

# A+ Guide to Hardware, 4e

## *Chapter 1* *Hardware Needs Software to Work*

### **Brief Summarization**

# Table of Contents

Objectives .....	1
Introduction .....	1
Studying this text will help you do the following:.....	1
Hardware Needs Software to Work.....	1
• Hardware .....	1
• Software .....	1
Fundamental groupings of binary numbers: .....	1
PC Hardware Components.....	2
Central processing unit (CPU) .....	2
Elements required by I/O and storage devices.....	2
Hardware Used for Input and Output.....	2
• Port.....	3
Chief input devices:.....	3
Chief output devices: .....	3
Hardware Inside the Computer Case .....	3
Internal devices common to most computers:.....	3
The Motherboard.....	4
Categories used to group motherboard components .....	4
The Processor and the Chipset .....	6
• CPU.....	6
• Chipset .....	6
• Personal computer (PC) .....	6
Major manufacturers of CPUs and chipsets for PCs .....	6
Storage Devices.....	7
Primary storage (main memory):.....	7
Secondary storage (permanent storage): .....	7
Analogy to primary-secondary memory relationship.....	7

Primary Storage .....	8
RAM (random access memory):.....	8
Three types of RAM boards (memory modules): .....	8
Secondary Storage .....	9
Hard drive .....	9
Integrated Drive Electronics (IDE).....	9
ATA (AT Attachment) standard .....	9
Serial ATA standard.....	10
Floppy drive.....	10
CD-ROM (compact disc read-only memory) drive.....	10
Motherboard Components Used For Communication Among Devices .....	11
• Traces .....	11
• Bus.....	11
Data bus .....	11
Main bus on motherboard (system bus, memory bus) .....	11
Common ratings for motherboard buses .....	12
Interface (Expansion) Cards .....	13
Cards that connect the CPU to an external device:.....	13
The Electrical System .....	14
Power supply.....	14
Instructions Stored on the Motherboard and Other Boards .....	15
BIOS (basic input/output system) .....	15
Three purposes served by motherboard ROM BIOS: .....	15
• CMOS RAM.....	15
• Flash ROM .....	15
Advanced Configuration and Power Interface.....	16
Plug and Play .....	16
Summary .....	17

## Objectives

- Learn that a computer requires both hardware and software to work
- Learn about the many different hardware components inside of and connected to a computer

## Introduction

- End users need not know how a computer works
- To add to your end user knowledge, study is needed

### Studying this text will help you do the following:

- Install new hardware and software
- Diagnose hardware and software problems
- Solve hardware and software problems
- Evaluate new hardware and operating systems
- Pass the A+ series of exams

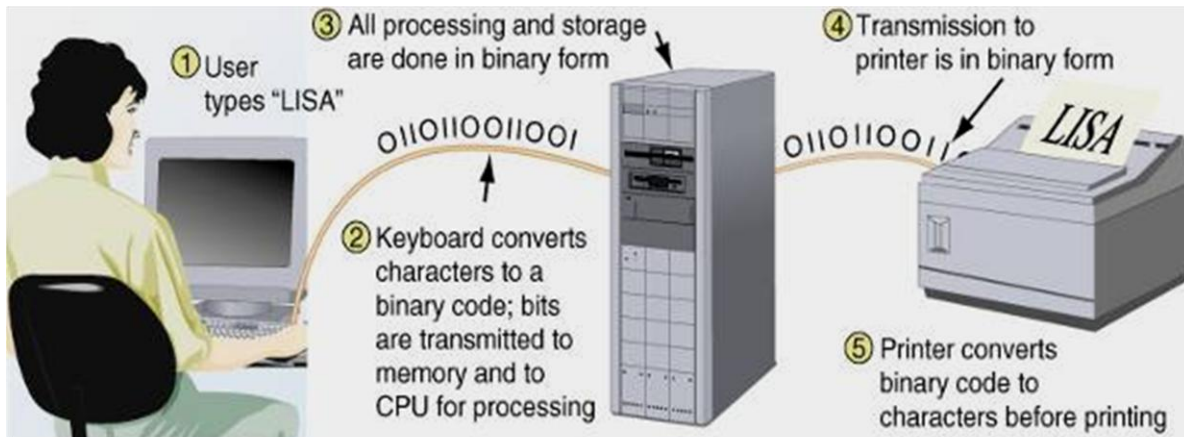
## Hardware Needs Software to Work

- **Hardware:** physical portion of a computer
  - Components: monitor, keyboard, memory, hard drive
- **Software:** instructions used to manipulate hardware
  - Requirements: input, processing, storage, output
- All hardware operations are based on binary values
- Binary number system consists of two digits: 0 and 1

### Fundamental groupings of binary numbers:

- Bit: binary digit that can take on values of 0 or 1
- Nibble: four bits

- Byte: four bits



**Figure 1-2** All communication, storage, and processing of data inside a computer are in binary form until presented as output to the user

