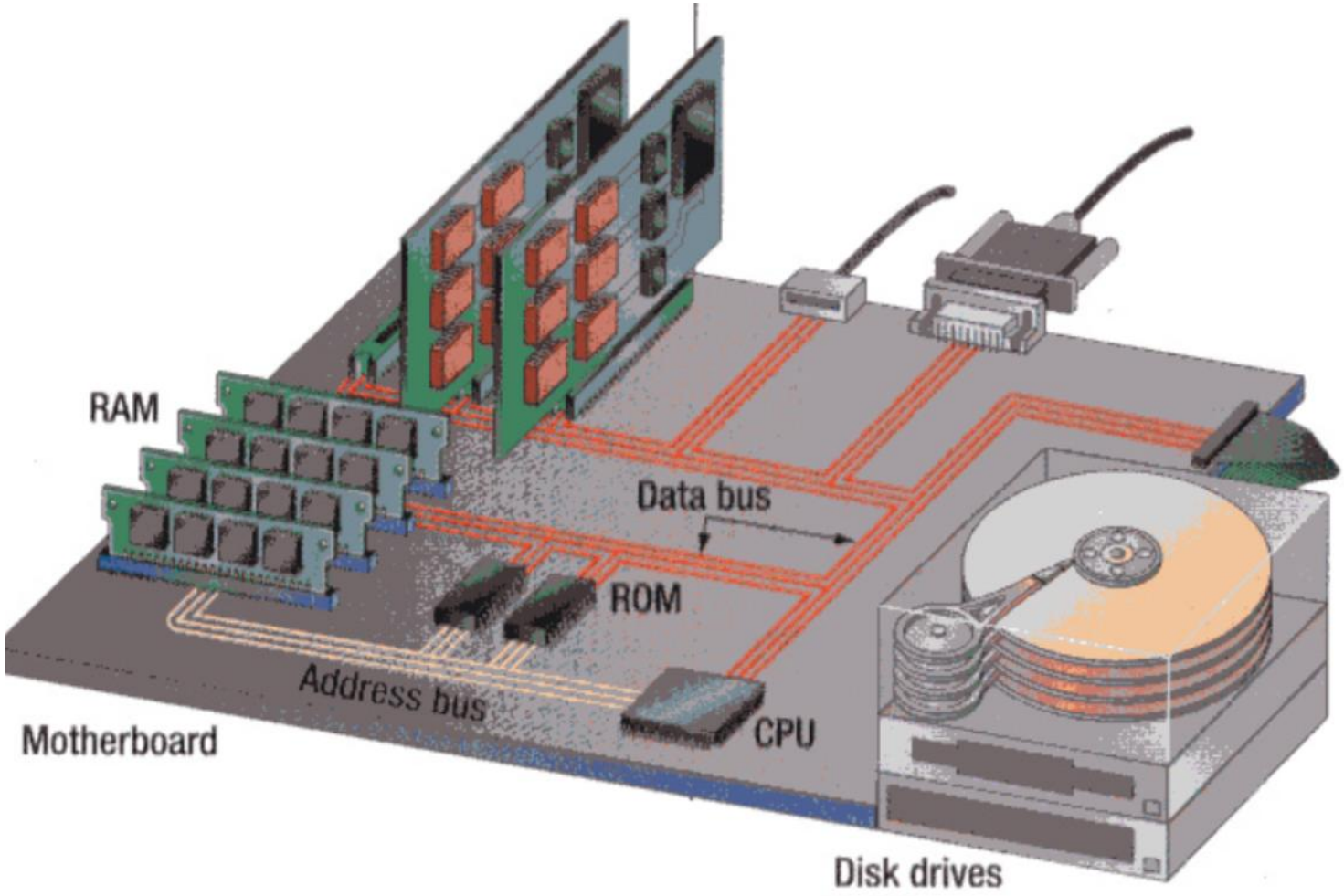
