Chapter 6

The System Unit
• Describe the four basic types of system units
• Discuss how a computer uses binary codes to represent data in electronic form
• Describe each of the major system unit components
• Discuss microprocessors, including specialty processors
• Describe the different types of memory
Competencies (2 of 2)

- Discuss **expansion slots** and boards
- Describe the five principal types of expansion buses
- Discuss the four standard **ports**
Speed, capacity, and flexibility determine the power of microcomputers. 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 basic principles of how microcomputers are put together. These principles will be covered in this chapter.
System Unit

**Memory**
holds data, instructions, and information; memory circuit boards plug into slots on the system board

**Microprocessor**
controls operations and performs arithmetic and logical operations; microprocessor cartridges plug into a special slot on the system board

**Expansion Cards**
allow external devices to connect to and expand a computer's capabilities; expansion cards plug into slots on the system board

**Expansion Slots**
provide connections for expansion cards to the system board
System Unit Types

- Desktop System Units
- Notebook System Units
- Tablet PC System Units
- Handheld Computer System Units
Electronic Data and Instructions

- Data and instructions are represented electronically
- Two-state system or **Binary System**
  - Off/on electrical states
  - Characters represented by 0s (off) and 1s (on)
  - Bits
  - Bytes
Binary Coding Schemes

- Three types of binary coding schemes
  - **ASCII** - American Standard Code for Information Exchange
  - **EBCDIC** - Extended Binary Coded Decimal Interchange Code (*for ancient IBM punch cards*)
  - **Unicode** – handles languages with large numbers of characters

<table>
<thead>
<tr>
<th>Code</th>
<th>Uses</th>
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<tbody>
<tr>
<td>ASCII</td>
<td>Microcomputers</td>
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<tr>
<td>EBCDIC</td>
<td>Large computers</td>
</tr>
<tr>
<td>Unicode</td>
<td>International languages</td>
</tr>
</tbody>
</table>
Each character is stored in one byte
1 byte = 1 char
The basis of “plaintext”
Unicode

• More than 100,000 characters, such as…

\[ \pi \ \mathbb{R} \ \text{音} \ \aleph \ \infty \]

• Rules to deal with things like directionality
  – Left-to-Right, Right-to-Left (Arabic, etc.)
• Still evolving, but in widespread use
• UTF-8 is the common version of Unicode
  – Backward compatible with ASCII
System Board

- Connects all components
- Allows communication between devices
- Main board or **motherboard**
- Circuit board
  - electronic components
    - Sockets
    - Slots
    - Bus lines
Microprocessor

- Central Processing Unit (CPU)
- Two Basic Components
  - Control unit
  - Arithmetic-logic unit (ALU)

<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>Prepare written documents</td>
</tr>
<tr>
<td>Picosecond</td>
<td>Trillionth of a second</td>
</tr>
</tbody>
</table>
Word Size of Processors

- Chip capacities are expressed in word sizes
  - 8-bit and 16-bit (embedded or older)
  - 32-bit (most PC’s today)
  - 64-bit (larger computers, some PCs)
Microprocessor Chips

- **Two Recent Significant Developments**
  - 64-bit processors
    - Becoming more commonplace
    - Windows XP Professional X64 Edition
  - **Dual-Core Chips**
    - Can provide two separate and independent CPUs
    - Parallel processing

<table>
<thead>
<tr>
<th>Processor</th>
<th>Manufacturer</th>
<th>Description</th>
</tr>
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<tbody>
<tr>
<td>Pentium 4</td>
<td>Intel</td>
<td>32-bit</td>
</tr>
<tr>
<td>Core 2</td>
<td>Intel</td>
<td>64-bit, dual-core</td>
</tr>
<tr>
<td>Xeon</td>
<td>Intel</td>
<td>64-bit, dual-core</td>
</tr>
<tr>
<td>Athlon 64</td>
<td>AMD</td>
<td>64-bit, dual-core</td>
</tr>
<tr>
<td>Opteron</td>
<td>AMD</td>
<td>64-bit, dual-core</td>
</tr>
<tr>
<td>PowerPC</td>
<td>IBM</td>
<td>64-bit, dual-core</td>
</tr>
</tbody>
</table>
Processor Clock Speeds

Hertz – a measure of frequency (Hz)

Megahertz (MHz)
  A million times a second (fast)

Gigahertz (GHz)
  A billion times a second (faster!)

My laptop:
  2.0 GHz
Clock Speed

• Kilohertz (thousand) millisecond
  – Camera Flash Bulb
• Megahertz (million) microsecond
  – Radio Waves, slow electronics
• Gigahertz (billion) nanosecond
  – Microwaves, modern electronics
• Terahertz (trillion) picosecond
  – Research, fastest transistors
Specialty Processors

• **Coprocessors**
  – Designed to improve specific computing operations
  – *Graphics coprocessors*

• **Smart cards**
  – Credit card sized with an embedded chip
  – Used by many universities

• **RFID tags**
  – Information chips
  – Used for tracking purposes
RFID Tags

- Reader sends a pulse
- RFID tag responds
  - Sends back an ID number

"How would you like it if, for instance, one day you realized your underwear was reporting on your whereabouts?"
—California State Senator Debra Bowen

