Principles and Learning Objectives

Assembling an effective, efficient computer system requires an understanding of its relationship to the information system and the organization. The computer system objectives are subordinate to, but supportive of, the information system and the needs of the organization.

- Describe how to select and organize computer system components to support information system objectives and business organization needs.

When selecting computer devices, you also must consider the current and future needs of the information system and the organization. Your choice of a particular computer system device should always allow for later improvements.

- Describe the power, speed, and capacity of central processing and memory devices.
- Describe the access methods, capacity, and portability of secondary storage devices.
- Discuss the speed, functionality, and importance of input and output devices.

Five Main Hardware Components

Machine Language

CLEAR A 000: 100
LOAD A, 7 001: 200 7
LOAD B, 5 003: 201 5
SUB A, B 005: 150
JUMP TO 034 IF ZERO 006: 170 034
008:

Assembler (Mnemonics) 034: …

Machine Language
Hardware Components in Action

Step 1: Fetch instruction
Step 2: Decode instruction
Step 3: Execute the instruction
Step 4: Store results

Processing & Memory Devices

Processing Characteristics and Functions

- **Clock speed**: electronic pulses affecting machine cycle time
  - Hertz: one cycle (pulse) per second
  - Megahertz (MHz): millions of cycles per second
- **Microcode**: internal, predefined elementary operations in a CPU

Clock Speed – The Computer’s Drum Beat

Clock Speed

- Machine cycle time is measured in:
  - Microseconds (1 millionth)
  - Nanoseconds (1 billionth)
  - Picoseconds (1 trillionth)
  - MIPS (Millions of Instructions Processed per Second)
Wordlength and Bus Line Width

- Bits (Binary Digits): smallest form of data in a computer
- Wordlength: number of bits that can be processed as a unit
- Bus lines: electrical paths of data flow

Physical Characteristics of the CPU

- Digital circuits on chips
- Electrical current flows through silicon
- “Moore’s Law” - transistor density of chips will double every 18 months

…Human capabilities do not double every 18 months!

Moore’s Law

Complex and Reduced Instruction Set Computing

- Complex instruction set computing (CISC) - places as many microcode instructions into the central processor as possible
  (French Restaurant 😊)
- Reduced instruction set computing (RISC) - involves reducing the number of microcode instructions built into a chip to an essential set of common microcode instructions
  (Fast food 😊)

Memory Characteristics and Functions

<table>
<thead>
<tr>
<th>Name</th>
<th>Abbreviation</th>
<th>Number of Bytes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Byte</td>
<td>B</td>
<td>1</td>
</tr>
<tr>
<td>Kilobyte</td>
<td>KB</td>
<td>1,024 Bytes</td>
</tr>
<tr>
<td>Megabyte</td>
<td>MB</td>
<td>1,024 Kilobytes (about 1 million)</td>
</tr>
<tr>
<td>Gigabyte</td>
<td>GB</td>
<td>1,024 Megabytes (about 1 billion)</td>
</tr>
<tr>
<td>Terabyte</td>
<td>TB</td>
<td>1,024 Gigabytes (about 1 million)</td>
</tr>
<tr>
<td>Petabyte</td>
<td>PB</td>
<td>1,024 Terabytes (about 1 quadrillion)</td>
</tr>
</tbody>
</table>
Secondary Storage

- Offers the advantages of **nonvolatility**, greater capacity, and greater economy

- Access methods, storage capacities, and portability required are determined by the information system’s objectives

**Access Methods**

- **Sequential**: records must be retrieved in order
  - Devices used are called sequential access storage devices (SASD)

- **Direct**: records can be retrieved in any order
  - Devices used are called direct access storage devices (DASDs)
Devices

- Magnetic tapes
- Magnetic disks
- RAID
- Storage area networks (SAN)
- Optical disks
- Magneto-optical (MO) disks
- Digital versatile disks (DVDs)

Storage Area Network

Comparison of Secondary Storage Devices

<table>
<thead>
<tr>
<th>Storage Device</th>
<th>Year First Introduced</th>
<th>Maximum Capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.5-inch drive</td>
<td>1987</td>
<td>1.44 MB</td>
</tr>
<tr>
<td>CD-ROM</td>
<td>1986</td>
<td>650 MB</td>
</tr>
<tr>
<td>ZIP</td>
<td>1998</td>
<td>100 GB</td>
</tr>
<tr>
<td>DVD</td>
<td>1996</td>
<td>17 GB</td>
</tr>
</tbody>
</table>

Characteristics and Functionality

- **Data** - can be human or machine readable
- **Data entry** - converts human readable data into machine-readable form
- **Data input** - transfers machine-readable data into the system
- **Source data automation** - capturing and editing data at its source

Input and Output Devices
Input Devices

- Personal computer input devices
  - Keyboard
  - Mouse
- Voice-recognition devices
- Digital cameras
- Terminals

What's that?

Thank you!
Any questions? Please send an e-mail to mhepp@computer.org!

http://ruby.fgcu.edu/courses/mhepp/