

# 2.1.1 Elements of a Computer System

## Looking Inside the Computer System



# Parts of the Computer System

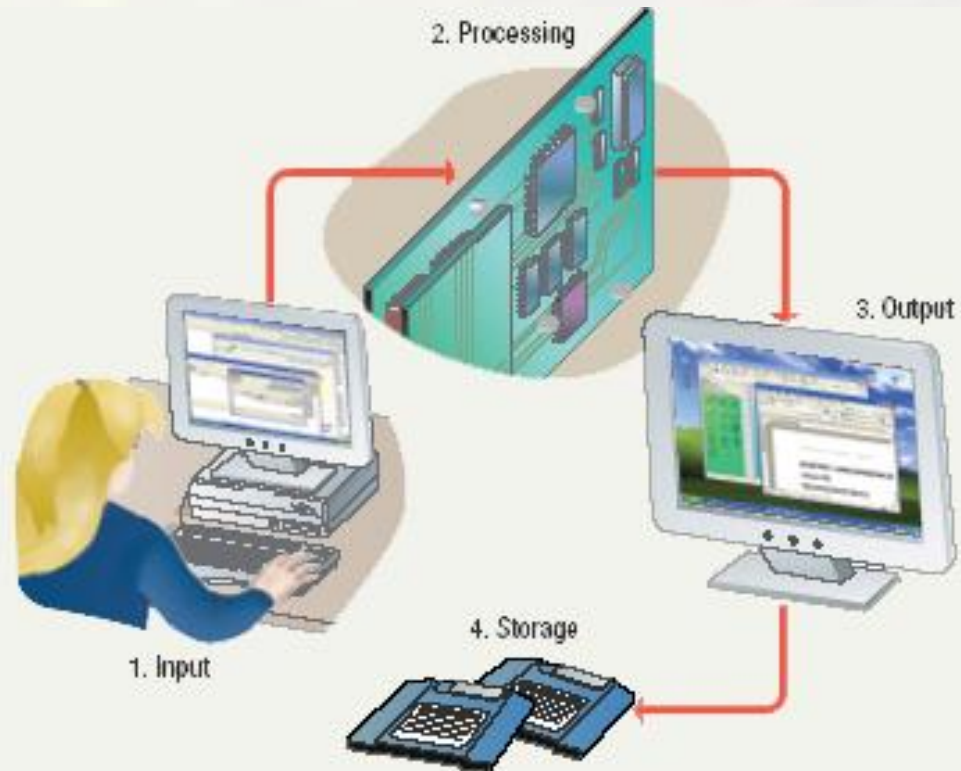
- Hardware
  - Mechanical devices in the computer
  - Anything that can be touched
- Software
  - Tell the computer what to do
  - Also called a program
  - Thousands of programs exist

# Parts of the Computer System

- Data
  - Pieces of information
  - Computer organize and present data
- Users
  - People operating the computer
  - Most important part
  - Tell the computer what to do

