

Chapter Four

The Components of the System Unit

Discovering Computers 2012

**Your Interactive Guide
to the Digital World**



Objectives Overview

Differentiate among various styles of system units on desktop computers, notebook computers, and mobile devices

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

Describe the control unit and arithmetic logic unit components of a processor, and explain the four steps in a machine cycle

Identify characteristics of various personal computer processors on the market today, and describe the ways processors are cooled

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

Explain how program instructions transfer in and out of memory

Objectives Overview

Differentiate among the various types of memory

Describe the purpose and types of expansion slots and adapter cards, and differentiate among slots for various removable flash memory devices

Differentiate between a port and a connector, and explain the differences among a USB port, FireWire port, Bluetooth port, SCSI port, eSATA port, IrDA port, serial port, and MIDI port

Describe the types of buses in a computer

Explain the purpose of a power supply and describe how it keeps cool

Understand how to clean a system unit on a computer or mobile device

The System Unit

- The **system unit** is a case that contains electronic components of the computer used to process data



The System Unit

- The inside of the system unit on a desktop personal computer includes:

Drive bay(s)

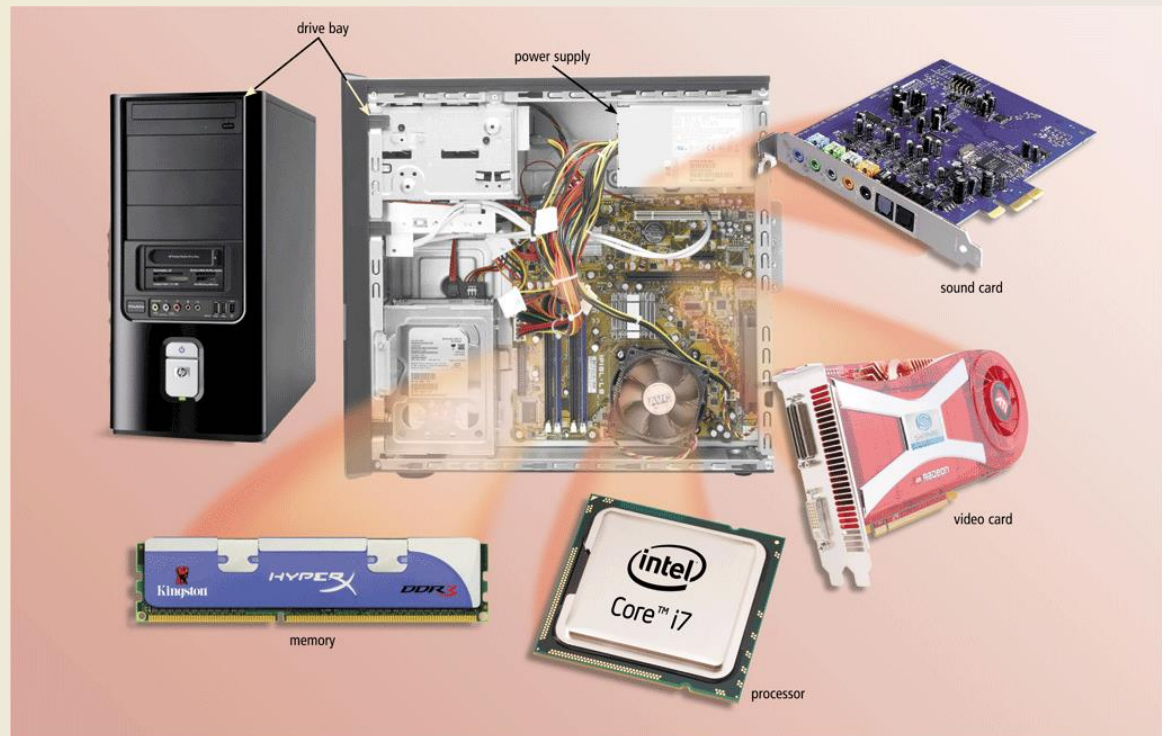
Power supply

Sound card

Video card

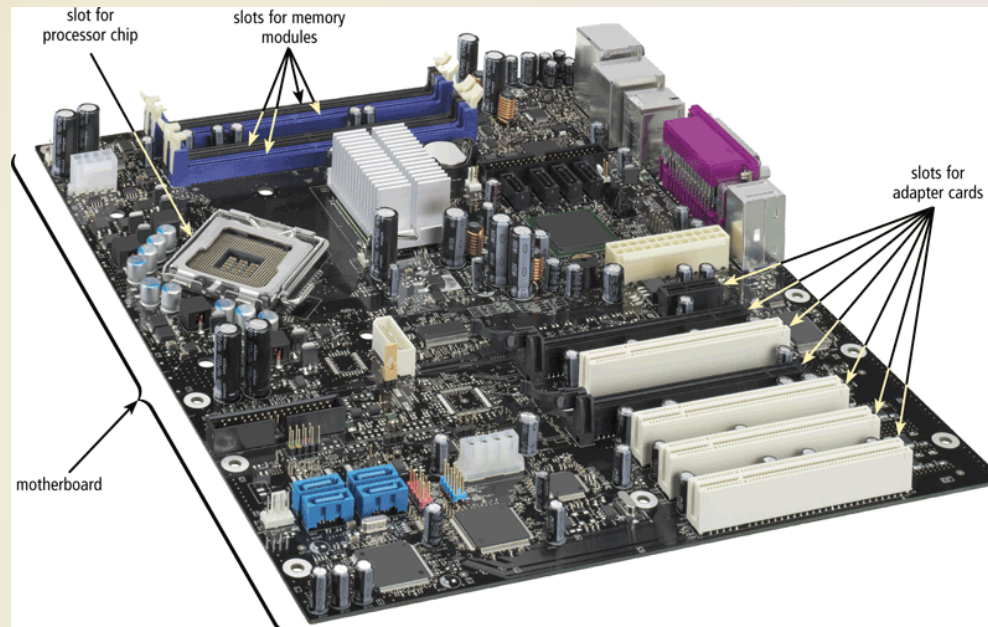
Processor

Memory



The System Unit

- The **motherboard** is the main circuit board of the system unit
 - A computer **chip** contains integrated circuits



