Objectives Overview

Describe the various computer and mobile device cases and the contents they protect

Describe multi-core processors the components of a processor, and 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

Explain the advantages and services of cloud computing

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

Explain how program and application instructions transfer in and out of memory

See Page 248 for Detailed Objectives
Objectives Overview

Differentiate among the various types of memory

Describe the purpose of adapter cards, USB adapters, and ExpressCard modules

Explain the function of a bus

Explain the purpose of a power supply and batteries

Understand how to care for computers and mobile devices
Inside the Case

- The case contains and protects the electronics of the computer or mobile device from damage
Inside the Case
Inside the Case

• The **motherboard** is the main circuit board of the computer
  – A computer **chip** contains integrated circuits
Processors

• 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)
• A **multi-core processor** is a single chip with two or more separate processor cores
Processors
Processors

- 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.
Processors

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

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)**.
Processors

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

- A processor chip generates heat that could cause the chip to malfunction or fail
- Require additional cooling
  - Heat sinks
  - Liquid cooling technology
  - Cooling mats
Cloud Computing

- Home and business users choose cloud computing for a variety of reasons

- Accessibility
- Cost savings
- Space savings
- Scalability
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

The circuitry in a computer or mobile device represents the on or the off states electronically by the presence or absence of an electronic charge.

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

<table>
<thead>
<tr>
<th>Binary Digit (BIT)</th>
<th>Electronic Charge</th>
<th>Electronic State</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Green</td>
<td>ON</td>
</tr>
<tr>
<td></td>
<td>Black</td>
<td>OFF</td>
</tr>
</tbody>
</table>

8-bit byte for the letter E

0 1 0 0 0 1 0 1

8-bit byte for the symbol *

0 0 1 0 1 0 0 1

8-bit byte for the number 6

0 0 1 1 0 1 1 0
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 electronic circuitry in the computer.

**Step 3**
The electronic circuitry in the computer 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.
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 programs
  - Applications
  - Data being processed and the resulting information
Memory

- Each location in memory has an address
- Memory size commonly is measured in gigabytes (GB) or terabytes (TB)
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

Figure 6-12

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 run a browser, the application’s instructions are loaded into RAM. The browser and certain operating system instructions are in RAM. The browser window appears on the screen.

Step 3
When you run a paint application, the application’s instructions are loaded into RAM. The paint application, along with the browser and certain operating system instructions, are in RAM. The paint application window appears on the screen.

Step 4
When you exit an application, such as the browser, its instructions are removed from RAM. The browser no longer is displayed on the screen.
Memory

- Two common types of RAM chips exist:

  **Dynamic RAM (DRAM)**
  **Static RAM (SRAM)**

### Table 6-1 Common DRAM Variations

<table>
<thead>
<tr>
<th>Name</th>
<th>Comments</th>
</tr>
</thead>
</table>
| SDRAM (Synchronous DRAM) | • Synchronized to the system clock  
                      |   • Much faster than DRAM                                  |
| DDR SDRAM (Double Data Rate SDRAM) | • Transfers data twice, instead of once, for each clock cycle  
                      |   • Faster than SDRAM                                      |
| DDR2                 | • Second generation of DDR  
                      |   • Faster than DDR                                        |
| DDR3                 | • Third generation of DDR  
                      |   • Designed for computers with multi-core processors  
                      |   • Faster than DDR2                                       |
| DDR4                 | • Fourth generation of DDR  
                      |   • Faster than DDR3                                       |
| RDRAM (Rambus DRAM)  | • Much faster than SDRAM                                    |
Memory

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

### Table 6-2 Access Time Terminology

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

10 million operations = 1 blink
Adapters

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

<table>
<thead>
<tr>
<th><strong>Table 6-3 Adapter Cards</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Type</strong></td>
</tr>
<tr>
<td>Bluetooth</td>
</tr>
<tr>
<td>MIDI</td>
</tr>
<tr>
<td>Modem</td>
</tr>
<tr>
<td>Network</td>
</tr>
<tr>
<td>Sound</td>
</tr>
<tr>
<td>TV tuner</td>
</tr>
<tr>
<td>USB</td>
</tr>
<tr>
<td>Video</td>
</tr>
<tr>
<td>Video capture</td>
</tr>
</tbody>
</table>
Adapters

• With **Plug and Play**, the computer automatically can recognize peripheral devices as you install them.
Adapters

- Adapters for mobile computers are in the form of a removable flash memory device
  - USB adapter
  - ExpressCard module
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

• A computer might have these three types of buses:

  - System bus
  - Backside bus
  - Expansion bus
Power Supply and Battery

- The **power supply** or laptop AC adapter converts the wall outlet AC power into DC power.
Power Supply and Battery

- Mobile computers and devices can run using either a power supply or batteries
- Batteries typically are rechargeable lithium-ion batteries
Summary

Various components inside computers and mobile devices

Types of processors, steps in a machine cycle, and processor cooling methods

Advantages and services of cloud computing

How memory stores data and described various types of memory

Adapters, buses, power supplies and batteries

Ways to care for computers and mobile devices