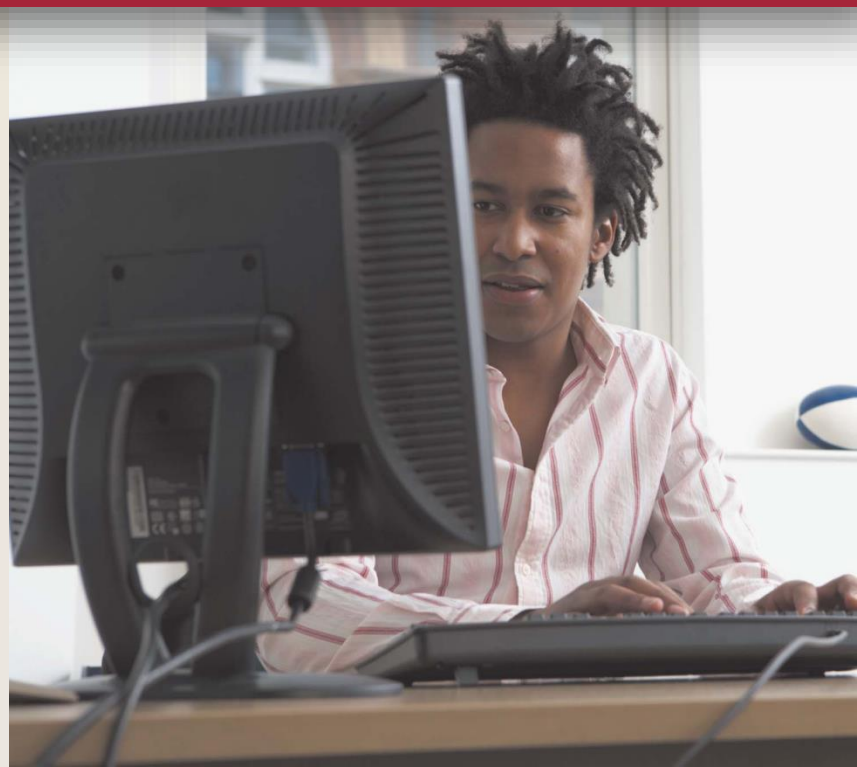
Chapter Four

The Components of the System Unit

Discovering Computers 2012

Your Interactive Guide to the Digital World



The System Unit

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

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Figure 4-1

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

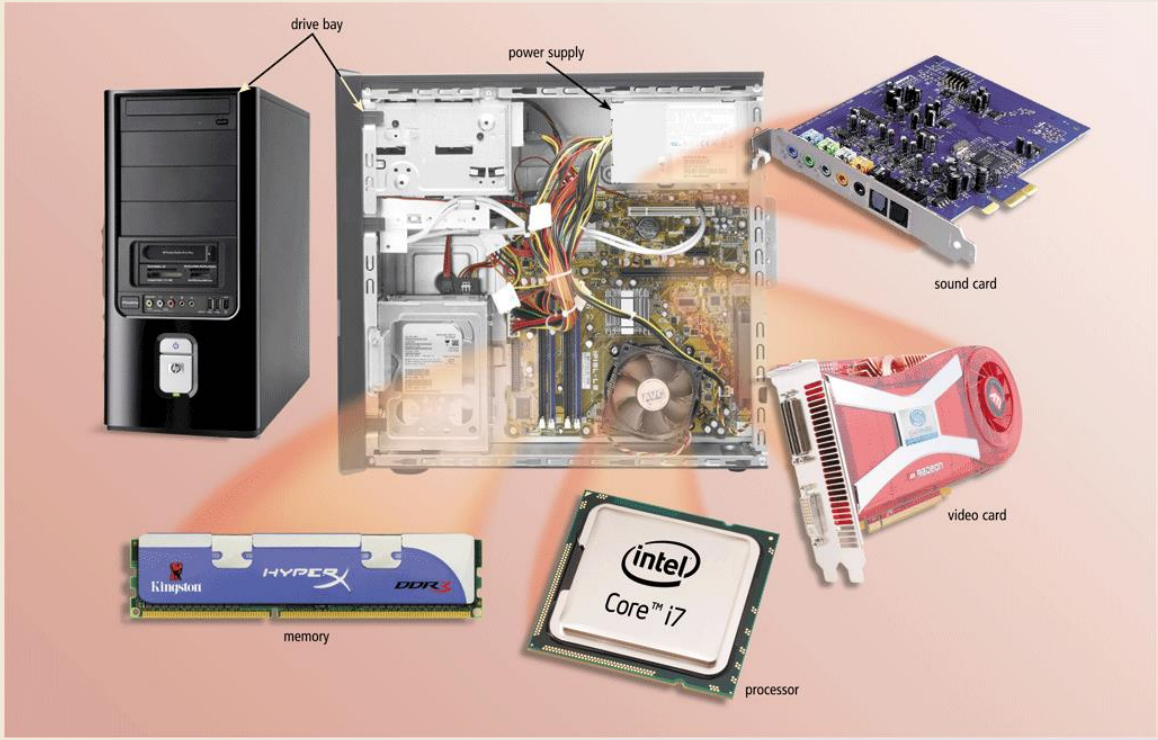

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Figure 4-2

The System Unit

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

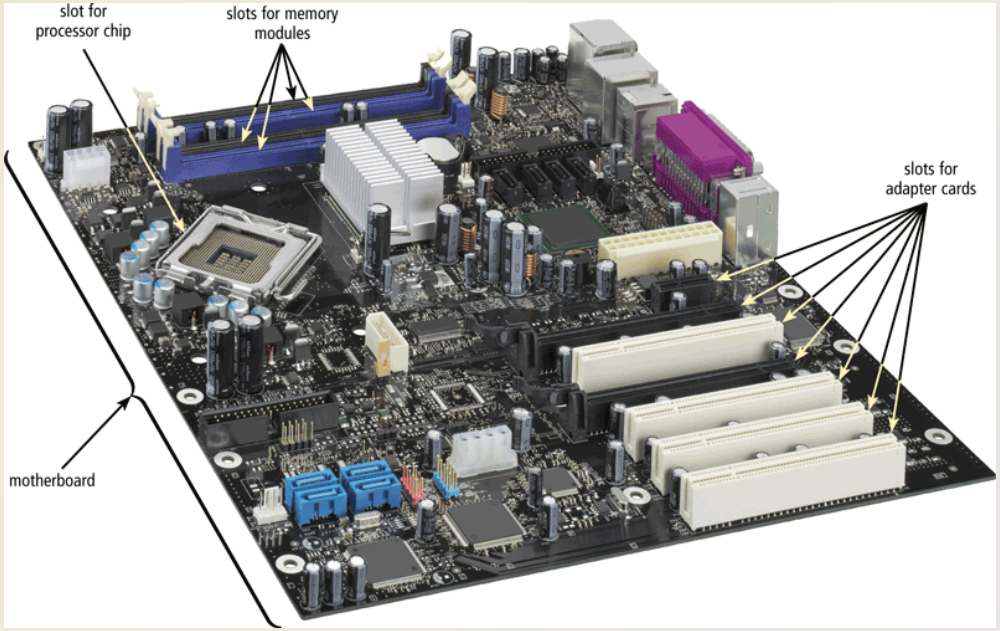