## PC Hardware Components

- Most input/output (I/O) devices are external to case
- Most processing and storage devices are internal

### Central processing unit (CPU)

- Also called the processor or microprocessor
- Reads input, processes data, writes data to storage

### Elements required by I/O and storage devices

- A method for CPU to communicate with the device
- Software to instruct and control the device
- Electricity to power the device

## Hardware Used for Input and Output

- Connections to the case can be cabled or wireless

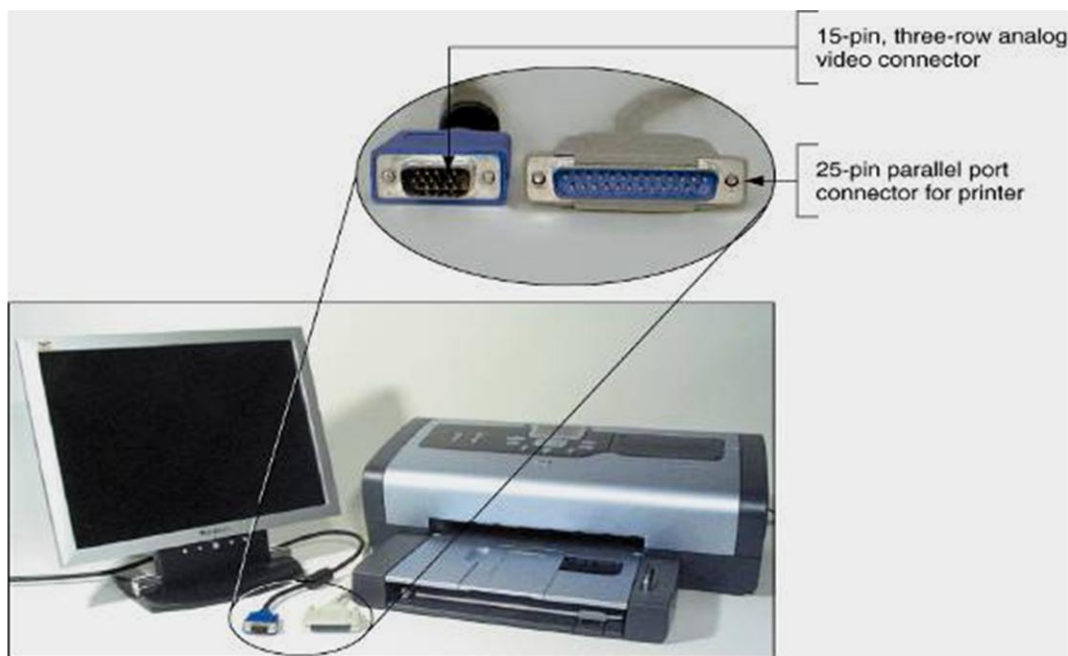
- **Port:** access point located in back or front of case

### Chief input devices:

- Keyboard: enhanced type holds 104 keys
- Mouse: pointing device used to select screen items

### Chief output devices:

- Monitor: visually displays primary output of computer
- Printer: produces output on paper (hard copy)



