Chapter 5

The System Unit

Chapter 5
Learning Objectives

1. Differentiate between the five basic types of system units.
2. Describe system boards, including sockets, slots, and bus lines.
3. Recognize different microprocessors, including microprocessor chips and specialty processors.
4. Compare different types of computer memory including RAM, ROM, and flash memory.
5. Explain expansion slots and cards.
6. Describe bus lines, bus widths, and expansion buses.
7. Describe ports, including standard and specialized ports.
8. Identify power supplies for desktop, laptop, tablet, and mobile devices.
9. Explain how a computer can represent numbers and encode characters electronically.
Introduction

• Speed, capacity, and flexibility determine the power of personal computers.
• Knowledge of a computer’s power allows you to make good buying decisions and to determine if your current system will run new applications.
• Competent end users need to understand the functionality of the basic components of the system unit.
System Chassis

- Container that houses most of the electronic components that make up a computer system

System Unit

- Contains system’s electronic components and selected secondary storage devices
System Unit Types

1. Desktops
   - System unit is in a separate case
     - Tower Units
     - All-in-Ones
       - All components including monitor

2. Laptops
   - Portable and much smaller
     - Ultrabooks – laptop and tablet in one
     - Gaming – high end graphics
3. Tablets
   - Mini tablet

4. Smartphone
   - Most popular device – handheld computer
   - Extend the capabilities of cell phones

5. Wearables
   - Contain embedded computers
Components

- Although all devices come in many shapes and sizes they have similarities such as:
  - System boards
  - Microprocessors
  - Memory
System Board

System board or main board or motherboard controls communication for the entire computer system

- All components and devices connect to the system board
- Data path and traffic monitor
  - Allows various components to communicate efficiently with one another
The system board contains a variety of electronic components

- **Sockets** – the connection point for chips
- **Chips**
  - Tiny circuit boards etched onto squares of silicon
  - Also called silicon chip, semiconductor, or integrated circuit
  - Mounted on chip carriers
Additional system board components:

- **Slots**
  - Provide a connection point for specialized cards or circuit boards
  - Provide expansion capabilities for the computer

- **Bus lines**
  - Connecting lines that provide pathways to support communication among electronic components
Microprocessor

- Central Processing Unit (CPU) or Processor
  - Contained on a single chip call a Microprocessor
  - Brains of the computer

- Two Basic Components of the CPU
  - Control unit
    - Tells the computer system how to carry out a program’s instruction
  - Arithmetic-logic unit (ALU)
    - Performs arithmetic and logical operations
Microprocessor Chips

- Chip capacities are expressed in word size
  - Word is the number of bits that can be processed at one time: 16, 32 or 64

- Clock Speed
  - Processing speed or the number of times the CPU fetches and processes data or instructions in a second

<table>
<thead>
<tr>
<th>Unit</th>
<th>Speed</th>
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<tbody>
<tr>
<td>Microsecond</td>
<td>Millionth of a second</td>
</tr>
<tr>
<td>Nanosecond</td>
<td>Billionth of a second</td>
</tr>
<tr>
<td>Picosecond</td>
<td>Trillionth of a second</td>
</tr>
<tr>
<td>Femtosecond</td>
<td>Quadrillionth of a second</td>
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</table>
Multicore Chips

• Multicore Processors
  • Two or more separate and independent CPUs within a system unit
    • Quad-core supports 4 core processes

• Parallel Processing
  • Computer’s ability to divided tasks into parts that can be distributed across each core
  • Windows 8 and Mac OS X support parallel processing

<table>
<thead>
<tr>
<th>Processor</th>
<th>Manufacturer</th>
</tr>
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<tbody>
<tr>
<td>A-Series</td>
<td>AMD</td>
</tr>
<tr>
<td>Cortex-A series</td>
<td>ARM</td>
</tr>
<tr>
<td>Edison</td>
<td>Intel</td>
</tr>
<tr>
<td>i7</td>
<td>Intel</td>
</tr>
</tbody>
</table>
Specialty Processors

- **Coprocessors**
  - Designed to improve specific computing operations
  - Graphics Processing Unit (GPU) / Graphics coprocessors
  - Designed to handle a variety of specialized tasks
    - 3D images
    - Encrypting data
    - Standard features in gaming computers
Memory

- Holding area for data, instructions, and information
- Contained on chips connected to the system board
- Three well-known types of memory chips:
  - RAM
    - Random Access Memory
  - ROM
    - Read Only Memory
  - Flash Memory
Random Access Memory (RAM) chips hold programs and data that the CPU is presently processing:
- Volatile or temporary – contents are lost when computer is powered off
- Cache memory – temporary, high-speed holding area between the memory and CPU
- Additional RAM can be added using an expansion module called a DIMM (Dual in-line memory module)
Virtual Memory
- Dividing a program between memory and storage enabling the system to run very large programs

