

Discovering Computers 2005

A Gateway to Information



Chapter 4 The Components of the System Unit

Chapter 4 Objectives

Differentiate among various styles
of system units

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

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

Identify characteristics of various personal
computer processors on the market today

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

Explain how programs transfer in
and out of memory

Differentiate among the various
types of memory

Describe the types of expansion slots and
adapter cards

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

Describe how buses contribute to a
computer's processing speed

Identify components in mobile computers
and mobile devices

Next

The System Unit

What is the **system unit**?

- Case that contains electronic components of the computer used to process data
 - Sometimes called the **chassis**



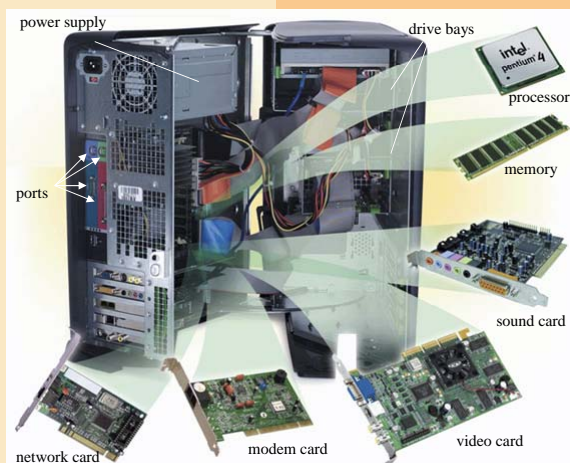
p. 180 Fig. 4-1

Next

The System Unit

What are common components inside the system unit?

- **Processor**
- **Memory**
- **Adapter cards**
 - **Sound card**
 - **Modem card**
 - **Video card**
 - **Network card**
- **Ports**
- **Drive bays**
- **Power supply**



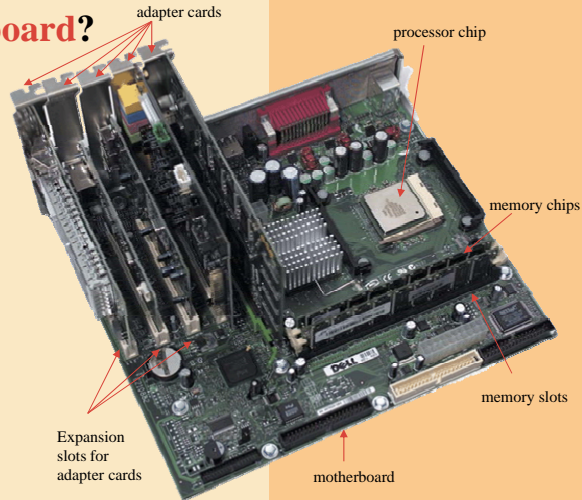
p. 181 Fig. 4-2

Next

The System Unit

What is the **motherboard**?

- Main circuit board in system unit
- Contains adapter cards, processor chips, and memory chips
- Also called system board



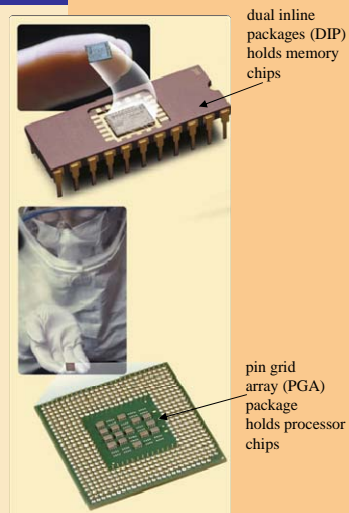
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click Chapter 4, Click Web Link
from left navigation, then click
Clock Motherboards
below Chapter 4
p. 182 Fig. 4-3

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 they can be attached to a circuit board