**Figure 1-6** The two most popular output devices are the monitor and the printer

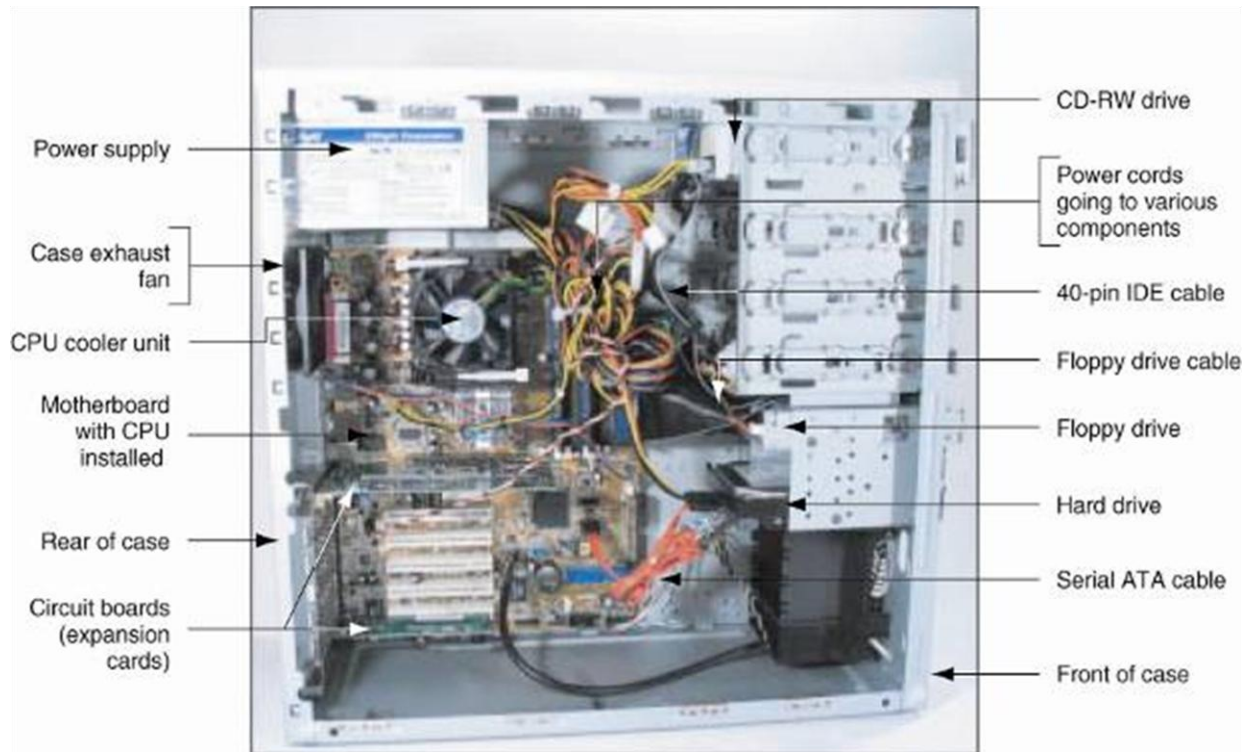
## Hardware Inside the Computer Case

- Most storage and processing occurs in the case

### Internal devices common to most computers:

- Motherboard containing CPU, memory, other parts
- Floppy drive, hard drive, CD drive for persistent storage

- Power supply with power cords supplying electricity
- Circuit boards for internal and external communication
- Cables to connect devices to all circuit boards
- Expansion cards are installed in expansion slots
- Two types of cables: data (communication) and power



**Figure 1-8** Inside the computer case

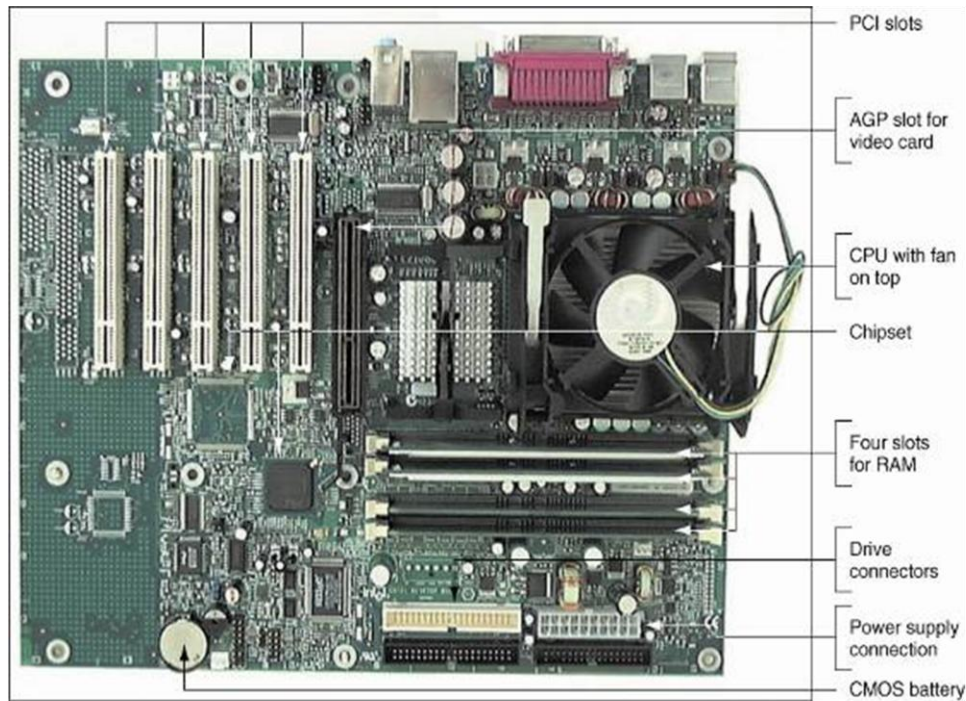
## **The Motherboard**

- The largest and most important circuit board
  - Also known as the main board or system board
  - Contains the CPU, expansion slots, other devices

## **Categories used to group motherboard components**

- Processing, temporary storage, communication, power

- All devices communicate with CPU on motherboard
- A peripheral device links to motherboard via cable
- Some motherboard ports outside of the case:
  - Keyboard, mouse, parallel, USB ports, sound ports



**Figure 1-9** All hardware components are either located on the motherboard or directly or indirectly connected to it because they must all communicate with the CPU