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Figure 4-3

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

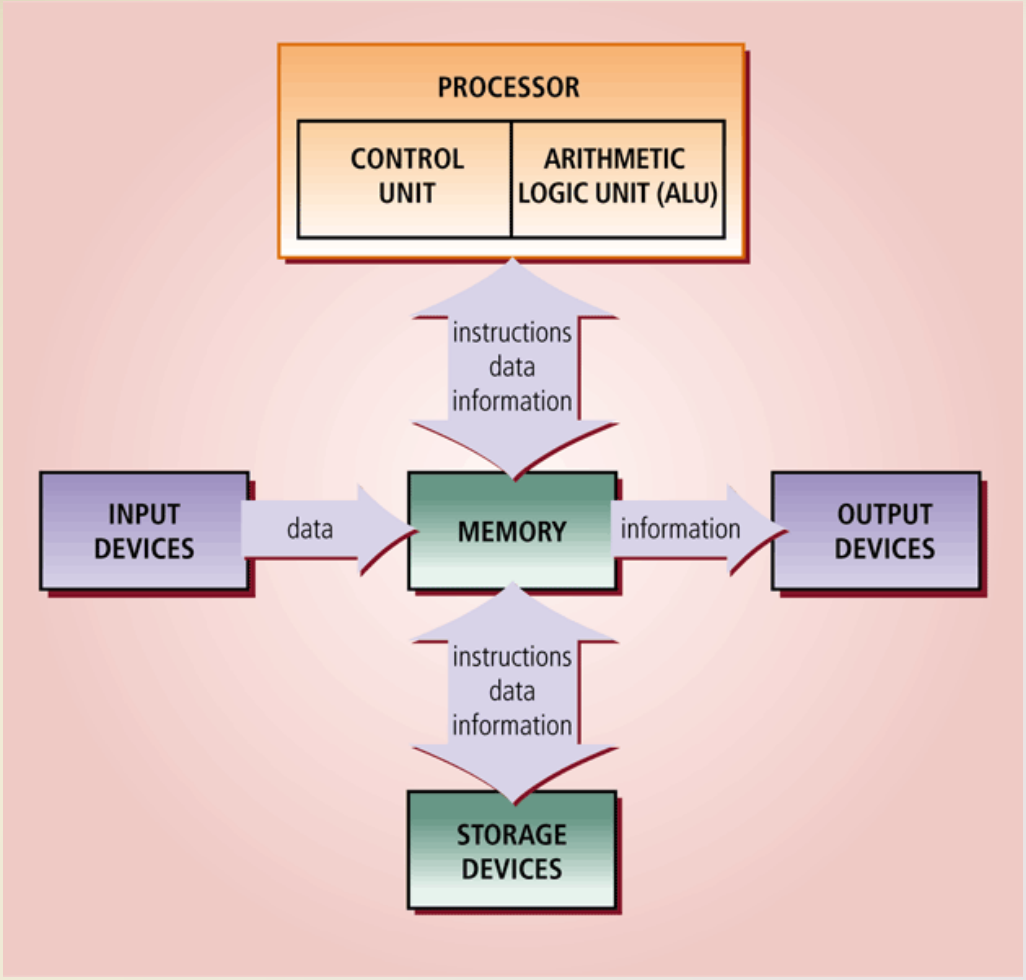

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Figure 4-4

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

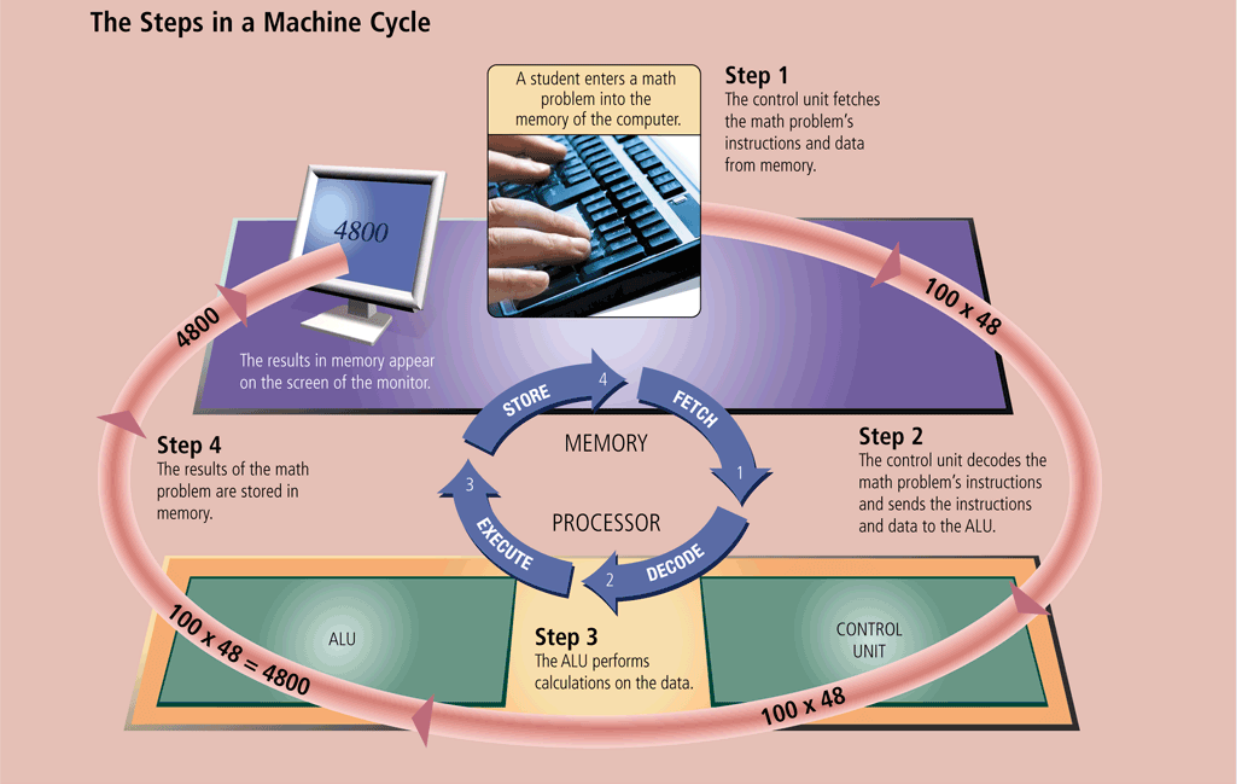

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Figure 4-5

Processor

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

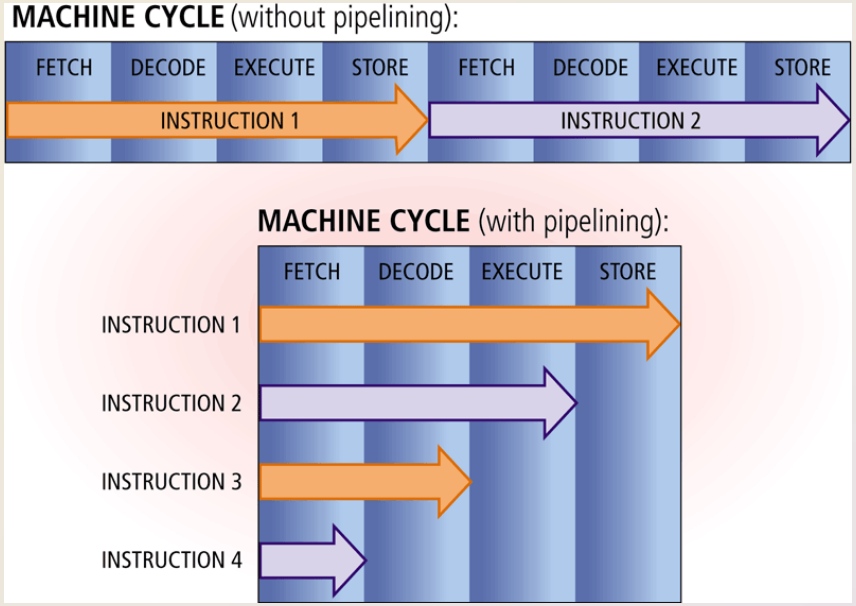

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Figure 4-6