Processor

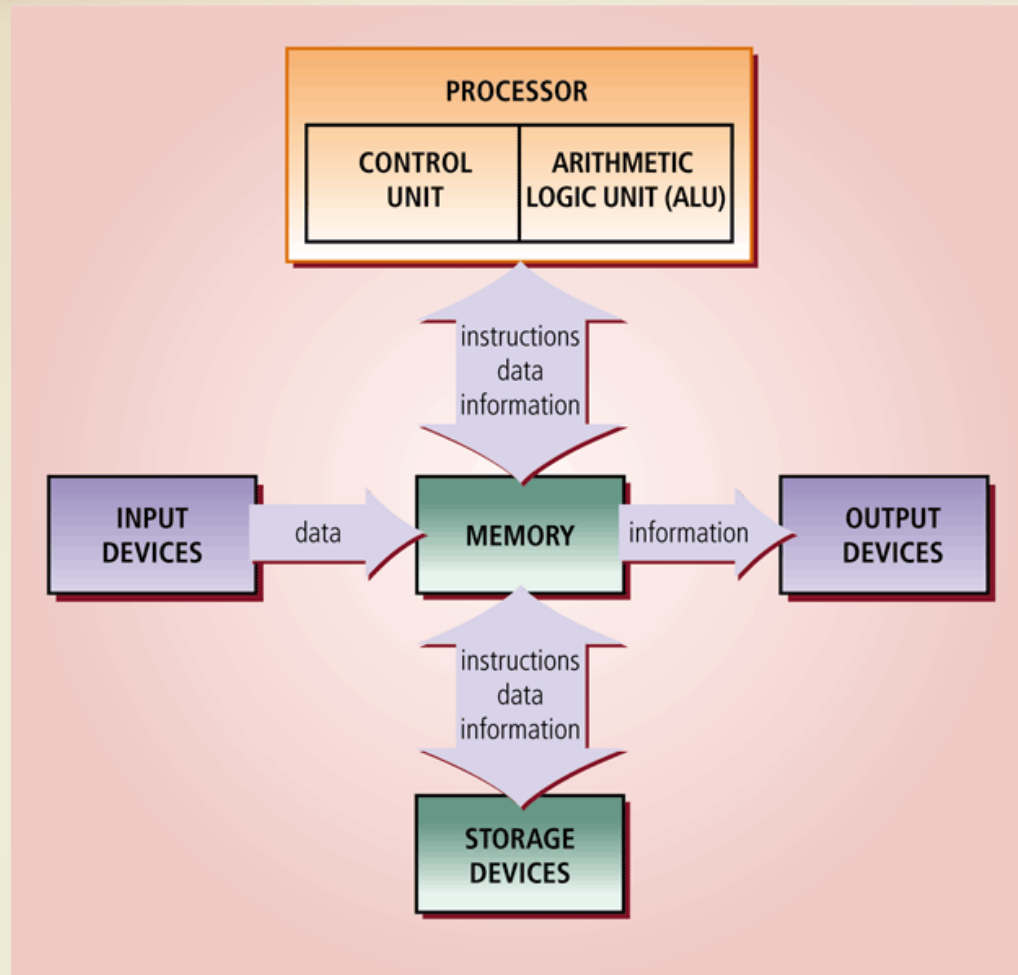
- The **processor**, also called the **central processing unit (CPU)**, interprets and carries out the basic instructions that operate a computer
 - Contain a control unit and an arithmetic logic unit (ALU)

**Multi-core
processor**

**Dual-core
processor**

**Quad-core
processor**

Processor

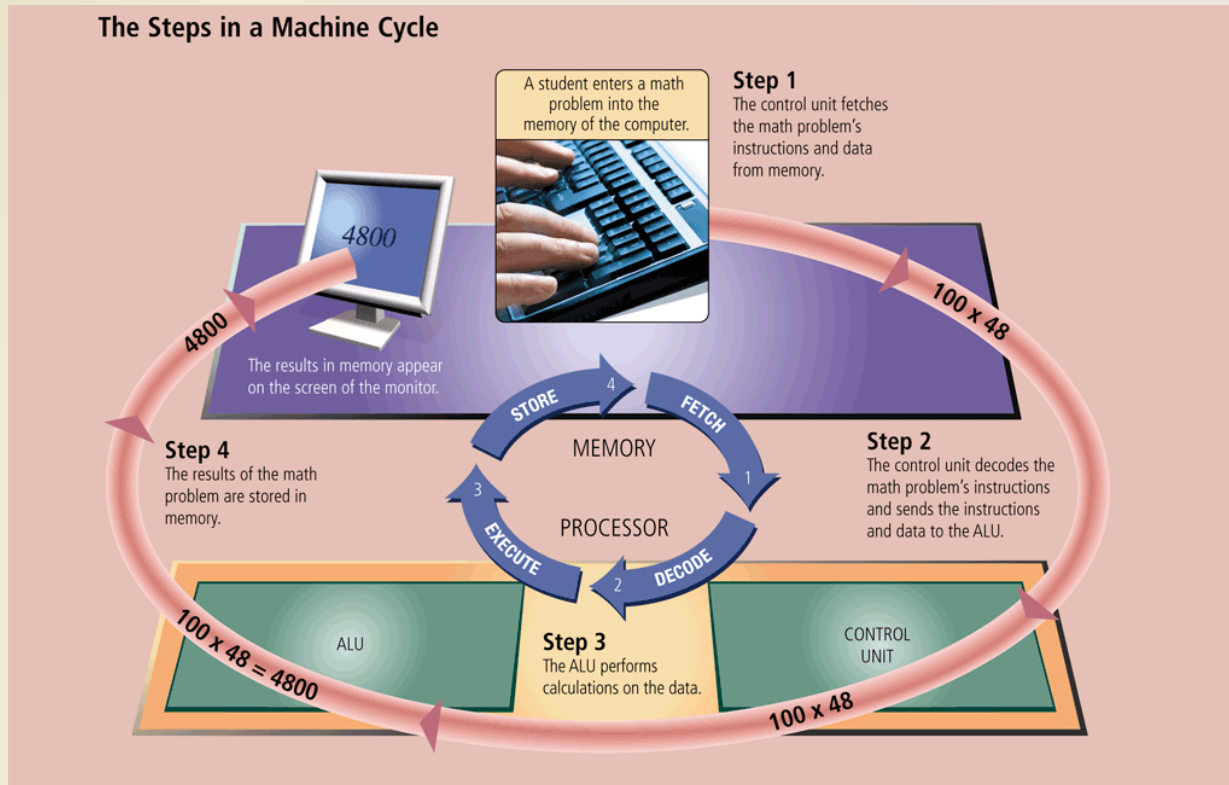


Processor

- The **control unit** is the component of the processor that directs and coordinates most of the operations in the computer
- The **arithmetic logic unit** (ALU) performs arithmetic, comparison, and other operations