**Figure 1-10** A motherboard provides ports for common I/O devices

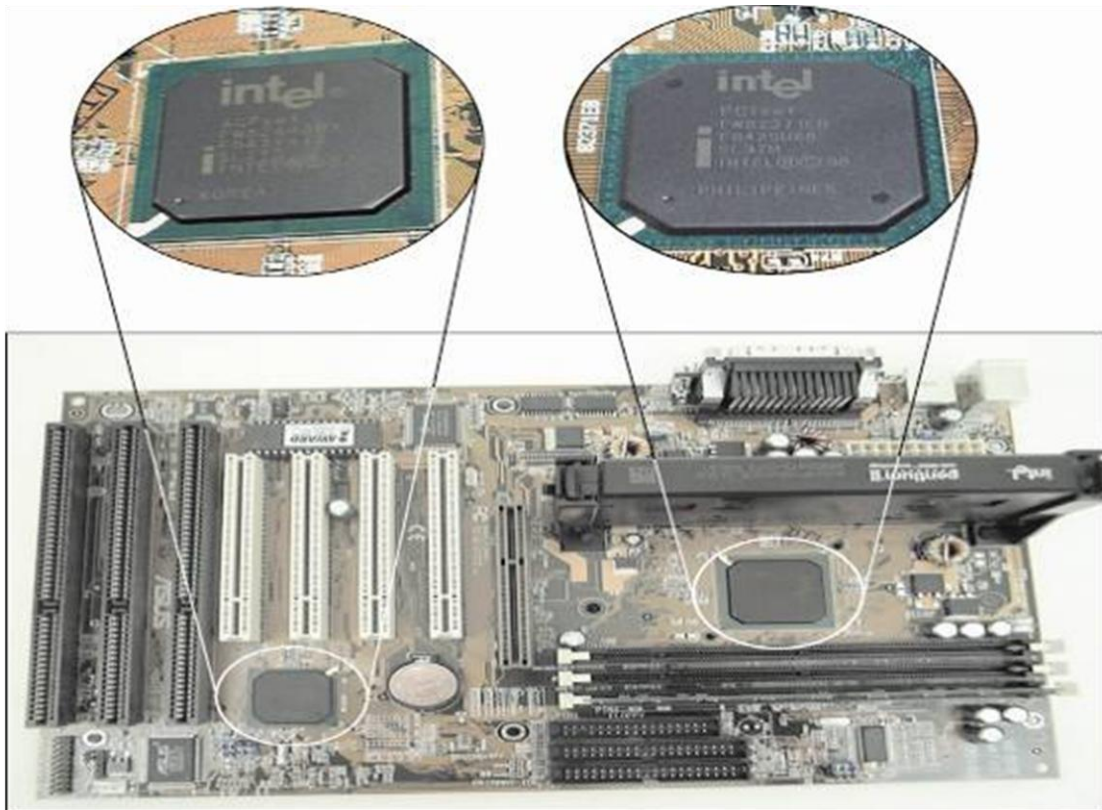


## The Processor and the Chipset

- **CPU**: chip that performs most data processing
- **Chipset**: group of microchips controlling data flow
- **Personal computer (PC)**: chief focus of this text

### Major manufacturers of CPUs and chipsets for PCs

- Intel Corporation, AMD, VIA, SiS, and Cyrix



**Figure 1-12** This motherboard uses two chips in its chipset (notice the bus lines coming from each chip used for communication)

# Storage Devices

## Primary storage (main memory):

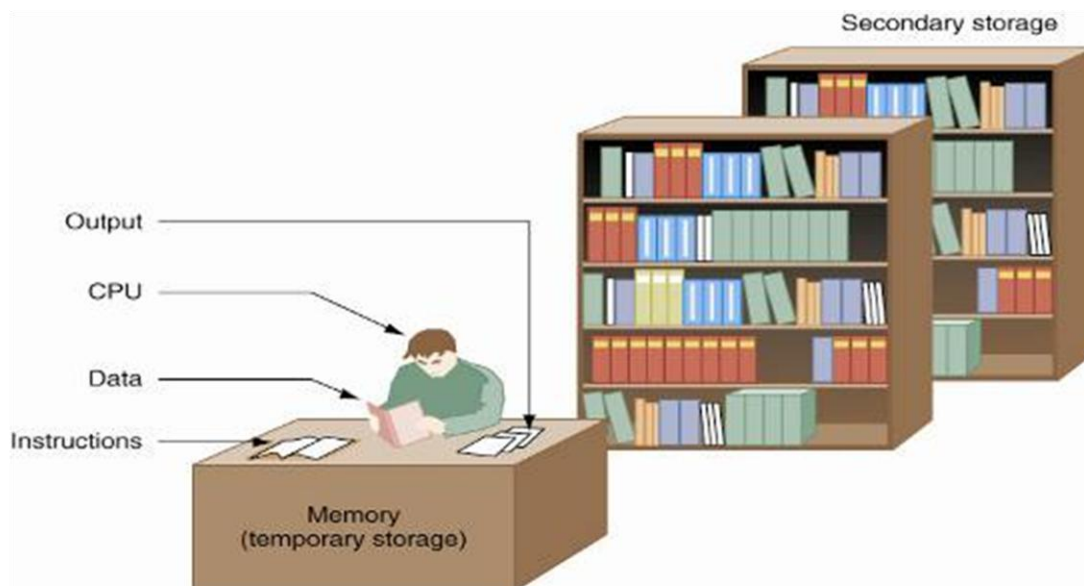
- Temporary storage used by the processor
- Example: RAM (random access memory)