Click to view animation

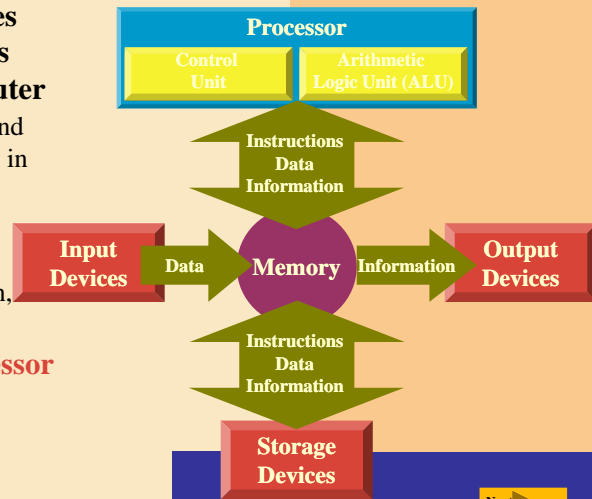
p. 182 Fig. 4-4

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****

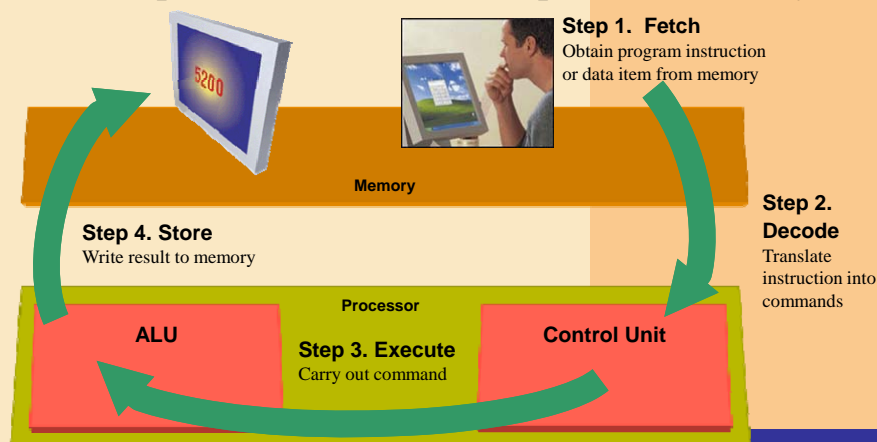


p. 183 Fig. 4-5

Processor

What is a machine cycle?

- **Four operations of the CPU comprise a machine cycle**

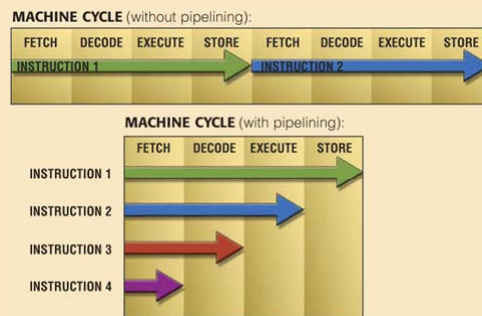


p. 184 Fig. 4-6

Processor

What is pipelining?

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



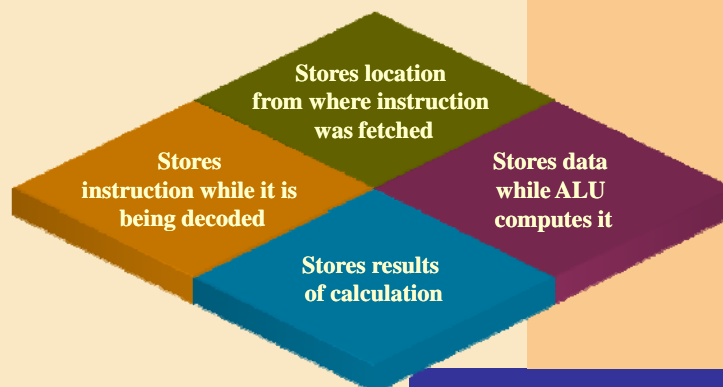
p. 185 Fig. 4-7

Next

Processor

What is a register?

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



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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

Each tick
is a
clock cycle

Pace of system
clock is **clock speed**
Most clock speeds are
in the gigahertz (GHz)
range (1 GHz = one
billion ticks of system
clock per second)

Processor speed can
also be measured in
millions of instructions
per second (MIPS)



Click to view Web Link,
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Clock Speed
below Chapter 4
p. 185

Next

Processor

How do personal computer processors compare?

Comparison of Widely Used Personal Computer Processors		
Name	Date Introduced	Clock Speed
Itanium 2	2002	1.3–1.5 GHz
Xeon	2001	1.4–3.06 GHz
Itanium	2001	733–800 MHz
Pentium 4	2000	1.4–3.2 GHz
Pentium III Xeon™	1999	500–900 MHz
Pentium III	1999	400 MHz–1.4 GHz
Celeron	1998	266 MHz–2.6 GHz
Operon	2003	2–2.4 GHz
Athlon MP	2002	1.53–2.25 GHz
Athlon XP	2001	1.33–2.26 GHz
Athlon	1999	500 MHz–1.4 GHz



Click to view video




p. 186 Fig. 4-8

Next

Processor

Which processor should you select?

