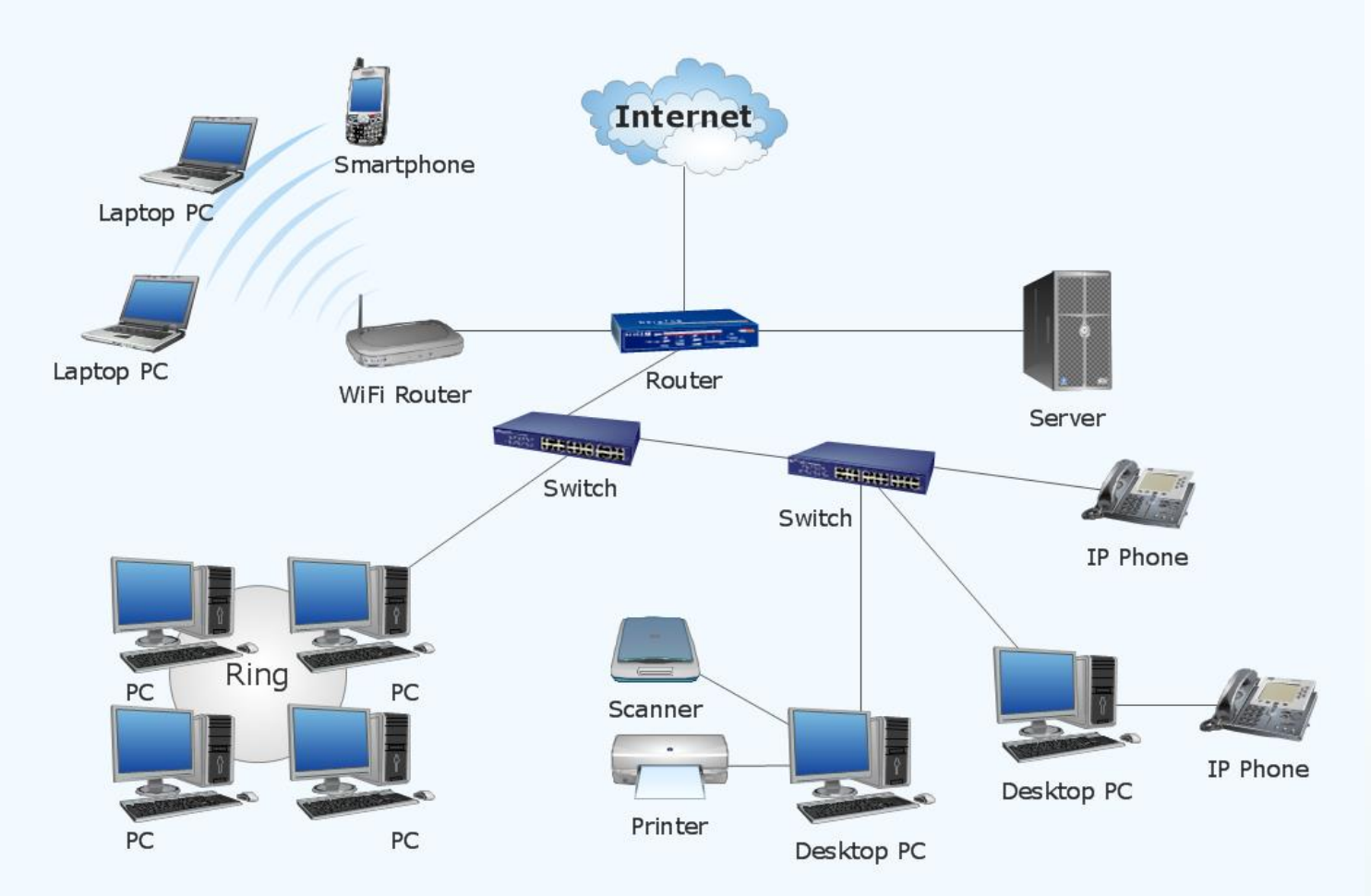
Topic 01A
Basic Structure of Computers

Objectives

Describe basic computer components and operation
Explain the fundamentals of network communication
Hands on LINUX Operating System
Understand Client/server Application
Describe basic cloud Computing services



