

# Discovering Computers 2009



## Chapter 4 The Components of the System Unit

### Chapter 4 Objectives

Differentiate among various styles of system units

Differentiate among the various types of memory

Identify chips, adapter cards, and other components of a motherboard

Describe the types of expansion slots and adapter cards

Describe the components of a processor and how they complete a machine cycle

Explain the differences among a serial port, a parallel port, a USB port, a FireWire port, and other ports

Identify characteristics of various personal computer processors on the market today

Describe how buses contribute to a computer's processing speed

Define a bit and describe how a series of bits represents data

Identify components in mobile computers and mobile devices

Explain how programs transfer in and out of memory

Understand how to clean a system unit

# The System Unit

## What is the system

➤ **Case** that contains electronic components of the computer used to process data

- Sometimes called the chassis



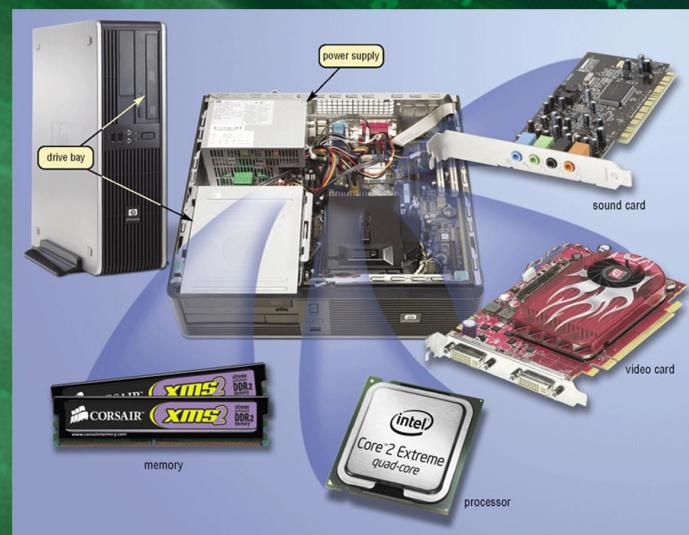
p. 184 Fig. 4-1

Next ➔

# The System Unit

## What are common components inside the system unit?

- Processor
- Memory
- Adapter cards
  - Sound card
  - Video card
- Drive bays
- Power supply



p. 185 Fig. 4-2

Next ➔

# The System Unit

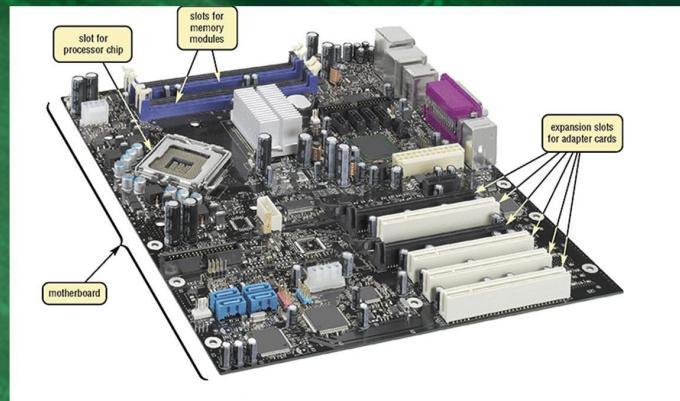
## What is the motherboard?

- Main circuit board of the system unit
- Contains expansion slots, processor chips, and memory slots
- Also called system board



Click to view Web Link,  
click Chapter 4, Click Web Link  
from left navigation,  
then click Motherboards below  
Chapter

p. 186 Fig. 4-3



Next ➤

# The System Unit

## What is a chip?

- Small piece of semi-conducting material on which integrated circuits are etched
  - Integrated circuits contain many microscopic pathways capable of carrying electrical current
- Chips are packaged so that they can be attached to a circuit board

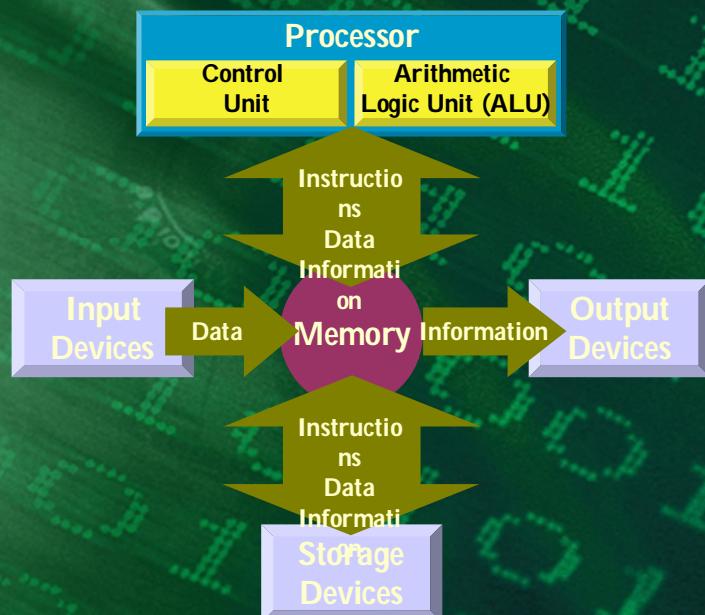
p. 186

Next ➤

# Processor

## What is the central processing unit (CPU)?

- Interprets and carries out basic instructions that operate a computer
  - **Control unit** directs and coordinates operations in computer
  - **Arithmetic logic unit (ALU)** performs arithmetic, comparison, and logical operations
- Also called the **processor**



p. 186 - 187 Fig. 4-4

Next ➔

# Processor

## What are multi-core processors?

- A **multi-core processor** is a chip with two or more separate processors
- A **dual-core processor** is a single chip that contains two separate processors
- A **quad-core processor** is a single chip that contains four separate processors
- Each processor on a multi-core chip generally runs at a slower clock speed, but increases overall performance



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Processors below Chapter 4.