- The faster the processor, the more expensive the computer

Intel Processor	Desired Clock Speed
Itanium or Xeon 	1.3 GHz and up
Pentium family 	3.0 GHz and up 2.4 GHz to 3.0 GHz Up to 2.4 GHz
Celeron 	2.2 GHz and up



Click to view video

p. 188 Fig. 4-9

Next ➤

Processor

What are the types of processor upgrades?

Chip-for chip upgrade
replace the chip

Piggyback upgrade
stack new chip on top of old one

Daughterboard upgrade
chip is on adapter card that plugs into motherboard

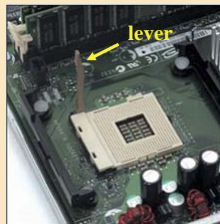
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Next ➤

Processor

What is a zero-insertion force (ZIF) socket?

- Allows you to install and remove chips with no force



Step 1.
Lift the lever on the socket.



Step 2.
Insert the chip.



Step 3.
Push the lever down.

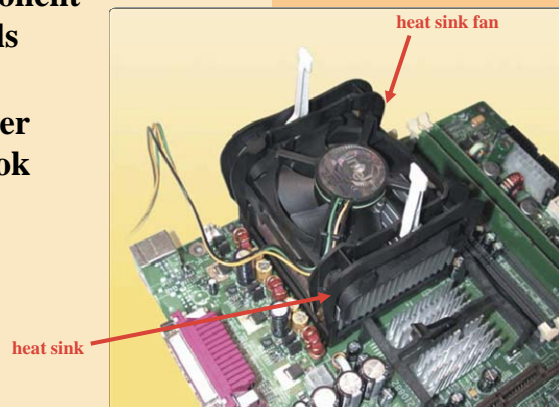
p. 189 Fig. 4-10

Next

Processor

What are heat sinks and heat pipes?

- Heat sink—component with fins that cools processor
- Heat pipe—smaller device for notebook computers



p. 190 Fig. 4-11

Next

Processor

What is a coprocessor?

Chip that assists processor in performing specific tasks

One type is a **floating-point coprocessor**, also known as a math or numeric coprocessor

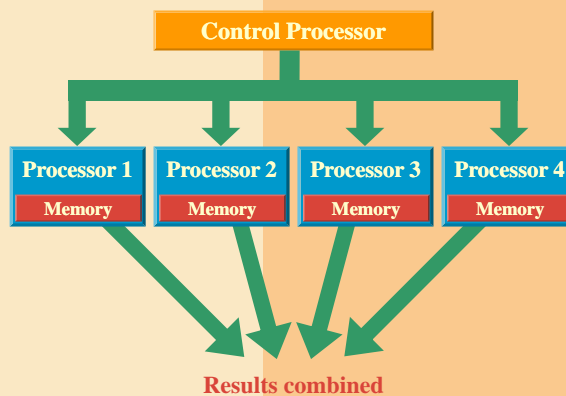
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Next

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. 190 Fig. 4-12

Next

Data Representation

How do computers represent data?

- Most computers are **digital**

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

- 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)