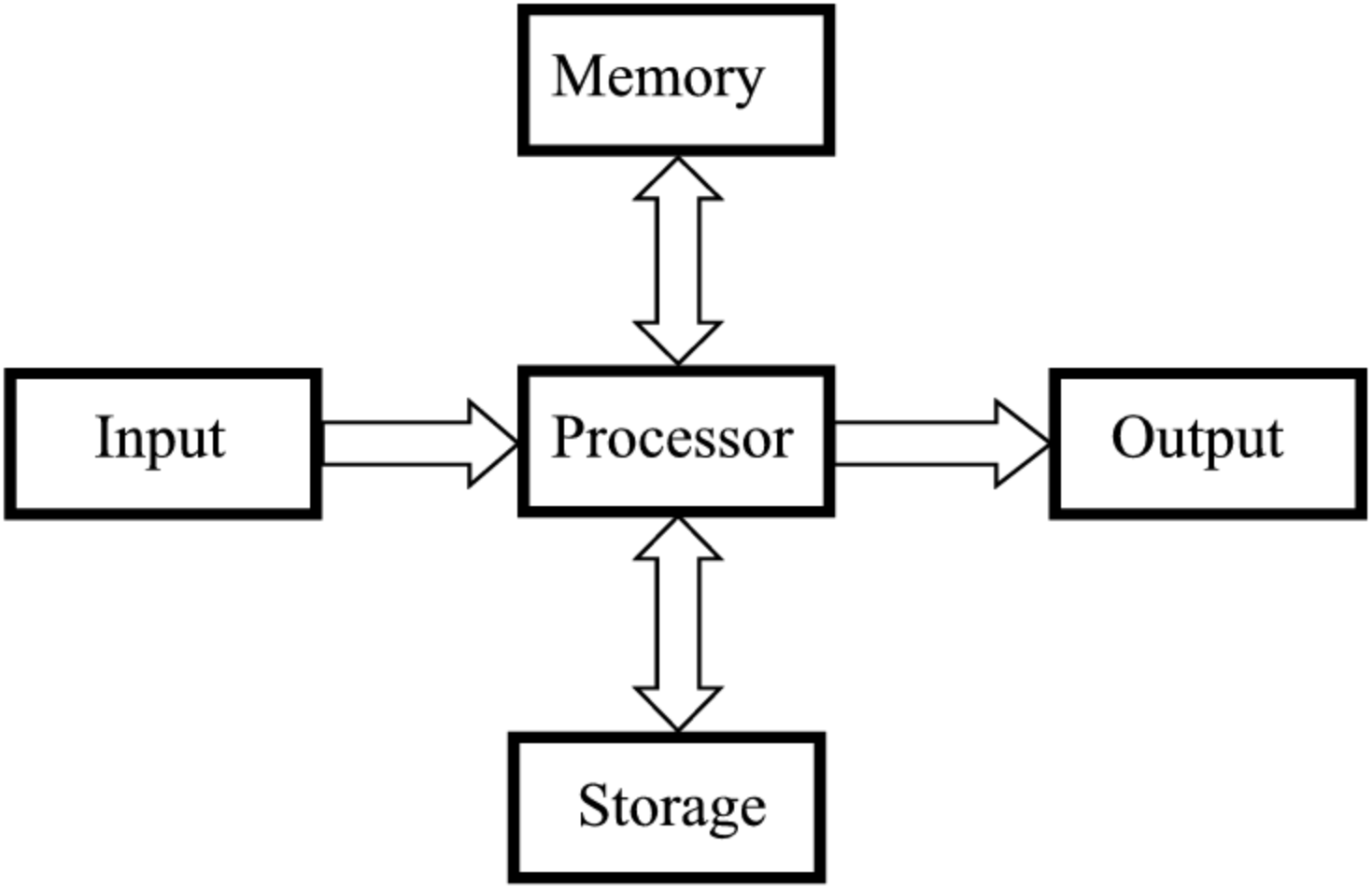
Lecture-5