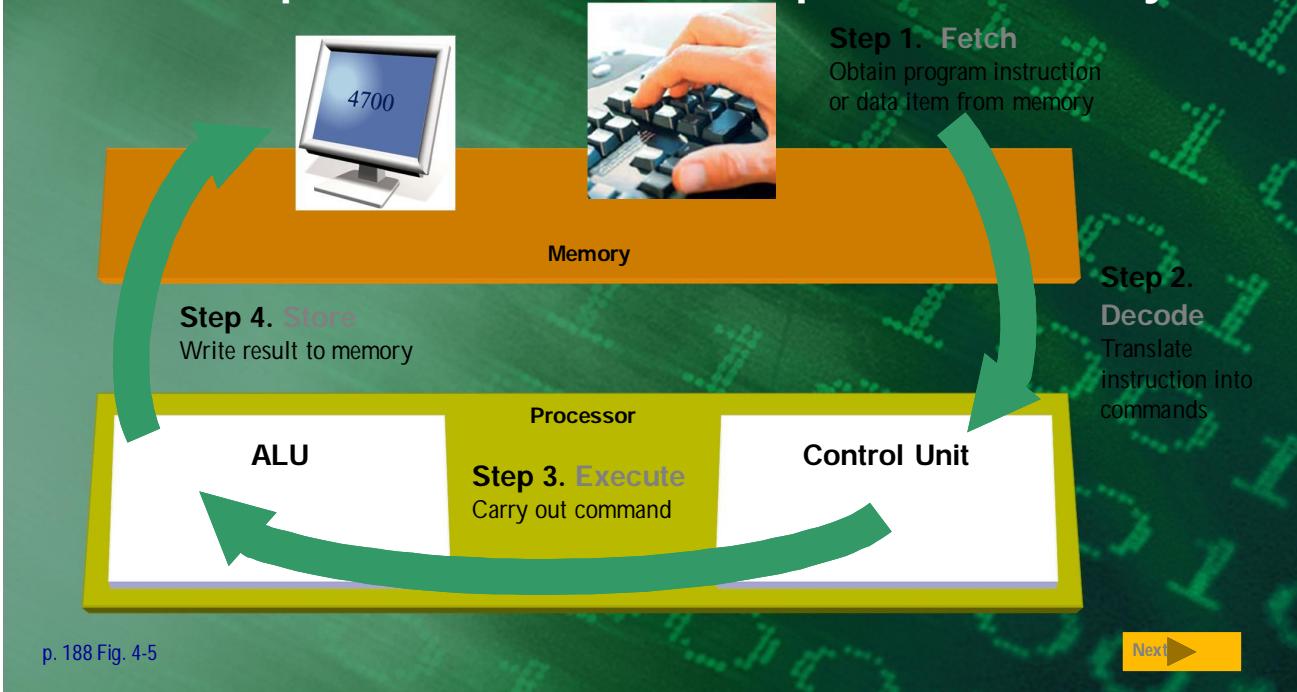
p. 187

Next ➔

# Processor

## What is a machine cycle?

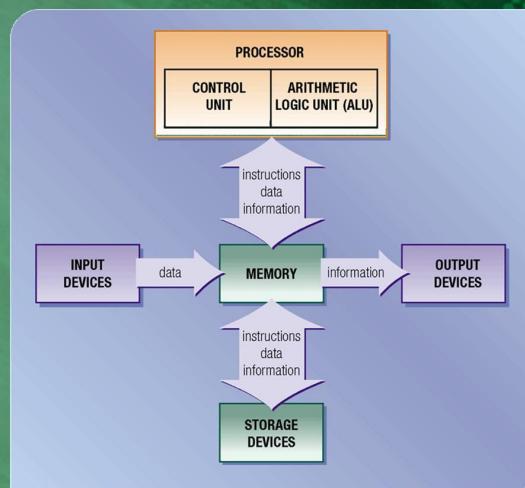
- Four operations of the CPU comprise a machine cycle



# Processor

## What is pipelining?

- Processor begins fetching second instruction before completing machine cycle for first instruction
- Results in faster processing