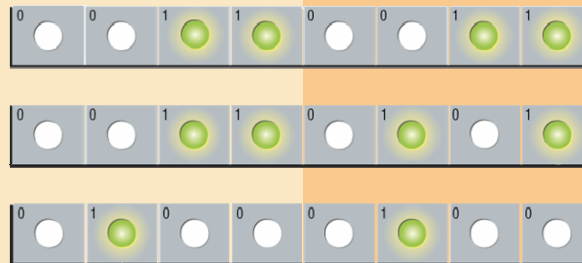
p. 191 Fig. 4-13

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



p. 191 Fig. 4-14

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

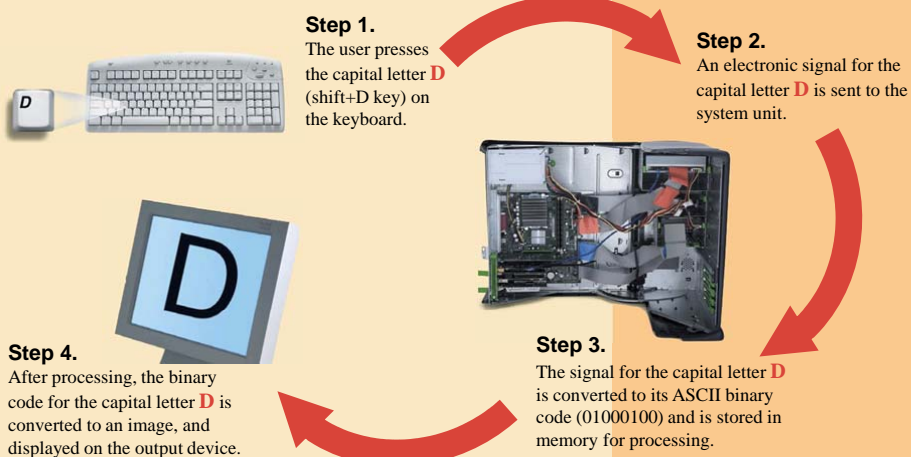
ASCII	Symbol	EBCDIC
00110000	0	11110000
00110001	1	11110001
00110010	2	11110010
00110011	3	11110011

p. 192 Fig. 4-15

Next

Data Representation

How is a letter converted to binary form and back?



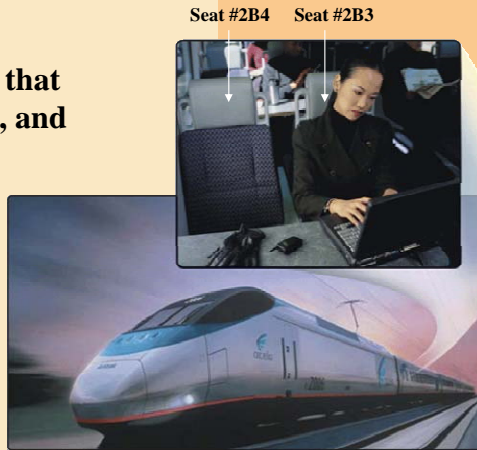
p. 193 Fig. 4-16

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 on a passenger train



p. 193 Fig. 4-17

Next ➤

Memory

How is memory measured?

- By number of bytes available for storage

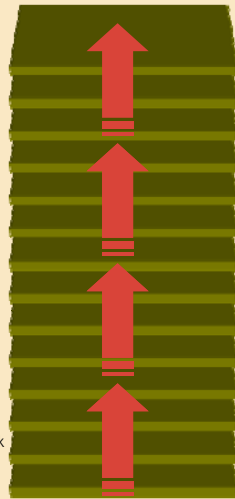
Term	Abbreviation	Approximate Size
Kilobyte	KB or K	1 thousand bytes
Megabyte	MB	1 million bytes
Gigabyte	GB	1 billion bytes
Terabyte	TB	1 trillion bytes

p. 194 Fig. 4-18

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

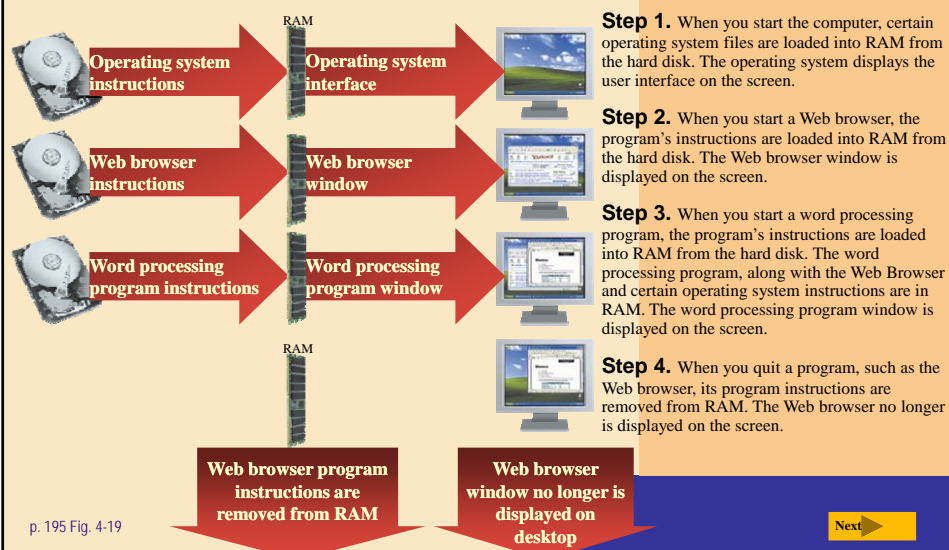


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Next

Memory

How do program instructions transfer in and out of RAM?

