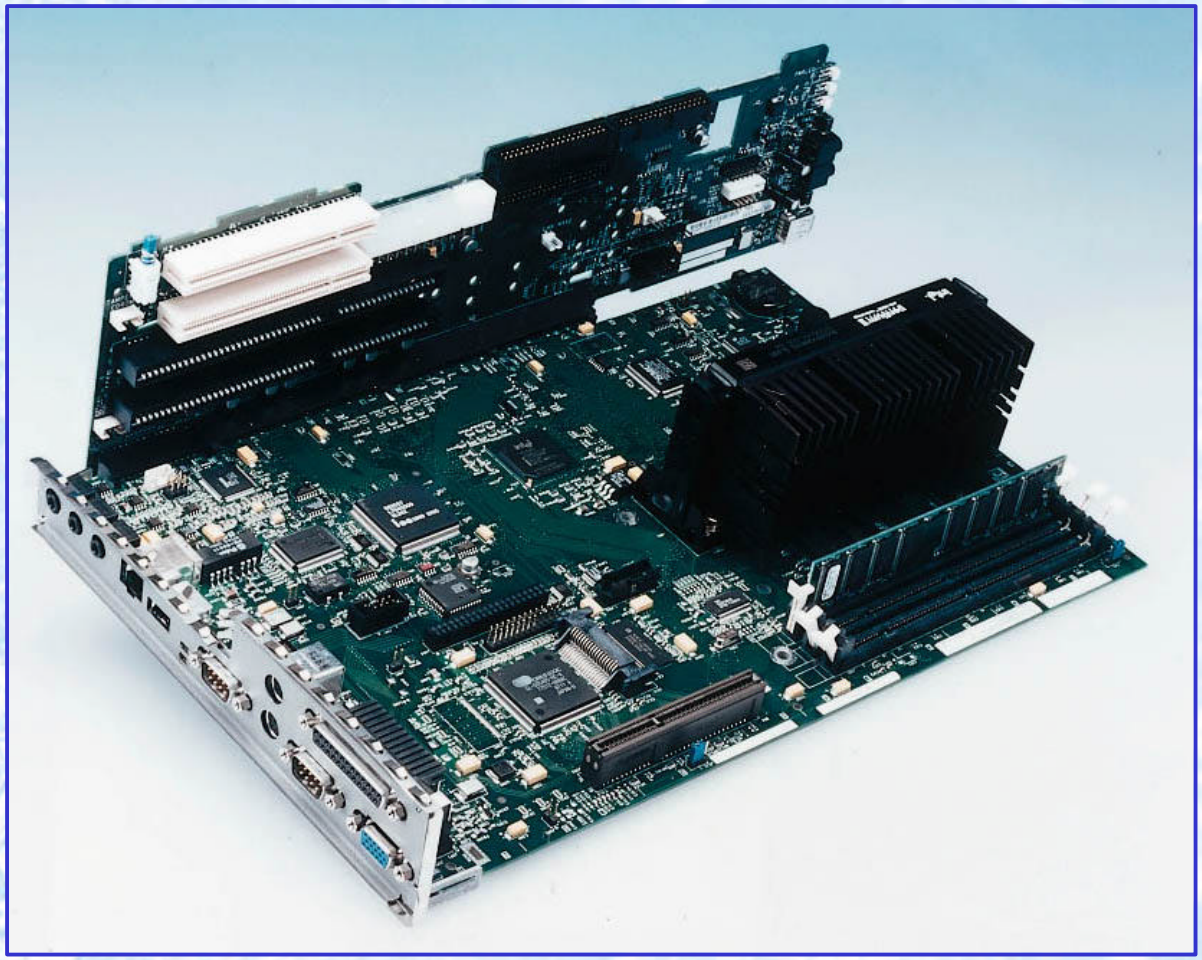
Chapter Two



Hardware Basics: Inside the Box

After reading this chapter, you should be able to:

- Explain general terms how computers store and manipulate information.
- Describe the basic structure of a computer
- Discuss the functions and interactions of a computer system's principal internal components

After reading this chapter, you should be able to:

- Explain why a computer typically has different types of memory and storage devices
- Describe several examples of input and output devices and explain how they enhance a computer's usefulness