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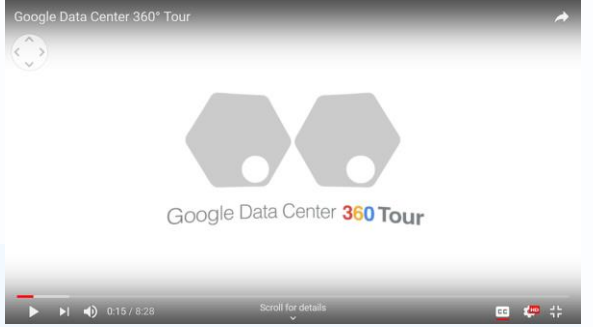
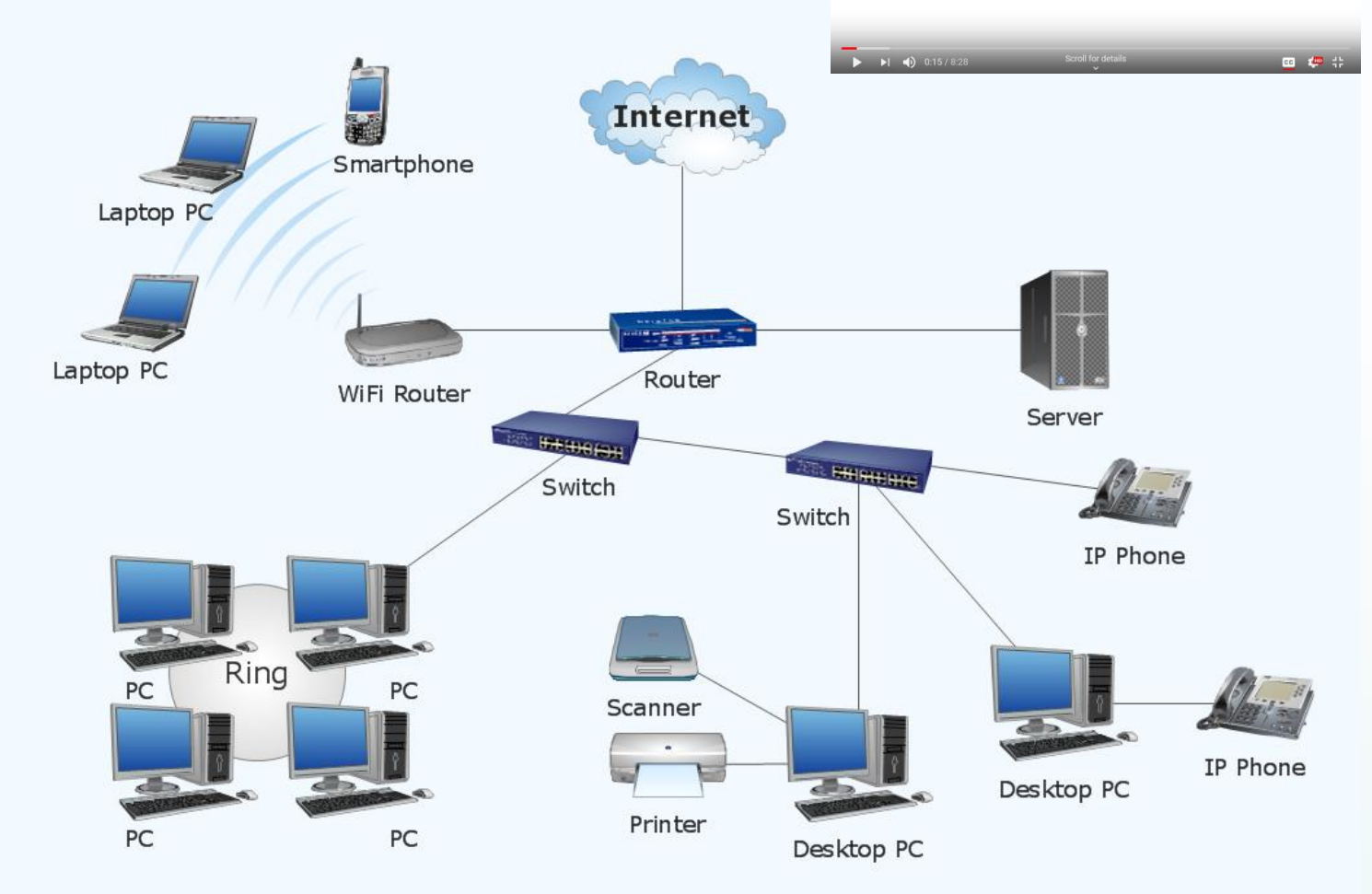
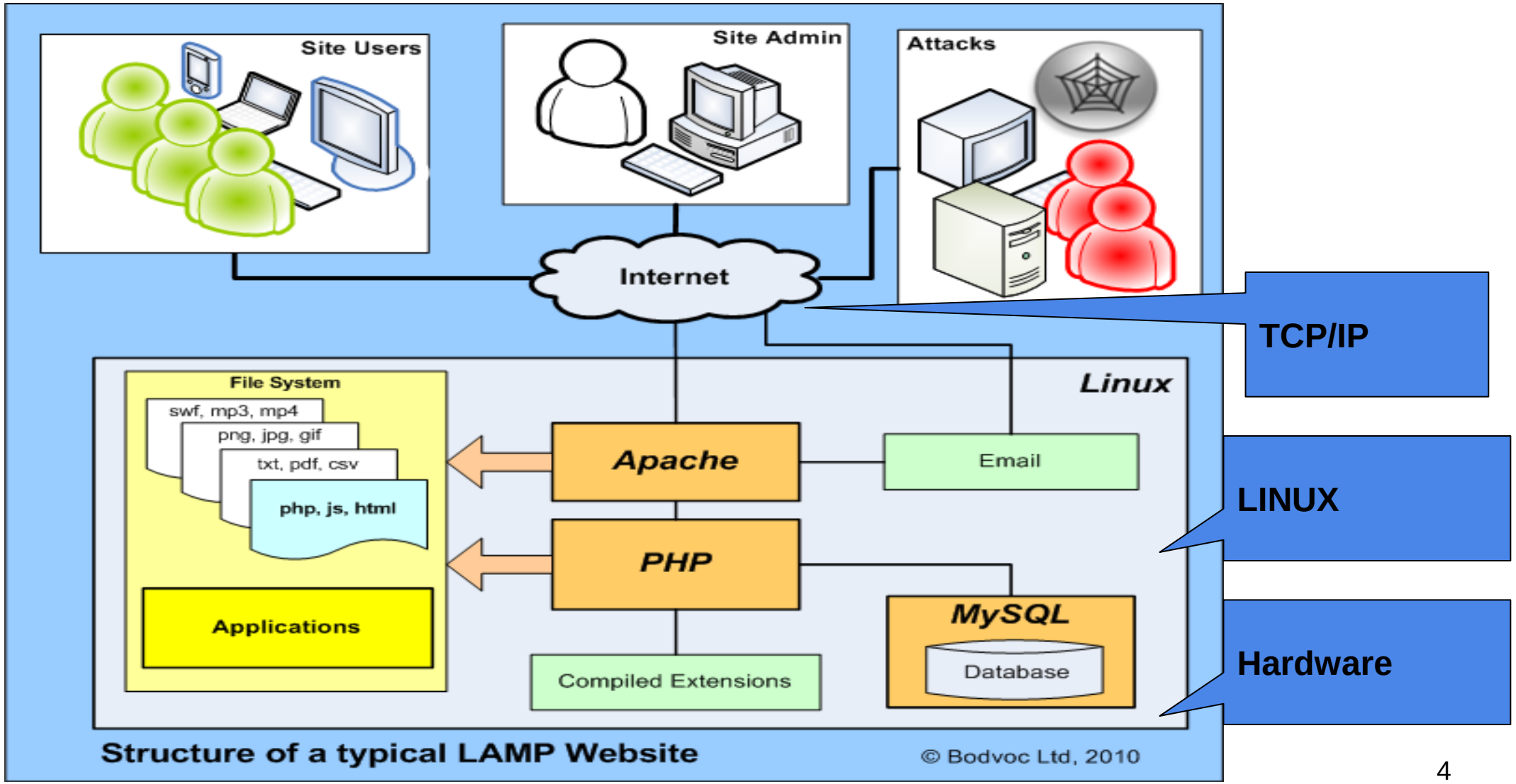




Sample Web Application



An Overview of Computer Concepts

Most devices encountered when working with a network involve a computer

Most obvious devices are workstations (PCs and laptops) and network servers running operating systems such as:

- Windows, Linux, UNIX, and Mac OS

Also includes routers and switches

- Specialized computers used to move data from computer to computer and network to network
- You will learn more about them in later chapters

Basic Functions of a Computer

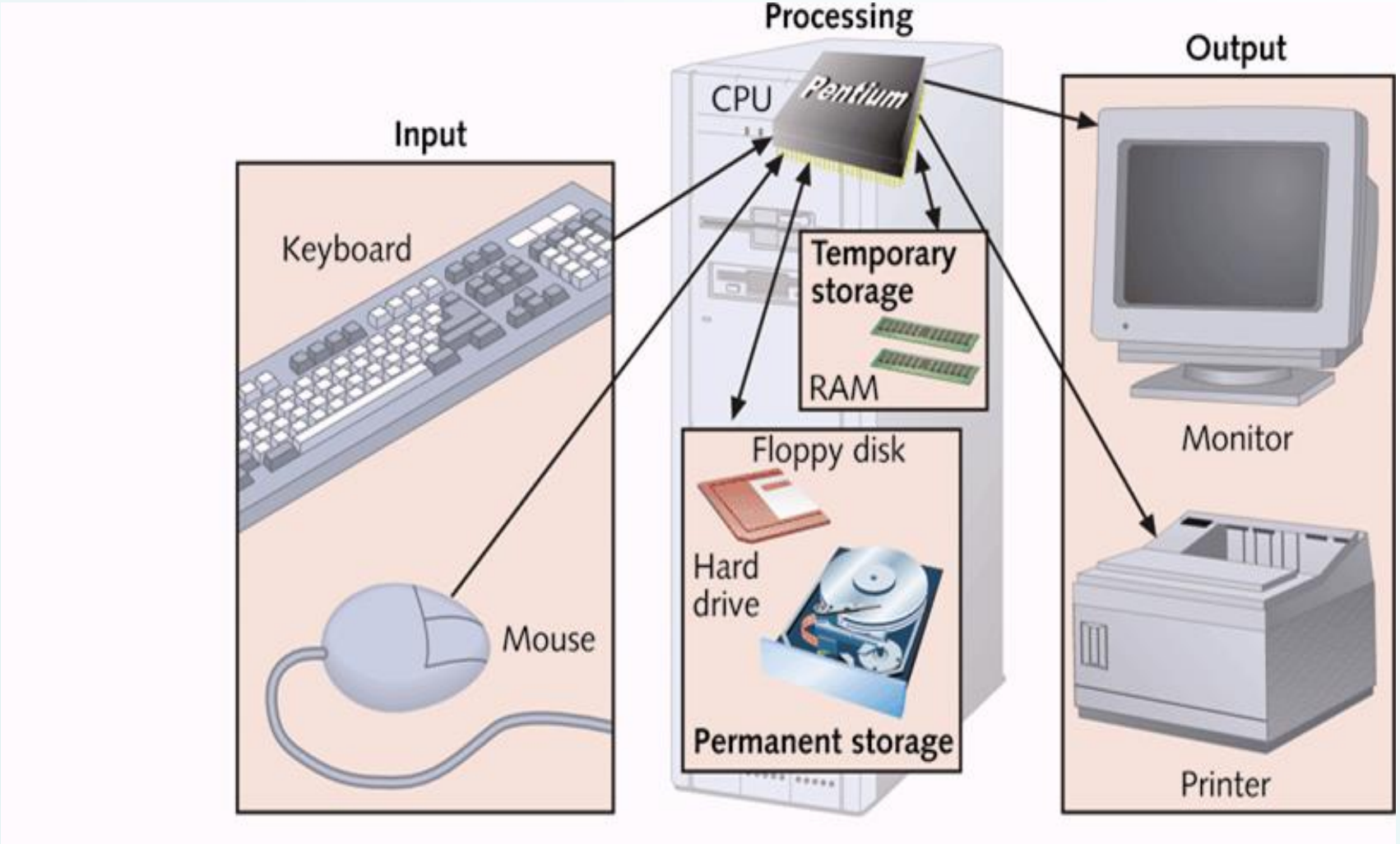
A computer's functions can be broken down into three basic tasks:

