Chapter 4 Objectives

- Differentiate among various styles of system units
- Describe the components of a processor and how they complete a machine cycle
- Define a bit and describe how a series of bits represents data
- Differentiate among the various types of memory
- Describe the types of expansion slots and adapter cards
- Explain the differences 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
- Understand how to clean a system unit
The System Unit

What is the system unit?

- Case that contains electronic components of the computer used to process data
The System Unit

What are common components inside the system unit?

- Processor
- Memory
- Adapter cards
  - Sound card
  - Video card
- Ports
- Drive bays
- Power supply
The System Unit

What is the **motherboard**?

- **Main circuit board in system unit**
- Contains adapter cards, processor chips, and memory modules
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
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**
What is a machine cycle?

Four operations of the CPU comprise a machine cycle

- **Step 1. Fetch**
  - Obtain program instruction or data item from memory

- **Step 2. Decode**
  - Translate instruction into commands

- **Step 3. Execute**
  - Carry out command

- **Step 4. Store**
  - Write result to memory
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

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)
Which processor should you select?

- The faster the processor, the more expensive the computer.

<table>
<thead>
<tr>
<th>Intel Processor</th>
<th>Desired Clock Speed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Itanium or Xeon</td>
<td>1.3 GHz and up</td>
</tr>
<tr>
<td>Pentium family</td>
<td>3.0 GHz and up</td>
</tr>
<tr>
<td></td>
<td>2.4 GHz to 3.0 GHz</td>
</tr>
<tr>
<td></td>
<td>Up to 2.4 GHz</td>
</tr>
<tr>
<td>Celeron</td>
<td>2.2 GHz and up</td>
</tr>
</tbody>
</table>
Data Representation

- How do computers represent data?
  - Most computers are **digital**

- 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)
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
Data Representation

- What are two popular coding systems to represent data?
  - ASCII—American Standard Code for Information Interchange
  - EBCDIC—Extended Binary Coded Decimal Interchange Code

<table>
<thead>
<tr>
<th>ASCII</th>
<th>Symbol</th>
<th>EBCDIC</th>
</tr>
</thead>
<tbody>
<tr>
<td>00110000</td>
<td>0</td>
<td>11110000</td>
</tr>
<tr>
<td>00110001</td>
<td>1</td>
<td>11110001</td>
</tr>
<tr>
<td>00110010</td>
<td>2</td>
<td>11110010</td>
</tr>
<tr>
<td>00110011</td>
<td>3</td>
<td>11110011</td>
</tr>
</tbody>
</table>
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 2.
An electronic signal for the capital letter T is sent to the system unit.

Step 3.
The signal for the capital letter T is converted to its ASCII binary code (01010100) and is stored 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.
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
Memory

- How is memory measured?
  - By number of bytes available for storage

<table>
<thead>
<tr>
<th>Term</th>
<th>Abbreviation</th>
<th>Approximate Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kilobyte</td>
<td>KB or K</td>
<td>1 thousand bytes</td>
</tr>
<tr>
<td>Megabyte</td>
<td>MB</td>
<td>1 million bytes</td>
</tr>
<tr>
<td>Gigabyte</td>
<td>GB</td>
<td>1 billion bytes</td>
</tr>
<tr>
<td>Terabyte</td>
<td>TB</td>
<td>1 trillion bytes</td>
</tr>
</tbody>
</table>
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
How do 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 window is displayed on the screen.

**Step 3.** When you start a word processing program, the program’s instructions are loaded into RAM from the hard disk. The word processing program, along with the Web Browser and certain operating system instructions are in RAM. The word processing program window is displayed 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 is no longer displayed on the screen.
What are two basic types of RAM chips?

- **Static RAM (SRAM)**: Most common type. Must be re-energized constantly. Faster and more reliable than DRAM.

- **Dynamic RAM (DRAM)**: Do not have to be re-energized as often as DRAM. Newer Type: Magnetoresistive RAM (MRAM)
Memory

- Where does memory reside?
  - Resides on small circuit board called **memory module**
  - **Memory slots** on motherboard hold memory modules
Memory

- How much RAM does a computer require?
  - Depends on the types of software you plan to use
  - For optimal performance, you need more than minimum specifications
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
Memory

What is read-only memory (ROM)?

Memory chips that store permanent data and instructions.

The data on most ROM chips cannot be modified.

Firmware—Manufactured with permanently written data, instructions, or information.
Memory

What is flash memory?

- Nonvolatile memory that can be erased electronically and rewritten
- Used with PDAs, smart phones, printers, digital cameras, automotive devices, audio players, digital voice recorders, 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.