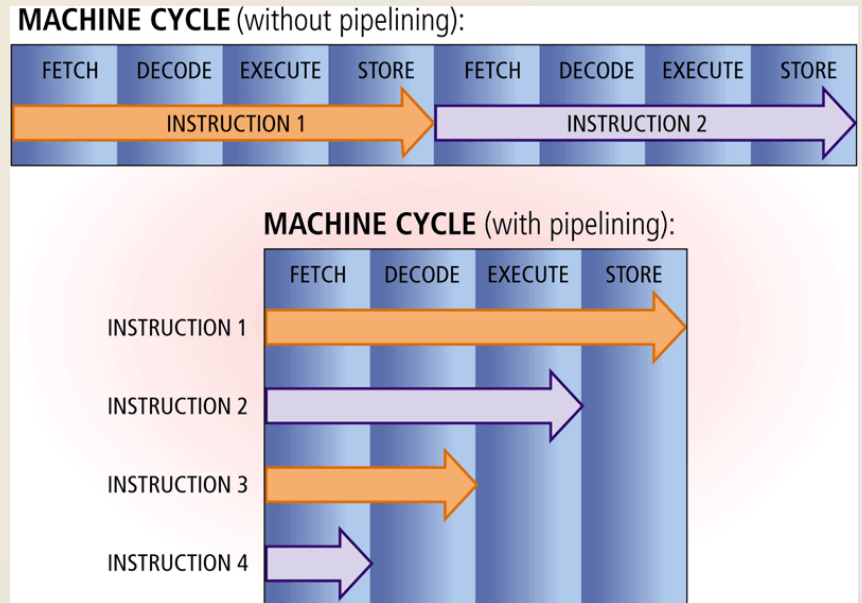
Processor

- For every instruction, a processor repeats a set of four basic operations, which comprise a machine cycle



Processor

- Most current personal computers support pipelining
 - Processor begins fetching a second instruction before it completes the machine cycle for the first instruction



Processor

The processor contains registers, that temporarily hold data and instructions

The **system clock** controls the timing of all computer operations

- The pace of the system clock is called the **clock speed**, and is measured in **gigahertz (GHz)**


















Processor

- The leading manufacturers of personal computer processor chips are Intel and AMD

Comparison of Currently Available Personal Computer Processors			
	Name	Multi-Core Availability	Manufacturer
SERVER PROCESSORS	Xeon	8 Core, 6 Core, Quad Core, Dual Core	Intel
	Itanium	Quad Core, Dual Core	Intel
	Opteron	6 Core, Quad Core	AMD
DESKTOP PERSONAL COMPUTER PROCESSORS	Core i7 Extreme	6 Core, Quad Core	Intel
	Core i7	6 Core, Quad Core	Intel
	Core i5	Quad Core, Dual Core	Intel
	Core i3	Dual Core	Intel
	Celeron	Dual Core	Intel
	Phenom	6 Core, Quad Core, Triple Core	AMD
	Athlon	Quad Core, Triple Core, Dual Core	AMD
	Sempron		AMD
NOTEBOOK COMPUTER PROCESSORS	Core i7 Extreme	Quad Core	Intel
	Core i7	Quad Core, Dual Core	Intel
	Core i5 and i3	Dual Core	Intel
	Atom		Intel
	Phenom	Quad Core, Triple Core, Dual Core	AMD
	Turion	Dual Core	AMD
	Athlon	Dual Core	AMD
	Sempron		AMD

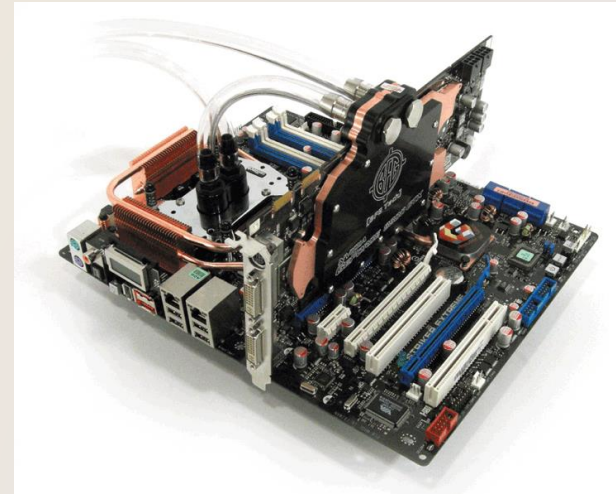
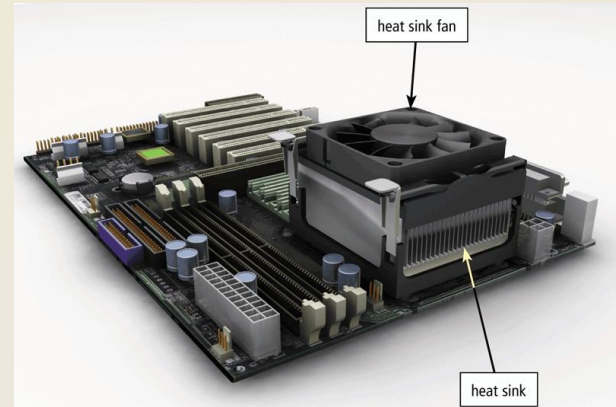
Processor

- Determine how you plan to use a new computer before selecting a processor

Guidelines for Selecting a Personal Computer Processor					
USE	<ul style="list-style-type: none"> • Power users with workstations • Low-end servers on a network 	<p>Itanium</p> 	<p>Xeon</p> 	<p>Opteron</p> 	
	<ul style="list-style-type: none"> • 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 optical discs, create personal Web sites 	<p>Core i7</p> 	<p>Core i7 Extreme</p> 		
	<ul style="list-style-type: none"> • 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 	<p>Phenom II</p> 	<p>Athlon X2</p> 	<p>Athlon II</p> 	
	<ul style="list-style-type: none"> • 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 	<p>Core i7</p> 	<p>Core i5</p> 	<p>Sempron</p> 	
	<ul style="list-style-type: none"> • Users with traditional notebook computers and Tablet PCs 	<p>Core i7</p> 	<p>Core i5</p> 	<p>Turion II</p> 	
	<ul style="list-style-type: none"> • Users with netbooks 	<p>Atom</p> 	<p>Celeron</p> 	<p>Athlon X2</p> 	

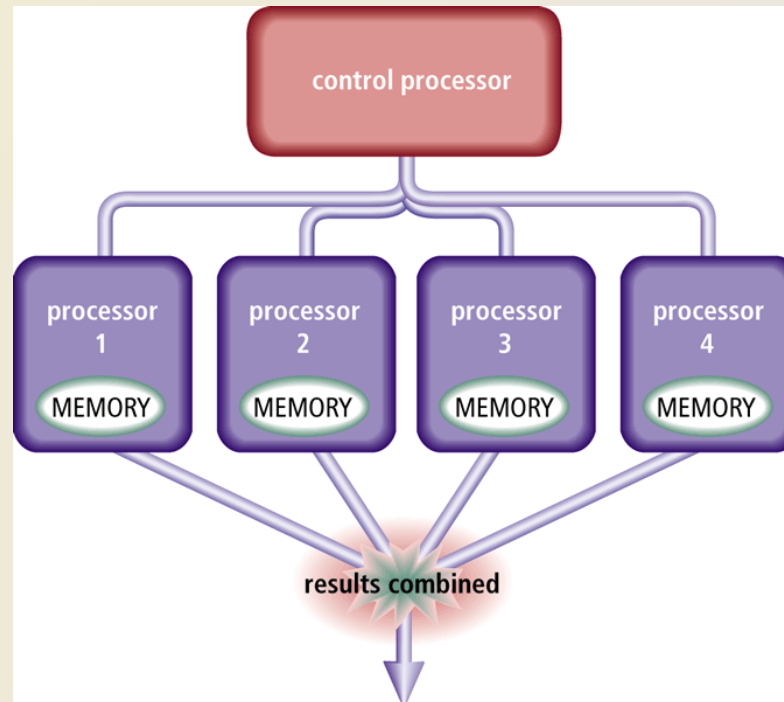
Processor

- A processor chip generates heat that could cause the chip to burn up
- Require additional cooling
 - Heat sinks
 - Liquid cooling technology