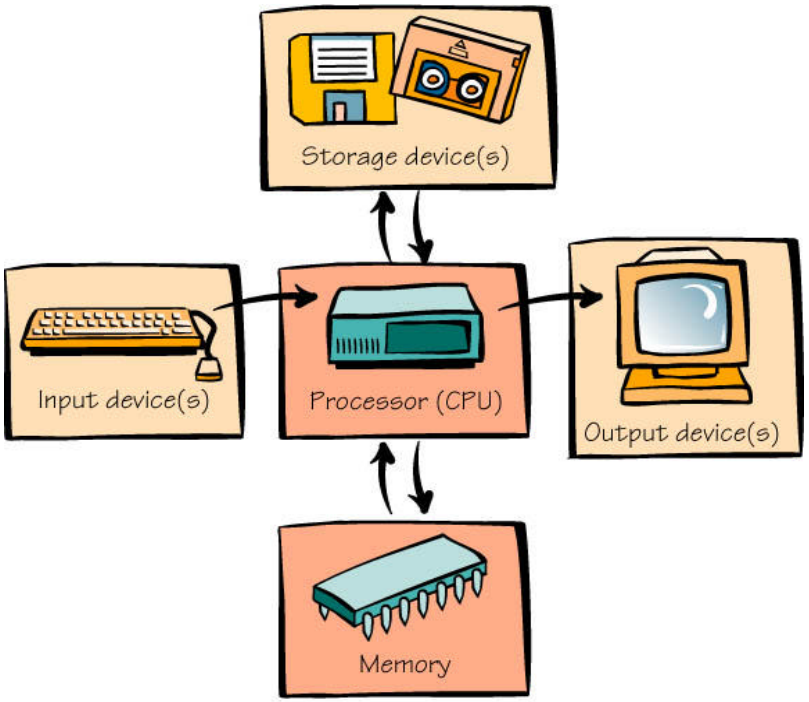
Chapter Outline

- What Computers Do
- A Bit About Bits
- The Computer's Core: CPU and Memory

What Computers Do

Four basic functions of computers include:

- Receive input
- Process information
- Produce output
- Store information

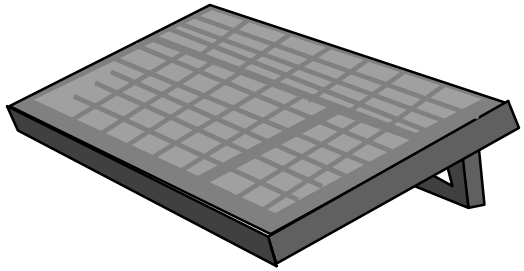


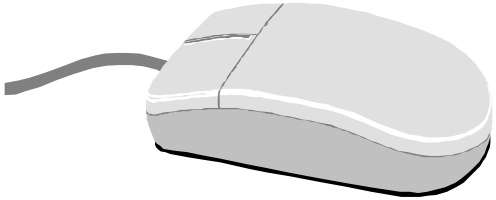
Input Devices

Computers accept information from the outside world.

The **keyboard** is the most common input device.

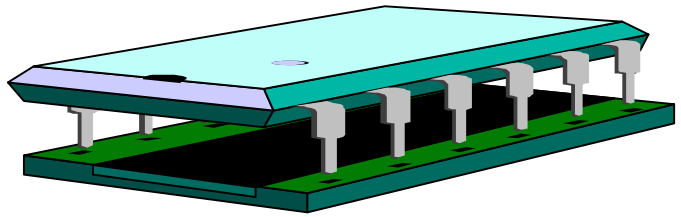
Pointing devices like the mouse also receive input.





Process Information

The processor, or **central processing unit** (CPU), processes information, and performs all the necessary arithmetic calculations. The CPU is like the “brain” of the computer.

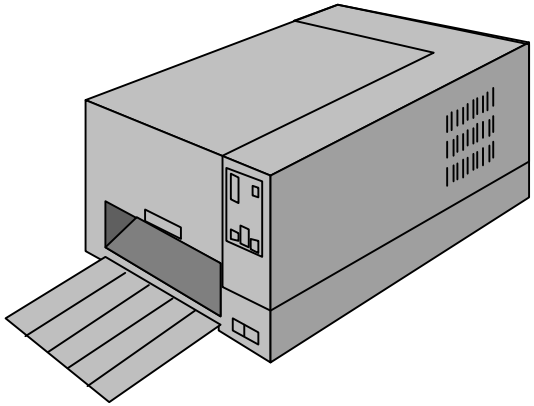


Output Devices

Computers produce information and send it to the outside world.

A **video monitor** is a common output device.