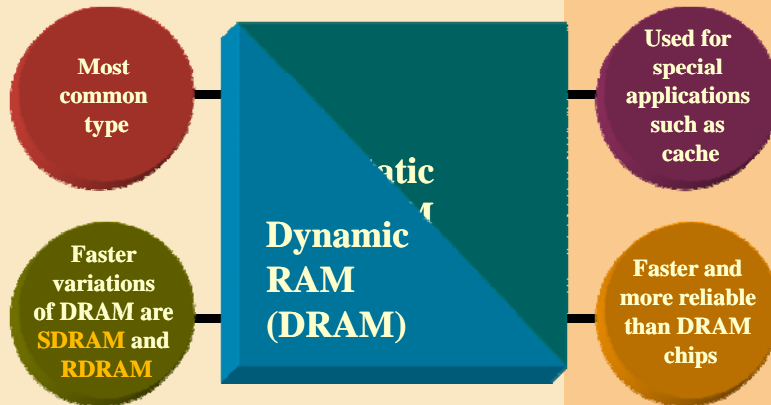


p. 195 Fig. 4-19

Next

Memory

What are two basic types of RAM chips?



Future: Magnetoresistive RAM (MRAM)

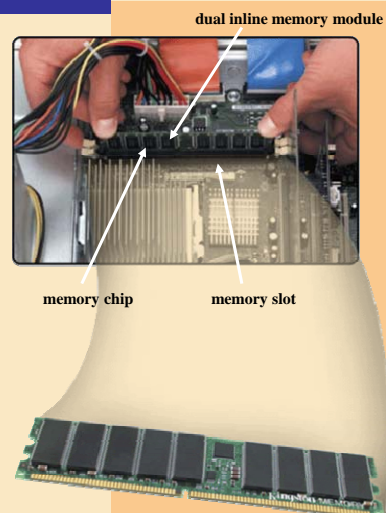
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Next

Memory

Where does memory reside?

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



p. 196 Fig. 4-20

Next

Memory

How much RAM does an application require?

- Software package typically indicates RAM requirements
- For optimal performance, you need more than minimum specifications

System Requirements
Windows® XP Home Edition/Professional

- Intel Pentium processor at 233MHz or higher
- AMD K6 (Athlon Duron Family processor at 233MHz or higher
- 64 MB of RAM



p. 197 Fig. 4-21

Next

Memory

How much RAM do you need?

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

RAM	128 to 256 MB	256 to 1 GB	1 GB and up
Use	<ul style="list-style-type: none">• Home and business users managing personal finance• Using standard application software such as word processing• Using educational or entertainment CD-ROMs• Communicating with others on the Web	<ul style="list-style-type: none">• 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	<ul style="list-style-type: none">• Power users creating professional Web sites• Running sophisticated CAD, 3D design, or other graphics-intensive software

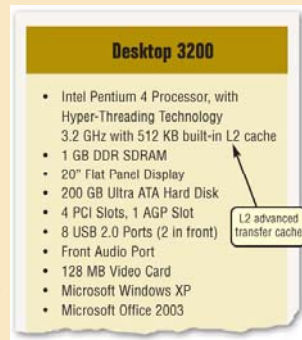
p. 197 Fig. 4-22

Next

Memory

What is **cache**?

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



- L1 cache built into processor
- L2 cache slower but has larger capacity
- L2 advanced transfer cache is faster, built directly on processor chip
- L3 cache is separate from processor chip on motherboard (L3 is only on computers that use L2 advanced transfer cache)

Click to view Web Link, click Chapter 4, Click Web Link from left navigation, then click Cache below Chapter 4
p. 198 Fig. 4-23

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

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

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

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Next

Memory

What is **flash memory**?

- Nonvolatile memory that can be erased electronically and reprogrammed
- Used with PDAs, digital cameras, digital cellular phones, music players, digital voice recorders, printers, Internet receivers, and pagers

Step 1.