Processor

- Parallel processing uses multiple processors simultaneously to execute a single program or task
 - Massively parallel processing involves hundreds or thousands of processors



Data Representation

Analog signals are continuous and vary in strength and quality





Digital signals are in one of two states: on or off

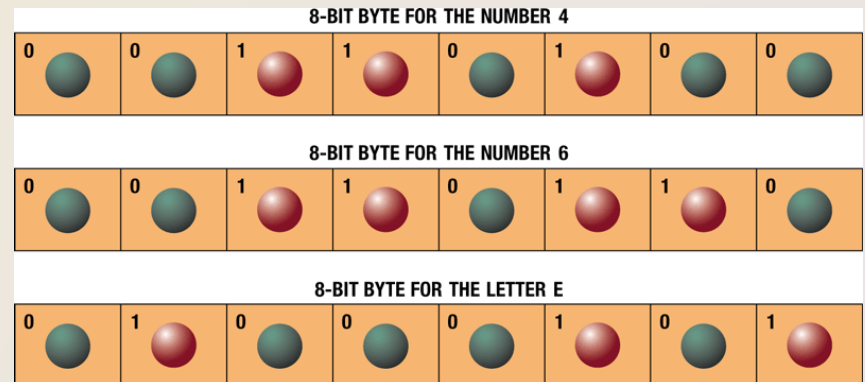
- Most computers are digital
- The **binary system** uses two unique digits (0 and 1)
 - **Bits** and **bytes**

Data Representation

A computer circuit represents the 0 or the 1 electronically by the presence or absence of an electrical charge

Eight bits grouped together as a unit are called a byte. A byte represents a single character in the computer

BINARY DIGIT (BIT)	ELECTRONIC CHARGE	ELECTRONIC STATE
		ON
		OFF



Data Representation

- ASCII (American Standard Code for Information Interchange) is the most widely used coding scheme to represent data

ASCII	SYMBOL	ASCII	SYMBOL
00110000	0	01001110	N
00110001	1	01001111	O
00110010	2	01010000	P
00110011	3	01010001	Q
00110100	4	01010010	R
00110101	5	01010011	S
00110110	6	01010100	T
00110111	7	01010101	U
00111000	8	01010110	V
00111001	9	01010111	W
01000001	A	01011000	X
01000010	B	01011001	Y
01000011	C	01011010	Z
01000100	D	00100001	!
01000101	E	00100010	
01000110	F	00100011	#
01000111	G	00100100	\$
01001000	H	00100101	%
01001001	I	00100110	&
01001010	J	00101000	(
01001011	K	00101001)
01001100	L	00101010	*
01001101	M	00101011	+

Data Representation

How a Letter Is Converted to Binary Form and Back

Step 1

A user presses the capital letter **T** (SHIFT+T keys) on the keyboard, which in turn creates a special code, called a scan code, for the capital letter **T**.



Step 2

The scan code 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.

Step 4

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



T

Memory

- **Memory** consists of electronic components that store instructions waiting to be executed by the processor, data needed by those instructions, and the results of processing the data
- Stores three basic categories of items:

The operating system and other system software

Application programs

Data being processed and the resulting information

Memory

- Each location in memory has an address
- Memory size is measured in **kilobytes (KB or K)**, **megabytes (MB)**, **gigabytes (GB)**, or **terabytes (TB)**

Memory Sizes				
Term	Abbreviation	Approximate Number of Bytes	Exact Number of Bytes	Approximate Number of Pages of Text
Kilobyte	KB or K	1 thousand	1,024	1/2
Megabyte	MB	1 million	1,048,576	500
Gigabyte	GB	1 billion	1,073,741,824	500,000
Terabyte	TB	1 trillion	1,099,511,627,776	500,000,000

Memory

- The system unit contains two types of memory:

Volatile memory

Loses its contents when power is turned off

Example includes **RAM**

Nonvolatile memory

Does not lose contents when power is removed

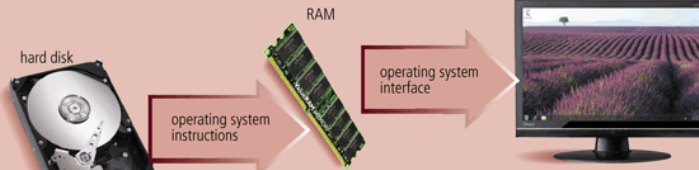
Examples include ROM, flash memory, and CMOS

Memory

How Program Instructions Transfer in and out of RAM

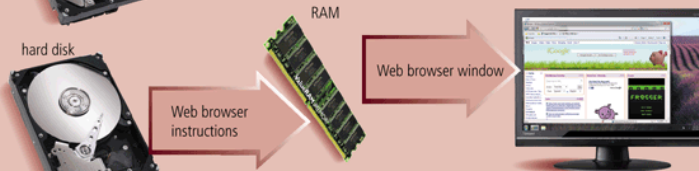
Step 1

When you start the computer, certain operating system files are loaded into RAM from the hard disk. The operating system displays the user interface on the screen.



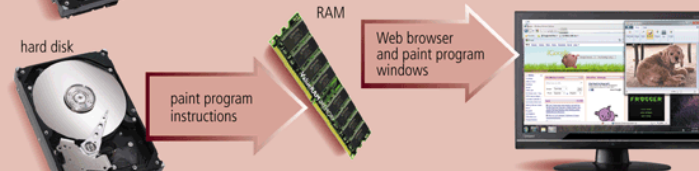
Step 2

When you start a Web browser, the program's instructions are loaded into RAM from the hard disk. The Web browser and certain operating system instructions are in RAM. The Web browser window appears on the screen.



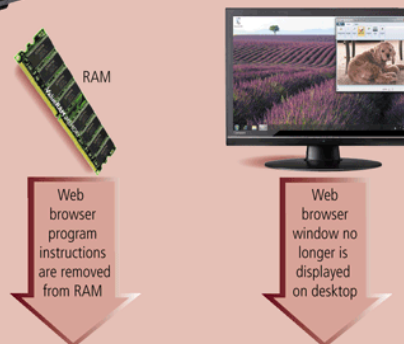
Step 3

When you start a paint program, the program's instructions are loaded into RAM from the hard disk. The paint program, along with the Web browser and certain operating system instructions, are in RAM. The paint program window appears on the screen.



Step 4

When you quit a program, such as the Web browser, its program instructions are removed from RAM. The Web browser no longer is displayed on the screen.