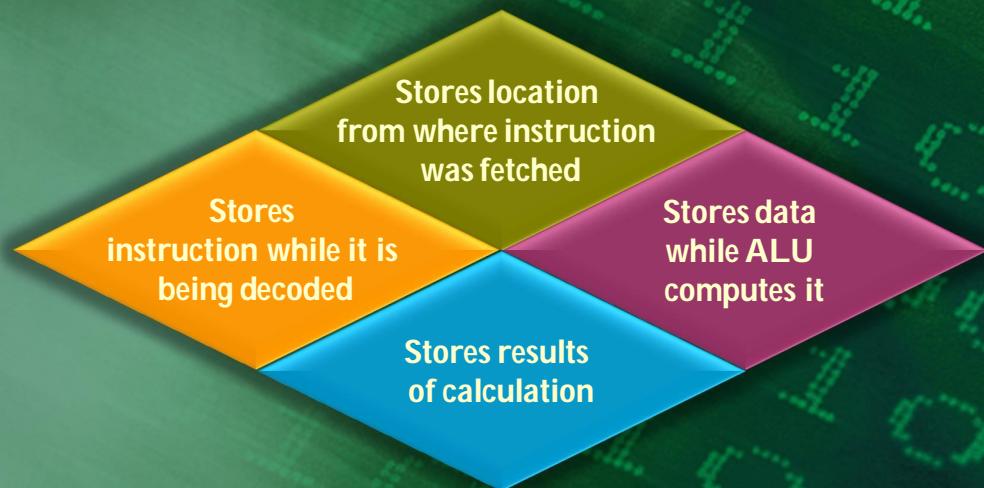
p. 189 Fig. 4-6

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# Processor

## What is a register?

- Temporary high-speed storage area that holds data and instructions



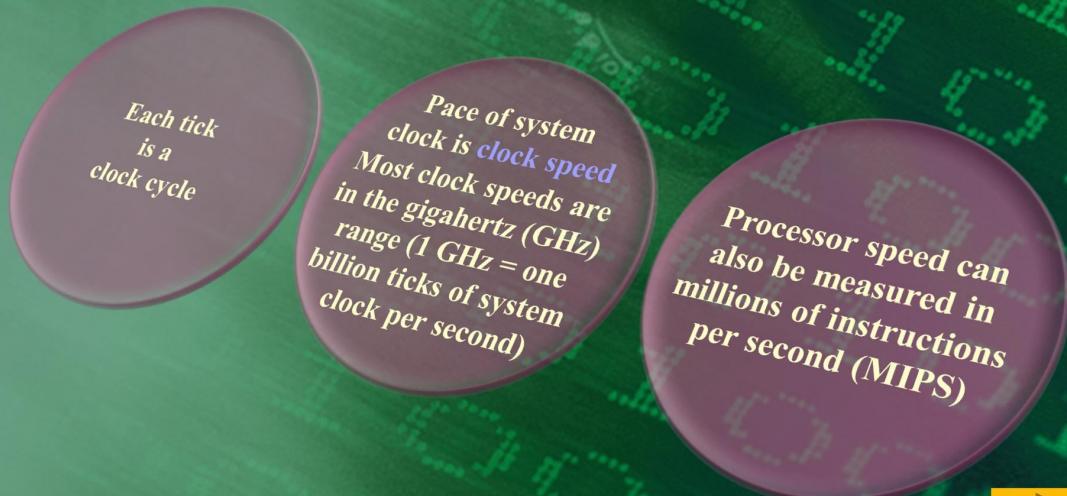
p. 189

Next ➔

# Processor

## What is the system clock?

- Controls timing of all computer operations
- Generates regular electronic pulses, or ticks, that set operating pace of components of system unit



p. 189 - 190

Next ➔

# Processor

## What are the guidelines for selecting a processor?

GUIDELINES FOR SELECTING AN INTEL OR INTEL-COMPATIBLE PROCESSOR			
	• Power users with workstations • Low-end servers on a network	Itanium 2	Xeon
USE	• Power users or users who design professional drawings; produce and edit videos; record and edit music; participate in video conferences; create professional Web sites; play graphic-intensive multiplayer Internet games • Users who design professional documents containing graphics such as newsletters or number-intensive spreadsheets; produce multimedia presentations; use the Web as an intensive research tool; send documents and graphics via the Web; watch videos; play graphic-intensive games on CD or DVD; create personal Web sites • Home users who manage personal finances; create basic documents with word processing and spreadsheet software; edit photos; communicate with others on the Web via e-mail, chat rooms, and discussions; shop on the Web; create basic Web pages; use the computer as a digital entertainment unit	Core 2 Quad	Core 2 Duo
	• Home users who manage personal finances; create basic documents with word processing and spreadsheet software; edit photos; make greeting cards and calendars; use educational or entertainment CDs; communicate with others on the Web via e-mail, chat rooms, and discussions	Core 2 Extreme	Athlon 64 FX
	• Users with mobile computers or mobile devices	Pentium Extreme Edition	Celeron D
		Sempron	Athlon 64 X2
		Core 2 Extreme	Core 2 Duo
		Turion 64	

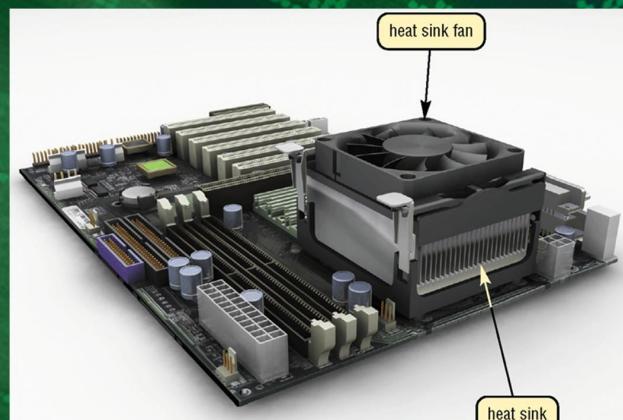
p. 192 Fig. 4-8

Next ➤

# Processor

## What are heat sinks, heat pipes, and liquid cooling?

- Heat sink—component with fins that cools processor
- Heat pipe—smaller device for notebook computers
- Liquid cooling—uses a continuous flow of fluids to transfer heat away



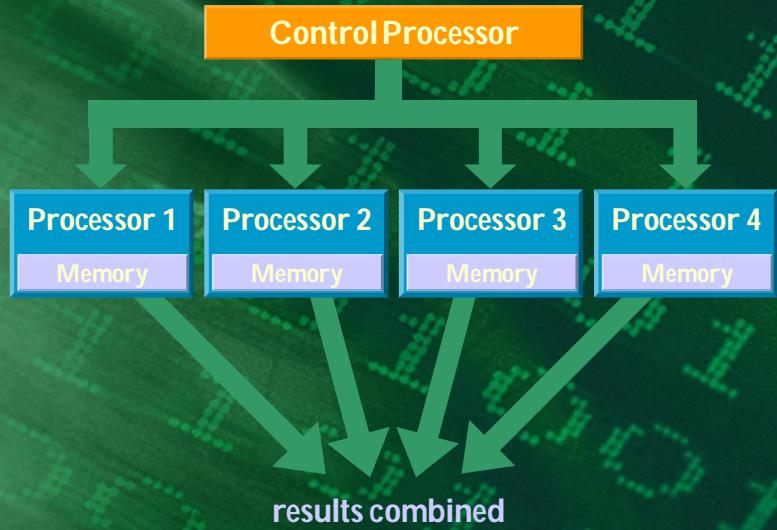
p. 193 Fig. 4-9

Next ➤

# Processor

## What is parallel processing?

- Using multiple processors simultaneously to execute a program faster
- Requires special software to divide problem and bring results together