## Secondary storage (permanent storage):

- Enables data to persist after the machine is turned off
- Examples: hard drive, CD, floppy disk

## Analogy to primary-secondary memory relationship

- Book stacks in a library are like permanent storage
- Books can be moved to a desk (temporary storage)



**Figure 1-13** Memory is a temporary place to hold instructions and data while the CPU processes both

## Primary Storage

### RAM (random access memory):

- Device providing temporary storage
- Located on motherboard and on other circuit boards

### Three types of RAM boards (memory modules):

- DIMM (dual inline memory module)
  - RIMM (Rambus inline memory module)
  - SIMM (single inline memory module)
- RAM is volatile (data does not persist)
  - ROM (read-only memory) is nonvolatile



**Figure 1-14** A SIMM, DIMM, or RIMM holds RAM and is mounted directly on a motherboard

## Secondary Storage

### Hard drive

- Case containing disks that rotate at high speeds
- An arm with a read/write head traverses the platter

### Integrated Drive Electronics (IDE)

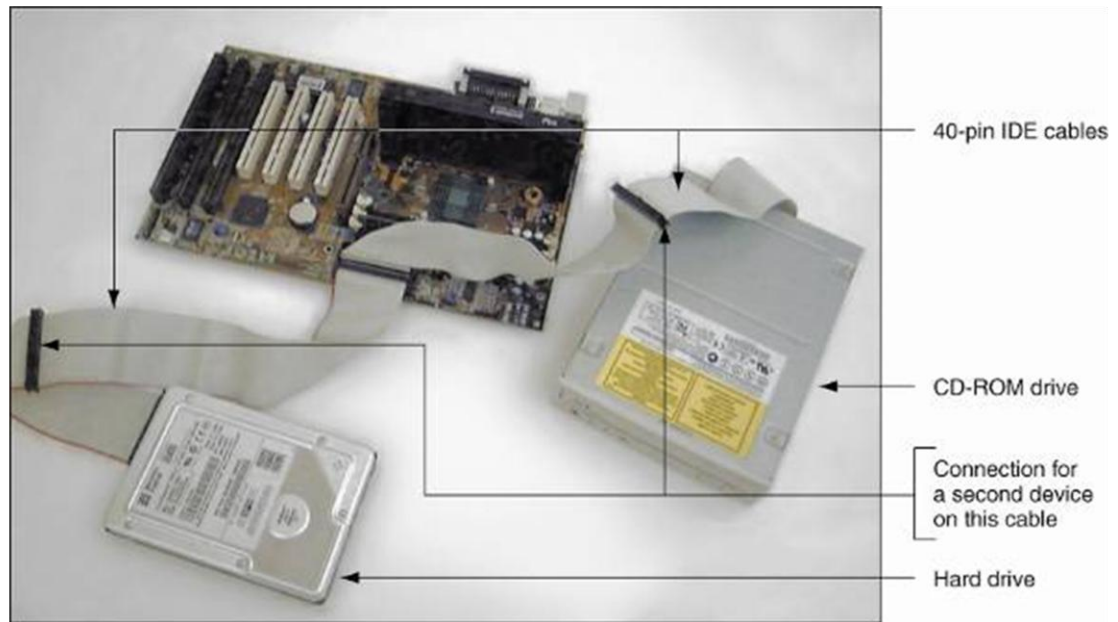
- Technology used internally by a hard drive

### ATA (AT Attachment) standard

- Specifies motherboard-hard drive interface
- Types: Serial ATA or parallel ATA (Enhanced IDE)
- Parallel ATA accommodates up to four IDE devices