Memory

- Three basic types of RAM chips exist:

Dynamic RAM
(DRAM)

Static RAM (SRAM)

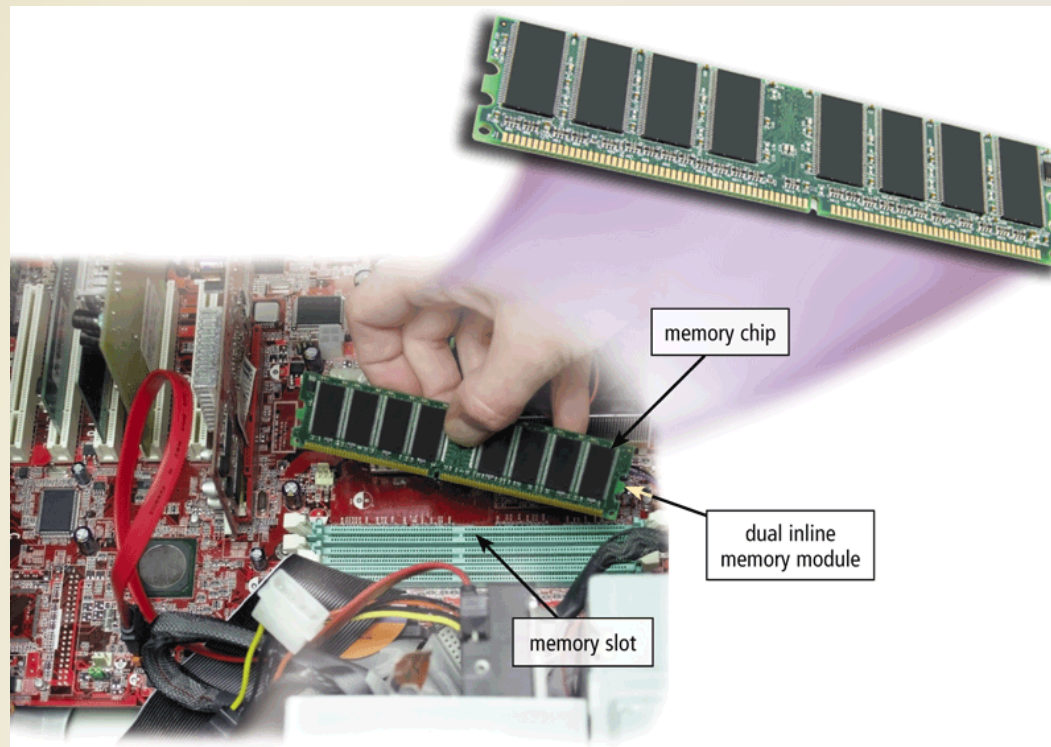
Magnetoresistive
RAM (MRAM)

DRAM Variations

Name	Comments
<i>SDRAM</i> (Synchronous DRAM)	<ul style="list-style-type: none">• synchronized to the system clock• much faster than DRAM
<i>DDR SDRAM</i> (Double Data Rate SDRAM)	<ul style="list-style-type: none">• transfers data twice, instead of once, for each clock cycle• faster than SDRAM
<i>DDR2</i>	<ul style="list-style-type: none">• second generation of DDR• faster than DDR
<i>DDR3</i>	<ul style="list-style-type: none">• third generation of DDR• designed for computers with multi-core processors• faster than DDR2
<i>RDRAM</i> (Rambus DRAM)	<ul style="list-style-type: none">• uses pipelining techniques• much faster than SDRAM

Memory

- RAM chips usually reside on a **memory module** and are inserted into **memory slots**



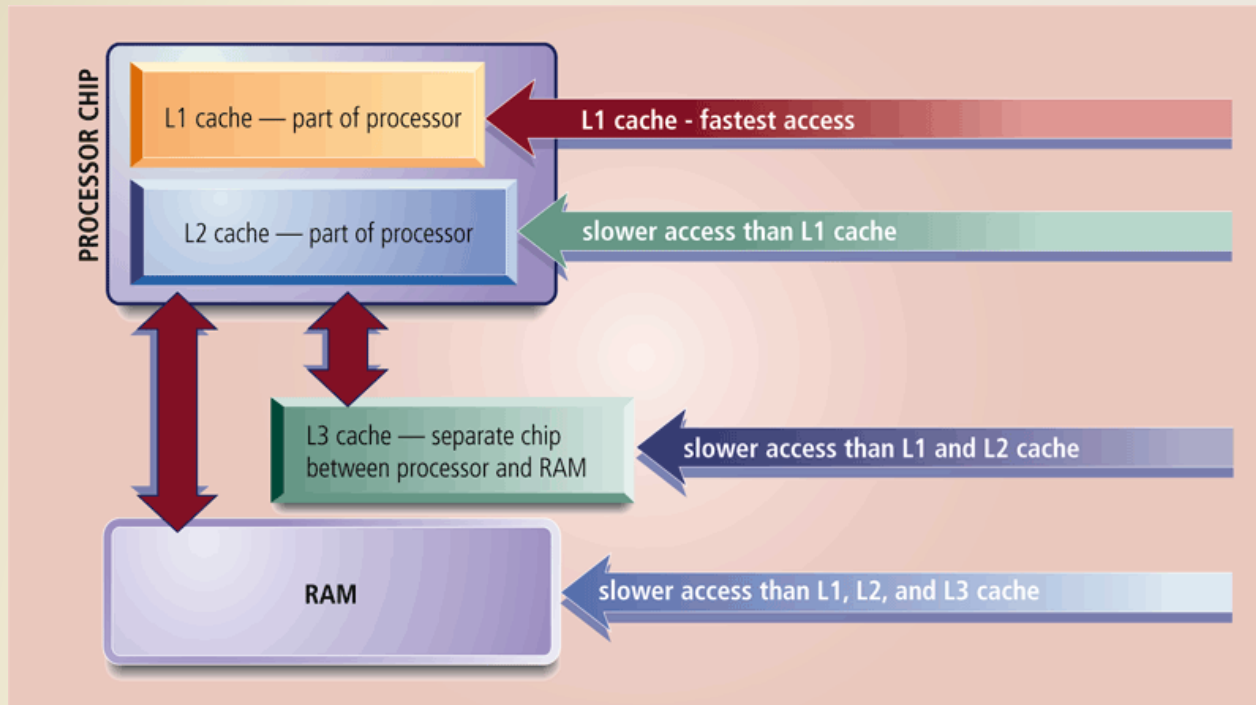
Memory

- The amount of RAM necessary in a computer often depends on the types of software you plan to use

RAM	2 GB or less	2 GB to 8 GB	8 GB and up
Use	Home and business users managing personal finances; using standard application software such as word processing; using educational or entertainment optical discs; communicating with others on the Web	Users requiring more advanced multimedia capabilities; running number-intensive accounting, financial, or spreadsheet programs; using voice recognition; working with videos, music, and digital imaging; creating Web sites; participating in video conferences; playing Internet games	Power users creating professional Web sites; running sophisticated CAD, 3-D design, or other graphics-intensive software

Memory

- **Memory cache** speeds the processes of the computer because it stores frequently used instructions and data