p. 194 Fig. 4-10

Next ➔

# Data Representation

## How do computers represent data?

- Most computers are **digital**

BINARY DIGIT (BIT)	ELECTRONIC CHARGE	ELECTRONIC STATE
1		ON
0		OFF

p. 194 - 195 Fig. 4-11

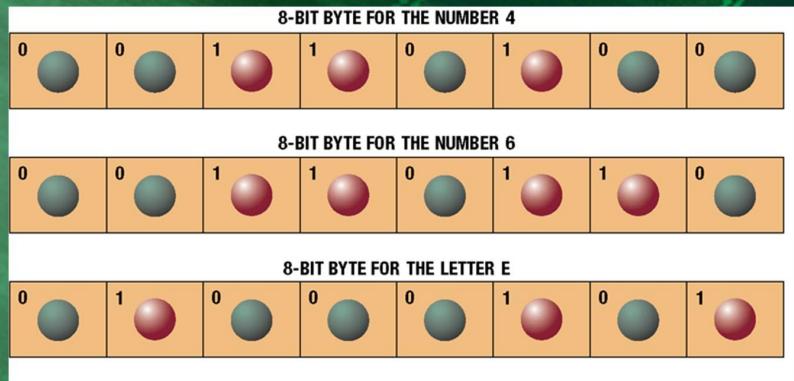
- Recognize only two discrete states: on or off
- Use a **binary system** to recognize two states
- Use Number system with two unique digits: 0 and 1, called **bits** (short for binary digits)

Next ➔

# Data Representation

## What is a byte?

- Eight bits grouped together as a unit
- Provides enough different combinations of 0s and 1s to represent 256 individual characters
  - Numbers
  - Uppercase and lowercase letters
  - Punctuation marks
  - Other



p. 195 Fig. 4-12

Next ➔

# Data Representation

## What are three popular coding systems to represent data?

- ASCII—American Standard Code for Information Interchange
- EBCDIC—Extended Binary Coded Decimal Interchange Code
- Unicode—coding scheme capable of representing all world's languages

ASCII	Symbol	EBCDIC
00110000	0	11110000
00110001	1	11110001
00110010	2	11110010
00110011	3	11110011

p. 195 Fig. 4-13

Next ➔

# Data Representation

## How is a letter converted to binary form and back?



**Step 1.**  
The user presses the capital letter **T** (SHIFT+T key) on the keyboard.



**Step 4.**  
After processing, the binary code for the capital letter **T** is converted to an image, and displayed on the output device.



**Step 2.**  
An electronic signal for the capital letter **T** is sent to the system unit.

**Step 3.**  
The system unit converts the scan code for the capital letter **T** to its ASCII binary code (01010100) and stores it in memory for processing.

p. 196 Fig. 4-14

Next ➤

# Memory

## What is memory?

- Electronic components that store instructions, data, and results
- Consists of one or more chips on motherboard or other circuit board
- Each byte stored in unique location called an address, similar to seats in a concert hall



p. 197 Fig. 4-15

Next ➤

# Memory

## How is memory measured?

- By number of bytes available for storage

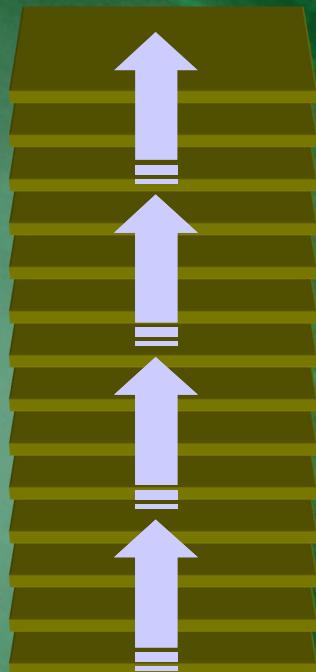
Term	Abbreviation	Approximate Size
Kilobyte	KB or K	1 thousand bytes
Megabyte	MB	1 million bytes
Gigabyte	GB	1 billion bytes
Terabyte	TB	1 trillion bytes

p. 197 Fig. 4-16

Next ➤

# Memory

## What is random access memory (**RAM**)?



Memory chips that can be  
read from and written  
to by processor

Also called  
main memory  
or primary  
storage

Most RAM is  
volatile, it is lost  
when computer's  
power is  
turned off

The more RAM a  
computer has, the  
faster it responds



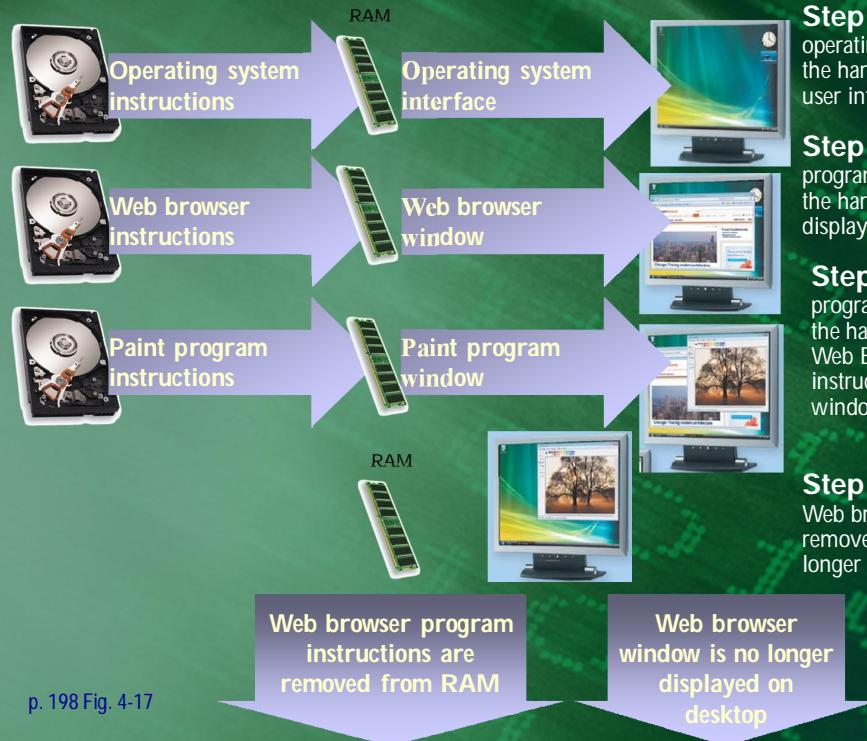
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then click RAM below Chapter