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

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

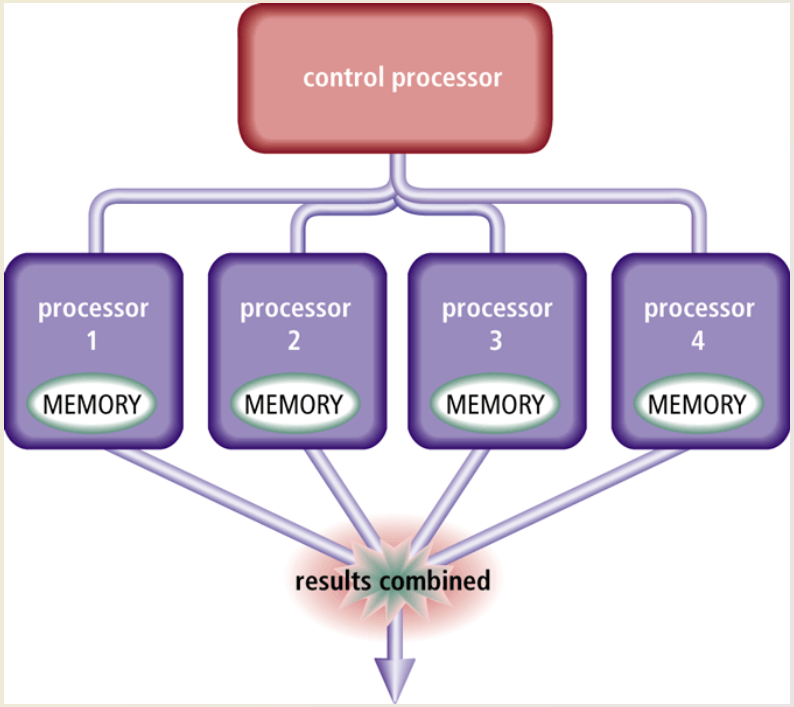

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Figure 4-11

Data Representation

Analog signals are continuous and vary in strength and quality

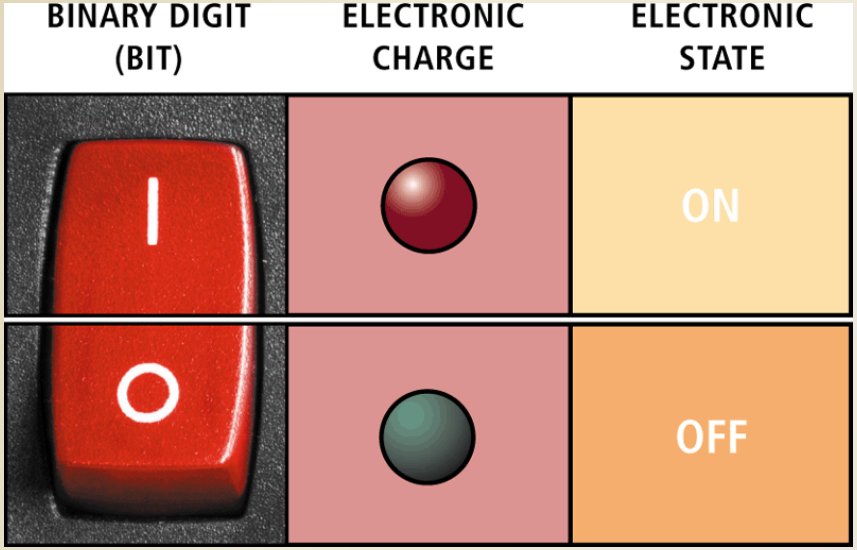
Digital signals are in one of two states: on or off

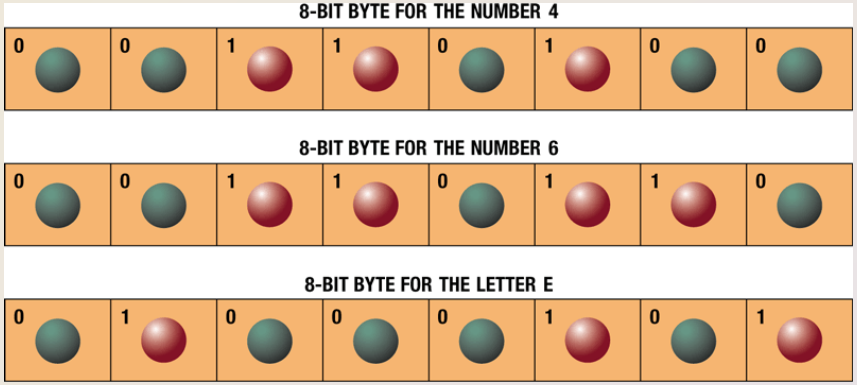
- Most computers are digital
- The **binary system** uses two unique digits (0 and 1)
  - **Bits** and **bytes**