Input: A user types the letter 'A' on the keyboard, which results in sending a code representing the letter 'A' to the computer

Processing: The computer's CPU determines what letter was typed by looking up the keyboard code in a table

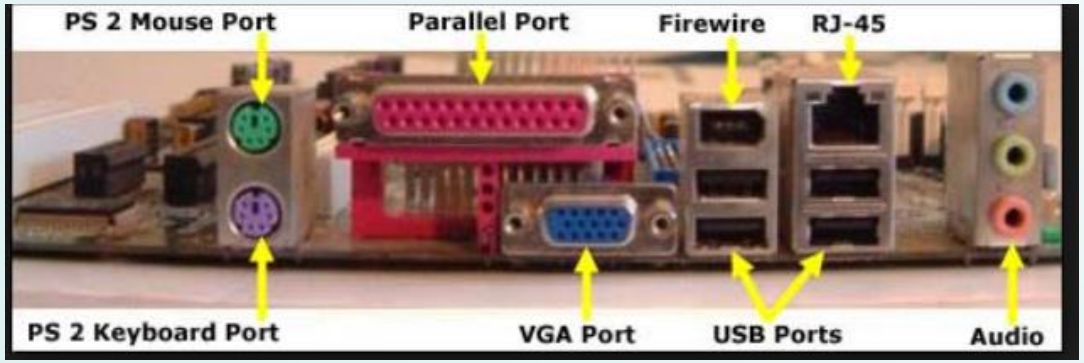
Output: The CPU sends instructions to the graphics cards to display the letter 'A', which is then sent to the computer monitor

Components of a Computer

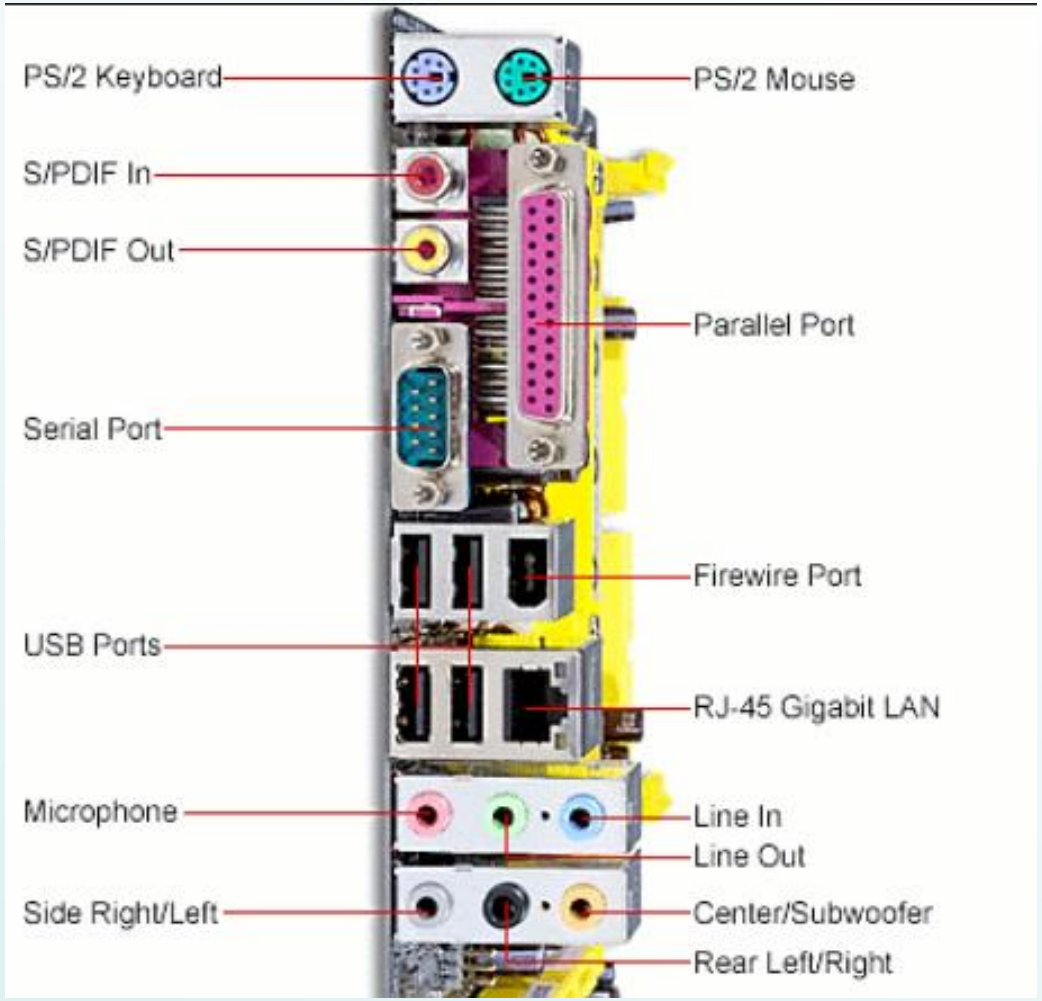


Input Components

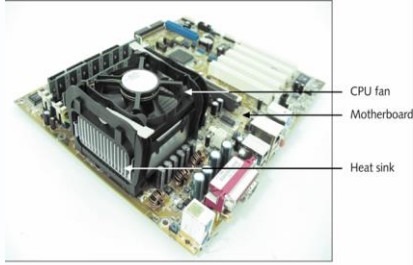
Common user controlled devices such as keyboards, microphones, Webcams, and scanners
External interfaces, such as serial, FireWire, and USB ports can also be used to get input from external devices.



Storage devices such as hard disks and CDs/DVDs


PS/2 Keyboard
PS/2 Mouse
S/PDIF In
S/PDIF Out
Parallel Port
Serial Port
Firewire Port
USB Ports
RJ-45 Gigabit LAN
Microphone
Line In
Line Out
Side Right/Left
Center/Subwoofer
Rear Left/Right

Processing Components



CPU: a computer's main processing component

- Executes instructions from computer programs, such as word processors and from the computer's operating system

Current CPUs are composed of two or more processors called **cores**

- A multicore CPU is like a person with two brains
- Multicore CPUs enable computers to carry out multiple instructions simultaneously
- Results in better overall performance