**Figure 1-16** Hard drive with sealed cover removed



**Figure 1-18** Two IDE devices connected to a motherboard using both IDE connections and two cables

### **Serial ATA standard**

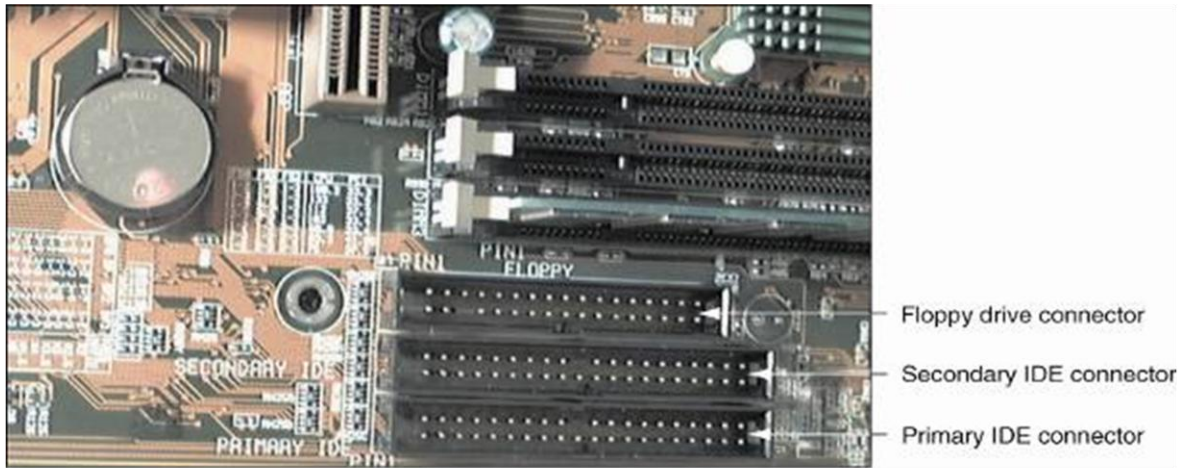
- Allows for more than four drives in a system
- Applies only to hard drives and not to other drives
- Some IDE devices: hard drives, Zip drives, CD drive

### **Floppy drive**

- 3.5-inch disk holding 1.44 MB of data
- Floppy drive connector is distinct from IDE connectors

### **CD-ROM (compact disc read-only memory) drive**

- Standard equipment for reading software distributions



**Figure 1-22** A motherboard usually provides a connection for a floppy drive cable

## Motherboard Components Used For Communication Among Devices

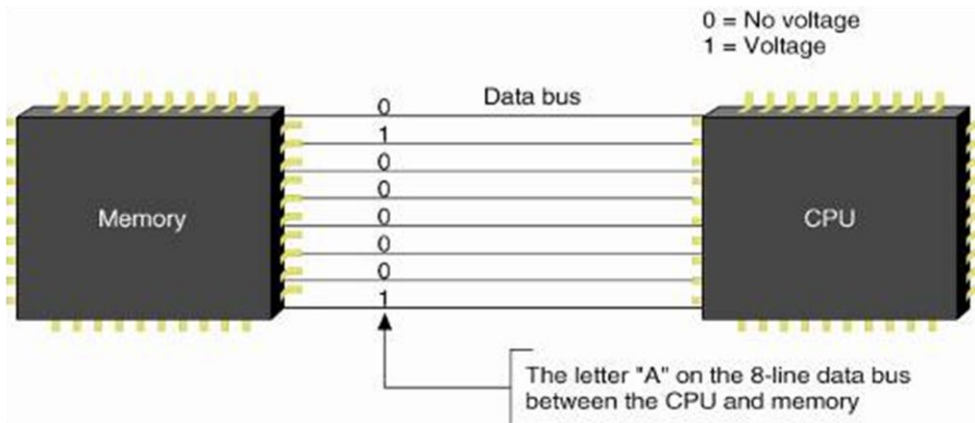
- **Traces:** circuits or paths that move data and power
- **Bus:** system of pathways and transmission protocols

### Data bus

- Lines in a bus that carry the data
- Binary bits correspond to voltage values of on or off
- Data path sizes: 8, 16, 32, 64, or 128 bits wide

### Main bus on motherboard (system bus, memory bus)

- Communicates with CPU, memory, and chipset
- Pulse of system clock carried by line on motherboard



**Figure 1-26** A data bus has traces or lines that carry voltage interpreted by the CPU and other devices as bits

- Devices work according to beats (or cycles)
- Clock speed is measured in hertz (cycles/second)
  - One megahertz (MHz): one million cycles per second
  - One gigahertz (GHz): one billion cycles per second

### Common ratings for motherboard buses

- 1066 MHz, 800 MHz, 533 MHz, or 400 MHz
- Range of CPU speeds: 166 MHz to 4 GHz
- Buses for expansion slots: PCI, AGP, ISA



**Figure 1-29** PCI bus expansion slots are shorter than ISA slots and offset farther; the one AGP slot is set farther from the edge of the board