p. 198 - 199

Next ➤

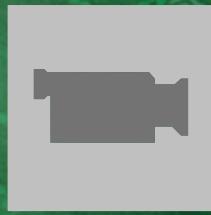
# Memory

## How do program instructions transfer in and out of RAM?

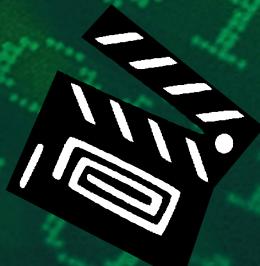


# Memory

Video: The Leopard with a Time Machine



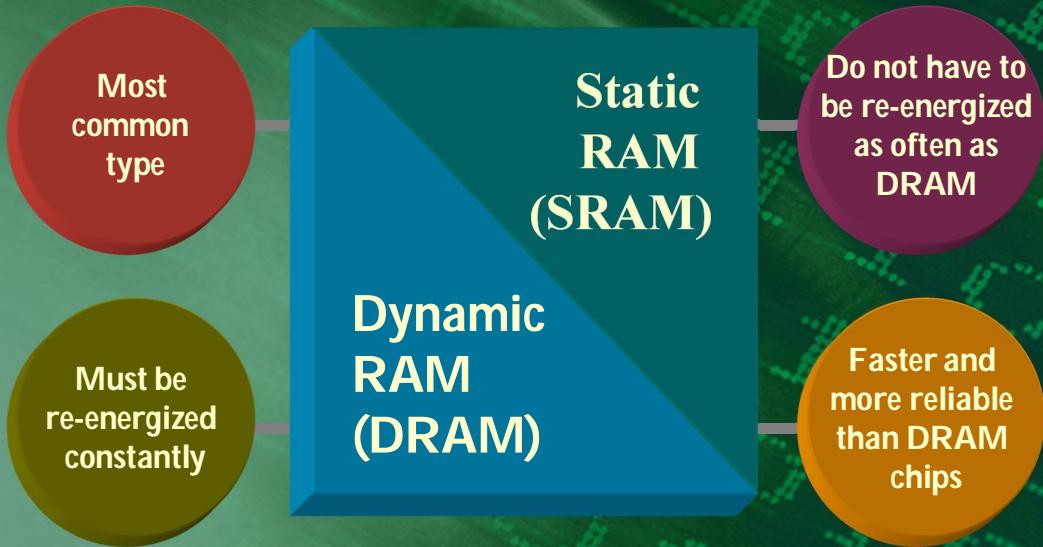
CLICK TO START



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# Memory

What are two basic types of RAM chips?



Newer Type: Magnetoresistive RAM (MRAM)

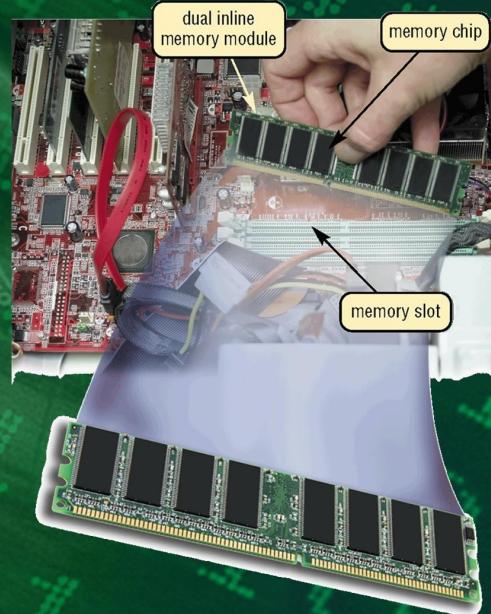
p. 199

Next ➔

# Memory

Where does memory reside?

- Resides on small circuit board called **memory module**
- **Memory slots** on motherboard hold memory modules



p. 199 Fig. 4-18

Next ➔

# Memory

## How much RAM does an application require?

- Depends on the types of software you plan to use
- For optimal performance, you need more than minimum specifications

p. 199

Next ➔

# Memory

## How much RAM do you need?

- Depends on type of applications you intend to run on your computer

RAM	1 GB or less	1 GB to 4 GB	4 GB and up
Use	<ul style="list-style-type: none"><li>• Home and business users managing personal finances</li><li>• Using standard application software such as word processing</li><li>• Using educational or entertainment CDs</li><li>• Communicating with others on the Web</li></ul>	<ul style="list-style-type: none"><li>• Users requiring more advanced multimedia capabilities</li><li>• Running number-intensive accounting, financial, or spreadsheet programs</li><li>• Using voice recognition</li><li>• Working with videos, music, and digital imaging</li><li>• Creating Web sites</li><li>• Participating in video conferences</li><li>• Playing Internet games</li></ul>	<ul style="list-style-type: none"><li>• Power users creating professional Web sites</li><li>• Running sophisticated CAD, 3-D design, or other graphics-intensive software</li></ul>

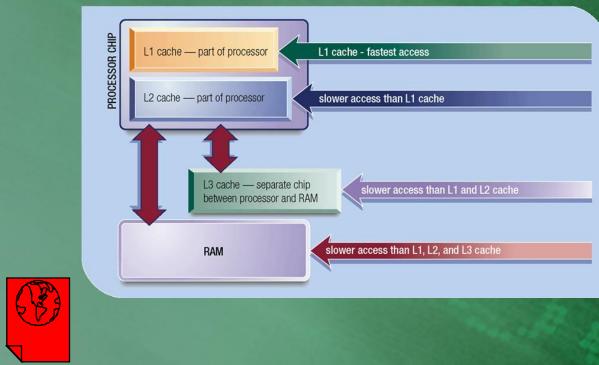
p. 200 Fig. 4-19

Next ➔

# Memory

## What is cache?

- Helps speed computer processes by storing frequently used instructions and data
- Also called **memory cache**



Click to view Web Links,  
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Web Link from left  
navigation, then click  
Windows ReadyBoost below  
Chapter 4

p. 201 Fig. 4-20

Next ➤

# Memory

## What is read-only memory (ROM)?

Memory chips that store permanent data and instructions

Nonvolatile memory, it is not lost when computer's power is turned off

Three types:

**Firmware**—  
Manufactured with permanently written data, instructions, or information

**EEPROM**  
(electrically erasable programmable read-only memory)—  
Type of PROM containing microcode programmer can erase

**PROM**  
(programmable read-only memory)—  
Blank ROM chip onto which a programmer can write permanently

p. 201 - 202

Next ➤

# Memory

## What is flash memory?

- Nonvolatile memory that can be erased electronically and rewritten
- Used with many mobile devices

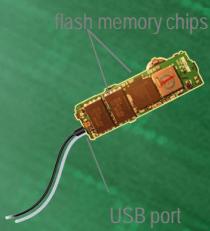
### Step 1.