Output Components

Most obvious are monitors and printers

Also include storage devices, network cards, and speakers

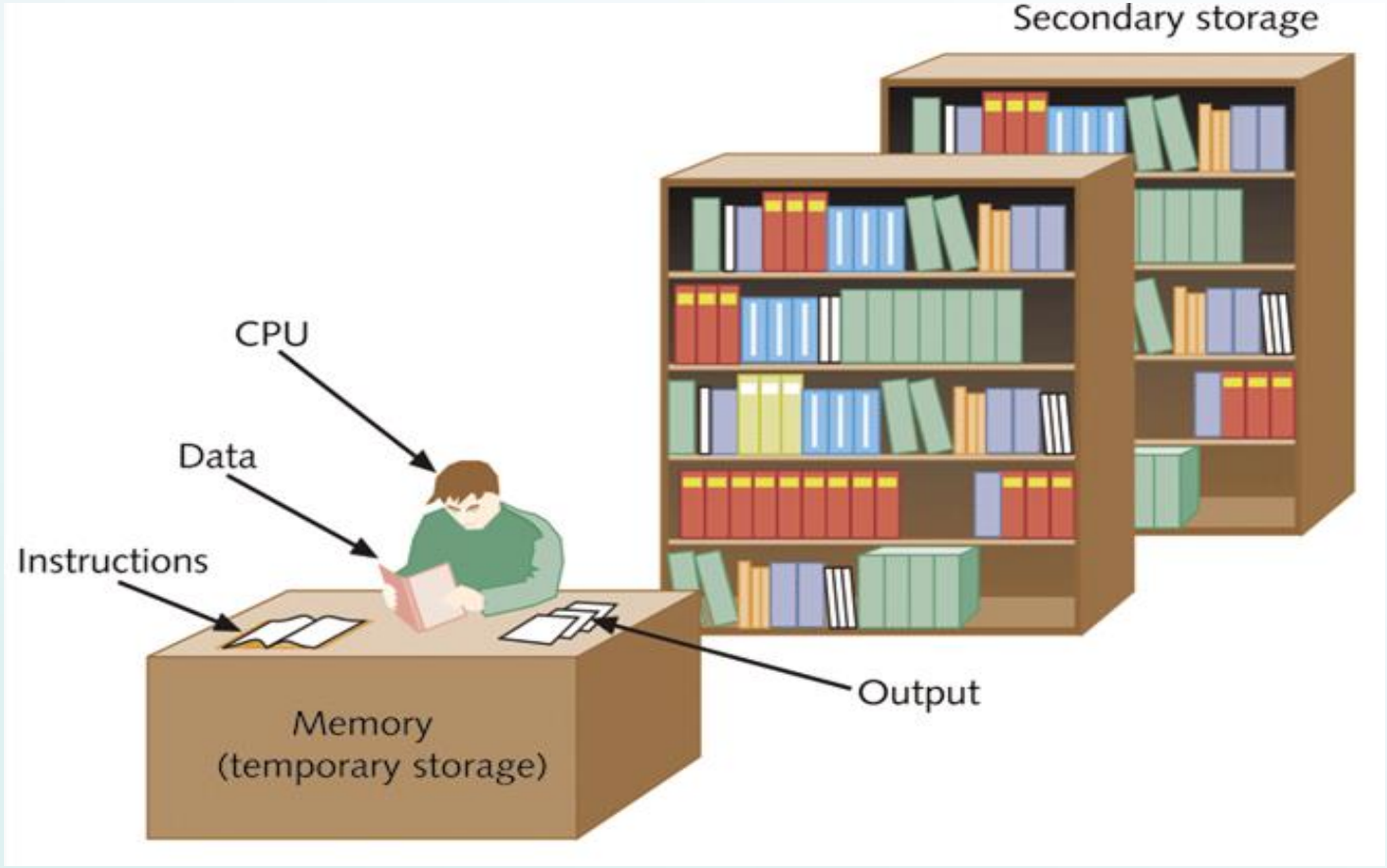
External interfaces

For example, a disk drive connected to a USB port allows reading files from the disk (input) and writing files to the disk (output)

Storage Components

The more storage a computer has, the better the performance
Most storage components are both input and output devices
Most people think of storage as disk drives, CD/DVD drives, and USB flash drives.
Two main categories of storage
- Short-term storage
- Long-term storage

Comparing temporary and permanent storage



RAM: Short-Term Storage

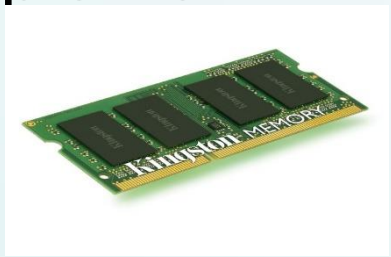
Random Access Memory (RAM) – when power to the computer is turned off, RAM's contents are gone

Short-term storage (volatile)

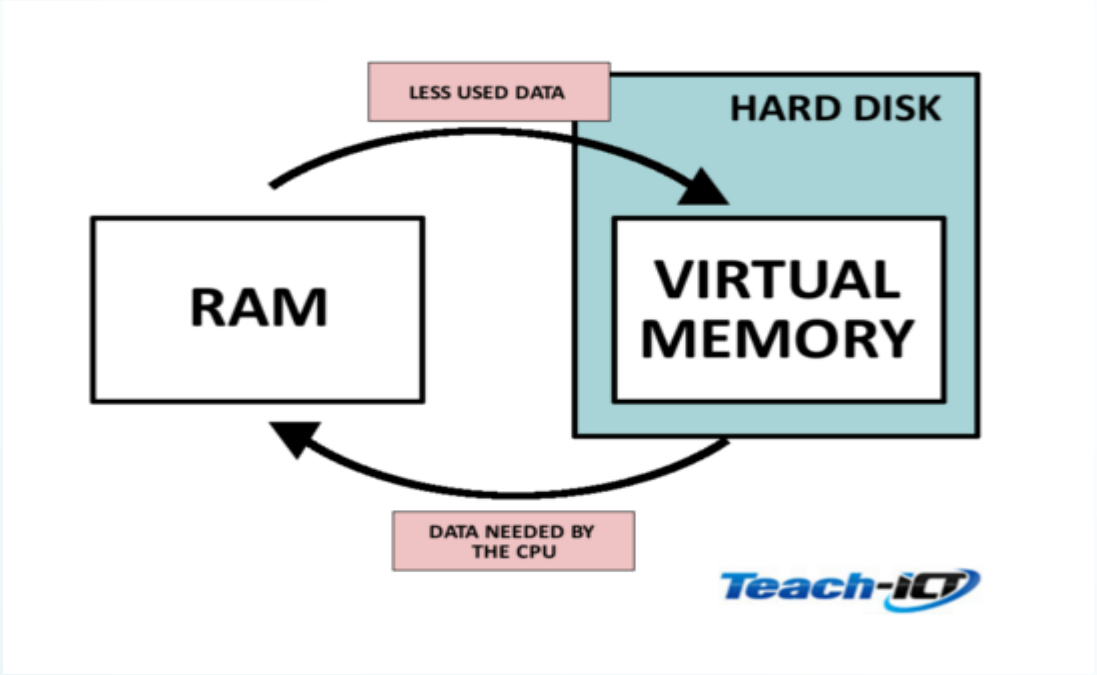
The amount of RAM in a computer is crucial to the computer's capability to operate efficiently

RAM is also referred to as "working storage"

If there's not enough RAM to run a program, the computer will use the disk drive to supplement (virtual memory)

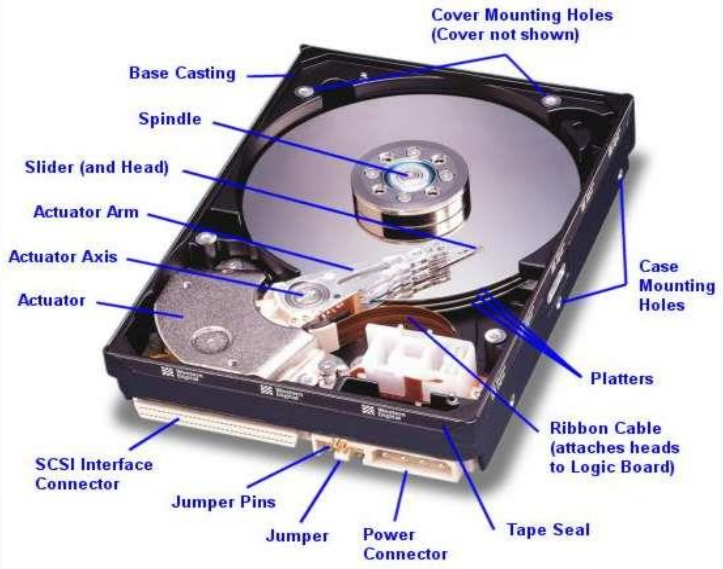


Virtual Memory



Part of disk storage can be set as virtual memory
CPU can only access data/code in RAM
Less used data/code are placed in virtual memory
Data/code needed by CPU are moved to RAM

Long-Term Storage



Maintains its data even when there's no power (non-volatile)

Examples:

- Hard disks
- CDs/DVDs
- USB flash drives

Used to store document and multimedia files

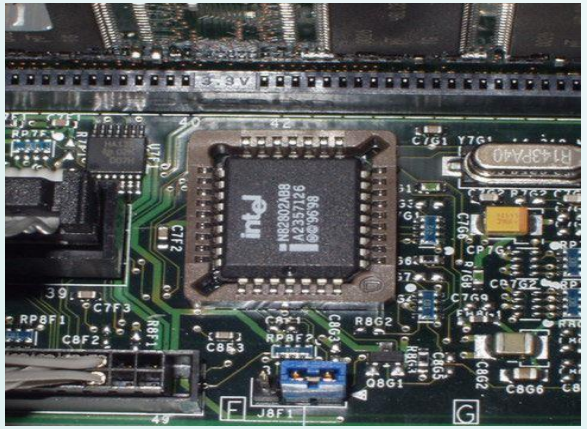
- As well as application and OS files

Amount of storage a computer needs depends on the type and quantity of files to be stored

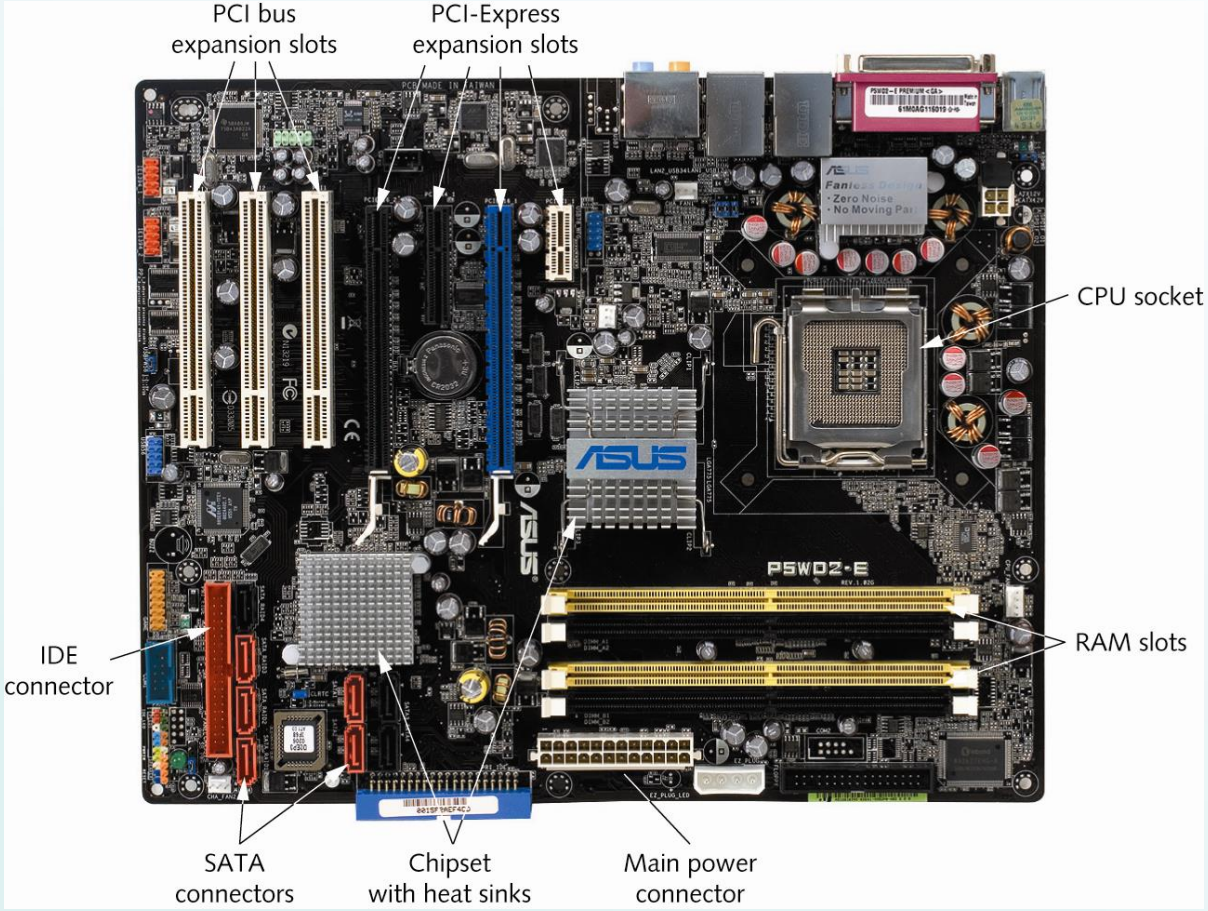
Personal Computer Hardware

Four major PC components:

- Motherboard
- Hard drive
- RAM
- BIOS/CMOS



The Motherboard and Its Components



The Motherboard and Its Components

Table 1-2 Key components of a motherboard

Component	Description
CPU socket	The CPU is installed in this socket.
PCI bus expansion slots	Used to add functionality to a PC by adding expansion cards that have a Peripheral Component Interconnect (PCI) connector.
PCI-Express expansion slots	PCI-Express supersedes PCI and supports faster data transfer speeds. The larger slots are suitable for high-performance expansion cards, such as graphics cards and disk controllers. The smaller slots are best suited to sound cards and network interface cards.
RAM slots	Slots for installing RAM on the motherboard.
Chipset with heat sinks	The chipset consists of two chips referred to as the Northbridge and the Southbridge. These chips control data transfers between memory, expansion slots, I/O devices, and the CPU. The heat sink sits on top of the chipset to prevent it from overheating.
SATA connectors	Used for connecting hard drives and CD/DVD drives that use the Serial AT Attachment (SATA) specification.
IDE connector	Used for connecting Integrated Drive Electronics (IDE) hard drives and CD/DVD-ROM drives. Most systems now use SATA for hard drives and IDE for CD/DVD-ROM drives.
Main power connector	This connector is where the motherboard receives power from the system power supply.

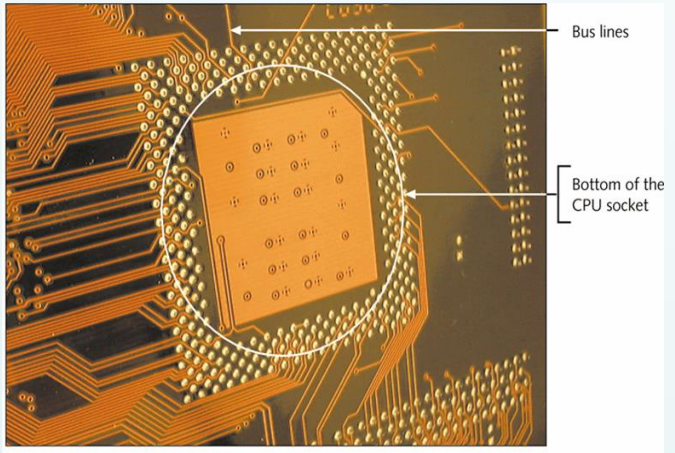
Computer Bus Fundamentals

Bus: a collection of wires carrying signals (data, address or control) from one place to another on the computer

All data that goes into or comes out of a computer goes through the motherboard

There are buses between:

- CPU and RAM
- CPU and disk drives
- CPU and expansion slots



Computer Bus Fundamentals

Data Bus

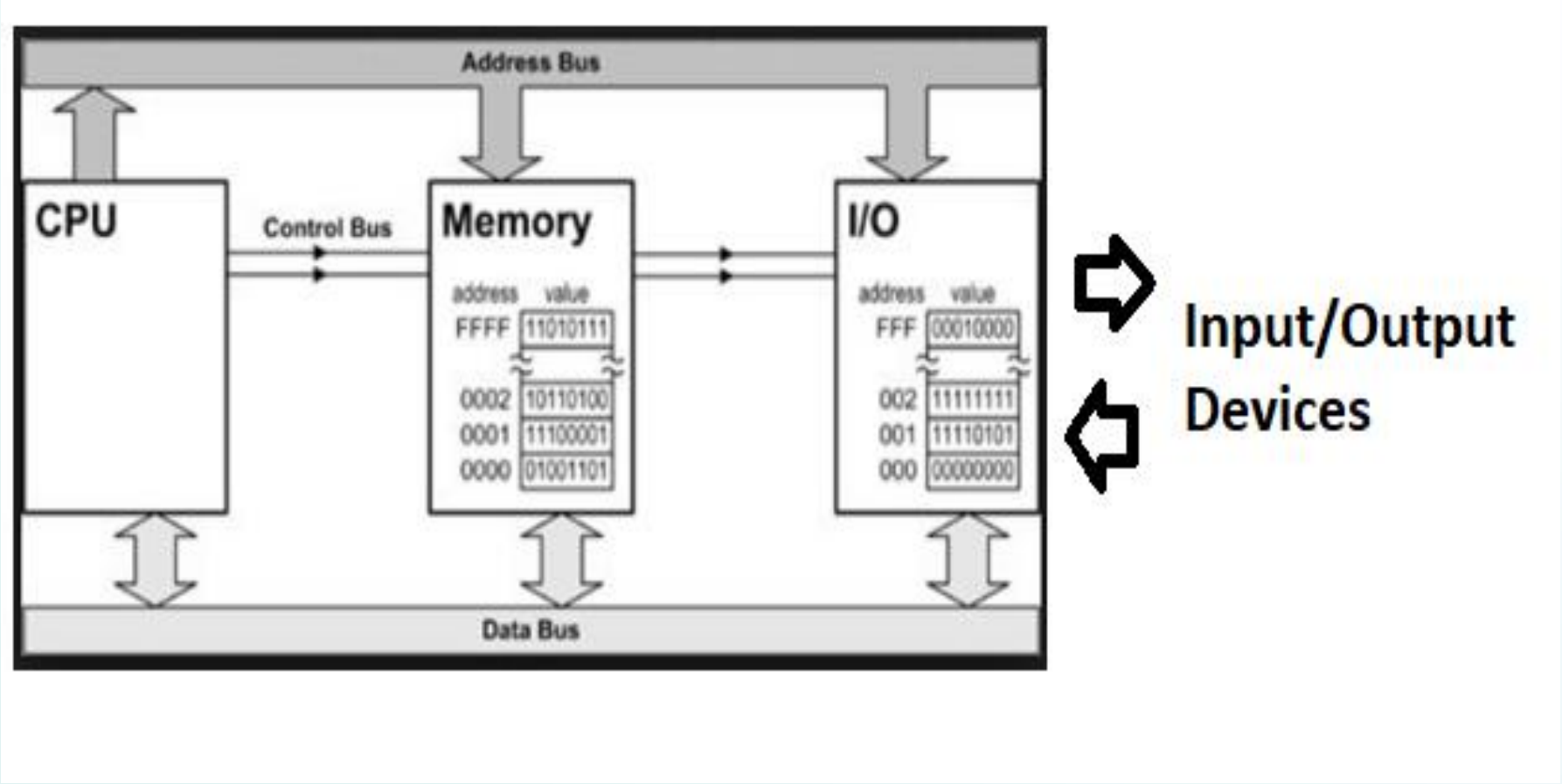
Used to carry data signals from main memory (Ram) to CPU and vice versa or from main memory (Ram) to input/output (I/O) devices vice versa

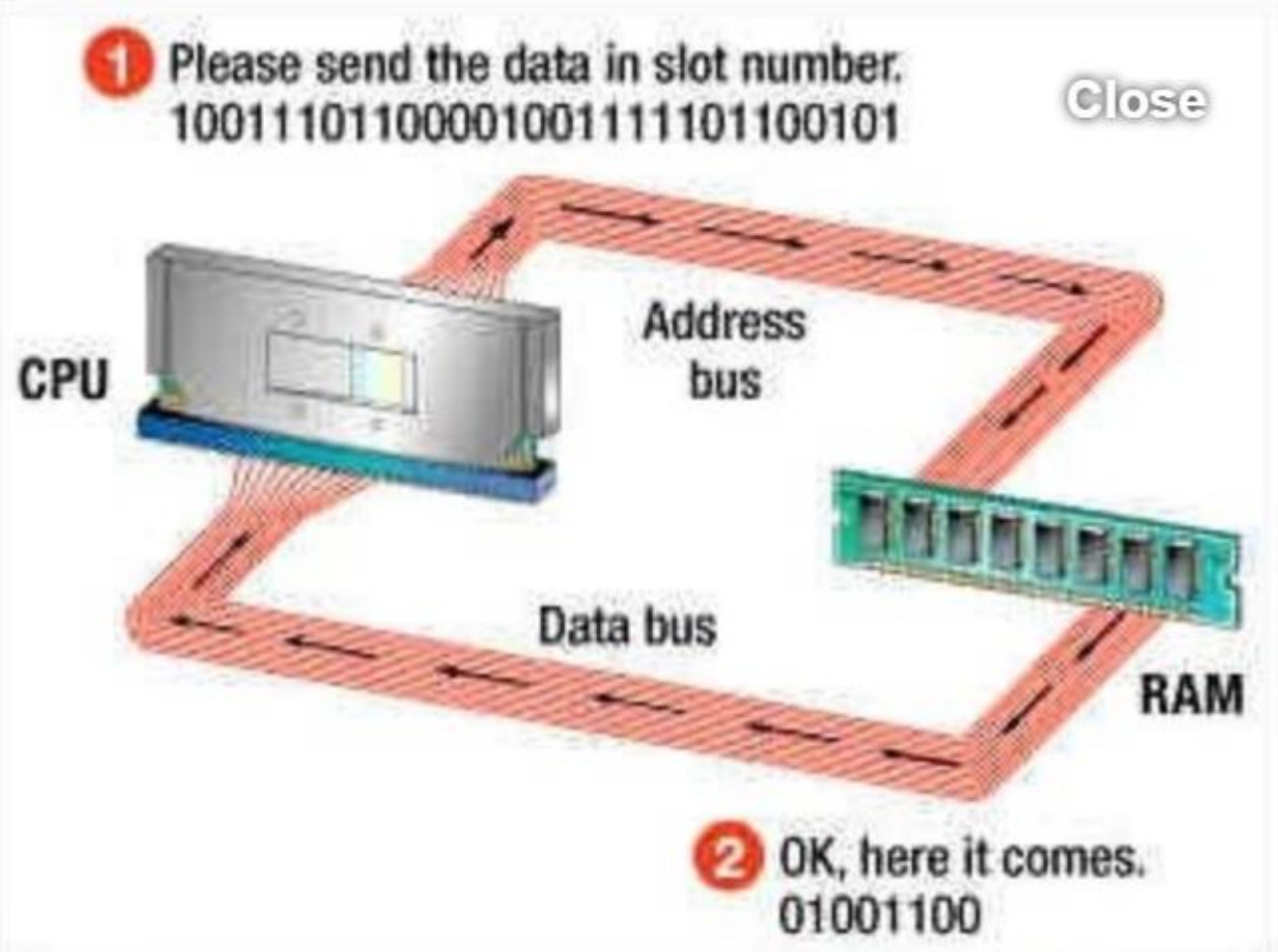
Address Bus

Used to carry address signals, example a memory location or port/interface where an input or output device is attached