Printers also produce output.

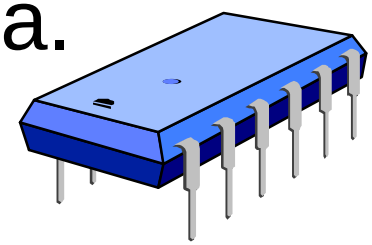


Store Information

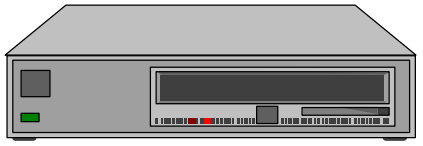
Memory and storage devices are used to store information.

Primary storage is the computer's main memory.

Secondary storage uses disks or other media.



Primary storage



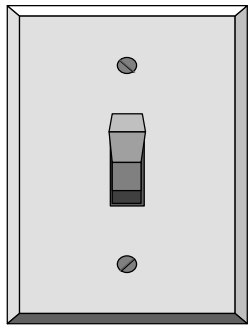
Secondary storage

A Bit About Bits

A bit (binary digit)

- is the smallest unit of information
- can have two values - 1 and 0.

Binary digits, or bits, can represent **numbers, codes,** or **instructions**.



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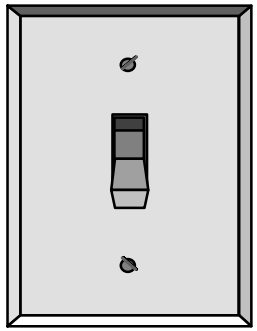
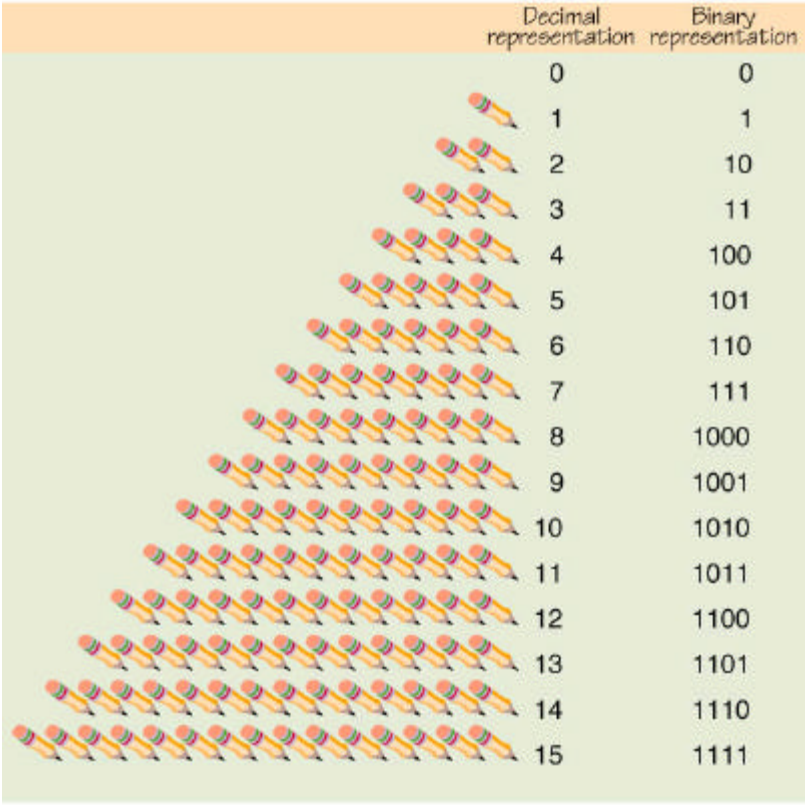


Off

Bits as Numbers

Binary number system - a system that denotes all numbers and combinations of two digits.

The binary system uses two digits to represent the numbers 0 and 1.



Bits as Codes

ASCII - American Standard Code for Information Interchange - most widely used code, represents each character as a unique 8-bit code.

Character	ASCII binary code
A	01000001
B	01000010
C	01000011
D	01000100
E	01000101
F	01000110
G	01000111
H	01001000
I	01001001
J	01001010
K	01001011
L	01001100
M	01001101
N	01001110
O	01001111
P	01010000
Q	01010001
R	01010010
S	01010011
T	01010100
U	01010101
V	01010110
W	01010111
X	01011000
Y	01011001
Z	01011010
0	00110000
1	00110001
2	00110010
3	00110011
4	00110100
5	00110101
6	00110110
7	00110111
8	00111000
9	00111001

Bits as Instructions

The computer stores programs as collections of bits.