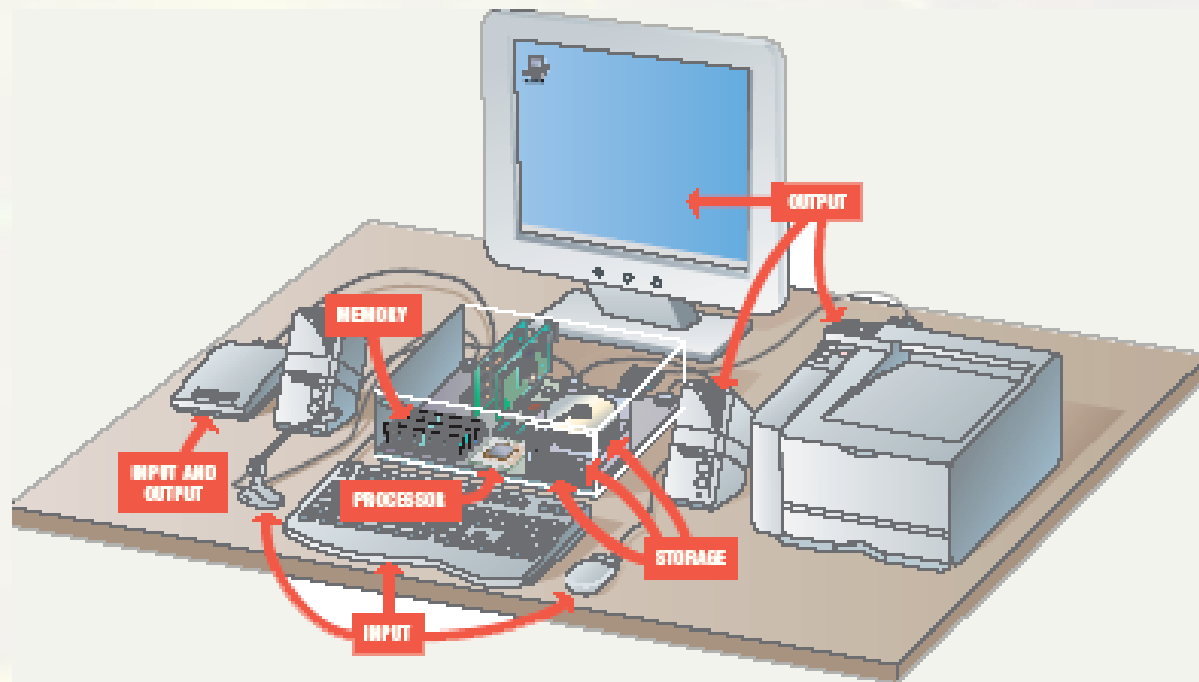
# Information Processing Cycle

- Steps followed to process data
- Input
- Processing
- Output
- Storage



# Essential Computer Hardware

- Computers use the same basic hardware
- Hardware categorized into four types



# Essential Computer Hardware

- Processing devices
  - Brains of the computer
  - Carries out instructions from the program
  - Manipulate the data
  - Most computers have several processors
  - Central Processing Unit (CPU)
  - Secondary processors
  - Processors made of silicon and copper

# Essential Computer Hardware

- Memory devices
  - Stores data or programs
  - Random Access Memory (RAM)
    - Volatile
    - Stores current data and programs
    - More RAM results in a faster system
  - Read Only Memory (ROM)
    - Permanent storage of programs
    - Holds the computer boot directions



# Essential Computer Hardware

- Input and output devices
  - Allows the user to interact
  - Input devices accept data
    - Keyboard, mouse
  - Output devices deliver data
    - Monitor, printer, speaker
  - Some devices are input and output
    - Touch screens

# Essential Computer Hardware

- Storage devices
  - Hold data and programs permanently
  - Different from RAM
  - Magnetic storage
    - Floppy and hard drive
    - Uses a magnet to access data
  - Optical storage
    - CD and DVD drives
    - Uses a laser to access data

# Software Runs The Machine

- Tells the computer what to do
- Reason people purchase computers
- Two types
  - System software
  - Application software

# Software Runs The Machine

- System software
  - Most important software
  - Operating system
    - Windows XP
  - Network operating system (OS)
    - Windows Server 2003
  - Utility
    - Symantec AntiVirus

# Software Runs The Machine

- Application software
  - Accomplishes a specific task
  - Most common type of software
    - MS Word
  - Covers most common uses of computers

# Computer data

- Fact with no meaning on its own
- Stored using the binary number system
- Data can be organized into files

# Computer users

- Role depends on ability
  - Setup the system
  - Install software
  - Manage files
  - Maintain the system
- “Userless” computers
  - Run with no user input
  - Automated systems

## 2.1.2 Data Representation

# Transforming Data Into Information



# How Computers Represent Data

- Number systems
  - A manner of counting
  - Several different number systems exist
- Decimal number system
  - Used by humans to count
  - Contains ten distinct digits
  - Digits combine to make larger numbers

# How Computers Represent Data

- Binary number system
  - Used by computers to count
  - Two distinct digits, 0 and 1
  - 0 and 1 combine to make numbers

# How Computers Represent Data

- Bits and bytes
  - Binary numbers are made of bits
  - Bit represents a switch
  - A byte is 8 bits
  - Byte represents one character



# How Computers Represent Data

- Text codes
  - Converts letters into binary
  - Standard codes necessary for data transfer
  - ASCII
    - American English symbols
  - Extended ASCII
    - Graphics and other symbols
  - Unicode
    - All languages on the planet

# How Computers Process Data

- The CPU
  - Central Processing Unit
  - Brain of the computer
  - Control unit
    - Controls resources in computer
    - Instruction set
  - Arithmetic logic unit
    - Simple math operations
    - Registers

# How Computers Process Data

- Machine cycles
  - Steps by CPU to process data
  - Instruction cycle
    - CPU gets the instruction
  - Execution cycle
    - CPU performs the instruction
  - Billions of cycles per second
  - Pipelining processes more data
  - Multitasking allows multiple instructions

# How Computers Process Data

- Memory
  - Stores open programs and data
  - Small chips on the motherboard
  - More memory makes a computer faster



# How Computers Process Data

- Nonvolatile memory
  - Holds data when power is off
  - Read Only Memory (ROM)
  - Basic Input Output System (BIOS)
  - Power On Self Test (POST)