Control Bus

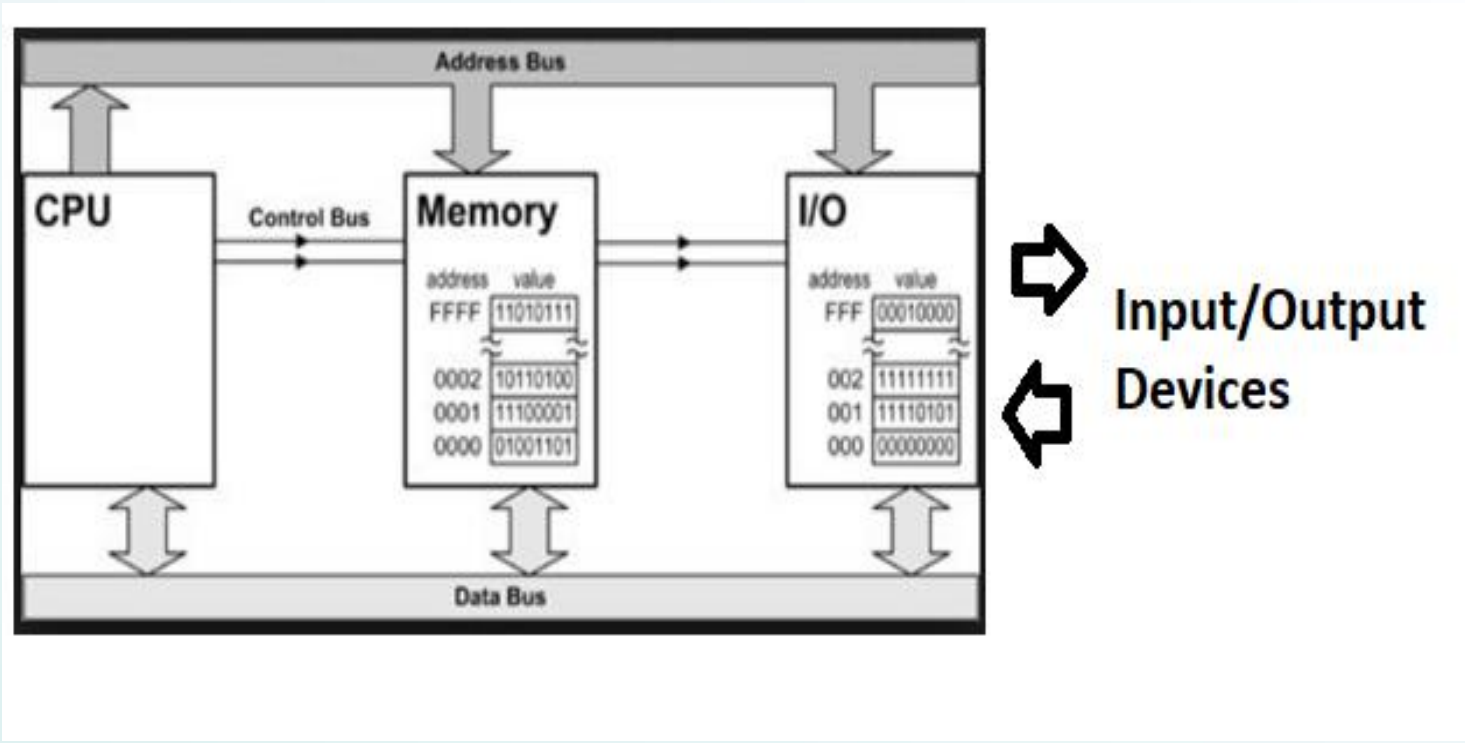
Used to carry control signals, example read or write, from CPU to memory or port/interface


Address Bus
CPU
Control Bus
Memory
address value
FFFF 11010111
0002 10110100
0001 11100001
0000 01001101
I/O
address value
FFF 00010000
002 11111111
001 11110101
000 00000000
Input/Output Devices
Data Bus

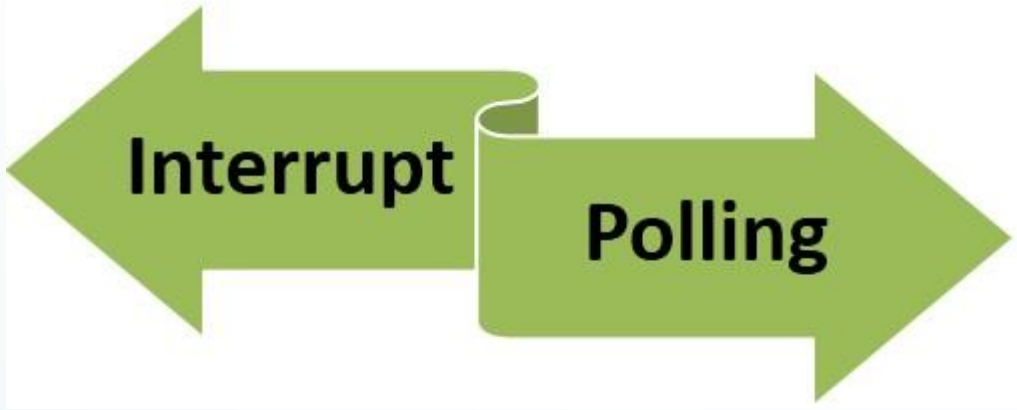

1 Please send the data in slot number.
10011101100001001111101100101
Close
CPU
Address bus
Data bus
RAM
2 OK, here it comes.
01001100

Difference between Address bus and data bus

The data bus carries the data to be stored, while address bus carries the location to where it should be stored.



I/O Polling and Interrupt



We have many external devices attached to the CPU like a mouse, keyboard, scanner, printer, etc. These devices also need CPU attention. Suppose, a CPU is busy in displaying a PDF and you click the window media player icon on the desktop. Though **the CPU does not have any idea when an event like this would occur, but it has to respond to such inputs from the I/O devices.** Interrupt and Polling are the two ways to handle the events generated by the devices that can happen at any moment while CPU is busy in executing another process.

Polling and Interrupt let CPU stop what it is currently doing and respond to the more important task. Polling and Interrupt are different from each other in many aspects. But the basic point that distinguishes Polling and Interrupt is that in **polling** CPU keeps on checking I/O devices at regular interval whether it needs CPU service whereas, in **interrupt**, the I/O device interrupts the CPU and tell CPU that it need CPU service.

https://techdifferences.com/difference-between-interrupt-and-polling-in-os.html

Hard Drive Fundamentals

Hard drive: primary long-term storage component on your computer
Consist of magnetic disks called “platters” that store data in the form of magnetic pulses
Stores the documents you use as well as the applications that open those documents
Stores the OS your computer loads when it boots