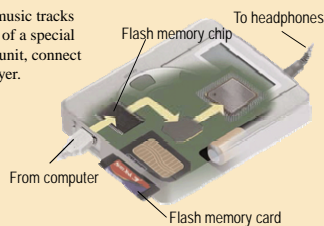
Purchase and download MP3 music tracks from a Web site. With one end of a special cable connected to the system unit, connect the other end into the MP3 player.



Click to view Web Link, click Chapter 4, Click Web Link from left navigation, then click Flash Memory below Chapter 4
p. 199 Fig. 4-24

Step 2.

Instruct the computer to copy the MP3 music track to the flash memory chip in the MP3 player.



Step 3.

Plug the headphones into the MP3 player, push a button on the MP3 player, and listen to the music through the headphones.

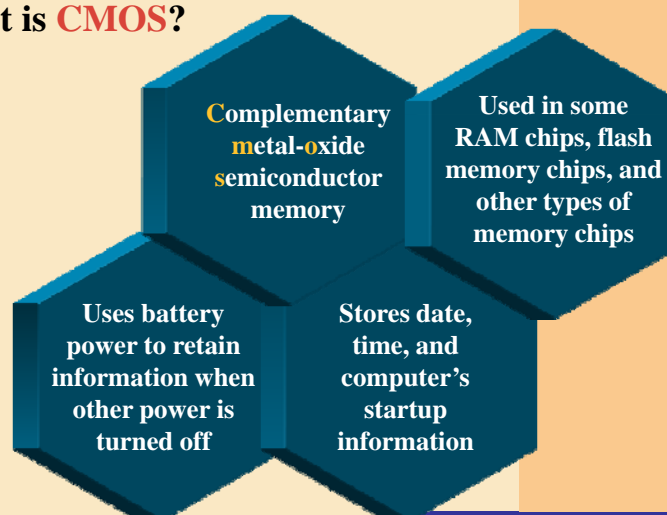


MP3 Player

Next ➤

Memory

What is **CMOS**?



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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. 200 Figs. 4-25-4-26

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
Accelerator	Increases the speed of the processor
Disk controller	Connects disk drives
Game	Connects a joystick
I/O	Connects input and output devices such as a printer or mouse; being phased out because newer motherboards support these connections
Interface	Connects other peripherals such as a mouse, CD, DVD, or scanner
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 USB 2.0 devices
Video	Connects a monitor
Video capture	Connects a camcorder



Click to view Web Link,
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from left navigation, then click
Adapter Cards
below Chapter 4
p. 201 Fig. 4-27

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. 201 Fig. 4-28

Next

Expansion Slots and Adapter Cards

What are **PC cards** and **flash memory cards**?

- A **PC card** 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
 - **Hot plugging** allows you to insert and remove cards while computer is running



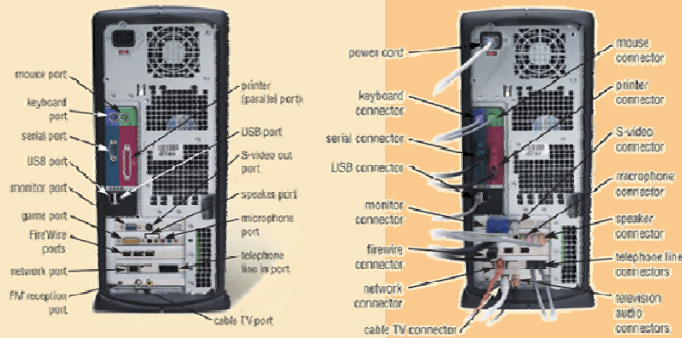
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PC Cards
below Chapter 4
p. 202 Fig. 4-29-4-30

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**



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Ports and Connectors
below Chapter 4
p. 203 Fig. 4-31–4.32

Next

Ports and Connectors

What are different types of connectors?