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



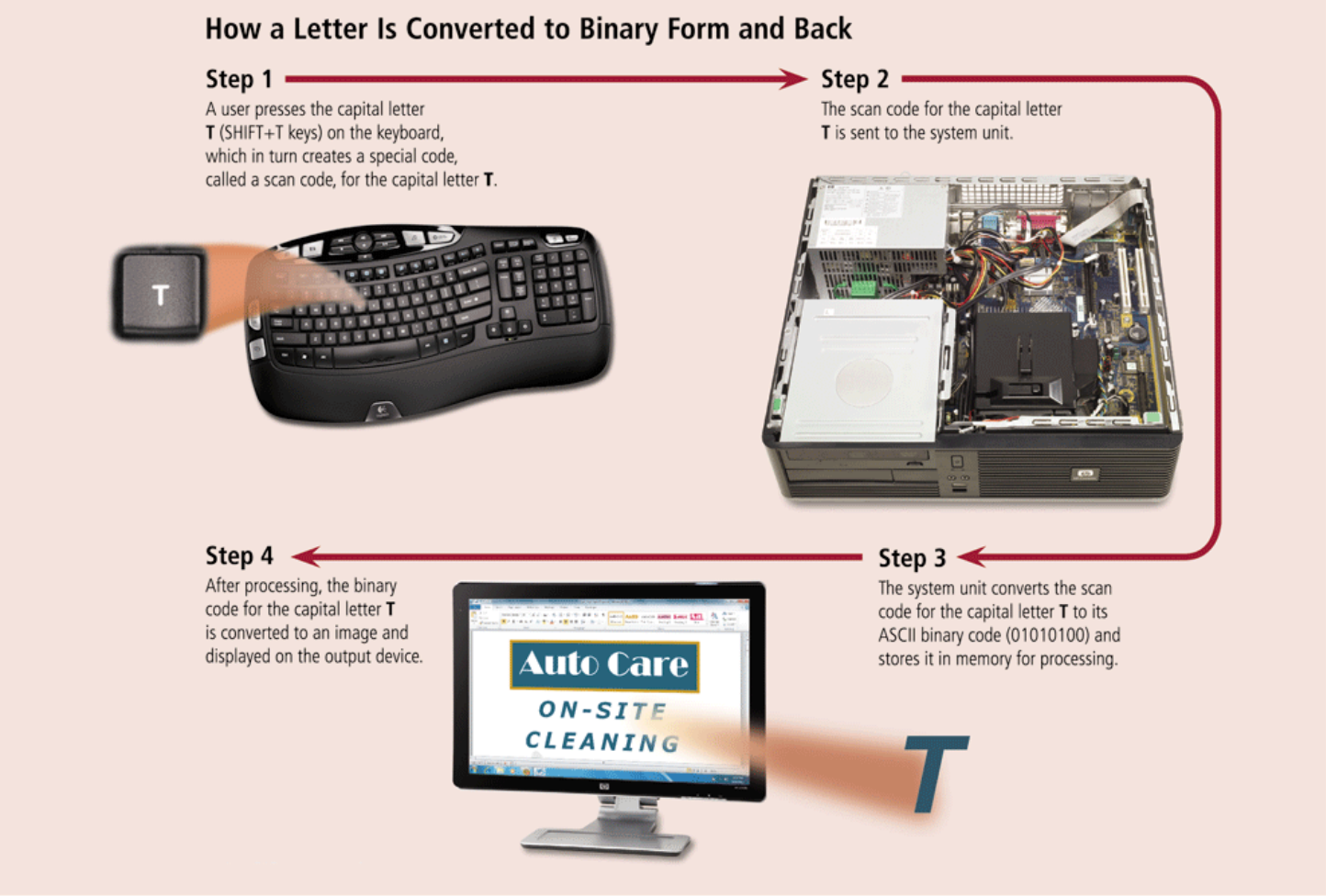


Data Representation

- 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



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

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Figure 4-17

Memory

- The system unit contains two types of memory:

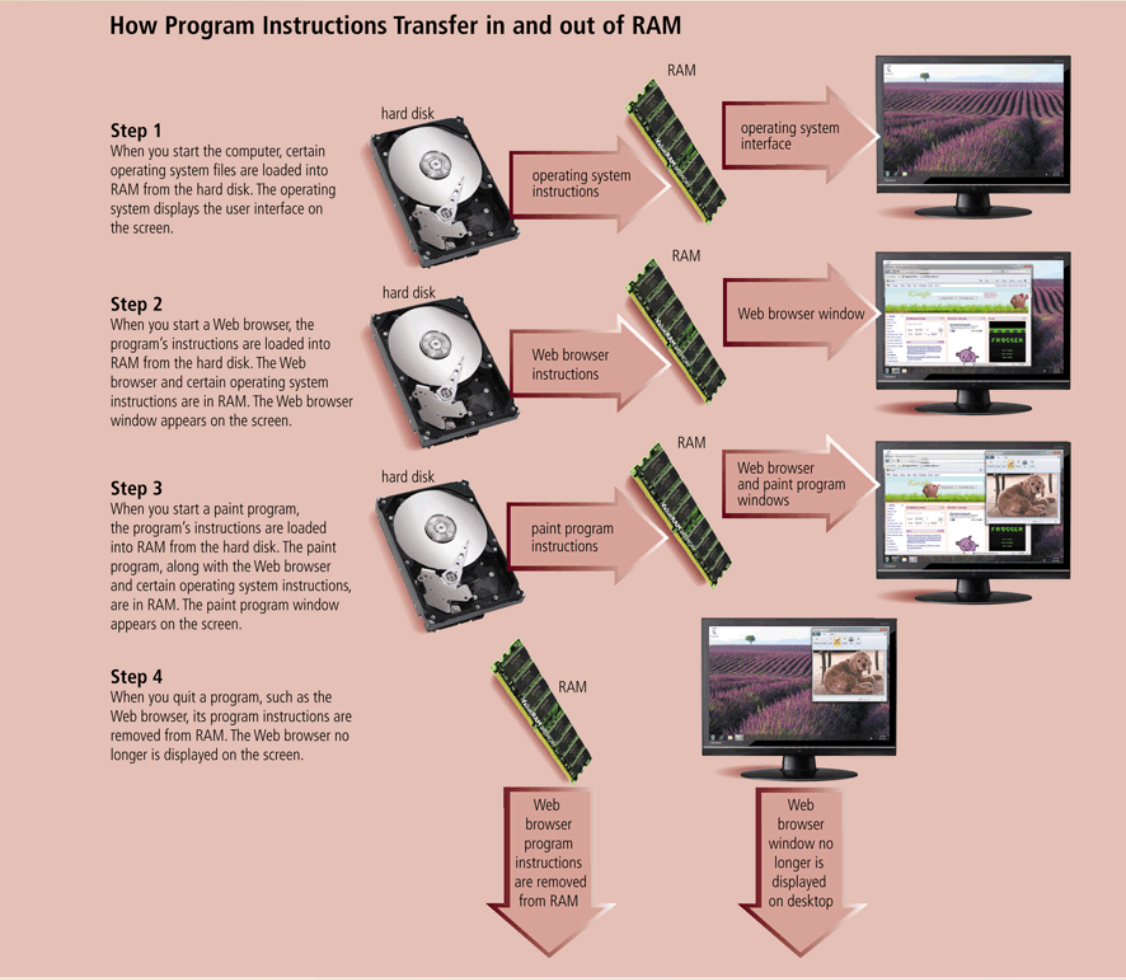
Volatile memory

- 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.
hard disk
RAM
operating system instructions
operating system interface
Web browser instructions
Web browser window
paint program instructions
Web browser and paint program windows
Web browser program instructions are removed from RAM
Web browser window no longer is displayed on desktop