Memory

Read-only memory (ROM) refers to memory chips storing permanent data and instructions

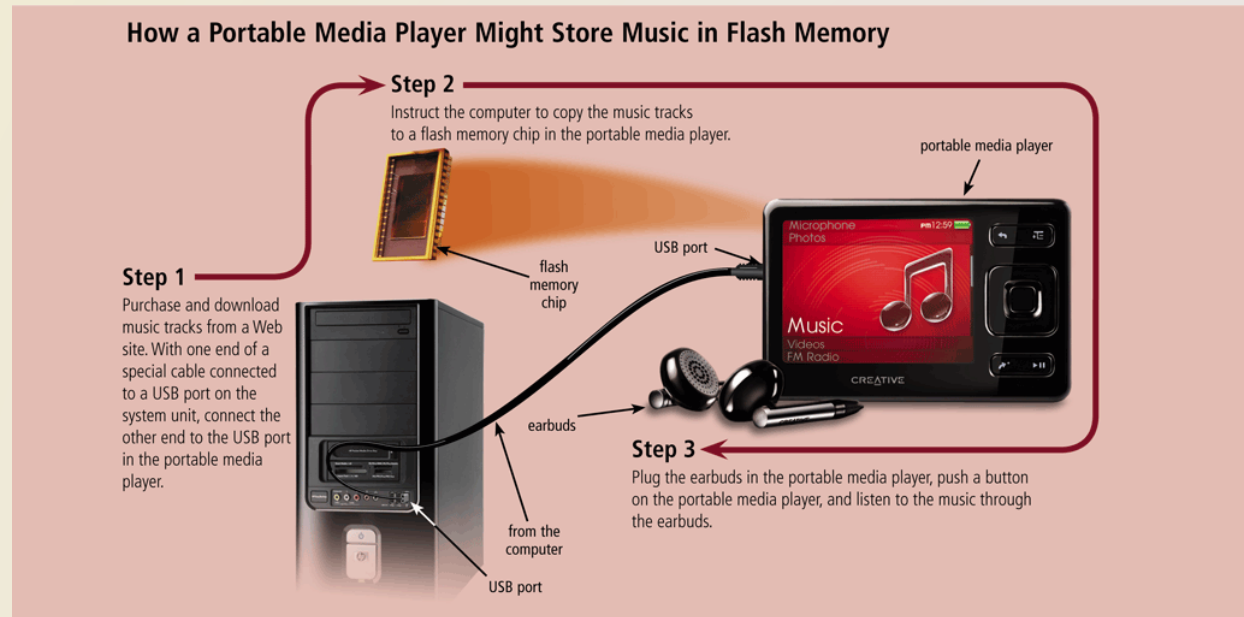
- **Firmware**

A PROM (programmable read-only memory) chip is a blank ROM chip that can be written to permanently

- EEPROM can be erased

Memory

- **Flash memory** can be erased electronically and rewritten
 - **CMOS** technology provides high speeds and consumes little power



Memory

- **Access time** is the amount of time it takes the processor to read from memory
 - Measured in **nanoseconds**

Access Time Terminology

Term	Abbreviation	Speed
Millisecond	ms	One-thousandth of a second
Microsecond	μ s	One-millionth of a second
Nanosecond	ns	One-billionth of a second
Picosecond	ps	One-trillionth of a second

10 million operations = 1 blink



Expansion Slots and Adapter Cards

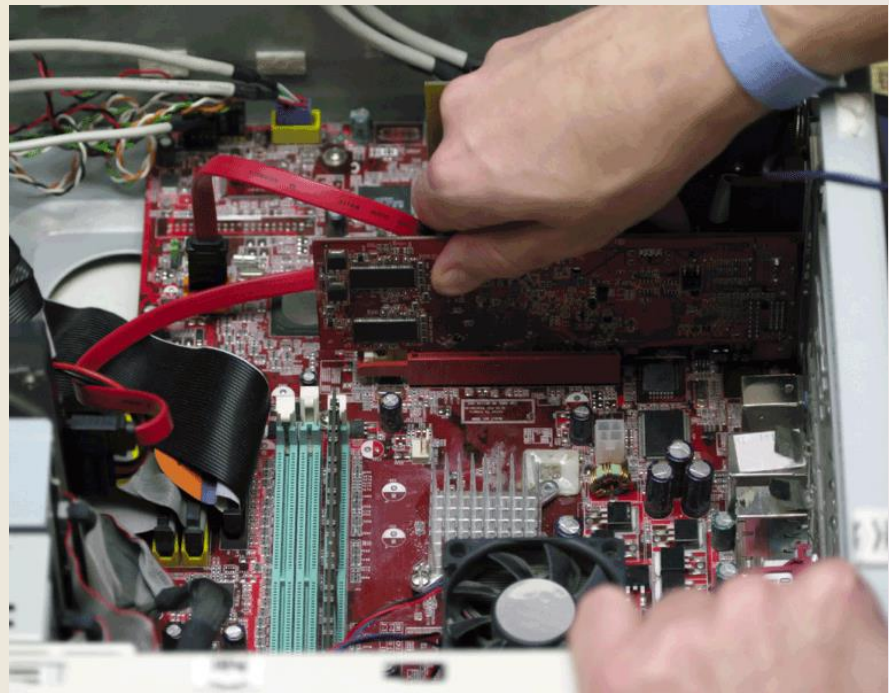
- An **expansion slot** is a socket on the motherboard that can hold an adapter card
- An **adapter card** enhances functions of a component of the system unit and/or provides connections to **peripherals**
 - **Sound card** and **video card**

Types of Adapter Cards

Adapter Card	Purpose
CableCARD	Allows viewing of digital cable television channels
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 lines, cable television lines, or other transmission media
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	Connects to USB devices
Video	Connects a monitor
Video capture	Connects an analog video camera or VCR

Expansion Slots and Adapter Cards

- With **Plug and Play**, the computer automatically can configure adapter cards and other peripherals as you install them



Expansion Slots and Adapter Cards

- Removable flash memory includes:
 - **Memory cards**, USB flash drives, and **PC Cards/ExpressCard modules**