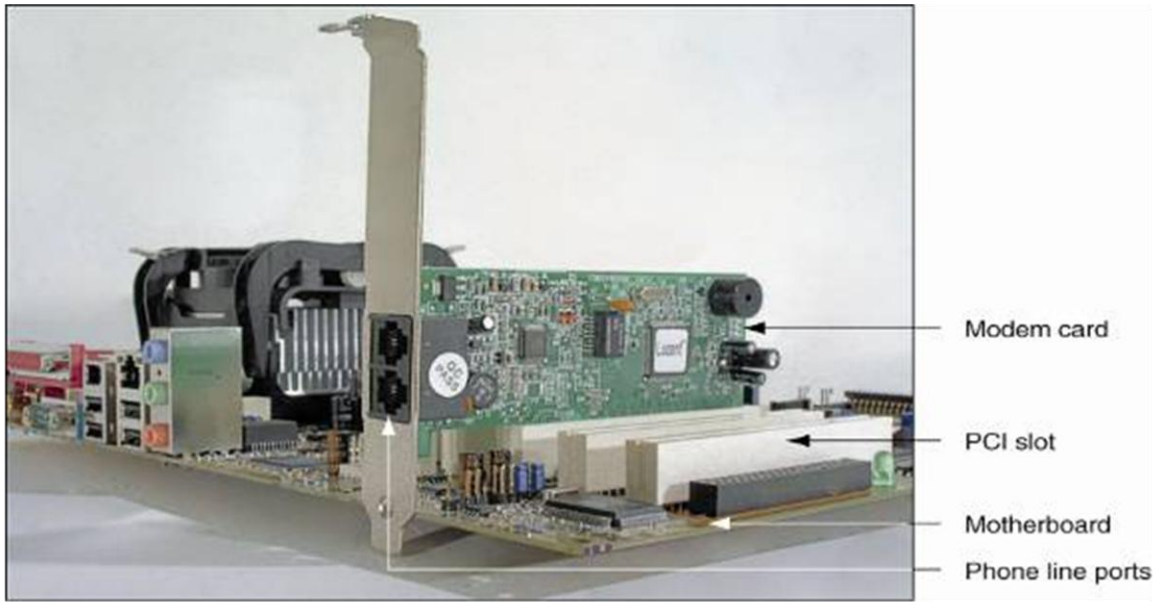
## Interface (Expansion) Cards

- Some names for circuits mounted in expansion slots:
  - Circuit cards, adapter boards, expansion cards, cards

### **Cards that connect the CPU to an external device:**

- Video: provides a port for the monitor
  - Sound: provides ports for speakers and microphones
  - Network: provides a port for a network cable
  - Modem: provides ports for phone lines
- Determine a card's function by identifying its port



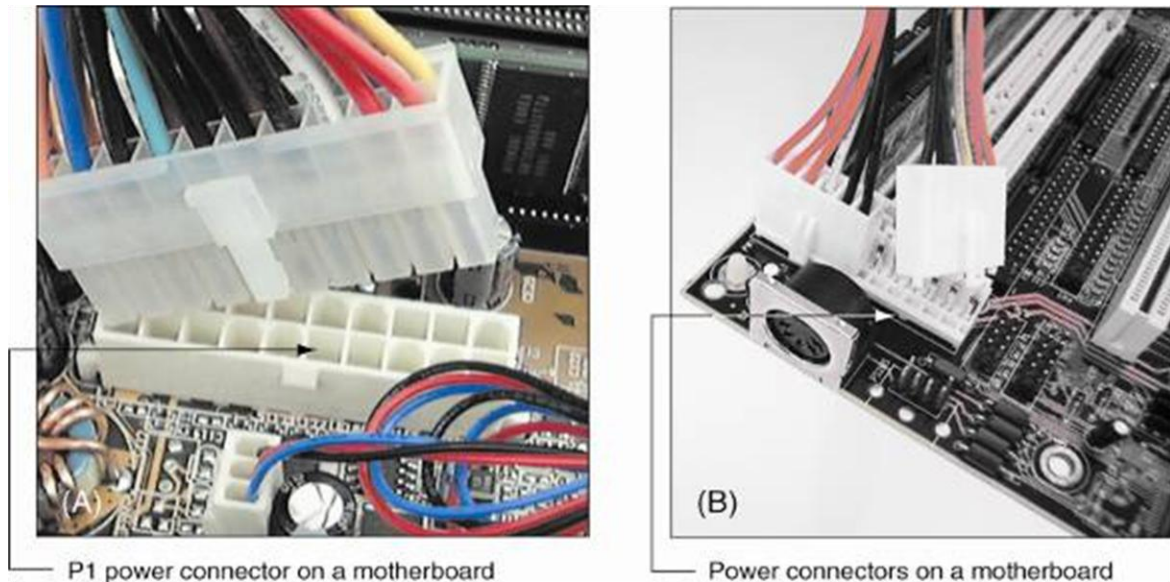


**Figure 1-31** This circuit board is a modem card and is mounted in a PCI slot on the motherboard

## The Electrical System

### Power supply

- Most important electrical component
- Converts AC voltage external source to DC voltage
- Reduces voltage from 110-120 volts to 12 volts or less
- Runs a fan to cool the inside of the computer case
- Temperatures > 185° F can cause component failure
- Motherboard has 1 or 2 connections to power supply