Memory

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

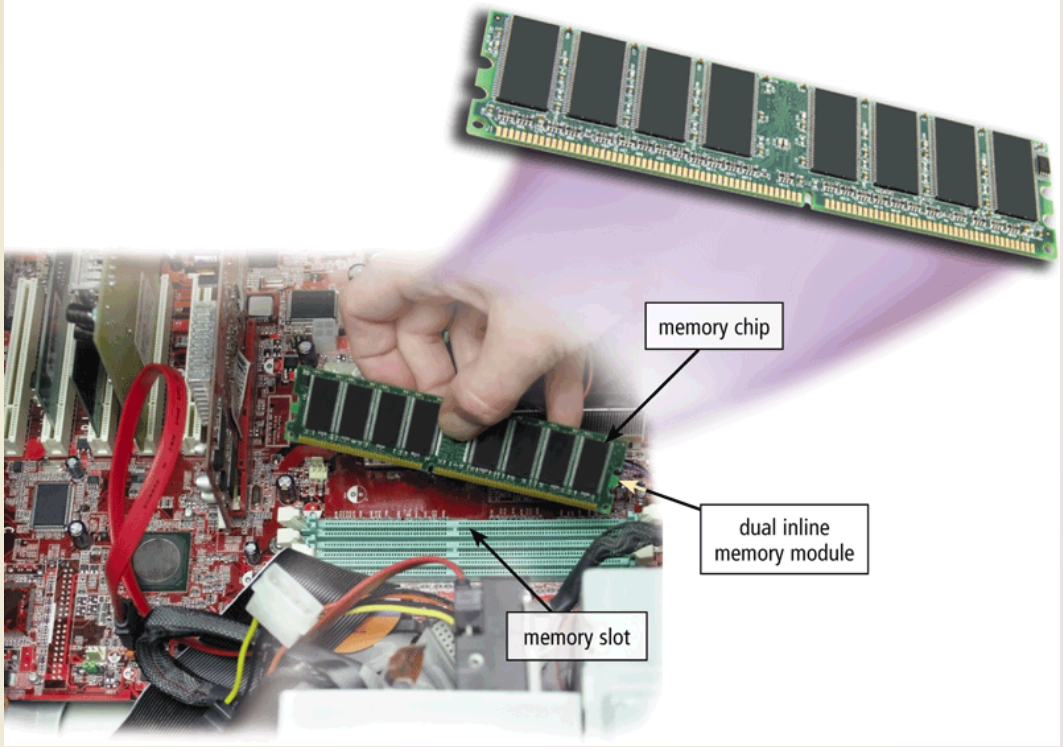


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Figure 4-20

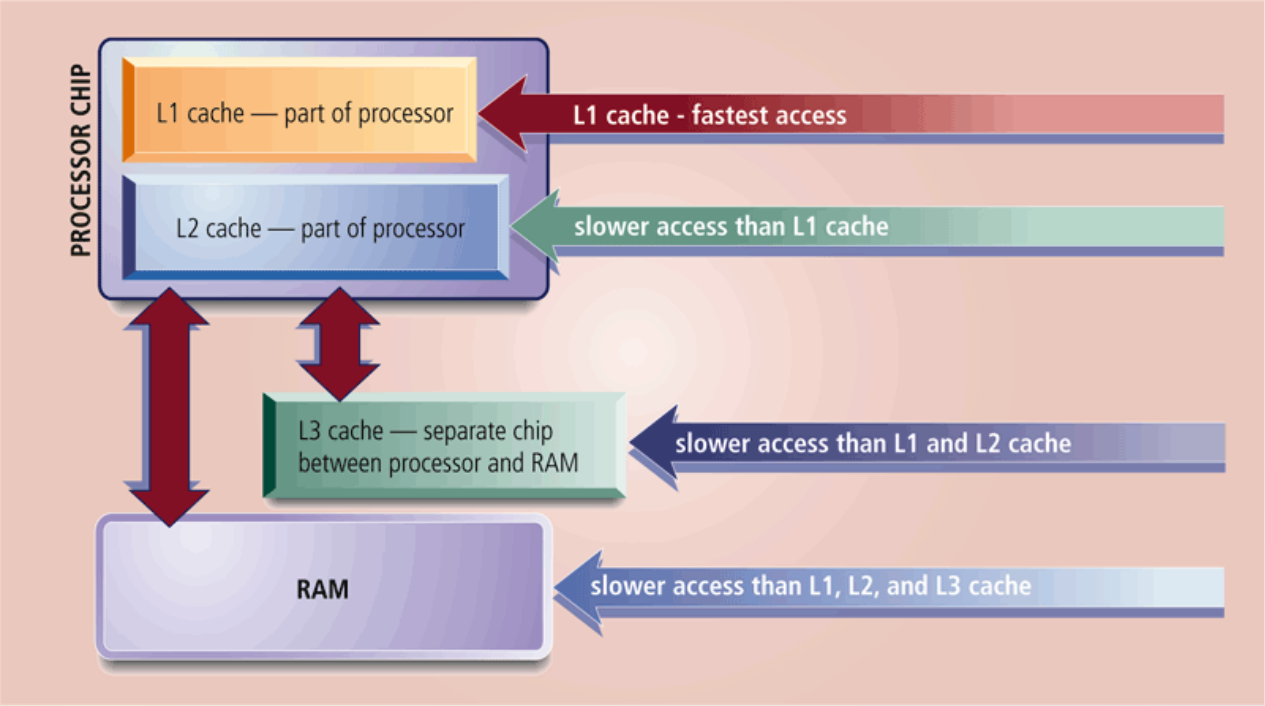
Memory

- 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

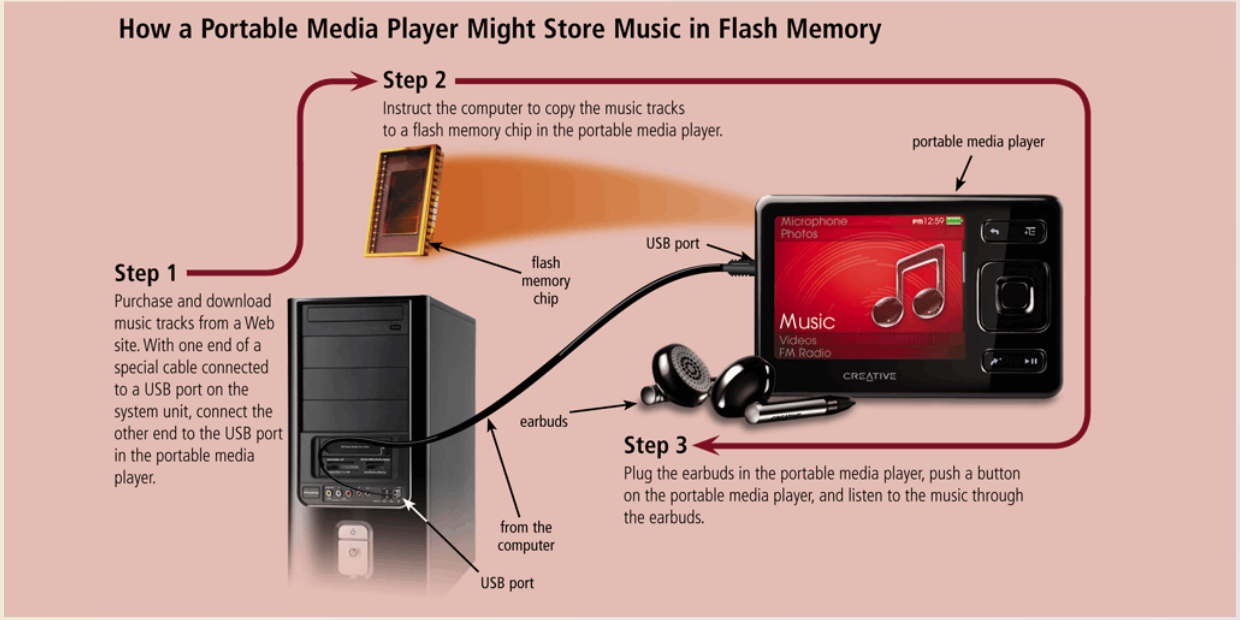


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Figure 4-23

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	µs	One-millionth of a second
Nanosecond	ns	One-billionth of a second
Picosecond	ps	One-trillionth of a second

Expansion Slots and Adapter Cards

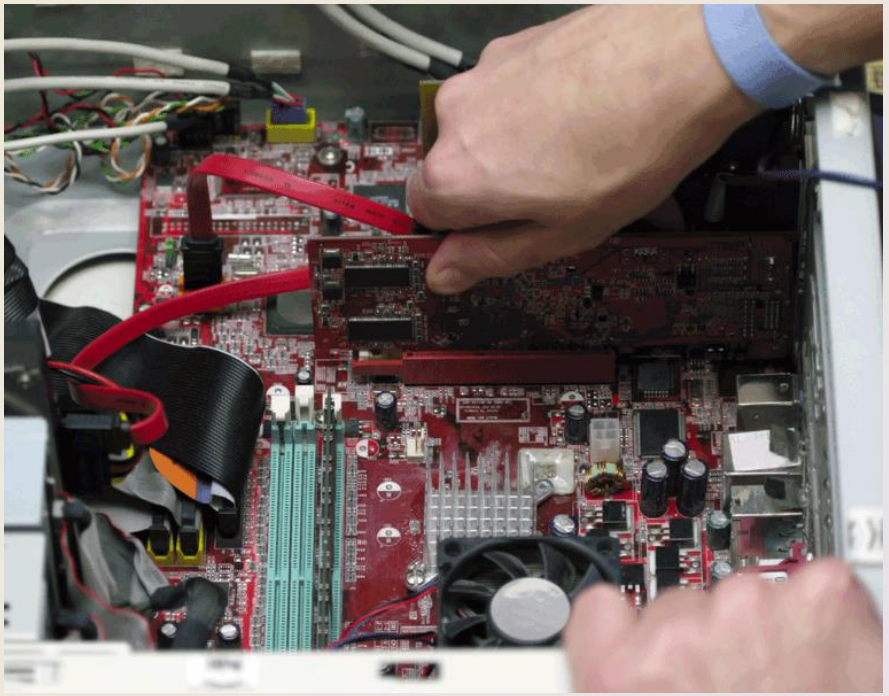
- An **expansion slot** is a socket on the motherboard that can hold an adapter card
- An **adapter card** enhances functions of a component of the system unit and/or provides connections to **peripherals**
  - **Sound card** and **video card**