Hard Drive Fundamentals

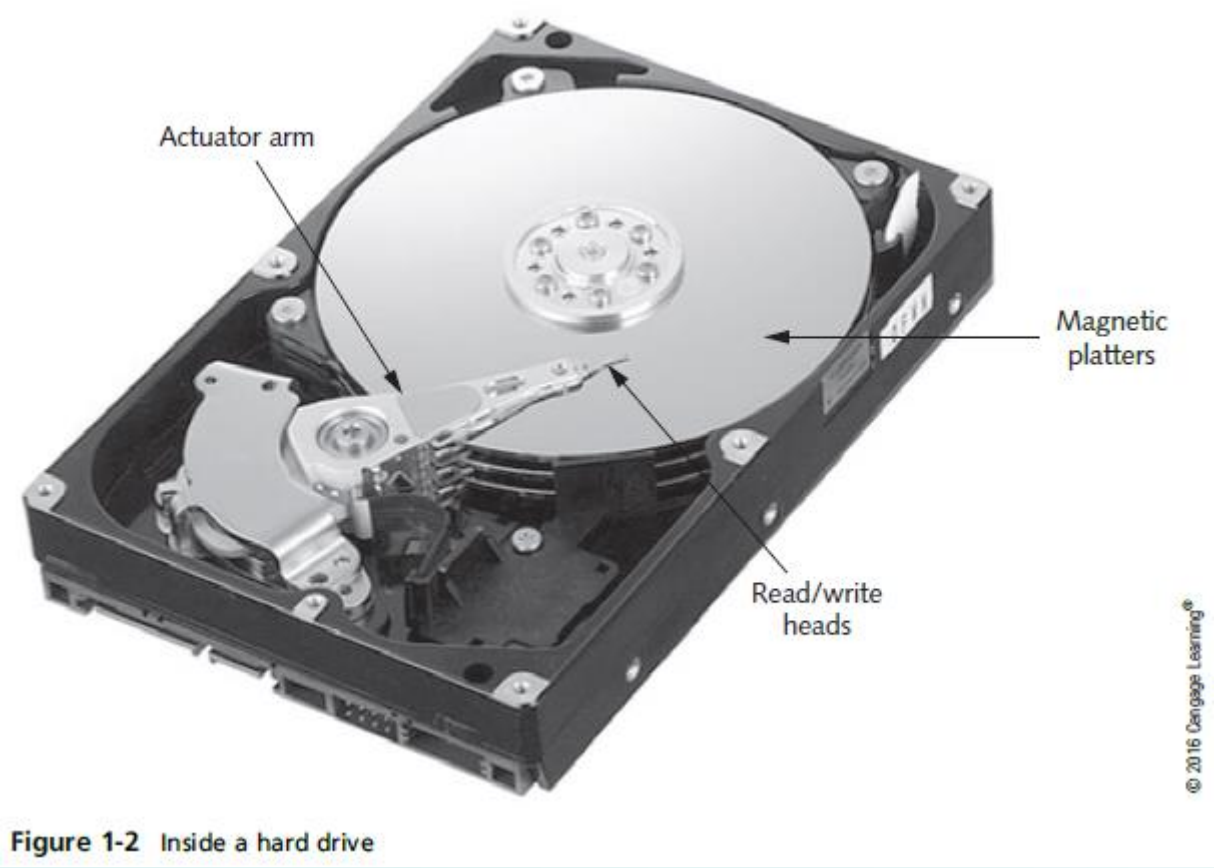


Figure 1-2 Inside a hard drive

Solid State Drives

SSDs are used in place of hard drives
- Due to speed and reliability

SSDs use flash memory
- No moving parts and has faster access times

More expensive than hard drives

Most often found in mobile devices
- Also found in high-performance desktops and servers

RAM Fundamentals

RAM is the main short-term storage component on a computer
RAM has no moving parts so accessing data in RAM is much faster than accessing data on a hard drive
In general, the more RAM your system has the faster it will run

BIOS/CMOS Fundamentals

BIOS: basic input/output system

- Set of instructions located in a chip on the motherboard
- Tells the CPU to perform certain tasks when power is first applied to the computer
- One of those instructions is to perform a power-on self test (POST)

When a computer boots, the BIOS program offers a chance to run the Setup utility in order to configure hardware components

- This configuration is stored in a type of memory called complementary metal oxide semiconductor (CMOS)

Computer Boot Procedure

1. Power is applied to the motherboard
2. The CPU starts
3. The CPU carries out the BIOS startup routines, including the POST(Power-on self-test)

1. Boot devices, as specified in the BIOS configuration, are searched for an OS
2. The OS is loaded into RAM
3. OS services are started

The Fundamentals of Network Communication

A computer network consists of two or more computers connected by some kind of transmission medium

- Such as a cable or air waves

In order to access the Internet, a computer has to be able to connect to a network

The next few slides will cover what is required to turn a standalone computer into a networked computer

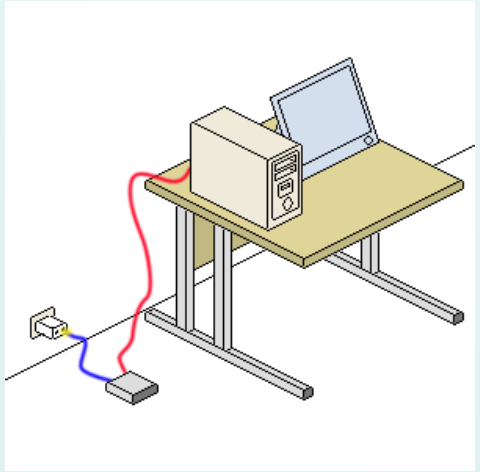
NIC Basics

Attaching a computer to a network requires a **network interface card (NIC)** to create and mediate the connection between a computer and the networking medium

It contains MAC address(Media Access Control Address)

Unique identifier assigned to NIC

Networking medium might be copper wire, fiber-optic cable, or airwaves



Wireless NICs

Wireless NICs must be chosen according to type of wireless AP being used

Typical are Wireless-n, 802.11ac or 802.11 a/b/g/n

- The letter a,b,g, n, and ac refer to the wireless networking standard the device supports

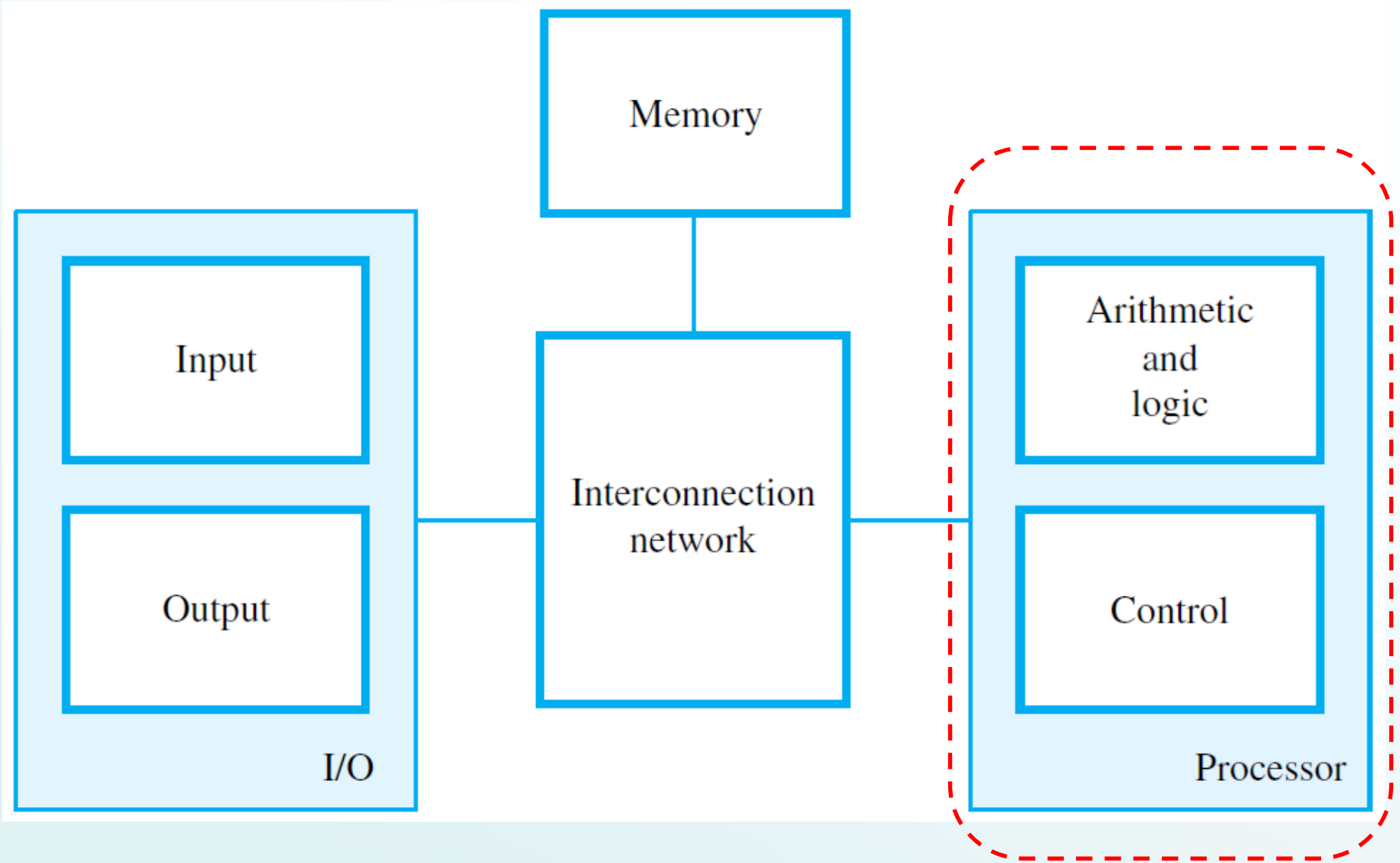
Wireless NICs connect to network using **service set identifier (SSID)**

- SSID is the name assigned to the wireless network

You may also need to enter a security key or a username and password, depending on the network's security configuration

Types of computers

1) Embedded computers
2) Personal computers
3) Servers and Enterprise systems
4) Supercomputers and Grid computers
5) “Cloud” computing



The “heart” of the computer is the CPU or Central Processing Unit, also called the Processor

Online Video: https://youtu.be/yRmPTbGBqVI