Passports / ID cards
Implantable Microchips
Timing Racing Events
Traffic Monitoring / Tollbooths
Product Tracking
Promotional Items
Library Books
Museum Guides
Medical / Patient IDs
Memory

- Holding area for data, instructions, and information
- Memory is contained on chips connected to the **system board**
- Types of memory chips
  - **RAM**
  - **ROM**
  - **CMOS**

<table>
<thead>
<tr>
<th>Type</th>
<th>Use</th>
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<tbody>
<tr>
<td>RAM</td>
<td>Programs and data</td>
</tr>
<tr>
<td>ROM</td>
<td>Fixed start-up Instructions</td>
</tr>
<tr>
<td>CMOS</td>
<td>Flexible start-up Instructions</td>
</tr>
</tbody>
</table>
### Memory Sizes

Measured in **bytes**

1 byte = 1 character

**Kilobyte (KB or Kbyte)**

1,024 bytes \( (\approx 2^{10}) \)

**Megabyte (MB or Mbyte)**

1,048,576 bytes \( (\approx 1K \times 1K) \)

**Gigabyte (GB or Gbyte)**

1,073,741,824 bytes \( (\approx 1K \times 1M) \)

**Terabyte (TB or Tbyte)**

1,099,511,627,776 bytes \( (\approx 1K \times 1G) \)
## Memory Sizes

Measured in **bytes**

- 1 byte = 1 character

### Kilobyte

- About 1/2 page

### Megabyte (MB or Mbyte)

- Novel (500 pages)

### Gigabyte (GB or Gbyte)

- 50 feet of shelf space

### Terabyte (TB or Tbyte)

- All of Powell’s Bookstore (est.)
RAM

- Random Access Memory (RAM) chips hold the program and data
  - Cache memory or RAM cache
  - Flash RAM or flash memory
- Other types of RAM
  - DRAM
  - SDRAM
  - DDR
  - Direct RDRAM
Cache Memory

- Inserted between processor and RAM
Cache Memory

- Inserted between processor and RAM
ROM

• Read-only memory (ROM) chips are not volatile and cannot be changed by the user
• CPU can read, or retrieve data and programs but the computer cannot write
• Contain special instructions
  – Needed to start a computer
  – Give keyboard keys their special capabilities
  – Put characters on screen
CMOS

- Complementary metal-oxides semiconductor (CMOS) chips provide flexibility for a computer system.
- Contains essential information every time the computer is turned on:
  - Date and time
  - Amount of RAM
  - Type of keyboard
- Content can be changed to reflect changes in the computer system.
System Clock

- Important measurement indicating speed
  - Located on a small chip
  - Produces electrical beats
- Synchronizes operations
- Expressed in gigahertz (GHz) (billions of beats per second)
- Faster clock speed, faster computer
Expansion Slots and Cards

- Allow for new devices to be added
  - Open architecture
  - Slots provide for expansion

- **Expansion cards** are also called …
  - Plug-in boards
  - Controller cards
  - Adapter cards
  - Interface cards
Commonly Used Expansion Cards

- Graphics cards
- Sound cards
- Modem cards
- Network interface cards (NIC)
- PC cards (PCMCIA cards)
- TV tuner cards
TV Tuner Cards And Video Clips

- Allows you to view your favorite TV shows while running other applications such as Excel
- Video can be captured to a file, added to a Web page, attached to an email, or added to a class presentation
- Relatively inexpensive and easy to install
Plug and Play

- Set of hardware and software standards developed by Intel, Microsoft, and others

- Creating devices that are able to configure themselves when installed
Bus Lines

• Connect parts of the CPU to each other
• Data roadway for traveling bits
  – Measured as bus width
  – More lanes, faster traffic
• Two basic categories
  – System buses
  – Expansion buses
Expansion Buses

- Connects the CPU to other components on the system board, including expansion slots
- Principal types
  - Industry Standard Architecture (ISA)
  - Peripheral Component Interconnect (PCI)
  - Accelerated Graphics Port (AGP)
  - Universal serial bus (USB)
  - FireWire buses (HPSB)
Ports

- Socket for connecting external devices
- Ports can connect directly to the system board or they can connect to cards that are inserted into slots on the system board
- Two Types
  - Standard Ports
  - Specialized Ports
Standard Ports

• Four common ports
  – Serial ports
  – Parallel ports
  – USB ports
  – FireWire ports
Specialized Ports

• Three specialized ports
  – Musical Instrument digital interface (MIDI)
  – Infrared data association (IrDA)
Cables

• Used to connect exterior 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
Power Supply

- Computers require direct current (DC)
- DC power provided by converting alternating current (AC) from wall outlets or batteries
- Desktop computers use power supply units
- Notebooks and handhelds use AC adapters
Careers In IT

- **Computer technicians** repair and install computer components and systems
- Employers look for
  - Certification in computer repair
  - Good communication skills
- Continued education is required
- Computer technicians can expect to earn an hourly wage of $13.00 to $22.00
A Look to the Future
Xybernaut Corporation

- Wearable computers
- Send and receive email
- Maintain your personal schedule book
- Play interactive games and surf the Web from anywhere
Discussion Questions

• Describe the four basic types of system units.
• Describe the two basic components of the CPU.
• What are the differences and similarities between the three types of memory?
• Identify five expansion cards and describe the function of each.
• Identify and describe four standard ports and two specialized ports.