CONNECTOR	DB-9, 9-pin male	DB-9, 9-pin female	DB-15HD, 15-pin high-density female	24-pin DVI
USE	serial port, external modem	EGA and CGA video	VGA and EGA video	digital video interface monitor
CONNECTOR	DB-25, 25-pin male	DB-25, 25-pin female	36-pin female, mini ribbon	
USE	serial port, external modem, SCSI	parallel port, printer, tape backup	printer	
CONNECTOR	36-pin Centronics female	50-pin Centronics female	DB-15, 15-pin female	
USE	printer	SCSI	game port	
CONNECTOR	USB	FireWire	RJ-11, 6-pin female, modular telephone	5-pin 180° female DIN
USE	connects to 127 different peripheral devices	connects to 63 different peripheral devices	telephone, modem	keyboard, MIDI
CONNECTOR	RJ-45, 8-pin female	BNC, male coaxial	6-pin male, mini DIN	Miniplug
USE	LAN	LAN	mouse, keyboard	speaker & microphone

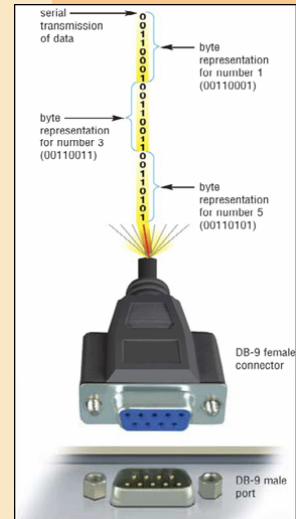
p. 204 Fig. 4-33

Next

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



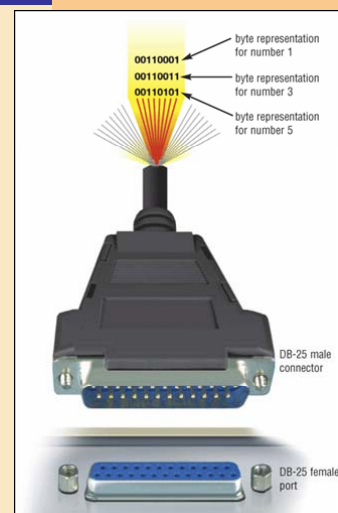
p. 205 Fig. 4-34

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. 205 Fig. 4-35

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 four 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

First USB device connects to USB port on computer

Second USB device connects to first USB device

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

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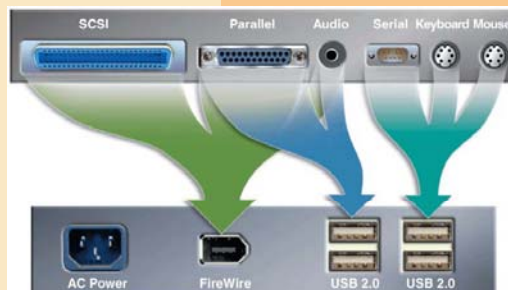
Next

Ports and Connectors

What are special-purpose ports?

- Allow users to attach specialized peripherals (digital video cameras, color printers, scanners, and disk drives) or transmit data to wireless devices

- FireWire port
- MIDI (Musical Instrument Digital Interface) port
- SCSI (small computer system interface) port
- IrDA (Infrared Data Association) port
- Bluetooth port



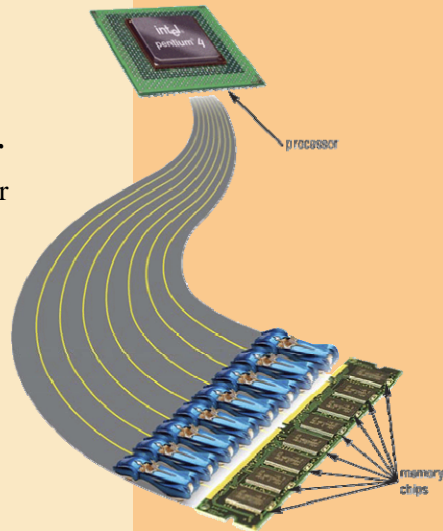
p. 206 Fig. 4-36

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



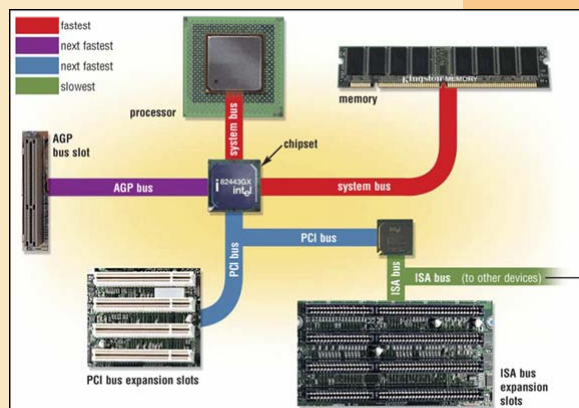
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Buses
below Chapter 4
p. 208 Fig. 4-38

Next

Buses

What is an expansion bus?