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

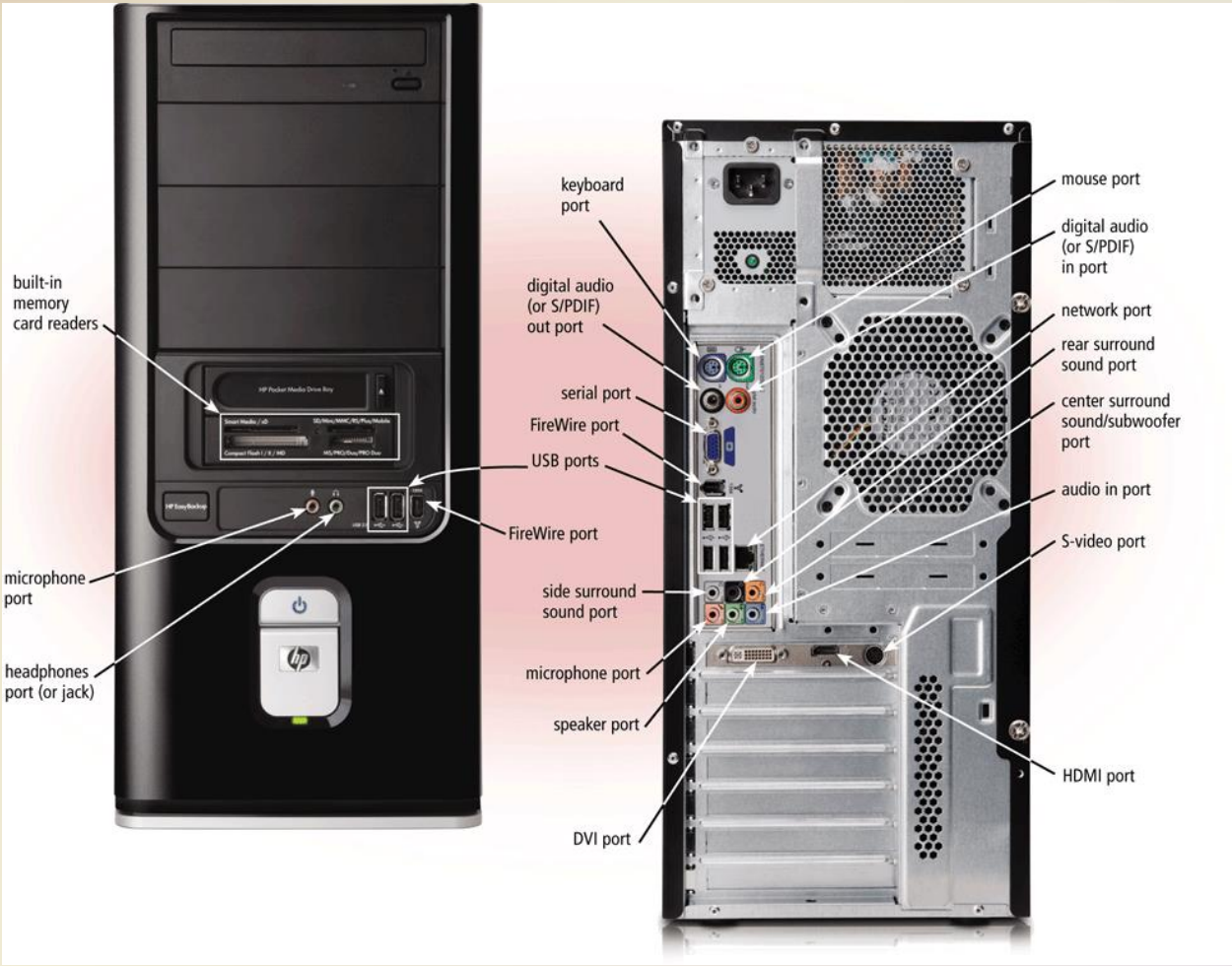


Ports and Connectors

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

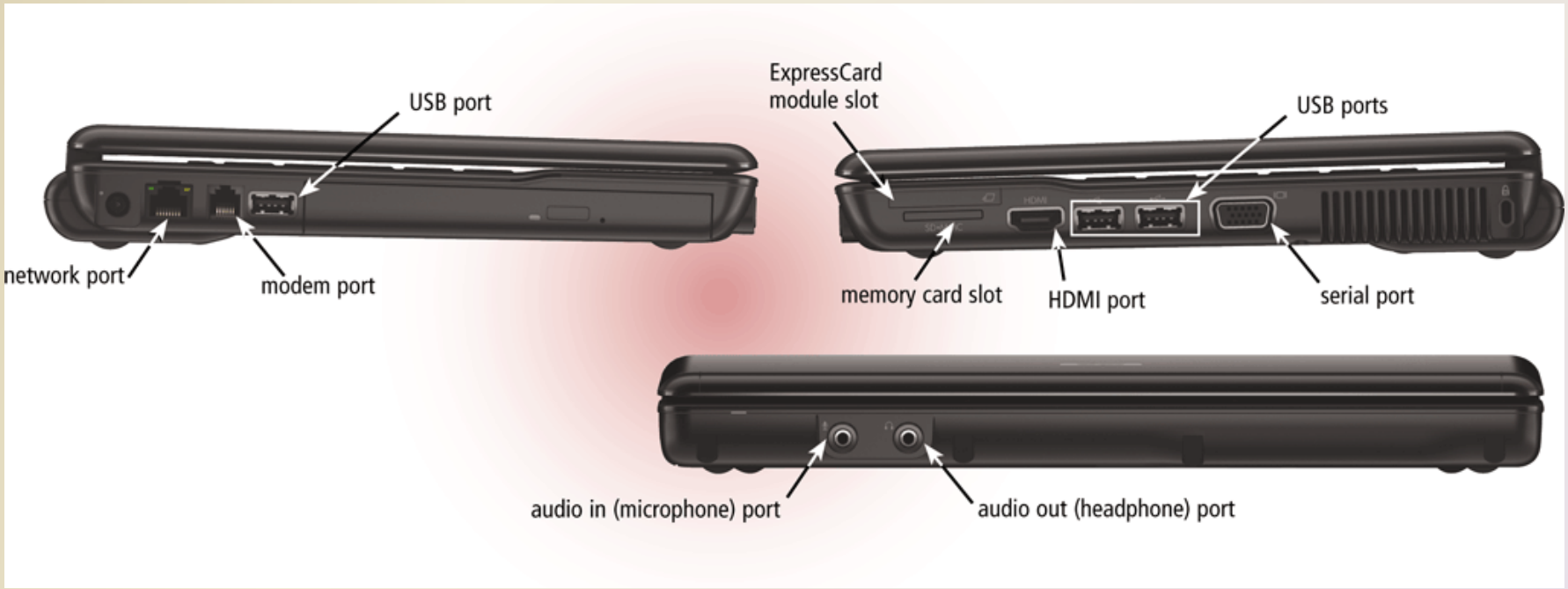


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Figure 4-30

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	

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Figure 4-31

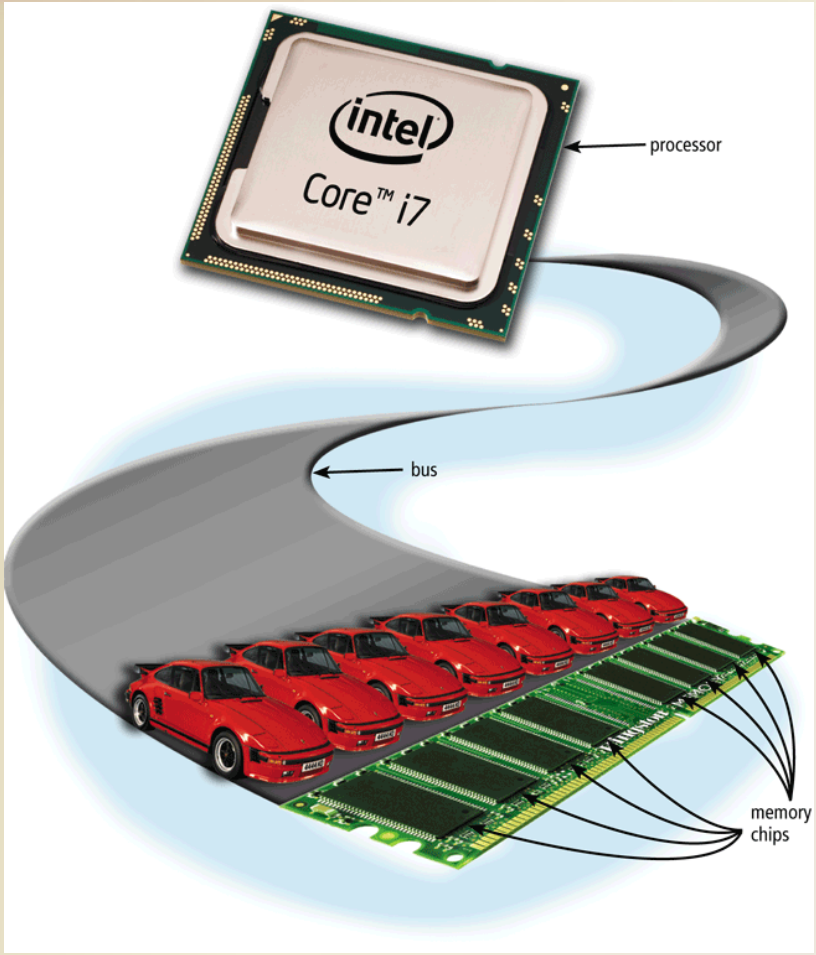
Ports and Connectors

