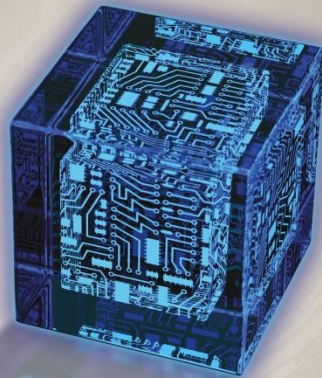


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MANAGEMENT INFORMATION SYSTEMS



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## 2

# Computers: The Machines Behind Computing



# Learning Objectives (1 of 2)

- Define a computer system, and describe its components
- Discuss the history of computer hardware and software
- Explain the factors distinguishing the computing power of computers
- Summarize computer operations
- Discuss the types of input, output, and memory devices



# Learning Objectives (2 of 2)

- Explain how computers are classified
- Describe the two major types of software
- List the generations of computer languages



# Defining a Computer (1 of 3)

- A computer is a machine that:
  - Accepts data as input
  - Processes data without human intervention using stored instructions
  - Outputs information
- Instructions (i.e., program) are:
  - Step-by-step directions for performing a specific task
  - Written in a language the computer can understand



# Defining a Computer (2 of 3)

- Garbage in, garbage out (GIGO)
  - If input data is erroneous, the information provided by the computer is also erroneous



# Defining a Computer (3 of 3)

- Writing a computer program
  - Identify what needs to be done
  - Plan a method to achieve the goal
  - Select the right language
    - Depends on the problem being solved and the type of computer being used
- A program is also called a source code
  - Must be translated into object code, consisting of binary 0s and 1s



# Components of a Computer System

## (1 of 5)

- Hardware components
  - Physical devices such as keyboards, monitors, and processing units
- Software components
  - Programs written in computer languages



# Components of a Computer System

## (2 of 5)

- Central processing unit (CPU): heart of a computer
  - Arithmetic logic unit (ALU): performs arithmetic operations (+, −, \*, /) and comparison or relational operations (<, >, =)
  - Control unit: tells the computer what to do, such as instructing the computer which device to read or send output to