Purchase and download music tracks from a Web site. With one end of a special cable connected to the system unit, connect the other end to the USB port in the portable media player.



Click to view Web Link.  
click Chapter 4, Click Web Link  
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then click Flash Memory  
below Chapter 4

p. 202 Fig. 4-21



### Step 2.

Instruct the computer to copy the music tracks to the flash memory chip in the portable media player.

### Step 3.

Plug the headphones into the portable media player, push a button on the portable media player, and listen to the music through the earphones.



MP3 Player

Next ➤

# Memory

## What is CMOS?

Complementary metal-oxide semiconductor memory

Used in some RAM chips, flash memory chips, and other types of memory chips

Uses battery power to retain information when other power is turned off

Stores date, time, and computer's startup information

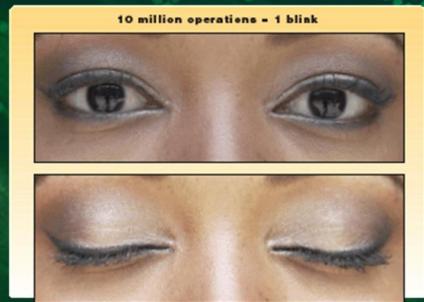
p. 203

Next ➤

# Memory

## What is access time?

- Amount of time it takes processor to read data from memory
- Measured in **nanoseconds (ns)**, one billionth of a second
- It takes 1/10 of a second to blink your eye; a computer can perform up to 10 million operations in same amount of time



Term	Speed
Millisecond	One-thousandth of a second
Microsecond	One-millionth of a second
Nanosecond	One-billionth of a second
Picosecond	One-trillionth of a second

p. 203 Figs. 4-22-4-23

Next ➔

# Expansion Slots and Adapter Cards

## What is an adapter card?

- Enhances system unit or provides connections to external devices called **peripherals**
- Also called an expansion card

### TYPES OF ADAPTER CARDS

Adapter Card	Purpose
Disk controller	Connects disk drives
FireWire	Connects to FireWire devices
HDTV tuner	Allows viewing of HDTV broadcasts on the monitor
MIDI	Connects musical instruments
Modem	Connects other computers through telephone or cable television lines
Network	Connects other computers and peripherals
PC-to-TV converter	Connects a television
Sound	Connects speakers or a microphone
TV tuner	Allows viewing of television channels on the monitor
USB 2.0	Connects to USB 2.0 devices
Video	Connects a monitor
Video capture	Connects a video camera



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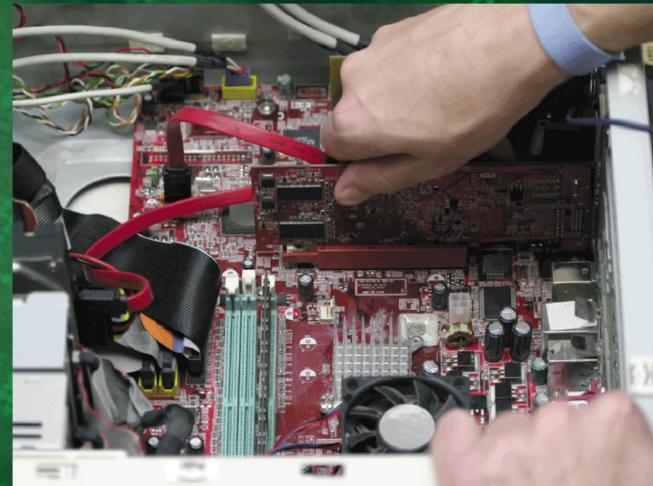
p. 204 Fig. 4-24

Next ➔

# Expansion Slots and Adapter Cards

## What is an **expansion slot**?

- An opening, or socket, on the motherboard that can hold an adapter card
- With **Plug and Play**, the computer automatically configures cards and other devices as you install them



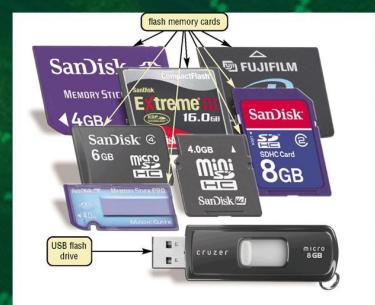
p. 204 - 205 Fig. 4-25

Next ➤

# Expansion Slots and Adapter Cards

## What are **flash memory cards**, **PC cards**, and **ExpressCard modules**?

- An **ExpressCard module** adds memory, storage, sound, fax/modem, communications, and other capabilities to notebook computers
- A **flash memory card** allows users to transfer data from mobile devices to desktop computers
- **USB Flash drive**
- An **PC card** adds various capabilities to computers



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below Chapter 4.