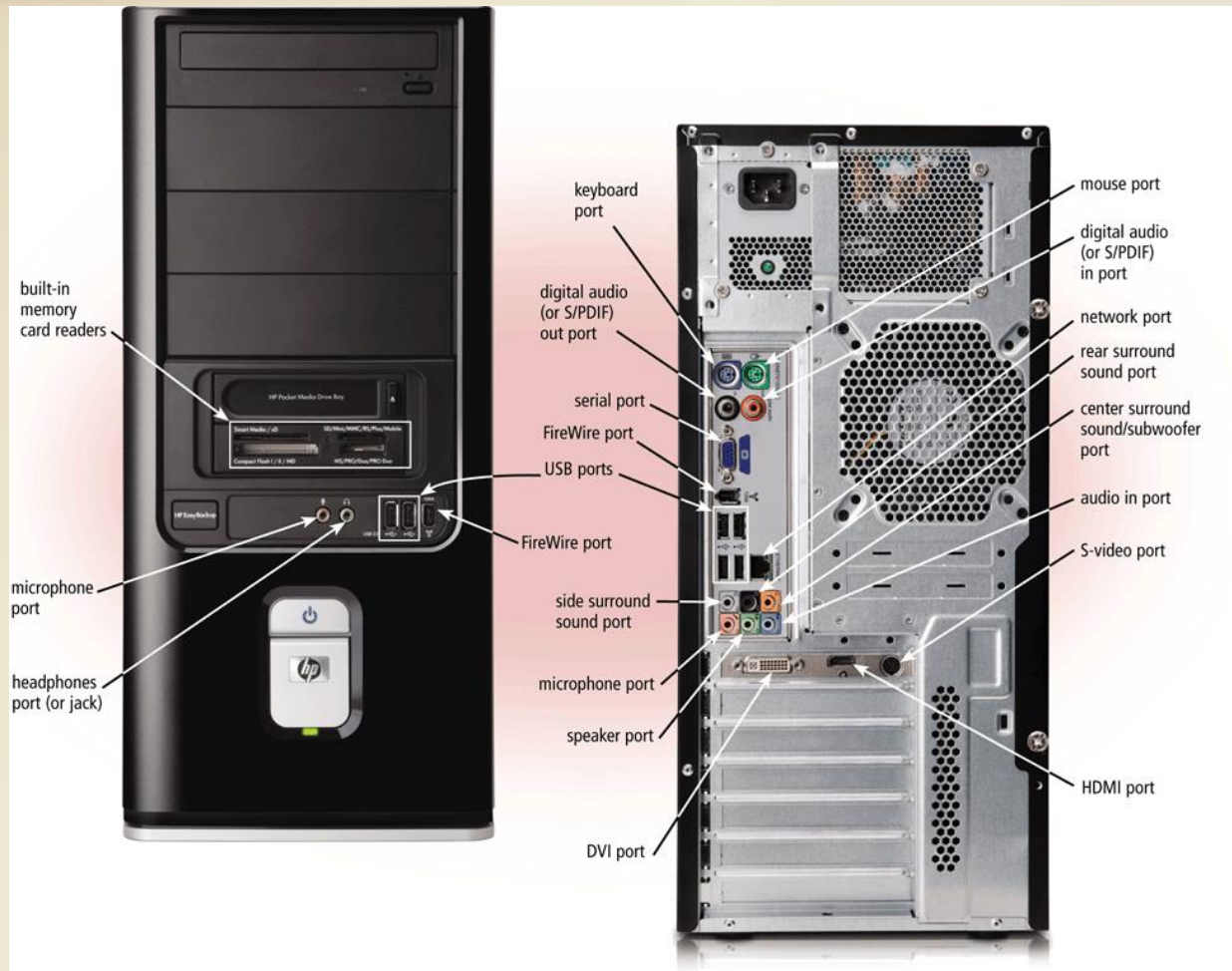


Ports and Connectors

A **port** is the point at which a peripheral attaches to or communicates with a system unit (sometimes referred to as a **jack**)

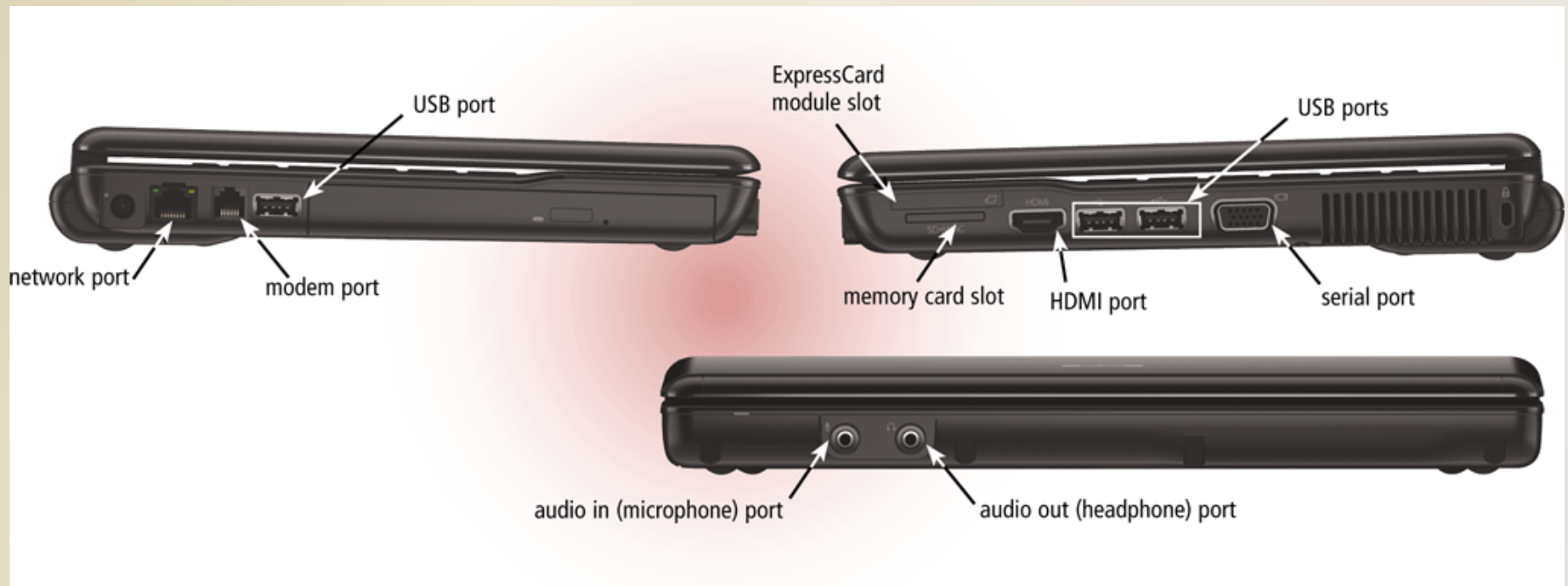
A **connector** joins a cable to a port

Ports and Connectors



























Ports and Connectors

- On a notebook computer, the ports are on the back, front, and/or sides









Ports and Connectors

Port Types					
Type	Picture	Type	Picture	Type	Picture
Audio in		HDMI port		Serial	
Cable TV		Headphones		Side surround sound	
Center surround sound/subwoofer		Keyboard		S/PDIF in	
Composite video in		Microphone		S/PDIF out	
Digital Video Interface (DVI)		Monitor		Speaker	
eSATA port		Mouse		S-video	
FireWire		Network		Telephone line in	
FM reception		Rear surround sound		USB	

Ports and Connectors

- A **USB port** can connect up to 127 different peripherals together with a single connector
 - You can attach multiple peripherals using a single USB port with a **USB hub**