- For instance, 01101010 might instruct the computer to add two numbers.

Other bit instructions might include where to find numbers stored in memory or where to store them.

Bits, Bytes, and Buzzwords

Common terms might describe file size or memory size:

Bit: smallest unit of information

Byte: a grouping of eight bits of information

K: (kilobyte); about 1,000 bytes of information - technically 1024 bytes equals 1K of storage.

Bits, Bytes, and Buzzwords

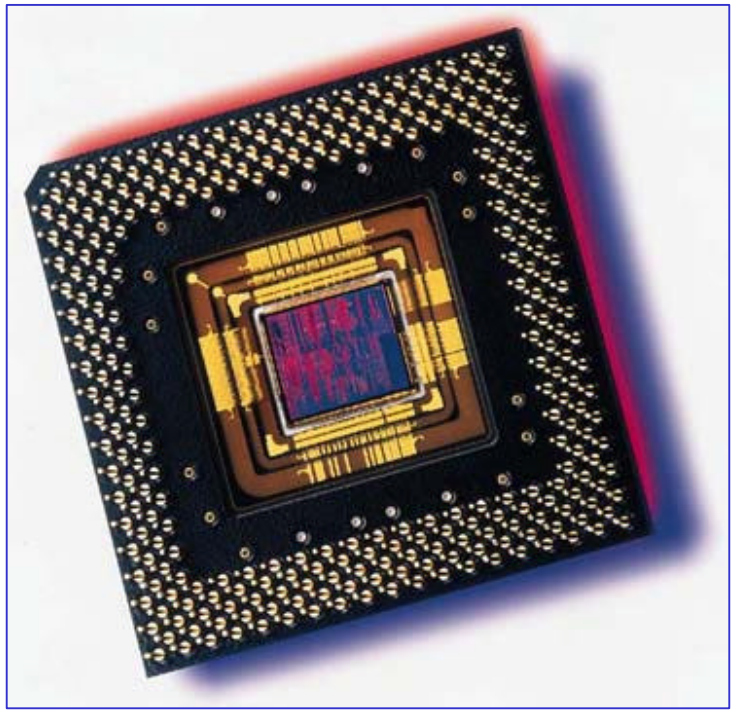
MB: (megabyte); about 1 million bytes of information

GB: (gigabyte); about 1 billion bytes of information

TB: (terabyte); about 1 million megabytes of information

The Computer's Core: The CPU and Memory

- The transformations are performed by the CPU - the ***central processing unit*** or processor.
- The microprocessor, which is a silicon chip, is located on the *motherboard.*



The Computer's Core: The CPU and Memory

When you purchase a computer, the selection of the CPU is a very important choice. There are two factors that are very important to computer users are:

- Compatibility
- Speed

Compatibility

Not all software is compatible with any given CPU. Each computer has a unique **instruction set** - a vocabulary of instructions the processor can execute.

New microprocessors can usually run older software, but new software is not usually compatible with old microprocessors.

Speed

The computer's speed is measured by the speed of its **internal clock** - a device to synchronize the electric pulses.

Speed is measured in units called **megahertz** (mHz).

Speed

The architecture of a computer determines its speed.

- **CISC** - complex computer instructions set computer
- **RISC** - reduced instruction set computer

Popular CPU Families and Where to Find Them

CPU Family	Type	Developer/Manufacturer	Where they're used
Pentium Family	CISC	Developed and manufactured by Intel; clones by AMD, Cirrix and others	Modern IBM-compatible computers
x86 Family (386, 486)	CISC	Developed and manufactured by Intel; clones by others	Older IBM-compatible computers
Power PC Family	RISC	Developed by IBM, manufactured by IBM and Motorola	Modern Macintoshes, network computers, special-purpose devices
680x0 Family (68000, 68020, and others)	CISC	Developed and manufactured by Motorola	Older Macintoshes, computer-controlled devices
Alpha	RISC	Developed by Digital (now owned by Compaq), manufactured by Intel	Supercomputers, workstations, servers
MIPS	RISC	Developed by Silicon Graphics, manufactured by many companies	Workstations, servers, network computers, video game machines, other devices
SPARC	RISC	Sun	Workstations