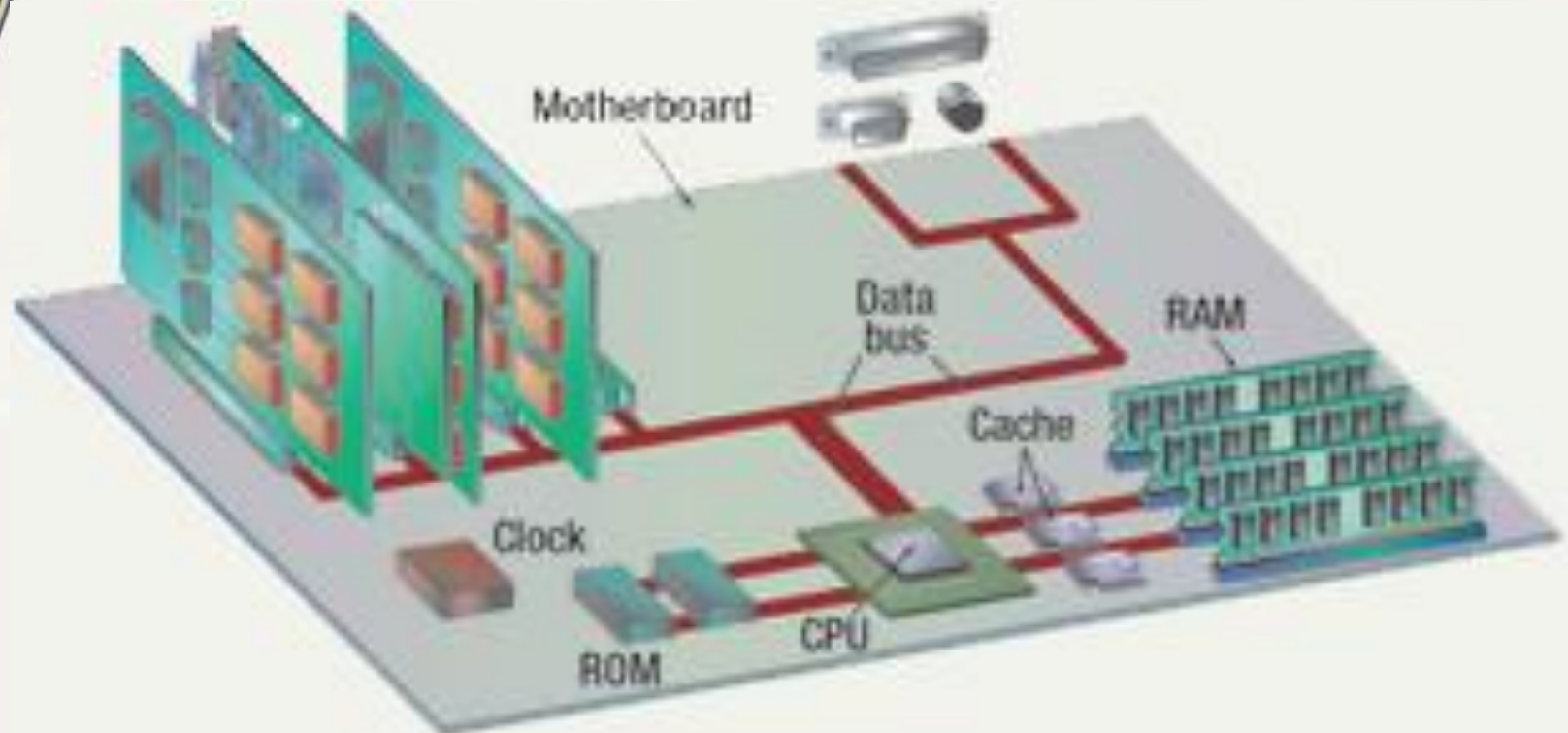
# How Computers Process Data

- Flash memory
  - Data is stored using physical switches
  - Special form of nonvolatile memory
  - Camera cards, USB key chains

# How Computers Process Data

- Volatile memory
  - Requires power to hold data
  - Random Access Memory (RAM)
  - Data in RAM has an address
  - CPU reads data using the address
  - CPU can read any address

# Components affecting Speed



# Affecting Processing Speed

- Registers
  - Number of bits processor can handle
  - Word size
  - Larger indicates more powerful computer
  - Increase by purchasing new CPU

# Affecting Processing Speed

- Virtual RAM
  - Computer is out of actual RAM
  - File that emulates RAM
  - Computer swaps data to virtual RAM
    - Least recently used data is moved

# Affecting Processing Speed

- The computer's internal clock
  - Quartz crystal
  - Every tick causes a cycle
  - Speeds measured in Hertz (Hz)
    - Modern machines use Giga Hertz (GHz)

# Affecting Processing Speed

- The bus
  - Electronic pathway between components
  - Expansion bus connects to peripherals
  - System bus connects CPU and RAM
  - Bus width is measured in bits
  - Speed is tied to the clock

# Affecting Processing Speed

- External bus standards
  - Industry Standard Architecture (ISA)
  - Local bus
  - Peripheral control interface
  - Accelerated graphics port
  - Universal serial bus
  - IEEE 1394 (FireWire)
  - PC Card



# Affecting Processing Speed

- Peripheral control interface (PCI)
  - Connects modems and sound cards
  - Found in most modern computers

# Affecting Processing Speed

- Accelerated Graphics Port (AGP)
  - Connects video card to motherboard
  - Extremely fast bus
  - Found in all modern computers

# Affecting Processing Speed

- Universal Serial Bus (USB)
  - Connects external devices
  - Hot swappable
  - Allows up to 127 devices
  - Cameras, printers, and scanners

# Affecting Processing Speed

- PC Card
  - Used on laptops
  - Hot swappable
  - Devices are the size of a credit card



# Affecting Processing Speed

- Cache memory
  - Very fast memory
  - Holds common or recently used data
  - Speeds up computer processing
  - Most computers have several caches
  - L1 holds recently used data
  - L2 holds upcoming data
  - L3 holds possible upcoming data

# Subtopic 2.1

End of Subtopic