Memories

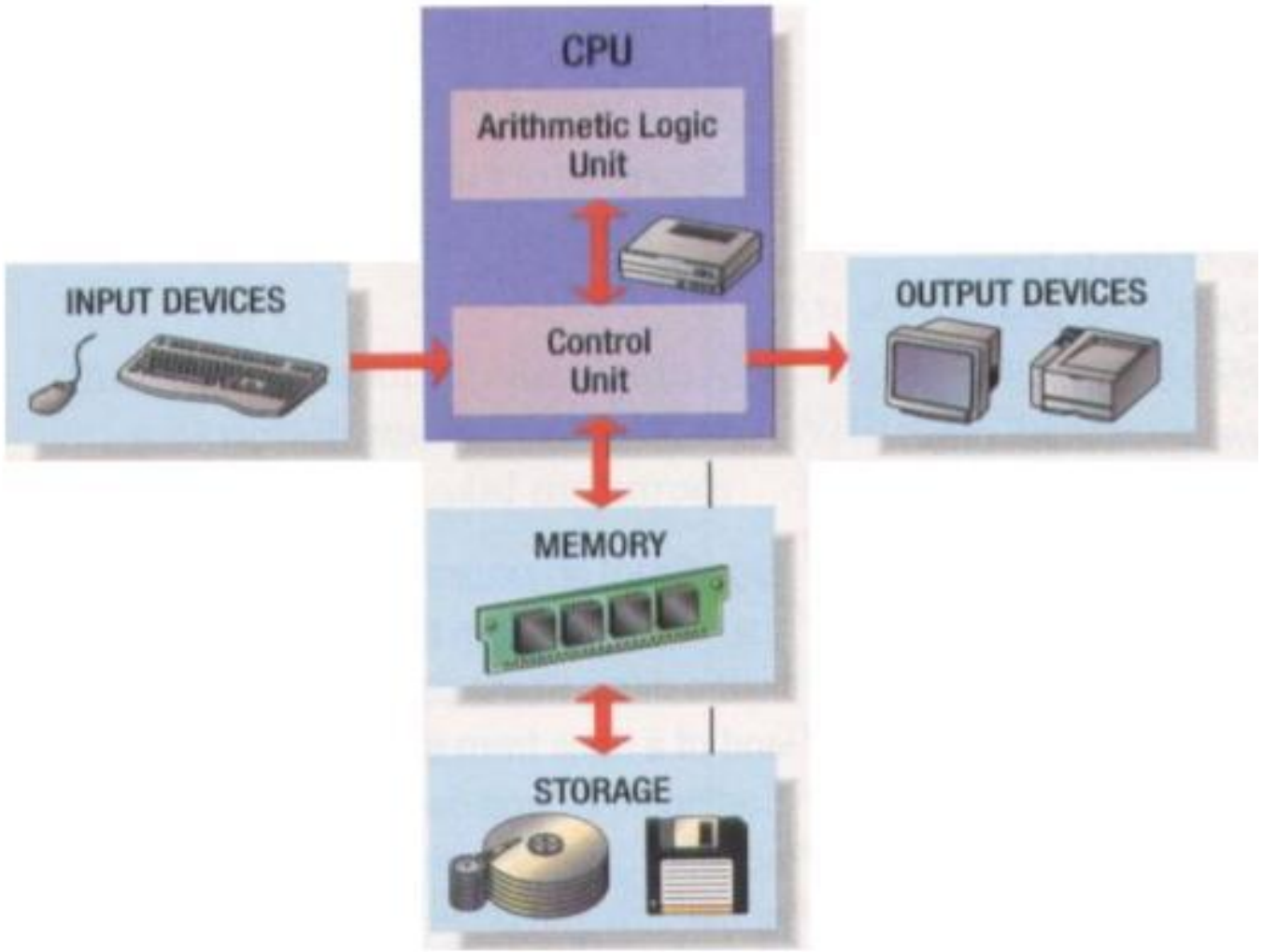

RAM
Data bus
ROM
Address bus
CPU
Motherboard
Disk drives

Memory



1. Introduction

- Memory Devices (RAM,ROM,PROM,EPROM)
- Storage Devices (Auxiliary Storage Devices-Magnetic Tape, Hard Disk, Floppy Disk .Optical Disks: CD-R Drive,CD-RW disks,DVD,Blue ray Discs)