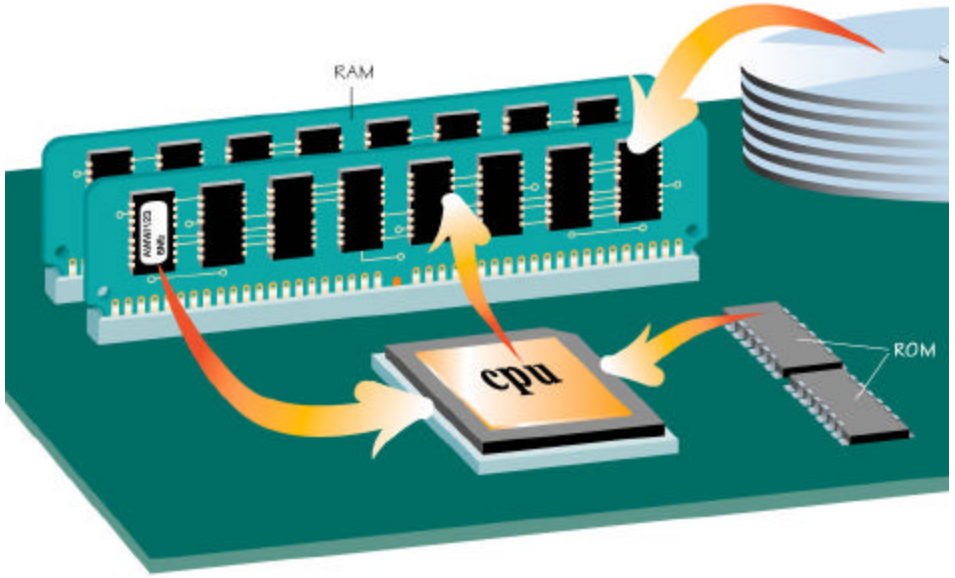
Primary Storage: The Computer's Memory

RAM (random access memory):

- is the most common type of primary storage, or computer memory.
- used to store program instructions and data temporarily
- unique addresses and can store in any location
- can quickly retrieve information
- will not remain if power goes off (volatile).

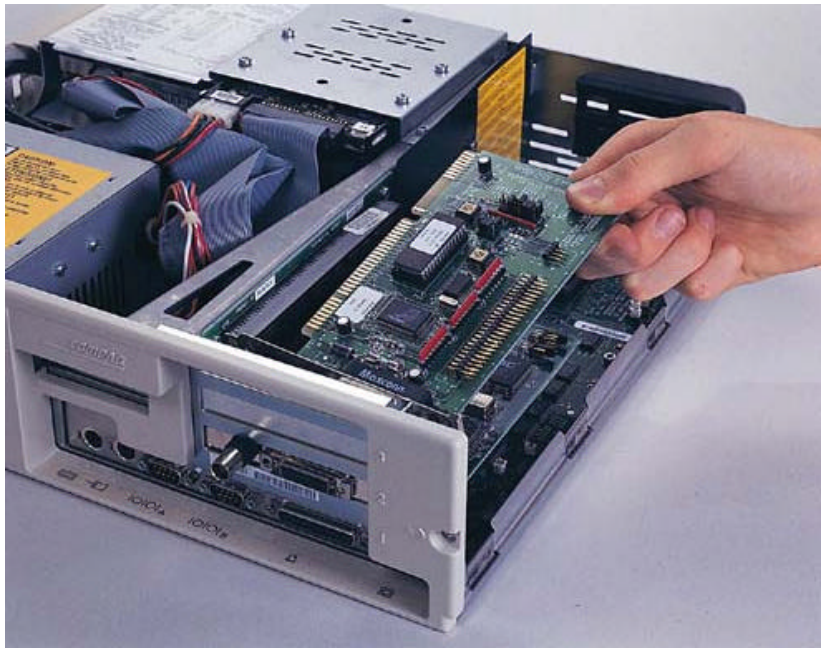
Primary Storage: The Computer's Memory

- **ROM** (read-only memory):
  - information is stored permanently on a chip.
  - contains startup instructions and other permanent data.



Buses, Ports, and Peripherals

Information travels between components through groups of wires called **buses**.



Buses, Ports, and Peripherals

Peripherals:

- are **external devices** for receiving input or producing output (keyboard, monitor, and mouse).
- communicate with other parts of the system.

Buses, Ports, and Peripherals

- provide attachment and communication with external devices by means of:
  - **slots** (for internal attachment)
  - **ports** (for external attachments)