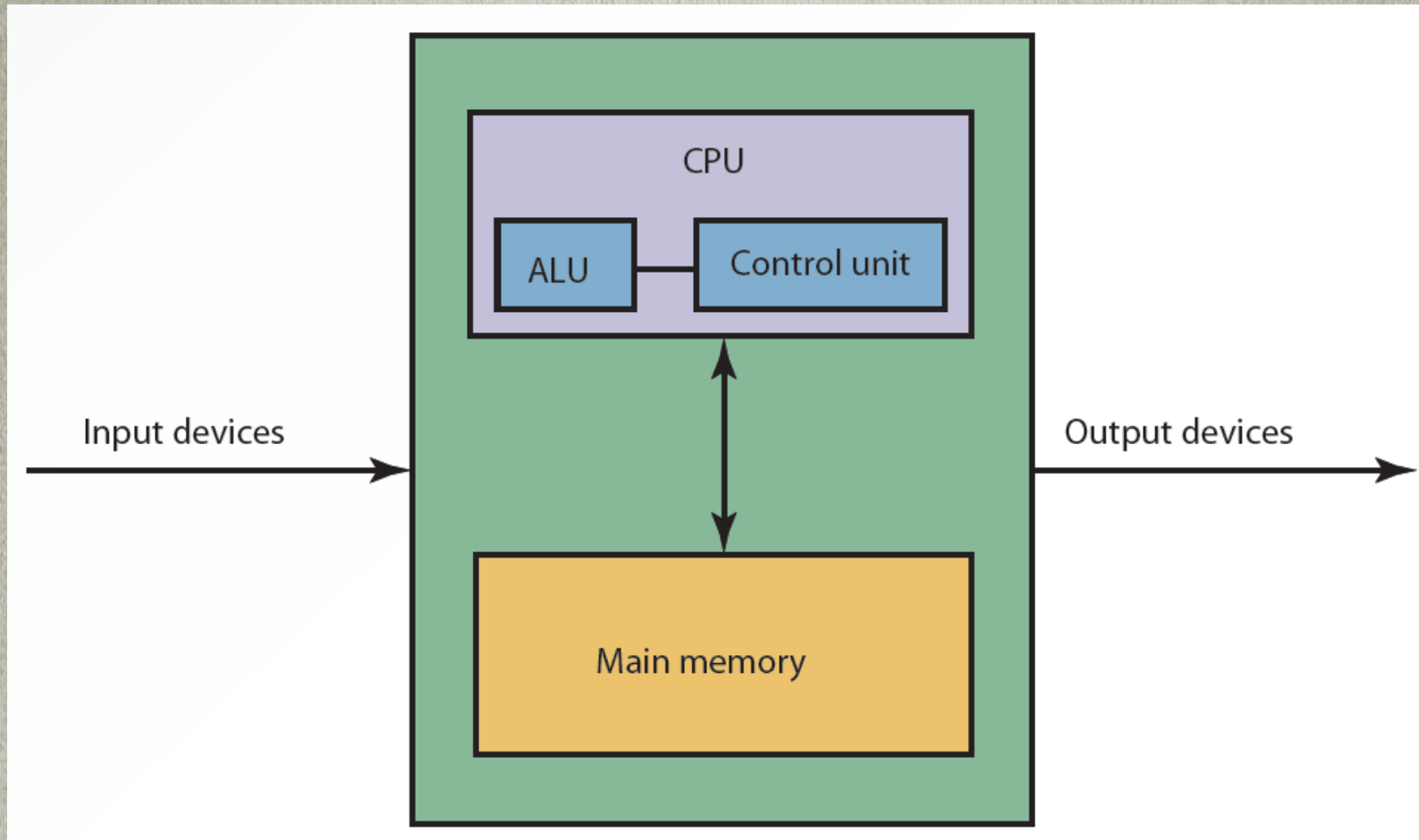
# Components of a Computer System

## (3 of 5)

- Computers can either have a single processor or multiprocessors
  - Multiprocessing: use of two or more CPUs in a single computer system



# The Building Blocks of a Computer





# Components of a Computer System

## (4 of 5)

- Bus: link between devices connected to the computer
  - Parallel or serial
  - Internal (local) or external
- Disk drive: peripheral device for recording, storing, and retrieving information



# Components of a Computer System

## (5 of 5)

- CPU case: enclosure containing the computer's main components
  - Referred to as computer chassis or tower
- Motherboard: main circuit board containing connectors for attaching additional boards



# Exhibit

## 2.2

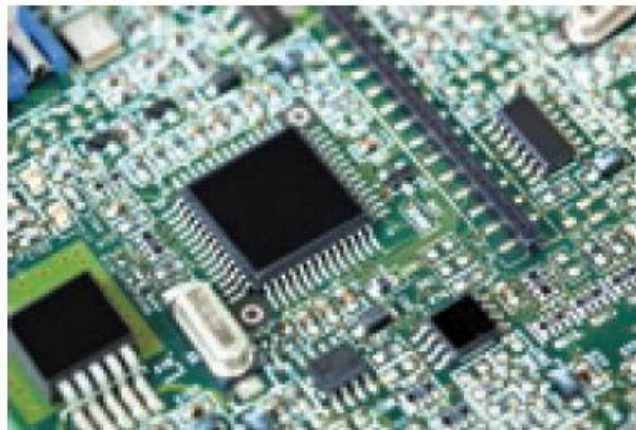
# Components of a Computer System



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# The History of Computer Hardware and Software

- Major developments in hardware have taken place over the past 60 years
  - To make these developments more clear, computers are often categorized into “generations”