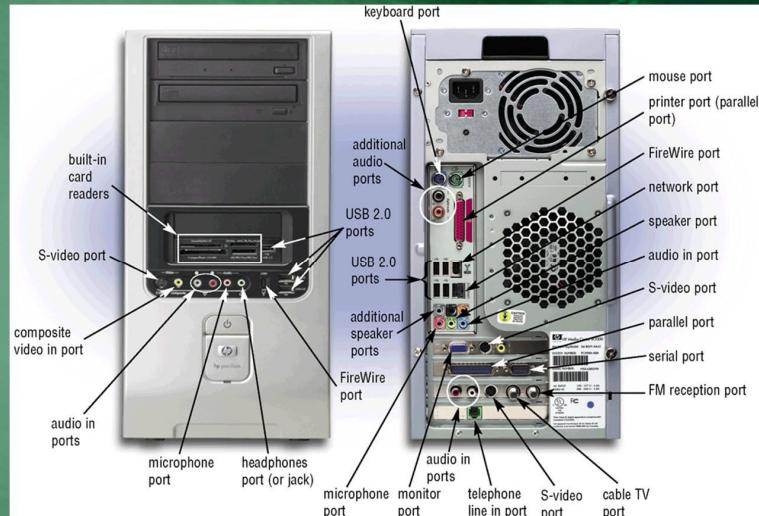
p. 205 Fig. 4-26-4-27

Next ➤

# Ports and Connectors

## What are ports and connectors?

- **Port** connects external devices to system unit
- **Connector** joins cable to peripheral
  - Available in one of two genders: male and female



p. 206 Fig. 4-28

Next ➤

# Ports and Connectors

## What are different types of connectors?

PORT TYPES			
Type	Picture	Type	Picture
Audio In		Monitor	
Cable TV		Mouse	
Center Surround Sound/Subwoofer		Network	
Composite video in		Printer	
Digital Video Interface (DVI)		Rear Surround Sound	
eSATA port		Serial	
FireWire		Side Surround Sound	
FM reception		S/PDIF	
HDMI port		Speaker	
Headphones		S-video	
Keyboard		Telephone line in	
Microphone		USB	

p. 207 Fig. 4-29

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# Ports and Connectors

## What is a **serial port**?

- Transmits one bit of data at a time
- Connects slow-speed devices, such as mouse, keyboard, modem



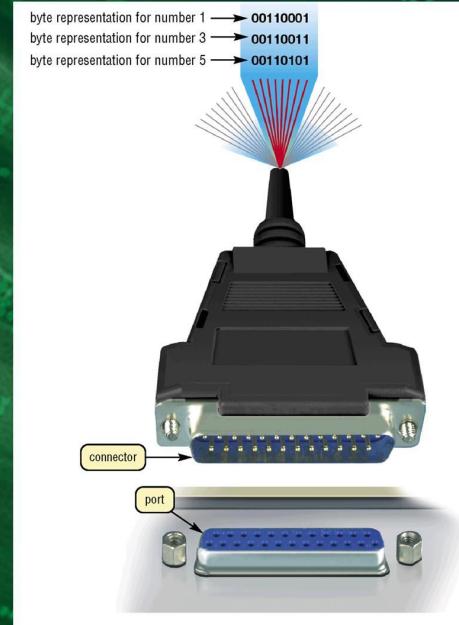
p. 207 Fig. 4-30

Next ➔

# Ports and Connectors

## What is a **parallel port**?

- Connects devices that can transfer more than one bit at a time, such as a printer



p. 208 Fig. 4-31

Next ➔

# Ports and Connectors

## What are **USB ports**?

**USB (universal serial bus) port** can connect up to 127 different peripherals together with a single connector type

PCs typically have six to eight USB ports on front or back of the system unit

Single USB port can be used to attach multiple peripherals in a **daisy chain**

Third USB device connects to second USB device, and so on

Second USB device connects to first USB device

First USB device connects to USB port on computer

p. 208

Next ➔

# Ports and Connectors

## What are **FireWire ports**?

- Connects multiple types of devices that require faster data transmission speeds
- Allows you to connect up to 63 devices together
- FireWire 800 is the latest FireWire version
- A **FireWire hub** is a device that plugs in a FireWire port on the system unit and contains multiple FireWire ports in which you plug cables from FireWire devices

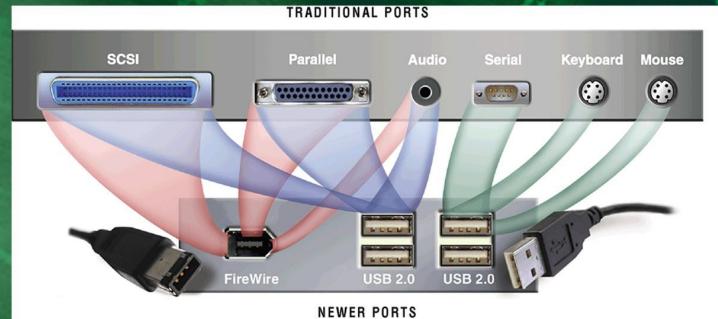
p. 208 - 209

Next ➔

# Ports and Connectors

## What are special-purpose ports?

- Allow users to attach specialized peripherals or transmit data to wireless devices
  - MIDI (Musical Instrument Digital Interface) port
  - eSATA port
  - SCSI port
  - IrDA (Infrared Data Association) port
  - Bluetooth port



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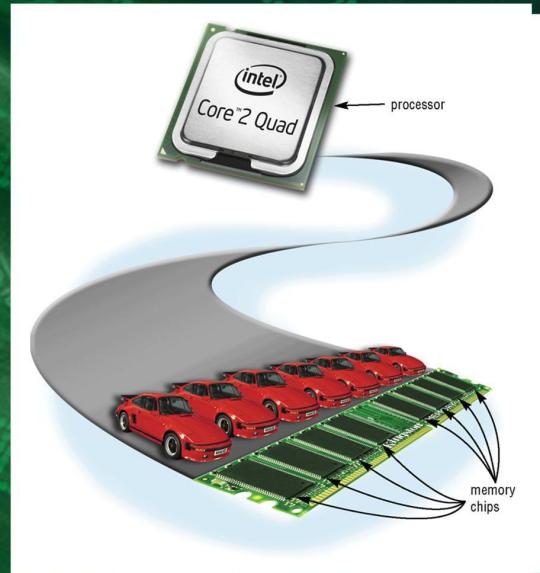
p. 209 - 210 Fig. 4-32

Next ➤

# Buses

## What is a bus?

- Channel that allows devices inside computer to communicate with each other
  - System bus connects processor and RAM
  - Bus width determines number of bits transmitted at one time
  - **Word size** is the number of bits processor can interpret and execute at a given time