CPU
Arithmetic Logic Unit
INPUT DEVICES
Control Unit
OUTPUT DEVICES
MEMORY
STORAGE

Characteristics of Storage Devices

- Speed
- Volatility
- Access method
- Portability
- Cost and capacity

Basic Units Of Measurement

- **Bit**  on OR off

  Bi*nary digi*t

  Smallest unit of measurement

  Two possible values 0 1

- **Byte** 

- **8 bits**

Small Units Of Measurement (Processor And Memory Speed)

Millisecond (ms) – a thousandth of a second ($1/1{,}000 = 10^{-3}$)

Microsecond (µs) - a millionth of a second ($1/1{,}000{,}000 = 10^{-6}$)

Nanosecond (ns) – a billionth of a second ($1/1{,}000{,}000{,}000 = 10^{-9}$)

Large Units Of Measurement (Memory, Storage)

- Note: powers of two are used because computer memory and storage are based on the basic unit (bit).
- Kilobyte (KB) – a thousand bytes (1,024 = 2^{10})
- Megabyte (MB) - a million (1,048,576 = 2^{20})

Large Units Of Measurement (Memory, Storage)

- Gigabyte (GB) – a billion (1,073,741,824 = 2^{30})
  - ~ A complete set of encyclopedias requires about 700 MB of storage
  - ~ 30 minutes of video (1/4 of the information stored on a typical DVD)

Large Units Of Measurement (Memory, Storage)

- Terabyte (TB) – a trillion (1,099,511,627,776 = 2^{40})
  - ~ 20 million four-drawer filing cabinets full of text
  - ~ 200 DVD's of information

2. RAM,ROM,PROM,EPROM

- Memory Devices
  - Memory: Is one or more sets of chips that store data/program instructions, either temporarily or permanently .
  - It is critical processing component in any computer
  - PCs use several different types

RAM,ROM,PROM,EPROM

- Memory Devices
  - Two most important are
    - RAM(Random Access Memory)
    - ROM(Read-only Memory)
  - They work in different ways and perform distinct functions
  - CPU Registers
  - Cache Memory

RAM

- RAM is packaged as a chip.
- Basic storage unit is a cell (one bit per cell).
- Multiple RAM chips form a memory.
- *R*andom *A*ccess *M*emory

  Volatile

  Used for temporary storage

  Typical ranges 256 MB - 4 GB
- Random Access means direct access to any part of memory

