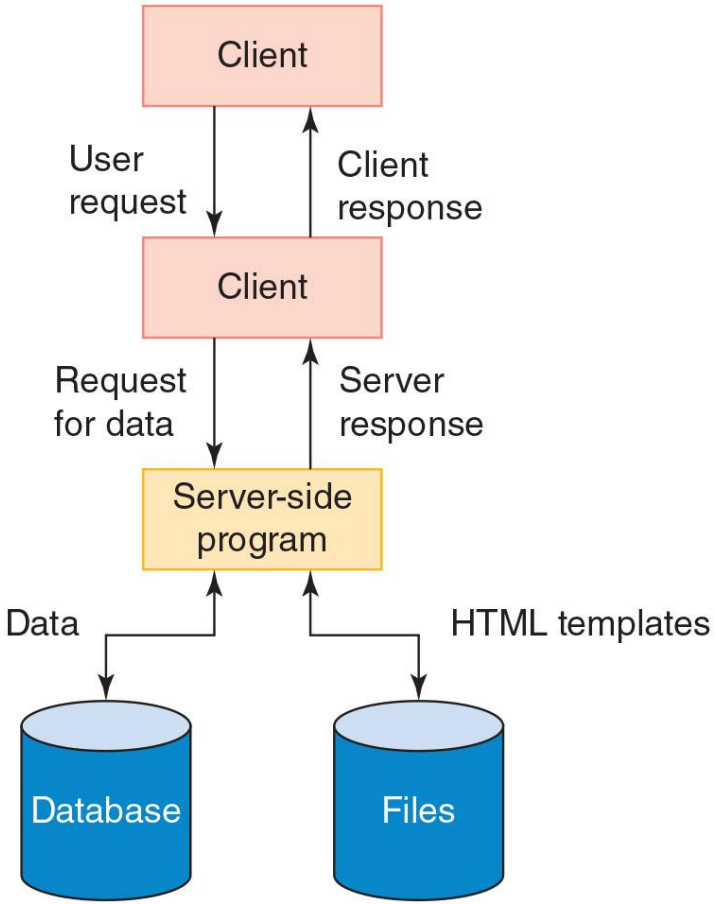
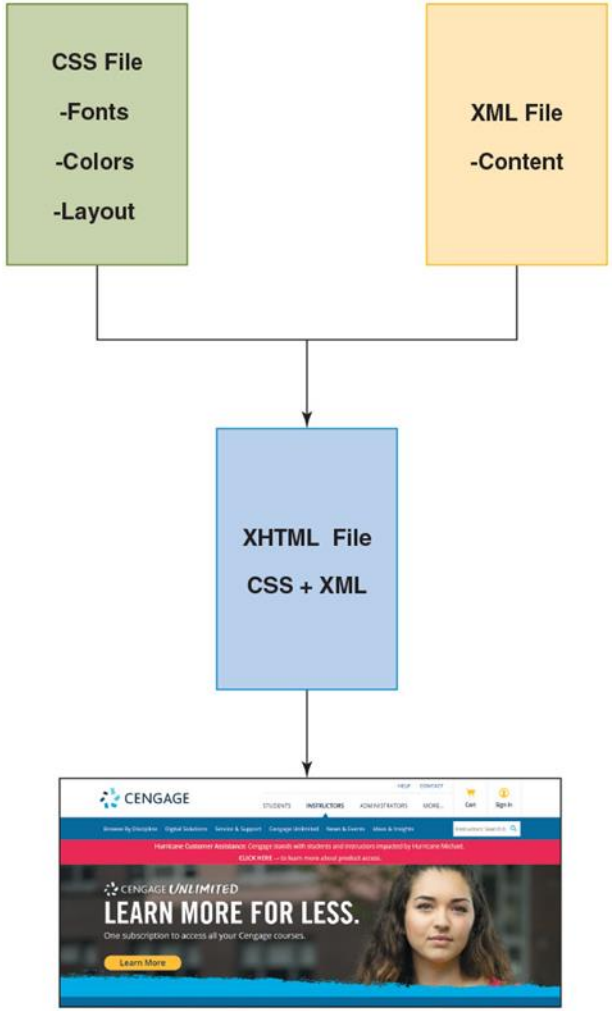
Client/Server Architecture (2 of 2)





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Domain Types

Affiliation ID	Affiliation
Biz	Business sites
Com	All types of entities including nonprofits, schools, and private individuals
Edu	Post-secondary educational sites
Gov	Government sites
Net	Networking sites
Org	Nonprofit organization sites

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Communication Types

1. Internet
2. Extranet
3. Intranet

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Any Questions?

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