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.
What is CMOS?

- Complementary metal-oxide semiconductor memory
- Uses battery power to retain information when other power is turned off
- Stores date, time, and computer’s startup information
- Used in some RAM chips, flash memory chips, and other types of memory chips
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

<table>
<thead>
<tr>
<th>Term</th>
<th>Speed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Millisecond</td>
<td>One-thousandth of a second</td>
</tr>
<tr>
<td>Microsecond</td>
<td>One-millionth of a second</td>
</tr>
<tr>
<td>Nanosecond</td>
<td>One-billionth of a second</td>
</tr>
<tr>
<td>Picosecond</td>
<td>One-trillionth of a second</td>
</tr>
</tbody>
</table>
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

<table>
<thead>
<tr>
<th>Adapter Card</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Disk controller</td>
<td>Connects disk drives</td>
</tr>
<tr>
<td>FireWire</td>
<td>Connects to FireWire devices</td>
</tr>
<tr>
<td>Graphics accelerator</td>
<td>Increases the speed at which graphics are displayed</td>
</tr>
<tr>
<td>MIDI</td>
<td>Connects musical instruments</td>
</tr>
<tr>
<td>Modem</td>
<td>Connects other computers through telephone or cable television lines</td>
</tr>
<tr>
<td>Network</td>
<td>Connects other computers and peripherals</td>
</tr>
<tr>
<td>PC-to-TV converter</td>
<td>Connects a television</td>
</tr>
<tr>
<td>Sound</td>
<td>Connects speakers or a microphone</td>
</tr>
<tr>
<td>TV tuner</td>
<td>Allows viewing of television channels on the monitor</td>
</tr>
<tr>
<td>USB 2.0</td>
<td>Connects to USB 2.0 devices</td>
</tr>
<tr>
<td>Video</td>
<td>Connects a monitor</td>
</tr>
<tr>
<td>Video capture</td>
<td>Connects a camcorder</td>
</tr>
</tbody>
</table>
Expansion Slots and Adapter Cards

- What is an expansion slot?
  - An opening, or socket, on the motherboard that can hold an adapter card
What are PC cards, flash memory cards, and USB Flash Drives?

- **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.
- **A USB flash drive** is a flash memory storage device that plugs into a USB port on a computer.
Ports and Connectors

- **What are ports and connectors?**
  - **Port** connects external devices to system unit
  - **Connector** joins cable to peripheral
Ports and Connectors

- What is a **serial port**?
  - Transmits one bit of data at a time
  - Connects slow-speed devices, such as a mouse, keyboard, or modem
Ports and Connectors

- What is a parallel port?
  - Connects devices that can transfer more than one bit at a time, such as a printer
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 using a USB hub.
- The latest version of USB is called USB 3.0.
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
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
- SCSI (small computer system interface) port
- IrDA (Infrared Data Association) port
- Bluetooth port
What is a bus?

Channel that allows devices inside and attached to the computer to communicate with each other

- **System bus** connects processor and main memory
- Bus width determines number of bits transmitted at one time
Bays

What is a bay?

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

What is a mobile computer?

- Notebook, weighing between 2.5 and 9 pounds, or mobile device such as a PDA
Mobile Computers and Devices

- What ports are on a notebook computer?

![Image of a notebook computer with various ports labeled](image-url)

**Figure 4.38** Ports on a typical notebook computer.
What ports and slots are on a tablet PC?
Putting It All Together

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

<table>
<thead>
<tr>
<th>SUGGESTED MINIMUM CONFIGURATIONS BY USER</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>User</strong></td>
</tr>
<tr>
<td><strong>HOME</strong></td>
</tr>
<tr>
<td>Minimum RAM: 256 MB</td>
</tr>
<tr>
<td><strong>SMALL OFFICE/HOME OFFICE</strong></td>
</tr>
<tr>
<td>Minimum RAM: 512 MB</td>
</tr>
<tr>
<td><strong>MOBILE</strong></td>
</tr>
<tr>
<td>Minimum RAM: 512 MB</td>
</tr>
<tr>
<td><strong>POWER</strong></td>
</tr>
<tr>
<td>Minimum RAM: 2 GB</td>
</tr>
<tr>
<td><strong>LARGE BUSINESS</strong></td>
</tr>
<tr>
<td>Minimum RAM: 1 GB</td>
</tr>
</tbody>
</table>
Keeping Your Computer Clean

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

- Preventative maintenance requires a few basic products:
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