USB Connectors and Ports			
	Connector	Port	Where Used
Type A			Desktop and notebook computers
Type B			Peripherals (printers, scanners, external hard disks, etc.)
Mini-B			Mobile devices (cameras, phones, handheld game consoles)

Ports and Connectors

- Other types of ports include:

**Firewire
port**

**Bluetooth
port**

SCSI port

eSATA port

IrDA port

Serial port

MIDI port

Ports and Connectors

A Bluetooth wireless port adapter converts a USB port into a Bluetooth port



A smart phone might communicate with a notebook computer using an IrDA port

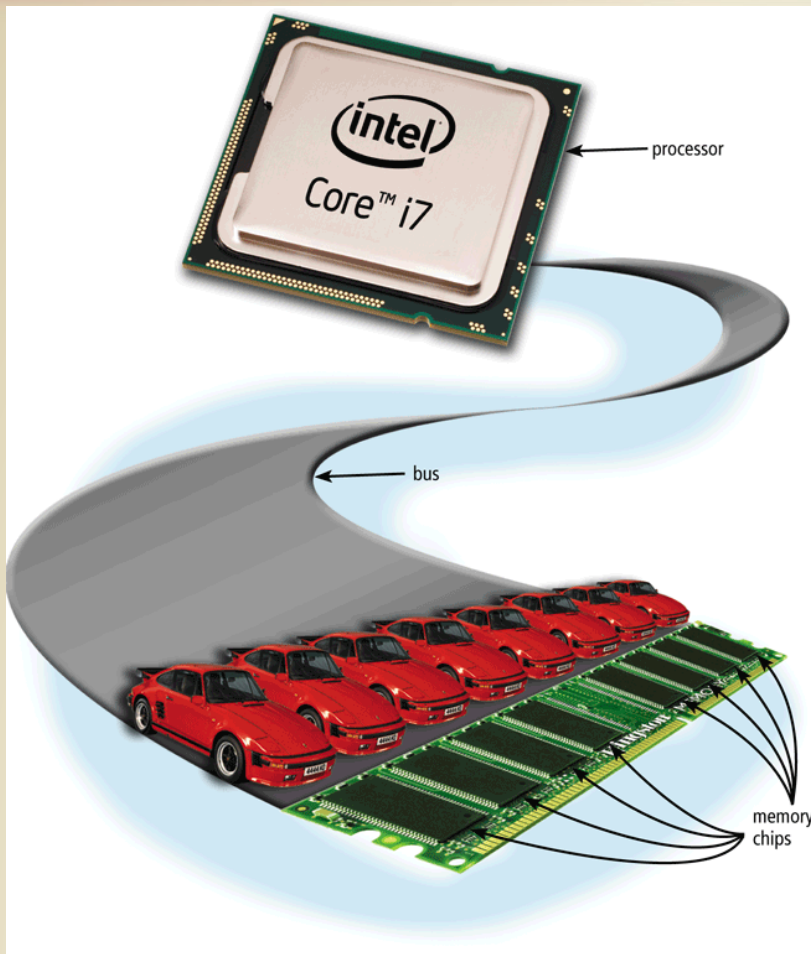


Ports and Connectors

- A port replicator is an external device that provides connections to peripherals through ports built into the device
- A docking station is an external device that attaches to a mobile computer or device



Buses



- A **bus** allows the various devices both inside and attached to the system unit to communicate with each other
 - Data bus
 - Address bus
- **Word size** is the number of bits the processor can interpret and execute at a given time

Buses

- Expansion slots connect to expansion buses
- Common types of expansion buses include:

PCI bus

PCI Express bus

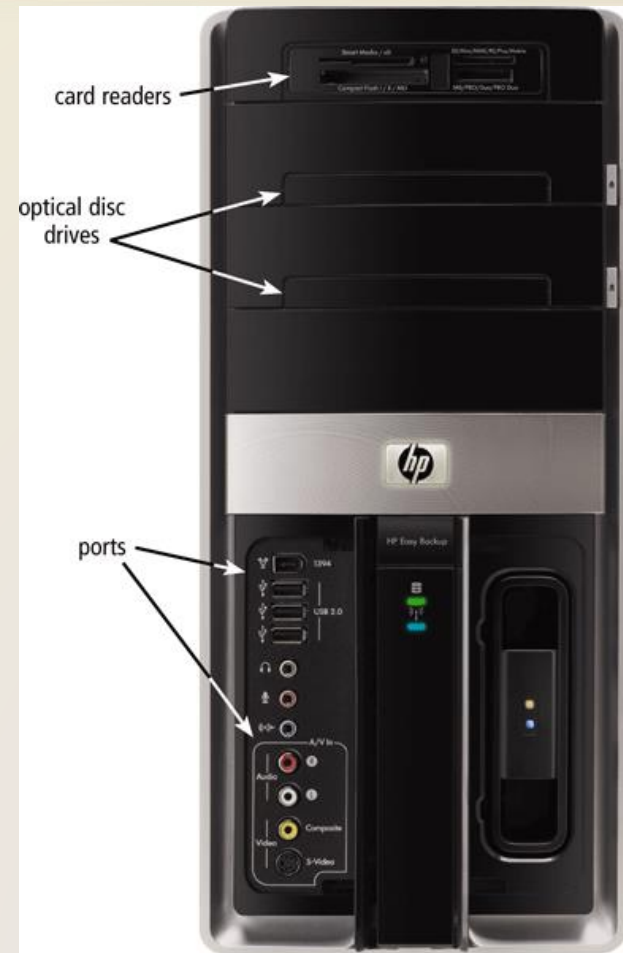
Accelerated
Graphics Port

USB and FireWire
bus

PC Card bus

Bays

- A **bay** is an opening inside the system unit in which you can install additional equipment
 - A **drive bay** typically holds disk drives



Power Supply

The **power supply** converts the wall outlet AC power into DC power

Some external peripherals have an **AC adapter**, which is an external power supply

Putting It All Together



Home

Intel Core i5 or
Intel Core 2 i3 or
AMD Athlon II or
AMD Sempron

Minimum RAM: 2 GB

Small Office/ Home Office

Intel Core i7 or
Intel Core i7 Extreme or
AMD Phenom II or
AMD Athlon II

Minimum RAM: 4 GB

Mobile

Intel Core i7 Extreme or
Intel Core i7 or
AMD Phenom II or
AMD Turion II

Minimum RAM: 2 GB

Putting It All Together



Power

Intel Xeon or
Intel Itanium or
AMD Opteron

Minimum RAM: 8 GB

Enterprise

Intel Core i7 or
Intel Core i7 Extreme
or AMD Phenom II or
AMD Athlon II

Minimum RAM: 4 GB

Keeping Your Computer or Mobile Device Clean

Clean your computer or mobile device once or twice a year

Turn off and unplug your computer or mobile device before cleaning it

Use compressed air to blow away dust

Use an antistatic wipe to clean the exterior of the case and a cleaning solution and soft cloth to clean the screen

Summary

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 the exterior and interior of a system unit

Chapter Four

The Components of the System Unit

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Chapter 4 Complete