Generation	Date	Major Technologies	Example
First	1946–1956	Vacuum tube	ENIAC
Second	1957–1963	Transistors	IBM 7094, 1401
Third	1964–1970	Integrated circuits, remote data entry, telecommunications	IBM 360, 370
Fourth	1971–1992	Miniaturization, VSLI, personal computers, optical disks	Cray XMP, Cray II
Fifth	1993–present	Parallel processing, gallium arsenide chips, optical technologies	IBM System zEnterprise EC12



# The Power of Computers

- Computers draw their power from three factors that far exceed human capacities
  - Speed
  - Accuracy
  - Storage and retrieval capabilities



# Speed

- Computer speed is measured as the number of instructions performed per fractions of a second
  - Millisecond:  $1/1,000$  of a second
  - Microsecond:  $1/1,000,000$  of a second
  - Nanosecond:  $1/1,000,000,000$  of a second
  - Picosecond:  $1/1,000,000,000,000$  of a second



# Accuracy

- Degree of accuracy is critical in many computer applications
  - A small degree of inaccuracy could lead the space shuttle to land in Canada instead of the United States



# Storage and Retrieval

- Storage: saving data in computer memory
- Retrieval: accessing data from memory
- Data is stored in bits
- American Standard Code for Information Interchange (ASCII)
  - Data code for text files, PC applications, and the Internet
  - Defines up to 128 characters



Value	Size in Bytes
1 bit	A single value of 0 or 1
8 bits	1 byte or character
$2^{10}$ bytes	1,000 bytes, or 1 kilobyte (KB)
$2^{20}$ bytes	1,000,000 bytes, or 1 megabyte (MB)
$2^{30}$ bytes	1,000,000,000 bytes, or 1 gigabyte (GB)
$2^{40}$ bytes	1,000,000,000,000 bytes, or 1 terabyte (TB)
$2^{50}$ bytes	1,000,000,000,000,000 bytes, or 1 petabyte (PB)
$2^{60}$ bytes	1,000,000,000,000,000,000 bytes, or 1 exabyte (EB)



# Computer Operations

- Computer functions
  - Three basic tasks: arithmetic operations, logical operations, and storage and retrieval operations
  - Add, subtract, multiply, divide, and raise numbers to a power (exponentiation)
  - Perform comparison operations by comparing two numbers
  - Store massive amounts of data in very small spaces and locate a particular item quickly



# Input, Output, and Memory Devices

- To use a computer and process data, three major components are needed
  - Input
  - Output
  - Memory



# Input Devices

- Send data and information to the computer
  - Keyboard, mouse, touch screen, light pen, trackball, data tablet, barcode reader, optical character reader (OCR), magnetic ink character recognition (MICR) system, and optical mark recognition (OMR) system



# Output Devices

- Many output devices are available for both mainframes and personal computers
  - Display output in the forms of soft copy and hard copy
    - Plotters convert output to graphics
    - Voice synthesizers convert output to voice



# Memory Devices

- Main memory
  - Stores data and information and is volatile
  - Contents are lost when electrical power is turned off
- Secondary memory
  - Nonvolatile; holds data when the computer is off or during course of a program's operation
  - Serves as archival storage



# Main Memory Devices (1 of 2)

- Semiconductor chips made of silicon
  - Can be volatile or nonvolatile
- Random access memory (RAM)
  - Volatile memory, in which data can be read from and written to
    - Known as read-write memory
  - Cache RAM: stores recently accessed memory
    - Resides on the processor



# Main Memory Devices (2 of 2)

- Read-only memory (ROM)
  - Nonvolatile
  - Data cannot be written to it
  - Includes BIOS information and the computer system's clock
  - Other types of ROM
    - Programmable read-only memory (PROM)
    - Erasable programmable read-only memory (EPROM)



# Secondary Memory Devices (1 of 2)

- Magnetic disks
  - Made of Mylar or metal
  - Used for random-access processing
- Magnetic tape
  - Made of a plastic material
  - Stores data sequentially
- Optical discs
  - Use laser beams to access and store data
  - CD-ROMs, WORM discs, and DVDs