Memory is expressed in bytes

<table>
<thead>
<tr>
<th>Unit</th>
<th>Capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Megabyte (MB)</td>
<td>1 million bytes</td>
</tr>
<tr>
<td>Gigabyte (GB)</td>
<td>1 billion bytes</td>
</tr>
<tr>
<td>Terabyte (TB)</td>
<td>1 trillion bytes</td>
</tr>
</tbody>
</table>
ROM

- Read-only memory (ROM)
  - Information stored by the manufacturer
  - Non-volatile and cannot be changed
- CPU can read, or retrieve data and programs in ROM but the computer cannot change ROM
- Contain special instructions
  - Start the computer
  - Access memory
  - Handle keyboard input
Flash Memory

- Flash memory combines the features of:
  - RAM, it can be updated
  - ROM, it is non-volatile
  - Contains startup information
    - BIOS (basic input/output system)
    - Amount of RAM
    - Type of keyboard, mouse, and secondary storage devices connected

Many ROM chips are being replaced by flash memory
Expansion Slots and Cards

Expands your system’s capabilities

- Graphics cards for high quality 3D graphics
- Network interface cards (NIC) connect devices to networks via cables
- Wireless network cards connect devices to networks without cables
- SD cards
  - Expansion cards for mobile devices
Bus Lines / Bus

Connect parts of the CPU to each other and various other components on the system board

• Pathway for bits representing data and instructions
• Bus width
  • Number of bits that can travel simultaneously down a bus
• Architecture and design are tied to the speed and power for the computer
• Two basic categories of buses
  • System bus – connects CPU to memory
  • Expansion bus – connects CPU to other components
Expansion Buses

Principle types:
- Universal Serial Bus (USB)
  - Connects external USB devices onto the USB bus
- FireWire
  - Primarily used to connect audio and video equipment to the system board
- PCI Express (PCiE)
  - Single dedicated path for each connected device
Ports

Socket for connecting external devices to the system unit

- Ports connect directly
  - To the system board
  - To cards inserted into slots on the system board

- Two Types
  - Standard Ports
  - Specialized Ports
Standard Ports

• USB
  • Keyboards, mice, printers, storage devices

• Ethernet
  • High speed networking

• HDMI – High Definition Multimedia Interface
  • High definition video and audio

• Thunderbolt
  • Provides high-speed connections
  • Can connect up to 7 separate devices through 1 port
Specialized Ports

- External Serial Advanced Technology Attachment (eSATA)
  - High-speed connection for external secondary storage
- Musical Instrument Digital Interface (MIDI)
  - Connect musical instruments
- Mini DisplayPort (MiniDP or mDP)
  - Connection to large monitors
- VGA & DVI
  - Connections to analog and digital monitors
- FireWire
  - High-speed connections to FireWire devices
Cables

- Used to connect external devices to the system unit via the ports
- One end of the cable is attached to the device and the other end has a connector that is attached to a matching connector on the port
Making IT Work for You ~ TV Tuners

- Using Windows Media Center as a DVR
- Install TV Tuner to connect your computer or cable to your computer
Power Supply

- Computers require direct current (DC) power converting alternating current (AC) from wall outlets or batteries
  - Desktop computers have a power supply unit in the system unit
  - Laptops use AC adapters in the system unit
  - Tablets and mobile devices use internal AC adapters
  - Smartphones can use wireless charging platforms
Electronic Data and Instructions

- Digital electronic signals
  - Recognized by computers
- Analog signals
  - Continuous signal
  - Created by voices
- Conversion must take place from analog to digital before processing can occur
Numeric Representation

• Two-state binary system consists of only two digits called bits
  • On = 1; negative charge
  • Off = 0; no charge

• Byte = 8 bits grouped together

• Hexadecimal system
  • Uses 16 digits to represent binary numbers
    (0, 1, 2, 3, 4, 5, 6, 7, 8, 9, A, B, C, D, E, F)
Character Encoding

Character encoding standards assign a unique sequence of bits to each character

- **ASCII**
  - American Standard Code for Information Interchange
  - Used by personal computers

- **EBCDIC**
  - Extended Binary coded Decimal Interchange Code
  - Used by mainframe computers

- **Unicode**
  - New encoding due to explosion of the Internet
  - Uses 16 bits
  - Recognized by virtually all computer systems
Careers In IT

- Computer technicians repair and install computer components and systems
- Employers look for:
  - Certification or associate degree in computer repair
  - Communication skills
- Continued education is required
- Computer technicians can expect to earn an annual salary of $37K to $47K
A Look to the Future

- Wearable computers
- Send and receive email while jogging
- Maintain your personal schedule book
- Remember the names of people at a party
1. Describe the five most common types of personal computers.

2. Describe system boards including sockets, chips, chip carriers, slots, and bus lines.

3. Discuss microprocessor components, chips, and specialty processors.
4. Define computer memory including RAM, ROM, and flash memory.

5. Define expansion slots, cards, including graphics cards, network interface cards, wireless network cards, and SD cards.

6. Describe bus lines, bus width, system bus, and expansion bus.
7. Define ports including standard and specialized ports. Give examples of each.

8. Describe power supply including power supply units and AC adapters.

9. Discuss electronic data and instructions.