- 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)

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

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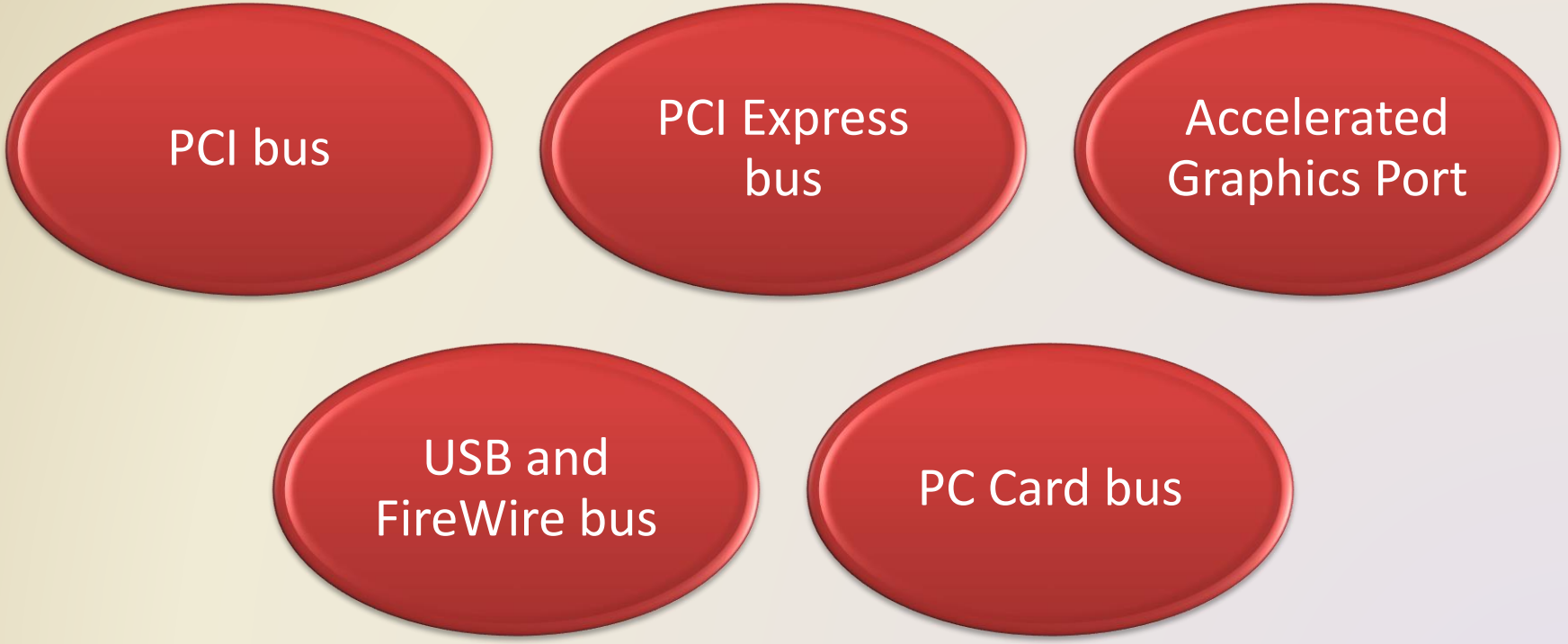
Figure 4-36

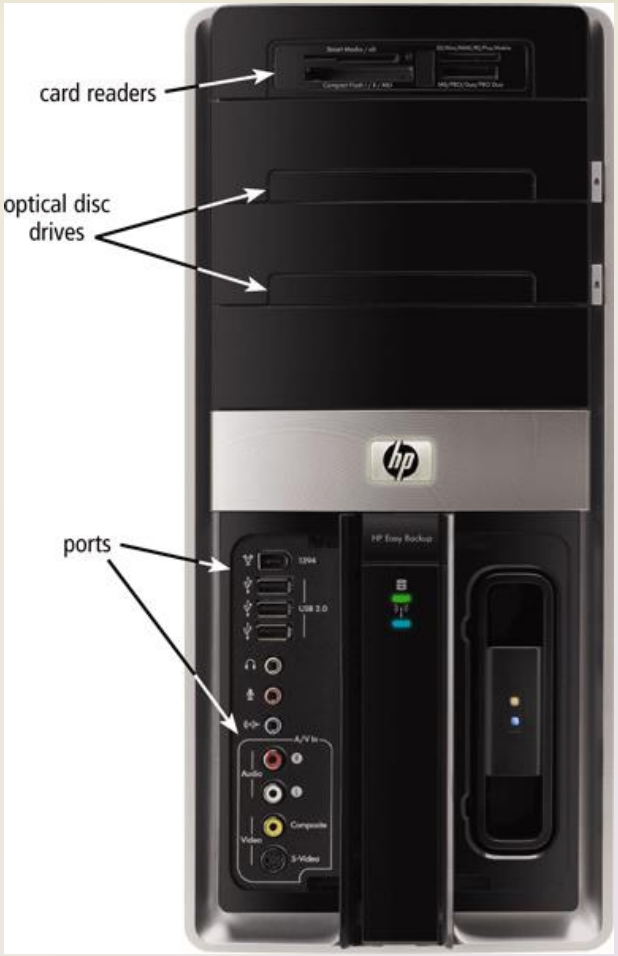
Buses

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



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

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Chapter 4 Complete