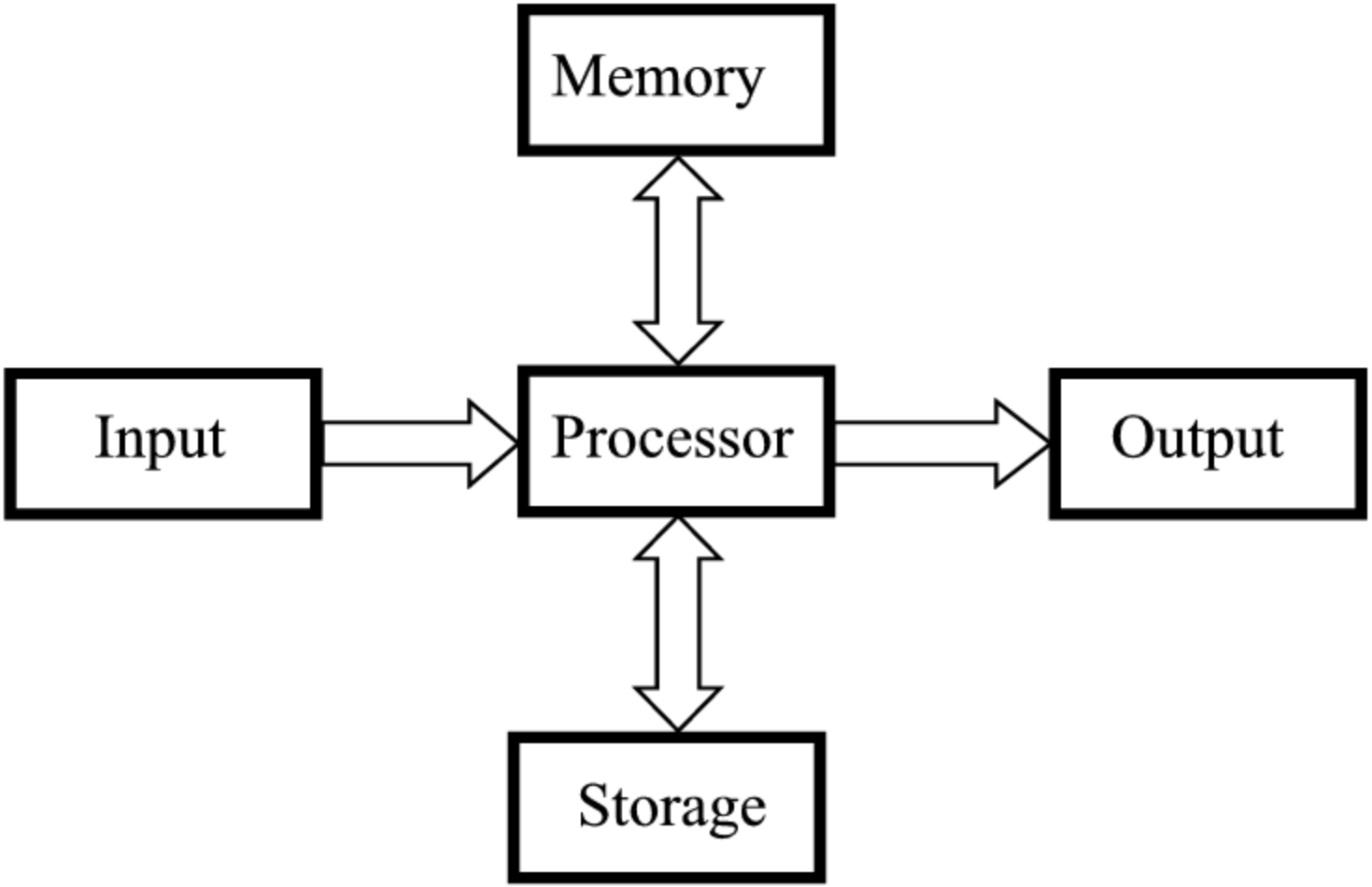
Nonvolatile Memories(ROM)

- DRAM and SRAM are volatile memories
  - Lose information if powered off.
- Nonvolatile memories retain value even if powered off.
  - Generic name is read-only memory (ROM).
  - Misleading because some ROMs can be read and modified.

Nonvolatile Memories(ROM)

- Types of ROMs
  - Programmable ROM (PROM)
  - Eraseable programmable ROM (EPROM)
  - Electrically eraseable PROM (EEPROM)
  - Flash memory (used in portable digital devices)
- Firmware (Program instruction used frequently)
  - Program stored in a ROM
    - Boot time code, BIOS (basic input/output system)
    - graphics cards, disk controllers.

Memory



3. Storage Vs. Memory

Memory (e.g., RAM)

- Keep the information for a shorter period of time (usually volatile)
- Faster
- More expensive

3. Storage Vs. Memory

Storage (e.g., Hard disk)

- The information is retained longer (non-volatile)
- Slower
- Cheaper

Categories Of Storage

- Magnetic
  - Floppy disks
  - Zip disks
  - Hard drives
- Optical
  - CD-ROM
  - DVD
- Solid state storage devices
  - USB Key (a very common form of solid state storage)

Magnetic Storage

- Exploits duality of magnetism and electricity
  - Converts electrical signals into magnetic charges
  - Captures magnetic charge on a storage medium
  - Later regenerates electrical current from stored magnetic charge
- Polarity of magnetic charge represents bit values zero and one