**Figure 1-35** The motherboard receives its power from the power supply by way of one or more connections located near the edge of the board or near the processor

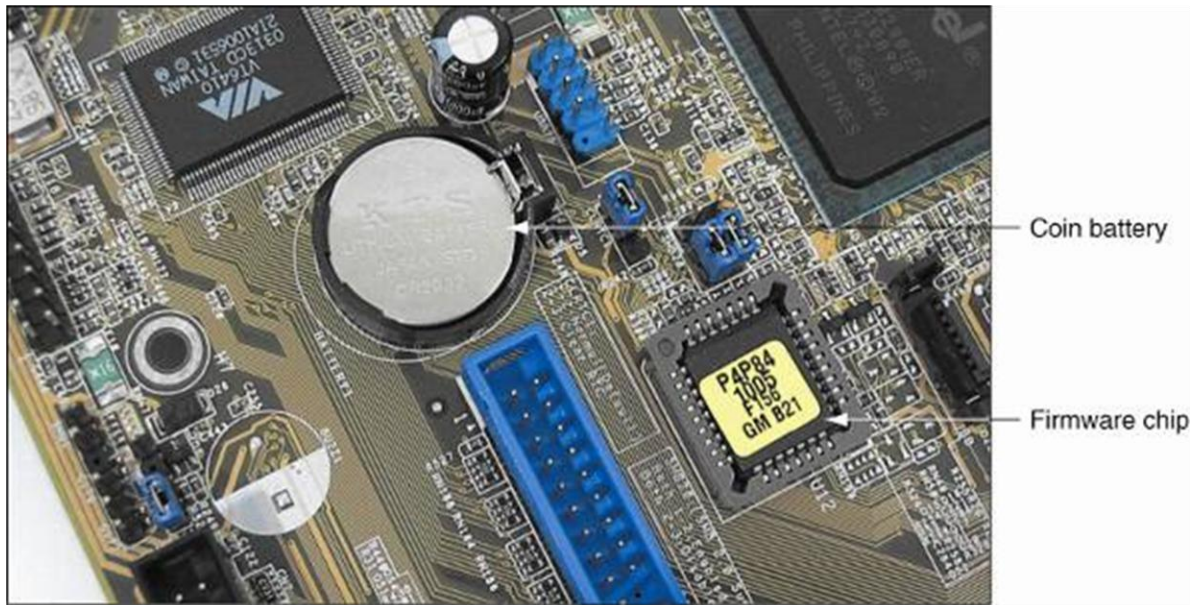
## Instructions Stored on the Motherboard and Other Boards

### BIOS (basic input/output system)

- Data and instructions stored on ROM chips
- ROM BIOS chips are a type of firmware

### Three purposes served by motherboard ROM BIOS:

- System BIOS: used to manage simple devices
- Startup BIOS: used to start the computer
- CMOS setup: used to change motherboard settings
- **CMOS RAM:** includes date, time, port configurations
- **Flash ROM:** ROM chips the can be overwritten



**Figure 1-36** This firmware chip contains flash ROM and CMOS RAM; CMOS RAM is powered by the coin battery located near the chip

## Advanced Configuration and Power Interface

- Also known as ACPI
- Standards specifying a power saving feature
- Enables a system to power up by a keyboard
- Supported by most systems, such as Windows XP
- Advanced Power Management (APM)
  - Older BIOS power management standard

## Plug and Play

- Also known as PnP
- Standard simplifying installation of hardware devices
- PnP BIOS begins process of configuring devices

- PnP-compliant operating system completes configuration
- ESCD (extended system configuration data) Plug and Play BIOS
  - Enhanced version of PnP
  - Stores manual configuration steps

## Summary

- A computer comprises hardware and software
- Main functions: input, output, processing, storage
- Data is stored in a binary format (1 or 0, on or off)
- Input/output devices: keyboard, mouse, printer, monitor
- Motherboard (system board): contains the CPU, access to other circuit boards and peripherals
- Primary storage (RAM) is volatile (temporary)
- Secondary storage is nonvolatile (permanent)
- Parallel and serial ATA standards: enable secondary storage devices to interface with the motherboard
- Computer bus: system of communication pathways and protocols
- ROM BIOS helps start PCs, manage simple devices, and change some motherboard settings

\*\*\*\*\*All images and text are property of Cengage, Thomson, and Jean Andrews\*\*\*\*\*

Get more at: <http://the-computer-wizard.tripod.com>



Comp Wiz



the\_comp\_wiz