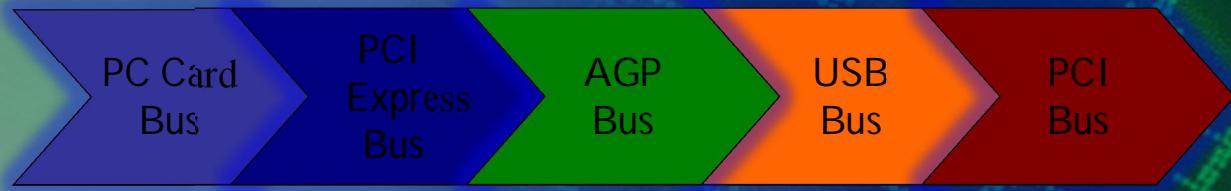
p. 211 - 212 Fig. 4-35

Next ➤

# Buses

## What is an expansion bus?

- Allows processor to communicate with peripherals



p. 212

Next ➤

# Bays

## What is a bay?

- Opening inside system unit used to install additional equipment
- **Drive bays** typically hold disk drives



p. 212 Fig. 4-36

Next ➤

# Power Supply

What is a **power supply**?

Converts  
AC Power  
into  
DC Power

Fan keeps  
system unit  
components  
cool

External peripherals  
might use an **AC  
adapter**, which is an  
external power supply

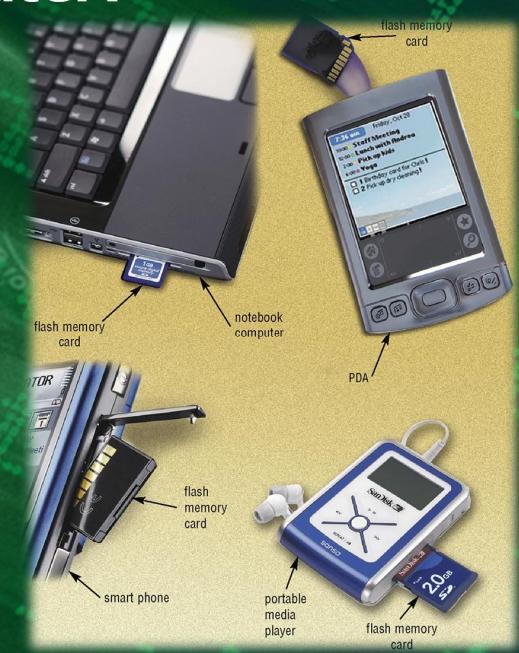
p. 213

Next ➔

# Mobile Computers and Devices

What is a **mobile computer**?

- Notebook, weighing between 2.5 and 10 pounds, or mobile device

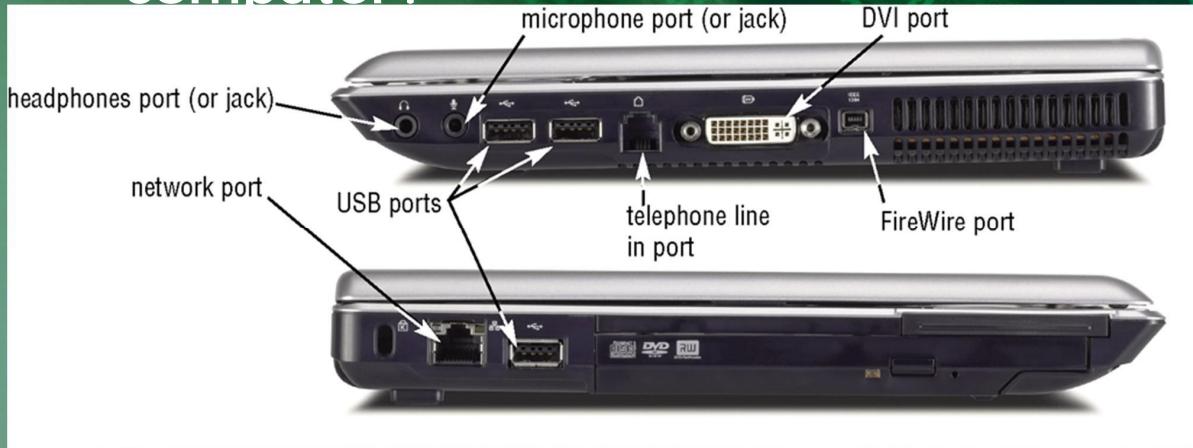


p. 213 - 214 Fig. 4-37

Next ➔

# Mobile Computers and Devices

What ports are on a notebook computer?



p. 214 Fig. 4-38

Next ➤

# Mobile Computers and Devices

What ports and slots are on a tablet PC?

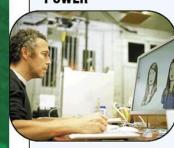


p. 214 Fig. 4-39

Next ➤

# Putting It All Together

What are suggested processor and RAM configurations based on the needs of various types of users?

SUGGESTED MINIMUM CONFIGURATIONS BY USER	
User	Processor and RAM
<b>HOME</b> 	Intel Celeron D or AMD Sempron or Intel Pentium Dual-Core or Intel Core 2 Duo or AMD Athlon 64 X2 Dual-Core  Minimum RAM: 1 GB
<b>SMALL OFFICE/ HOME OFFICE</b> 	Intel Core 2 Duo or Intel Core 2 Quad or AMD Athlon 64 X2 Dual-Core  Minimum RAM: 2 GB
<b>MOBILE</b> 	Intel Core 2 Extreme or AMD Turion X2  Minimum RAM: 1 GB
<b>POWER</b> 	Intel Itanium 2 or AMD Quad Core Opteron or Intel Quad Core Xeon  Minimum RAM: 4 GB
<b>LARGE BUSINESS</b> 	Intel Core 2 Duo or Intel Core 2 Quad or AMD Athlon 64 X2 Dual-Core  Minimum RAM: 2 GB

p. 215 Fig. 4-40

Next ➤

# Keeping Your Computer Clean

Over time, the system unit collects dust – even in a clean environment

- Preventative maintenance requires a few basic products:



p. 216 Fig. 4-41

Next ➤

# Summary of the Components of the System Unit

Components of the system unit

How memory stores data, instructions, and information

Sequence of operations that occur when a computer executes an instruction

Comparison of various personal computer processors on the market today

How to clean a system unit

Chapter 4 Complete