# Secondary Memory Devices (2 of 2)

- Other devices include hard disks, USB flash drives, and memory cards
- Redundant array of independent disks (RAID) system
  - Collection of disk drives used for fault tolerance and improved performance
  - Found in large network systems
- Cloud storage
  - Involves multiple virtual servers that are hosted by third parties



# Table

## 2.4 Capacity of Secondary Memory Devices

Device	Storage Capacity
Memory stick	1 TB
Hard disk	16 TB
CD-ROM, CD-R, CD-RW	800 MB
DVD-ROM, DVD-R, DVD-RW	4.7 GB or more
Blu-Ray (latest generation optical disc)	Up to 25 GB on a single-layer disc and 50 GB on a dual-layer disc
SD Card	1 TB
SSD	60 TB



# Storage Area Networks and Network-Attached Storage

- Storage area network (SAN)
  - Dedicated high-speed network consisting of both hardware and software
  - Connect and manage shared storage devices
    - Disk arrays, tape libraries, and optical storage devices
- Network-attached storage (NAS)
  - Network-connected computer dedicated to provide file-based data storage services to other network devices



# Classes of Computers

- Based on cost, amount of memory, speed, and sophistication
- Computer classifications
  - Subnotebooks and notebooks
  - Personal and minicomputers
  - Mainframes
  - Supercomputers



# Server Platforms: An Overview

- Server: computer and all the software for managing network resources and offering services to a network
  - Available server platforms: application servers, database servers, disk servers, fax servers, file servers, mail servers, print servers, remote access servers (RAS), and Web servers



# What is Software?

- Programs that run a computer system
  - Classifications
    - System software: works in the background and takes care of tasks, such as deleting waste files
    - Application software: performs specialized tasks



# Operating System Software (1 of 2)

- Set of programs for controlling and managing computer hardware and software
  - Provides an interface between a computer and the user
  - Increases computer efficiency by helping users share computer resources and performing repetitive tasks for users



# Operating System Software (2 of 2)

- Consists of control programs to manage hardware and resources by performing:
  - Job management
  - Resource allocation
  - Data management
  - Communication
- Supervisor program (i.e., the kernel)
  - Responsible for controlling all other programs in the OS



# Application Software

- Commercial software or software developed in house; used to perform variety of tasks on a personal computer
  - Word processing, spreadsheet, database, presentation, and graphics
  - Desktop publishing
  - Financial planning and accounting
  - Project management
  - Computer-aided design (CAD)



# Computer Languages (1 of 4)

- Machine language
  - First generation of computer languages
  - Consists of a series of 0s and 1s representing data or instructions
  - Dependent on the machine
  - Time-consuming to write a program



# Computer Languages (2 of 4)

- Assembly language
  - Second generation of computer languages
  - Machine dependent and a higher-level language than machine language
  - Uses a series of short codes, or mnemonics, to represent data or instructions



# Computer Languages (3 of 4)

- High-level languages
  - Third-generation of computer languages
  - Machine independent and self-documenting
  - Used for Web development and Internet applications
- Fourth-generation languages (4GLs)
  - Commands are powerful and easy to learn
  - Use macro codes that can take the place of several lines of programming



# Computer Languages (4 of 4)

- Fifth-generation languages
  - Use artificial intelligence technologies
  - Knowledge-based systems, natural language processing (NLP), visual programming, and a graphical approach to programming
  - Designed to facilitate natural conversations between an individual and the computer



# Summary (1 of 2)

- A computer can have many definitions
- Major developments in hardware have taken place over the past 60 years
- Computers draw their power from speed, accuracy, and storage and retrieval capabilities
- Computers perform arithmetic, logical, and storage and retrieval operations



# Summary (2 of 2)

- Computers are classified based on cost, amount of speed, and sophistication
- To process data, a computer requires input, output, and memory devices
- Software is all the programs that run a computer system
- Computer languages include machine, assembly, high-level, fourth- and fifth-generation languages