- **Allows processor to communicate with peripherals**



p. 209 Fig. 4-39

Next

Bays

What is a **bay**?

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

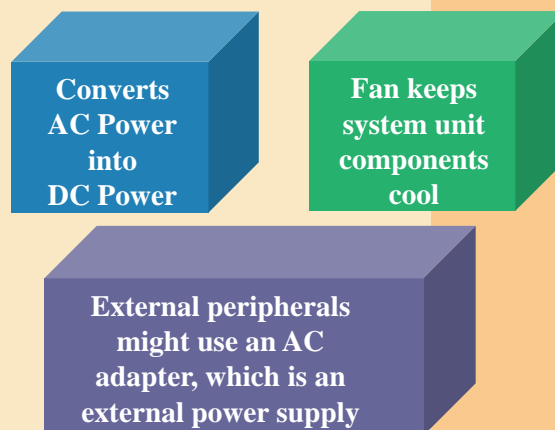


p. 210 Fig. 4-40

Next

Power Supply

What is a **power supply**?



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Next

Mobile Computers and Devices

What is a mobile computer?

- **Notebook, weighing between 2.5 and 8 pounds, or mobile device such as a PDA**

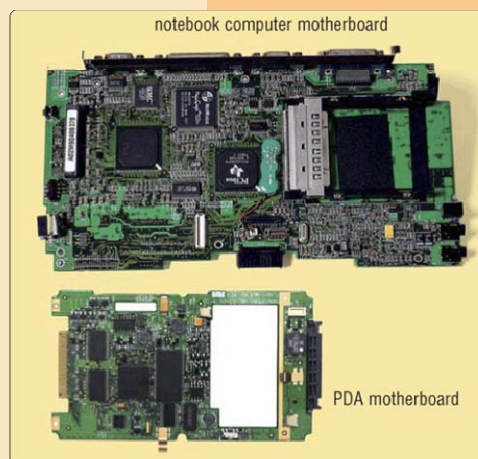


Next

Mobile Computers and Devices

What is in the system unit of a mobile computer?

- **Motherboard, processor, and memory—also devices such as the keyboard, speakers, and display**

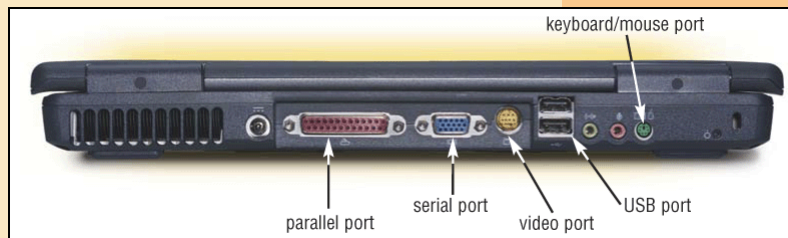


p. 212 Fig. 4-42

Next

Mobile Computers and Devices

What ports are on a notebook computer?



p. 212 Fig. 4-43

Next

Mobile Computers and Devices

What ports are on a tablet PC?


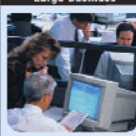
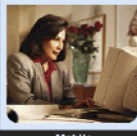
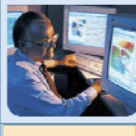
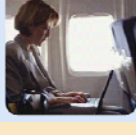


p. 212 Fig. 4-44

Next

Putting It All Together

What are suggested processor, **clock speed**, and **RAM** requirements based on the needs of various types of users?

User	Processor and Clock Speed	User	Processor and Clock Speed
 Home	Pentium® 4 or Athlon™ XP 1.7 GHz or higher or Celeron® or Duron™ 1.2 GHz or higher Minimum RAM: 128 MB	 Large Business	Pentium® 4 or Athlon™ XP 3 GHz or higher Minimum RAM: 512 MB
 Small Office/Home Office	Pentium® 4 or Athlon™ XP 2 GHz or higher Minimum RAM: 256 MB	 Power	Xeon™ or Itanium® or Athlon™ MP 2.5 GHz or higher Minimum RAM: 1 GB
 Mobile	Pentium® 4 or Athlon™ XP 1.8 GHz or higher Minimum RAM: 256 MB		

p. 213 Fig. 4-45

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

Chapter 4 Complete